Drainage Study

Wildomar MDP Lateral C-1 Project

City of Wildomar, CA

Prepared For:
City of Wildomar
23873 Clinton Keith Road
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Date: October 2014

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Table of Contents

SECTION 1 - Summary 1-1

Introduction 1-1

Proposed Drainage Facilities 1-1

Lateral C-1 1-1

Lateral C-1A 1-1

Lateral C-1.1 1-1

Lateral C-1.2 and Lateral C-1.2a 1-2

Laterals CB.1 and Lateral CB.2 1-2

Vicinity Map 1-3

Methodology 1-4

Conclusion 1-4

SECTION 2 - Hydrology Calculations 2-1

Overview 2-1

Rational Hydrology Results (CivilD© Output Files) 2-2

SECTION 3 - Hydraulic Calculations 3-1

Overview 3-1

WSPG Calculations 3-1

Inlet Calculations 3-2

SECTION 4 - Lateral C/C-1 Junction 4-1

Overview 4-1

APPENDICES

Appendix A – RCFCWCD Study

Appendix B – Reference Plans

Appendix C – Geotechnical Analysis

SECTION 1 - Summary

Introduction

The purpose of this study is to document hydrologic and hydraulic computations undertaken in support of the design of the Wildomar MDP Lateral C-1 project located in the City of Wildomar, County of Riverside, CA. The project consists of two backbone drainage facilities (Lateral C-1 and Lateral C-1A) and several ancillary laterals and inlets. The project is generally bounded by the intersection of Palomar St and Refa St on the southwest, the terminus of Billie Ann Rd on the northwest and the intersection of Charles St and Woshka Ln on the northeast.

This study was conducted in order to appropriately size the drainage facilities and inlets so that they will adequately convey local runoff and flows from upstream tributary areas. A local hydrology study was performed for the tributary areas adjacent to the proposed Lateral C-1 System and is presented herein. This localized study was performed to properly size laterals that tie into the storm drain system.

In January 2014, Riverside County Flood Control and Water Conservation District (District) prepared a hydrology study titled "Hydrology Study for Wildomar MDP Lateral C-1". This study updated the original MDP Hydrology from the 1980s. The flow rates established in the District's report are used for the current design of Lateral C-1 and Lateral C-1A. A reference copy of the District's Study is included in **Appendix A** of this report.

Proposed Drainage Facilities

The follow facilities are proposed as part of this project:

Lateral C-1

Lateral C-1 extends from the intersection of Palomar St and Refa Street. Lateral C-1 will tie into an existing stub out from Lateral C and from there will traverse northeasterly in Refa Street for approximately 1,400 feet. From there is traverses in an easterly direction in Charles Street for approximately 400 feet to the intersection of Charles Street and Woshka Lane. There it will connect to an existing City maintained 84" RCP. A reference copy of Lateral C is contained in **Appendix B** of this report.

Lateral C-1A

Lateral C-1A tie into Lateral C-1 at the projected intersection of Charles Street and Refa St. From there it traverses easterly for approximately 550 feet until it reaches the terminus of Bille Ann Rd. There it will tie into the existing outlet of the Bille Ann Stormdrain, a double 60" City owned RCP. Reference copies of the Billie Ann Rd Stormdrain are included in **Appendix B** of this report.

Lateral C-1.1

Lateral C-1.1 is a stub out inlet connection near the downstream end of Lateral C-1. It will collect existing condition runoff from a natural tributary that is currently captured by the existing Lateral C-1 stub out. Backup hydrology for this lateral is contained in **Section 2** of this report.

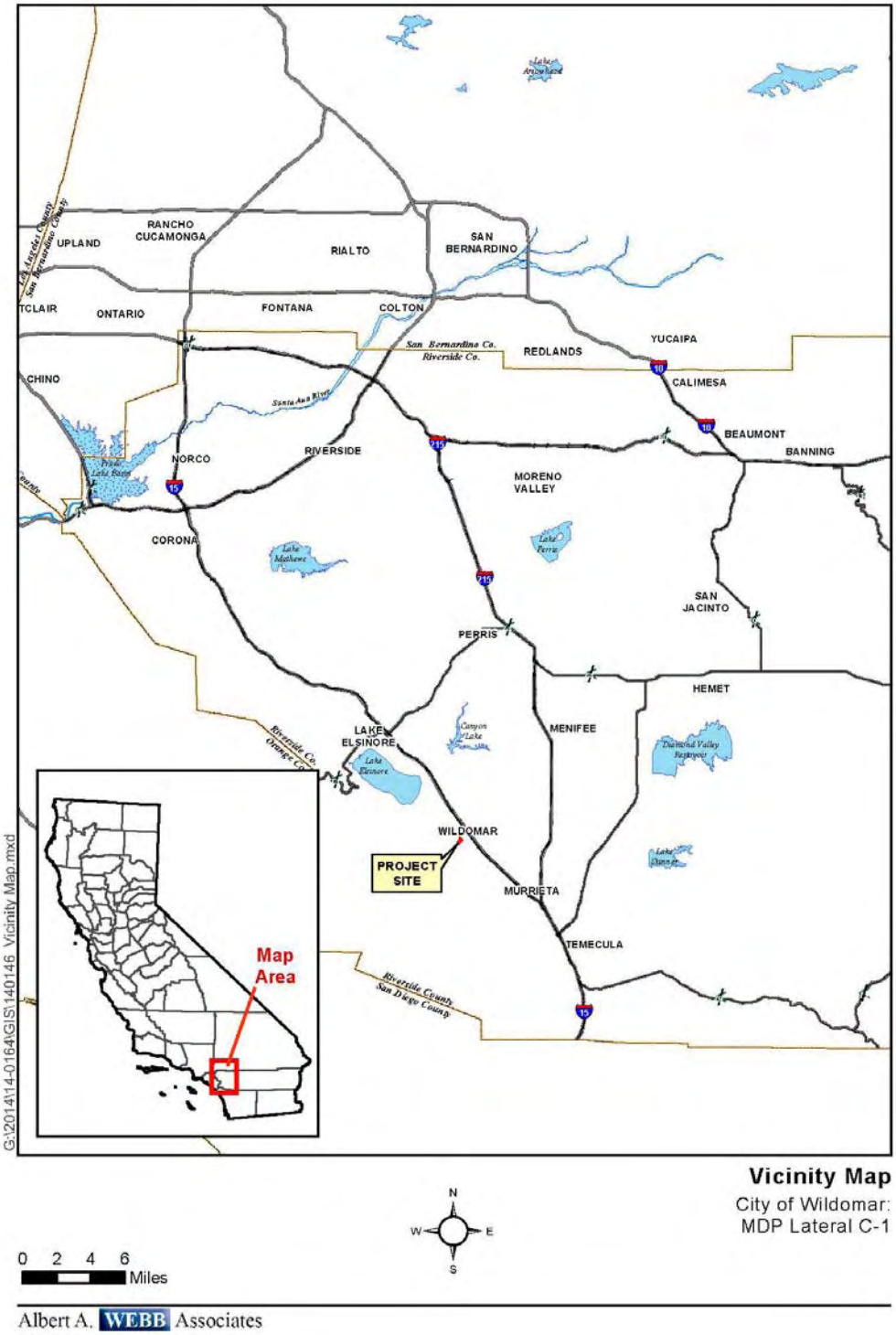
Lateral C-1.2 and Lateral C-1.2a

Lateral C-1.2 connects to Lateral C-1 where Charles Street, Ruth Avenue and Refa Street meet. These small laterals collect flows from Lateral D and Lateral D-1 of Tract 21741 and redirect this runoff to Lateral C-1. Improvement plans of the two existing laterals are included in **Appendix B** of this report for reference.

Laterals CB.1 and Lateral CB.2

Laterals CB.1 and CB.2 are located at the intersection of Washka Lane and Charles Street. Two catch basins are proposed at the northeasterly corner of the intersection to collect nuisance runoff. Lateral CB.1 is connected to the existing outlet of the Woshka Lane Stormdrain and is intended to provide flows to support the downstream riparian area.

Vicinity Map



Methodology

The Riverside County Rational Method, described in the Riverside County Hydrology Manual, was utilized to determine 100-year storm flows. Civil Design Version 7.0 Computer Software Program was utilized to perform the rational method calculations. WSPGW Version 14.06 was used for the hydraulic analysis of the various facilities.

Conclusion

Based upon the results of this report, it is concluded that the proposed facilities will adequately protect the surrounding tributary area from flood damage associated with a 100-Year Storm Event. The proposed facilities, with ultimate development and adequate maintenance, will convey flows safely through the region in accordance with Riverside County Requirements.

SECTION 2 - Hydrology Calculations

Overview

Design flow rates for the various facilities were derived from various sources. **Table 2-1** below references describes from where the flow rates were obtained for each facility

Table 2-1 - Summary of Design Flow Sources

Facility	Source	Comments
Lateral C-1	RCFC&WCD 2014 Study	Flows taken from updated hydrology study prepared by the District. A copy of this study is contained in **Appendix A** of this report.
Lateral C-1A	RCFC&WCD 2014 Study	Flows taken from updated hydrology study prepared by the District. A copy of this study is contained in **Appendix A** of this report. There is a slight modification of flow rates due to the re-routing of Lateral C-1.2
Lateral C-1.1	WEBB – This Section	This section contains an existing conditions rational hydrology study to calculation 100-Year flows that are tributary to Lateral C-1.1
Lateral C-1.2	Line "D" from Tract 21741 Improvement Plans	This facility redirects the Line "D" flows to Lateral C-1. A reference copy of the improvement plans are included in **Appendix B**
Lateral C-1.2a	Line "D-1" from Tract 21741 Improvement Plans	This facility redirects the Line"D-1" flows to Lateral C-1.2 and then to Lateral C-1. A reference copy of the improvement plans are included in **Appendix B**
Lateral CB.1	Assumed design flow (5cfs)	This facility collects nuisance runoff (along with other storm flows) and discharges it to the existing Washka Ln Stormdrain Outlet. Based upon inspection the 100 Year flow rate will not exceed the assumed rate.
Lateral CB-2	Assumed design flow (5cfs)	This facility collects nuisance runoff (along with other storm flows) and discharges it to the existing Washka Ln Stormdrain Outlet. Based upon inspection the 100 Year flow rate will not exceed the assumed rate.

Rational Hydrology Results (CivilD© Output Files)

```
               Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
       Rational Hydrology Study        Date: 10/01/14  File:wILDOMAR.out
----------------------------------------------------------------------
Wildomar Lateral C1A
EXISTING CONDITIONS TO SIZE LATERAL C-1.1
100 year storm event
lg             WO140164              10/1/2014
----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

----------------------------------------------------------------------


Program License Serial Number 4010

----------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.610(In.)
100 year, 1 hour precipitation =  1.470(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.470(In/Hr)
Slope of intensity duration curve = 0.5100




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   646.000(Ft.)
Top (of initial area) elevation =  1263.000(Ft.)
Bottom (of initial area) elevation =  1248.000(Ft.)
Difference in elevation =    15.000(Ft.)
Slope =    0.02322  s(percent)=       2.32
TC = k(0.710)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   20.053 min.
Rainfall intensity =      2.571(In/Hr) for a   100.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.788
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.180
Decimal fraction soil group C = 0.570
Decimal fraction soil group D = 0.250
RI index for soil(AMC 2)  =  78.45
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     18.044(CFS)
Total initial stream area =        8.910(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      120.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1248.000(Ft.)
End of natural channel elevation =   1240.000(Ft.)
Length of natural channel  =   563.000(Ft.)
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Estimated mean flow rate at midpoint of channel =     21.801(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   3.66(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0142
Corrected/adjusted channel slope =  0.0142
Travel time =    2.57 min.     TC =   22.62  min.


 Adding area flow to channel
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.782
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.100
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.100
RI index for soil(AMC 2)  =  78.50
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.418(In/Hr) for a   100.0 year storm
Subarea runoff =      7.013(CFS) for      3.710(Ac.)
Total runoff =     25.057(CFS)        Total area =      12.620(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.620(Ac.)
Runoff from this stream =     25.057(CFS)
Time of concentration =   22.62 min.
Rainfall intensity =     2.418(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      200.000 to Point/Station      210.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   467.000(Ft.)
Top (of initial area) elevation =  1266.000(Ft.)
Bottom (of initial area) elevation =  1254.000(Ft.)
Difference in elevation =    12.000(Ft.)
Slope =    0.02570  s(percent)=       2.57
TC = k(0.710)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.259 min.
Rainfall intensity =      2.775(In/Hr) for a   100.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.797
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.080
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.120
RI index for soil(AMC 2)  =  78.80
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      7.078(CFS)
Total initial stream area =        3.200(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      210.000 to Point/Station      120.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1254.000(Ft.)
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End of natural channel elevation =   1240.000(Ft.)
Length of natural channel  =   555.000(Ft.)
Estimated mean flow rate at midpoint of channel =      9.190(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   3.89(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0252
Corrected/adjusted channel slope =  0.0252
Travel time =    2.38 min.     TC =   19.64  min.


 Adding area flow to channel
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.758
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.430
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  73.30
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.598(In/Hr) for a   100.0 year storm
Subarea runoff =      3.763(CFS) for      1.910(Ac.)
Total runoff =     10.841(CFS)        Total area =       5.110(Ac.)


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Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.110(Ac.)
Runoff from this stream =     10.841(CFS)
Time of concentration =   19.64 min.
Rainfall intensity =     2.598(In/Hr)
Summary of stream data:

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


1       25.057     22.62               2.418
2       10.841     19.64               2.598
Largest stream flow has longer time of concentration
Qp =     25.057 + sum of
          Qb         Ia/Ib
          10.841 *    0.930 =     10.087
Qp =     35.145

Total of 2 main streams to confluence:
Flow rates before confluence point:
      25.057      10.841
Area of streams before confluence:
       12.620        5.110


Results of confluence:
Total flow rate =     35.145(CFS)
Time of concentration =    22.619 min.
Effective stream area after confluence  =     17.730(Ac.)


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Process from Point/Station      120.000 to Point/Station      130.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
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Upstream point elevation =  1240.000(Ft.)
Downstream point elevation =  1236.000(Ft.)
Channel length thru subarea  =   352.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   1.500
Slope or 'Z' of right channel bank =   1.500
Estimated mean flow rate at midpoint of channel =     37.282(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     37.282(CFS)
Depth of flow =   1.450(Ft.), Average velocity =   4.966(Ft/s)
Channel flow top width =    7.351(Ft.)
Flow Velocity =    4.97(Ft/s)
Travel time  =    1.18 min.
Time of concentration =   23.80 min.

Sub-Channel No. 1 Critical depth =      1.344(Ft.)
  '     '       '     Critical flow top width =      7.031(Ft.)
  '     '       '     Critical flow velocity=    5.532(Ft/s)
  '     '       '     Critical flow area =      6.740(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.776
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.100
Decimal fraction soil group C = 0.900
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  78.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.356(In/Hr) for a   100.0 year storm
Subarea runoff =      4.187(CFS) for      2.290(Ac.)
Total runoff =     39.331(CFS)        Total area =      20.020(Ac.)
Depth of flow =   1.491(Ft.), Average velocity =   5.038(Ft/s)

Sub-Channel No. 1 Critical depth =      1.375(Ft.)
  '     '       '     Critical flow top width =      7.125(Ft.)
  '     '       '     Critical flow velocity=    5.650(Ft/s)
  '     '       '     Critical flow area =      6.961(Sq.Ft)

End of computations, total study area =           20.02 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
```

NOAA Atlas 14, Volume 6, Version 2
Location name: Wildomar, California, US*
Latitude: 33.5987°, Longitude: -117.2657°
Elevation: 1230 ft*
* source: Google Maps

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	0.089 (0.075–0.107)	0.120 (0.100–0.144)	0.162 (0.135–0.195)	0.197 (0.163–0.240)	0.247 (0.197–0.312)	0.287 (0.224–0.371)	0.329 (0.250–0.436)	0.373 (0.276–0.510)	0.435 (0.308–0.621)	0.484 (0.330–0.717)
10-min	0.128 (0.107–0.154)	0.171 (0.144–0.207)	0.232 (0.193–0.280)	0.282 (0.234–0.344)	0.354 (0.283–0.447)	0.411 (0.321–0.531)	0.471 (0.359–0.625)	0.535 (0.395–0.730)	0.623 (0.441–0.890)	0.694 (0.473–1.03)
15-min	0.154 (0.129–0.186)	0.207 (0.174–0.250)	0.280 (0.234–0.339)	0.341 (0.283–0.416)	0.428 (0.342–0.541)	0.497 (0.389–0.643)	0.570 (0.434–0.756)	0.647 (0.478–0.883)	0.754 (0.533–1.08)	0.839 (0.573–1.24)
30-min	0.243 (0.204–0.293)	0.327 (0.274–0.394)	0.442 (0.369–0.534)	0.539 (0.446–0.657)	0.675 (0.540–0.854)	0.785 (0.613–1.01)	0.899 (0.685–1.19)	1.02 (0.755–1.39)	1.19 (0.842–1.70)	1.32 (0.904–1.96)
60-min	0.373 (0.313–0.449)	0.501 (0.420–0.604)	0.677 (0.565–0.818)	0.825 (0.683–1.01)	1.03 (0.827–1.31)	1.20 (0.939–1.55)	1.38 (1.05–1.83)	1.56 (1.16–2.13)	1.82 (1.29–2.60)	2.03 (1.38–3.00)
2-hr	0.552 (0.463–0.664)	0.725 (0.607–0.873)	0.960 (0.802–1.16)	1.16 (0.959–1.41)	1.44 (1.15–1.81)	1.66 (1.29–2.14)	1.89 (1.44–2.50)	2.13 (1.57–2.91)	2.46 (1.74–3.51)	2.73 (1.86–4.04)
3-hr	0.678 (0.569–0.816)	0.885 (0.742–1.07)	1.17 (0.974–1.41)	1.40 (1.16–1.71)	1.73 (1.38–2.18)	1.99 (1.56–2.57)	2.26 (1.72–3.00)	2.54 (1.88–3.48)	2.94 (2.08–4.19)	3.24 (2.21–4.80)
6-hr	0.961 (0.806–1.16)	1.25 (1.05–1.51)	1.64 (1.37–1.99)	1.97 (1.63–2.40)	2.42 (1.94–3.06)	2.78 (2.17–3.59)	3.14 (2.39–4.16)	3.52 (2.60–4.81)	4.05 (2.86–5.78)	4.46 (3.04–6.60)
12-hr	1.26 (1.06–1.52)	1.68 (1.40–2.02)	2.22 (1.86–2.69)	2.67 (2.21–3.26)	3.29 (2.63–4.15)	3.76 (2.94–4.86)	4.25 (3.23–5.63)	4.74 (3.51–6.48)	5.42 (3.83–7.73)	5.94 (4.05–8.79)
24-hr	1.67 (1.48–1.93)	2.29 (2.02–2.64)	3.09 (2.72–3.58)	3.75 (3.27–4.38)	4.63 (3.92–5.58)	5.31 (4.40–6.53)	5.99 (4.86–7.55)	6.70 (5.28–8.66)	7.65 (5.79–10.3)	8.37 (6.14–11.7)
2-day	2.00 (1.76–2.31)	2.82 (2.49–3.25)	3.90 (3.43–4.51)	4.78 (4.17–5.58)	5.98 (5.06–7.21)	6.91 (5.73–8.50)	7.86 (6.37–9.90)	8.84 (6.97–11.4)	10.2 (7.71–13.7)	11.2 (8.23–15.6)
3-day	2.16 (1.91–2.49)	3.09 (2.73–3.58)	4.34 (3.82–5.03)	5.37 (4.69–6.27)	6.79 (5.74–8.19)	7.89 (6.55–9.71)	9.03 (7.32–11.4)	10.2 (8.07–13.2)	11.9 (9.00–16.0)	13.2 (9.67–18.4)
4-day	2.32 (2.05–2.68)	3.36 (2.96–3.88)	4.75 (4.18–5.50)	5.90 (5.16–6.90)	7.50 (6.35–9.05)	8.76 (7.26–10.8)	10.1 (8.15–12.7)	11.4 (9.02–14.8)	13.3 (10.1–18.0)	14.9 (10.9–20.7)
7-day	2.63 (2.33–3.04)	3.84 (3.39–4.43)	5.47 (4.82–6.34)	6.84 (5.97–7.99)	8.76 (7.41–10.6)	10.3 (8.53–12.7)	11.9 (9.62–15.0)	13.6 (10.7–17.5)	15.9 (12.1–21.4)	17.8 (13.1–24.8)
10-day	2.78 (2.46–3.21)	4.07 (3.59–4.70)	5.83 (5.13–6.75)	7.31 (6.39–8.54)	9.42 (7.97–11.4)	11.1 (9.20–13.6)	12.9 (10.4–16.2)	14.7 (11.6–19.1)	17.4 (13.2–23.4)	19.5 (14.3–27.2)
20-day	3.27 (2.89–3.77)	4.83 (4.26–5.58)	7.02 (6.18–8.14)	8.90 (7.77–10.4)	11.6 (9.82–14.0)	13.8 (11.4–17.0)	16.1 (13.1–20.3)	18.7 (14.7–24.1)	22.2 (16.8–29.9)	25.1 (18.4–35.0)
30-day	3.84 (3.40–4.44)	5.68 (5.01–6.56)	8.28 (7.29–9.60)	10.5 (9.21–12.3)	13.8 (11.7–16.7)	16.5 (13.7–20.4)	19.4 (15.7–24.5)	22.6 (17.8–29.2)	27.1 (20.5–36.4)	30.7 (22.5–42.8)
45-day	4.42 (3.91–5.11)	6.51 (5.75–7.53)	9.51 (8.37–11.0)	12.1 (10.6–14.2)	16.0 (13.6–19.3)	19.3 (16.0–23.7)	22.8 (18.4–28.7)	26.5 (20.9–34.3)	32.0 (24.3–43.1)	36.5 (26.8–50.9)
60-day	5.06 (4.48–5.85)	7.38 (6.52–8.54)	10.8 (9.47–12.5)	13.7 (12.0–16.1)	18.2 (15.4–21.9)	21.9 (18.2–27.0)	25.9 (21.0–32.7)	30.3 (23.9–39.3)	36.8 (27.9–49.5)	42.1 (30.9–58.6)

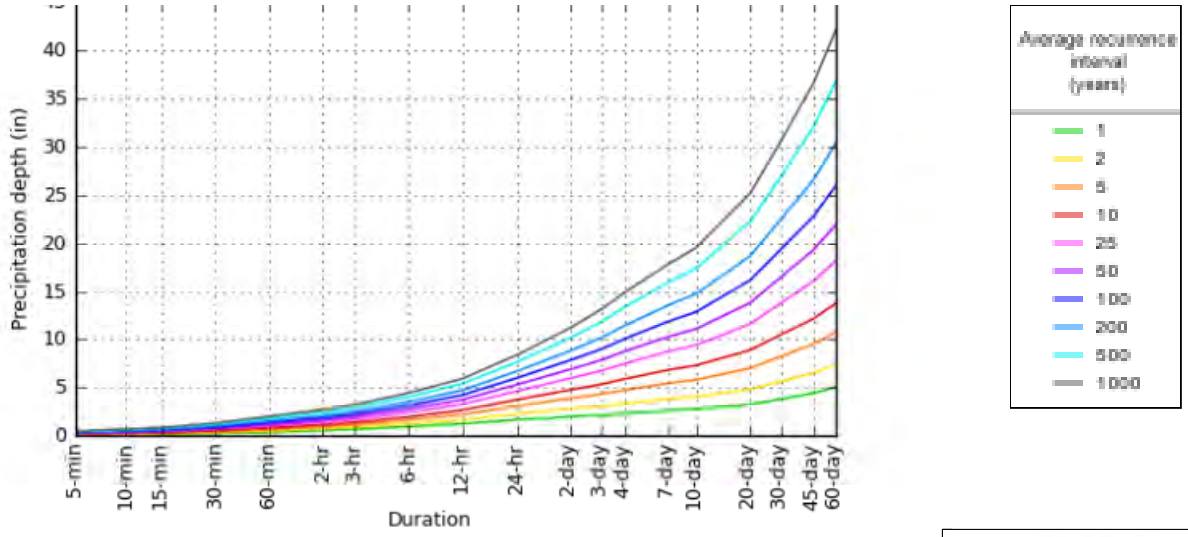
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

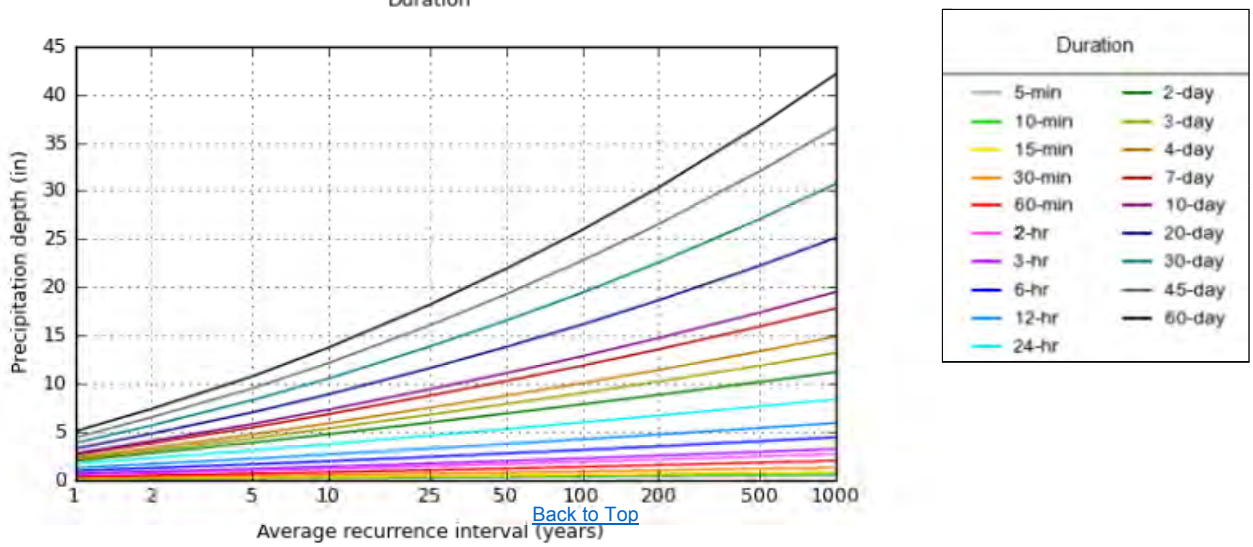
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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.

Back to Top

PF graphical





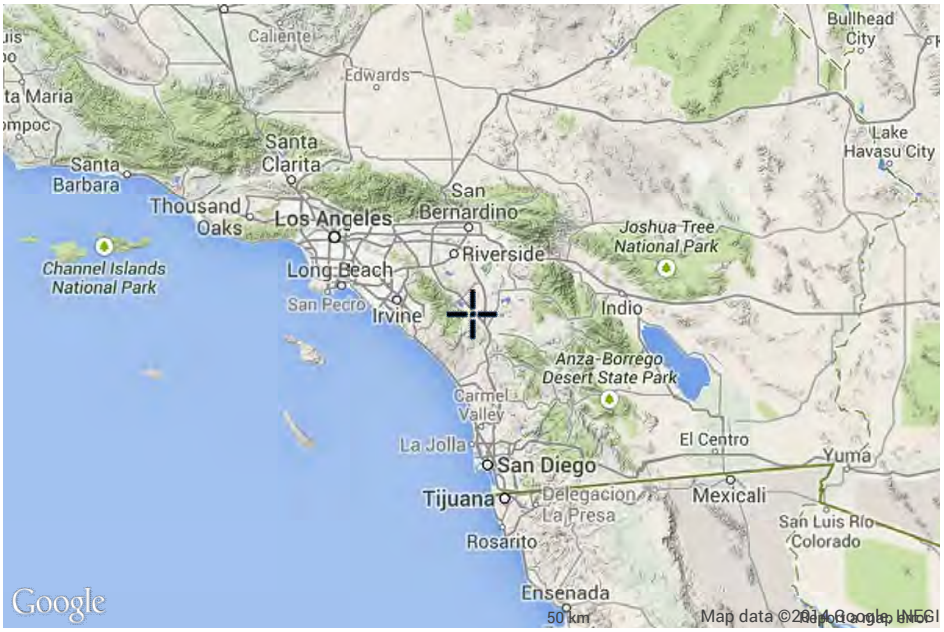
Back to Top

Maps & aerials

NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Aug 15 21:16:08 2014

Small scale terrain



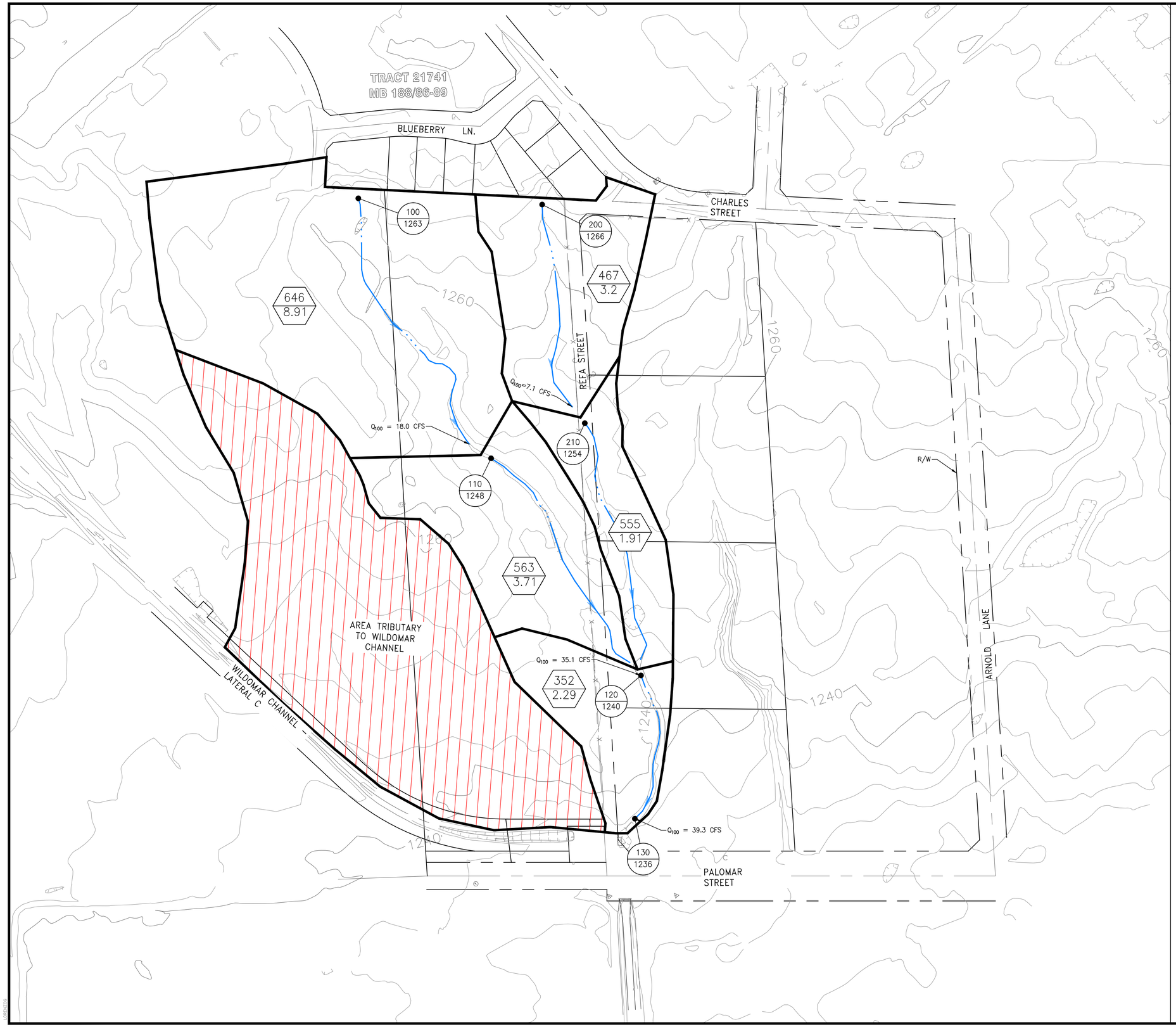
Large scale terrain

Large scale map

Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910



LEGEND

SUBAREA FLOW LENGTH — XXX
SUBAREA AREA, AC — X.X
—SUBAREA ID

NODE ID — ###
NODE ELEVATION — XXXX.X
—NODE ID

—SUBAREA BOUNDARY

—FLOWPATH

N E S W

1" = 100'
50 0 100

WILDOMAR LATERAL C-1 STORM DRAIN
HYDROLOGY EXHIBIT

100-YEAR STORM EVENT

SCALE: 1"=100'	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA. 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O.
DATE: 9/02/2014			SHEET 1
DESIGNED:			OF 1 SHEETS
CHECKED:			DWG. NO.
PLN CK REF:			
F.B.			

L:\DRN\700

G:\2014\14-0164\HYD\14-0164-C-HYD.dwg 10/1/2014 10:17:51 AM

SECTION 3 - Hydraulic Calculations

Overview

WSPG was used to size and analyze the various storm drain facilities. Copies of each model are included in this section. **Table 3-1** summarizes how the initial water surface elevations were obtained for each model.

Table 3-1 - Summary of Initial Water Surface Elevations

Facility	Initial Water Surface Elevation	Comments
Lateral C-1	1224.50	Water Surface Elevation from Lateral C Hydraulic Model
Lateral C-1A	1262.20	From Lateral C-1 Model
Lateral C-1.1	(CC needs to fill in this line	
Lateral C-1.2	1263.32	From Lateral C-1 Model
Lateral C-1.2a	1268.8	From Lateral C-1.2 Model
Lateral CB.1	1262.25	Invert
Lateral CB-2	1265.12	From CB-1

WSPG Calculations

Lateral C-1

```
T1 Wildomar MDP - Lateral C-1                                                0
T2 Updated RCFC&WCD Flow Rates
T3 jcc 17SEP2014
SO   1000.0001222.360  1                          1227.800
JX   1010.0001223.500  2  4   .014   35.000         1224.500         45.0         .000
R    1069.6501224.370  2      .013                                -37.973    .000 0
R    1113.4701225.010  2      .013                                 27.898    .000 0
R    1490.0001230.500  2      .013                                   .000    .000 0
JX   1500.0001231.200  5  6   .013   25.000         1232.000        -45.0         .000
R    2100.8001243.140  5      .013                                   .000    .000 0
R    2371.3401246.930  5      .013                                   .000    .000 0
JX   2394.0301249.270  7  8   .014  315.000         1249.300        -15.0         .000
WX   2394.0301249.270  9
R    2425.7801252.440  9      .013                                 80.857    .000 0
R    2599.9501257.360  9      .013                                   .000    .000 0
R    2622.7801258.000  9      .013                                  4.361    .000 0
R    2740.9101259.310  9      .013                                   .000    .000 0
R    2758.0401259.500  9      .013                                -21.806    .000 0
R    2772.1701259.660  9      .013                                   .000    .000 0
R    2790.0401259.730  9      .013                                   .000    .000 0
R    2849.9001259.970  9      .013                                -68.594    .000 0
R    3000.0001260.570  9      .013                                   .000    .000 0
WE   3000.0001260.570 10      .500
R    3005.0001260.590 10      .014                                   .000
SH   3005.0001260.590 10                          1260.590
CD   1  3   0    .000   5.000    9.000  .000  .000   .00
CD   2  4   1    .000   7.500     .000  .000  .000   .00
CD   3  4   1    .000   7.500     .000  .000  .000   .00
CD   4  4   1    .000   3.000     .000  .000  .000   .00
CD   5  4   1    .000   7.000     .000  .000  .000   .00
CD   6  4   1    .000   3.000     .000  .000  .000   .00
CD   7  3   0    .000   7.000    7.000  .000  .000   .00
CD   8  4   1    .000   6.000     .000  .000  .000   .00
CD   9  4   1    .000   7.000     .000  .000  .000   .00
CD  10  2   0    .000  90.000   10.000  .000  .000   .00
Q           545.000   .0
```

```
FILE: LatC1.WSW                          W S P G W  - EDIT LISTING - Version 14.06              Date: 9-17-2014  Time:11:36:21
                                   WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    3      0     .000    5.000    9.000    .000   .000    .00
 CD      2    4      1             7.500
 CD      3    4      1             7.500
 CD      4    4      1             3.000
 CD      5    4      1             7.000
 CD      6    4      1             3.000
 CD      7    3      0     .000    7.000    7.000    .000   .000    .00
 CD      8    4      1             6.000
 CD      9    4      1             7.000
 CD     10    2      0     .000   90.000   10.000                   .00
                                          W S P G W                                                          PAGE NO   1
                          WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                            Wildomar MDP - Lateral C-1
HEADING LINE NO 2 IS -
                            Updated RCFC&WCD Flow Rates
HEADING LINE NO 3 IS -
                            jcc 17SEP2014
                                          W S P G W                                                          PAGE NO   2
                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                     U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                1000.000 1222.360    1                                      1227.800
 ELEMENT NO   2 IS A JUNCTION          *         *     *     *                 *                  *               *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                                1010.000 1223.500    2     4     0   .014    35.000      .000  1224.500      .000  45.000     .000
                                                                                                  RADIUS    ANGLE
                                                                                                    .000     .000
 ELEMENT NO   3 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                           RADIUS    ANGLE     ANG PT  MAN H
                                1069.650 1224.370    2              .013                          90.003  -37.973      .000     0
 ELEMENT NO   4 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                           RADIUS    ANGLE     ANG PT  MAN H
                                1113.470 1225.010    2              .013                          89.996   27.898      .000     0
 ELEMENT NO   5 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                           RADIUS    ANGLE     ANG PT  MAN H
                                1490.000 1230.500    2              .013                           .000     .000      .000     0
 ELEMENT NO   6 IS A JUNCTION          *         *     *     *                 *                  *               *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                                1500.000 1231.200    5     6     0   .013    25.000      .000  1232.000      .000 -45.000     .000
                                                                                                  RADIUS    ANGLE
                                                                                                    .000     .000
 ELEMENT NO   7 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                           RADIUS    ANGLE     ANG PT  MAN H
                                2100.800 1243.140    5              .013                           .000     .000      .000     0
```

```
ELEMENT NO   8 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2371.340 1246.930    5             .013                           .000     .000      .000     0
ELEMENT NO   9 IS A JUNCTION         *         *     *     *                *                   *                *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                             2394.030 1249.270    7     8     0   .014   315.000      .000  1249.300      .000 -15.000     .000
                                                                                                RADIUS    ANGLE
                                                                                                  .000     .000
                                                W S P G W                                                                PAGE NO   3
                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
ELEMENT NO  10 IS A  WALL  EXIT                      *
                  U/S DATA   STATION    INVERT  SECT
                             2394.030 1249.270    9
ELEMENT NO  11 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2425.780 1252.440    9             .013                         22.498   80.857      .000     0
ELEMENT NO  12 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2599.950 1257.360    9             .013                           .000     .000      .000     0
ELEMENT NO  13 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2622.780 1258.000    9             .013                        299.947    4.361      .000     0
ELEMENT NO  14 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2740.910 1259.310    9             .013                           .000     .000      .000     0
ELEMENT NO  15 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2758.040 1259.500    9             .013                         45.010  -21.806      .000     0
ELEMENT NO  16 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2772.170 1259.660    9             .013                           .000     .000      .000     0
ELEMENT NO  17 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2790.040 1259.730    9             .013                           .000     .000      .000     0
ELEMENT NO  18 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             2849.900 1259.970    9             .013                         50.000  -68.594      .000     0
ELEMENT NO  19 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             3000.000 1260.570    9             .013                           .000     .000      .000     0
ELEMENT NO  20 IS A  WALL  ENTRANCE                  *
                  U/S DATA   STATION    INVERT  SECT             FP
                             3000.000 1260.570   10             .500
ELEMENT NO  21 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             3005.000 1260.590   10             .014                           .000     .000      .000     0
ELEMENT NO  22 IS A SYSTEM HEADWORKS                 *                     *
                  U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                             3005.000 1260.590   10                                  1260.590
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Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-17-2014 Time:11:36:23

Wildomar MDP - Lateral C-1
Updated RCFC&WCD Flow Rates
jcc 17SEP2014

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
						---------- WARNING - Junction Analysis - Large Lateral Flow(s)----------								
1000.000	1222.360	3.743	1226.103	920.00	27.31	11.58	1237.69	.00	5.00	9.00	5.000	9.000	.00	0 .0
JUNCT STR	.1140					.0218	.22	5.00	2.49		.014	.00	.00	BOX
						---------- WARNING - Junction Analysis - Change in Channel Type ----------								
1010.000	1223.500	5.688	1229.188	885.00	24.62	9.41	1238.60	1.34	7.11	6.42	7.500	.000	.00	1 .0
59.650	.0146					.0157	.93	7.03	1.83	5.86	.013	.00	.00	PIPE
1069.650	1224.370	5.662	1230.032	885.00	24.74	9.50	1239.53	1.36	7.11	6.45	7.500	.000	.00	1 .0
43.820	.0146					.0158	.69	7.02	1.85	5.86	.013	.00	.00	PIPE
1113.470	1225.010	5.640	1230.650	885.00	24.83	9.58	1240.23	.00	7.11	6.48	7.500	.000	.00	1 .0
98.799	.0146					.0161	1.59	5.64	1.87	5.86	.013	.00	.00	PIPE
1212.269	1226.451	5.582	1232.033	885.00	25.10	9.78	1241.81	.00	7.11	6.54	7.500	.000	.00	1 .0
277.731	.0146					.0172	4.78	5.58	1.91	5.86	.013	.00	.00	PIPE
1490.000	1230.500	5.336	1235.836	885.00	26.32	10.76	1246.60	.00	7.11	6.80	7.500	.000	.00	1 .0
JUNCT STR	.0700					.0186	.19	5.34	2.09		.013	.00	.00	PIPE
1500.000	1231.200	5.604	1236.804	860.00	26.04	10.53	1247.33	.00	6.79	5.59	7.000	.000	.00	1 .0
10.369	.0199					.0189	.20	5.60	1.89	5.47	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-17-2014 Time:11:36:23

Wildomar MDP - Lateral C-1
Updated RCFC&WCD Flow Rates
jcc 17SEP2014

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
1510.369	1231.406	5.608	1237.014	860.00	26.02	10.51	1247.53	.00	6.79	5.59	7.000	.000	.00	1 .0
362.980	.0199					.0181	6.56	5.61	1.89	5.47	.013	.00	.00	PIPE
1873.349	1238.620	5.910	1244.530	860.00	24.81	9.56	1254.09	.00	6.79	5.08	7.000	.000	.00	1 .0
156.402	.0199					.0166	2.60	5.91	1.67	5.47	.013	.00	.00	PIPE
2029.751	1241.728	6.271	1247.999	860.00	23.65	8.69	1256.69	.00	6.79	4.28	7.000	.000	.00	1 .0
71.049	.0199					.0160	1.14	6.27	1.43	5.47	.013	.00	.00	PIPE
2100.800	1243.140	6.785	1249.925	860.00	22.55	7.90	1257.82	.00	6.79	2.42	7.000	.000	.00	1 .0
26.587	.0140					.0167	.45	6.79	1.00	7.00	.013	.00	.00	PIPE
2127.387	1243.512	7.000	1250.512	860.00	22.35	7.75	1258.27	.00	6.79	.00	7.000	.000	.00	1 .0
243.953	.0140					.0178	4.35	7.00	.00	7.00	.013	.00	.00	PIPE
2371.340	1246.930	8.003	1254.934	860.00	22.35	7.75	1262.69	.00	6.79	.00	7.000	.000	.00	1 .0
JUNCT STR	.1031					.0052	.12	8.00	.00		.014	.00	.00	PIPE
---------- WARNING - Junction Analysis - Change in Channel Type ----------														
2394.030	1249.270	12.895	1262.165	545.00	11.12	1.92	1264.09	.00	5.73	7.00	7.000	7.000	.00	0 .0
WALL EXIT														
2394.030	1249.270	12.895	1262.165	545.00	14.16	3.11	1265.28	.00	6.05	.00	7.000	.000	.00	1 .0
31.750	.0998					.0073	.23	.00	.00	2.48	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-17-2014 Time:11:36:23

Wildomar MDP - Lateral C-1
Updated RCFC&WCD Flow Rates
jcc 17SEP2014

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
2425.780	1252.440	10.547	1262.987	545.00	14.16	3.11	1266.10	.00	6.05	.00	7.000	.000	.00	1 .0
132.250	.0282					.0073	.96	10.55	.00	3.53	.013	.00	.00	PIPE
2558.030	1256.176	7.774	1263.949	545.00	14.16	3.11	1267.06	.00	6.05	.00	7.000	.000	.00	1 .0
HYDRAULIC JUMP														
2558.030	1256.176	4.499	1260.675	545.00	20.85	6.75	1267.43	.00	6.05	6.71	7.000	.000	.00	1 .0
19.787	.0282					.0126	.25	4.50	1.86	3.53	.013	.00	.00	PIPE
2577.816	1256.735	4.632	1261.367	545.00	20.16	6.31	1267.68	.00	6.05	6.62	7.000	.000	.00	1 .0
22.134	.0282					.0114	.25	4.63	1.76	3.53	.013	.00	.00	PIPE
2599.950	1257.360	4.834	1262.194	545.00	19.23	5.74	1267.93	.25	6.05	6.47	7.000	.000	.00	1 .0
7.721	.0280					.0105	.08	5.08	1.62	3.54	.013	.00	.00	PIPE
2607.671	1257.576	4.922	1262.499	545.00	18.85	5.52	1268.01	.24	6.05	6.40	7.000	.000	.00	1 .0
15.109	.0280					.0097	.15	5.16	1.56	3.54	.013	.00	.00	PIPE
2622.780	1258.000	5.147	1263.147	545.00	17.97	5.01	1268.16	.00	6.05	6.18	7.000	.000	.00	1 .0
58.551	.0111					.0089	.52	5.15	1.43	4.78	.013	.00	.00	PIPE
2681.331	1258.649	5.283	1263.932	545.00	17.49	4.75	1268.68	.00	6.05	6.02	7.000	.000	.00	1 .0
59.579	.0111					.0082	.49	5.28	1.36	4.78	.013	.00	.00	PIPE
2740.910	1259.310	5.543	1264.853	545.00	16.68	4.32	1269.17	1.09	6.05	5.68	7.000	.000	.00	1 .0
17.130	.0111					.0076	.13	6.63	1.23	4.78	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-17-2014 Time:11:36:23

Wildomar MDP - Lateral C-1
Updated RCFC&WCD Flow Rates
jcc 17SEP2014

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
2758.040	1259.500	5.685	1265.185	545.00	16.28	4.12	1269.30	.00	6.05	5.47	7.000	.000	.00	1 .0
3.559	.0113					.0073	.03	5.68	1.16	4.74	.013	.00	.00	PIPE
2761.599	1259.540	5.728	1265.268	545.00	16.17	4.06	1269.33	.00	6.05	5.40	7.000	.000	.00	1 .0
10.571	.0113					.0070	.07	5.73	1.14	4.74	.013	.00	.00	PIPE
2772.170	1259.660	6.052	1265.712	545.00	15.41	3.69	1269.40	.00	6.05	4.79	7.000	.000	.00	1 .0
17.870	.0039					.0065	.12	6.05	1.00	7.00	.013	.00	.00	PIPE
2790.040	1259.730	6.390	1266.120	545.00	14.79	3.40	1269.52	.27	6.05	3.95	7.000	.000	.00	1 .0
59.860	.0040					.0063	.38	6.66	.85	7.00	.013	.00	.00	PIPE
2849.900	1259.970	6.734	1266.704	545.00	14.34	3.19	1269.90	.00	6.05	2.68	7.000	.000	.00	1 .0
69.293	.0040					.0067	.46	6.73	.67	7.00	.013	.00	.00	PIPE
2919.193	1260.247	7.000	1267.247	545.00	14.16	3.11	1270.36	.00	6.05	.00	7.000	.000	.00	1 .0
80.807	.0040					.0072	.58	7.00	.00	7.00	.013	.00	.00	PIPE
3000.000	1260.570	7.265	1267.835	545.00	14.16	3.11	1270.95	.00	6.05	.00	7.000	.000	.00	1 .0
WALL	ENTRANCE													
3000.000	1260.570	11.403	1271.973	545.00	4.78	.35	1272.33	.00	4.52	10.00	90.000	10.000	.00	0 .0
5.000	.0040					.0004	.00	11.40	.25	4.55	.014	.00	.00	RECTANG
3005.000	1260.590	11.384	1271.974	545.00	4.79	.36	1272.33	.00	4.52	10.00	90.000	10.000	.00	0 .0

Lateral C-1A

```
T1 Wildomar MDP                                                                0
T2 Lateral C-1 A - Updated RCFC&WCD Flows (less 15 cfs/ relocated outlet)
T3 jcc 30SEP2014
SO   1022.2701249.700  1                          1262.200
R    1032.1301250.780  1      .013                                  .000    .000 0
R    1060.5101253.860  1      .013                                -72.783    .000 0
R    1424.3801258.480  1      .013                                  .000    .000 0
R    1460.4901258.940  1      .013                                 22.984    .000 0
R    1503.2801259.480  1      .013                                  .000    .000 0
R    1522.2301259.720  1      .013                                -12.066    .000 0
R    1550.0001260.080  1      .013                                  .000    .000 0
TS   1573.4301262.370  2      .014                                  .000
WX   1573.4301262.370  3
R    1600.0001262.480  3      .013                                  .000    .000 0
WE   1600.0001262.480  4      .500
R    1605.0001262.500  4      .014                                  .000
SH   1605.0001262.500  4                          1262.500
CD   1  4   1    .000   6.000     .000  .000  .000   .00
CD   2  3   0    .000   6.000   14.000  .000  .000   .00
CD   3  4   2    .000   5.000     .000  .000  .000   .00
CD   4  2   0    .000  99.000   99.000  .000  .000   .00
Q           335.000   .0
```

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FILE: LatC1a.WSW                          W S P G W  - EDIT LISTING - Version 14.06              Date: 9-30-2014  Time: 5:34:50
                                     WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                              PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4      1            6.000
 CD      2    3      0     .000   6.000   14.000    .000   .000    .00
 CD      3    4      2            5.000
 CD      4    2      0     .000  99.000   99.000                   .00
                                          W S P G W                                                          PAGE NO   1
                           WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                             Wildomar MDP
HEADING LINE NO 2 IS -
                             Lateral C-1 A - Updated RCFC&WCD Flows (less 15 cfs/ relocated outlet)
HEADING LINE NO 3 IS -
                             jcc 30SEP2014
                                          W S P G W                                                          PAGE NO   2
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               1022.270 1249.700    1                                      1262.200
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1032.130 1250.780    1              .013                           .000     .000      .000     0
 ELEMENT NO   3 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1060.510 1253.860    1              .013                         22.341  -72.783      .000     0
 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1424.380 1258.480    1              .013                           .000     .000      .000     0
 ELEMENT NO   5 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1460.490 1258.940    1              .013                         90.017   22.984      .000     0
 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1503.280 1259.480    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
                               1522.230 1259.720    1              .013                         89.984  -12.066      .000     0
 ELEMENT NO   8 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1550.000 1260.080    1              .013                           .000     .000      .000     0
 ELEMENT NO   9 IS A TRANSITION        *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS   ANGLE
                               1573.430 1262.370    2              .014                           .000     .000
 ELEMENT NO  10 IS A  WALL  EXIT                     *
                    U/S DATA   STATION    INVERT  SECT
                               1573.430 1262.370    3
 ELEMENT NO  11 IS A REACH             *         *     *
```

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                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             1600.000 1262.480    3              .013                           .000     .000      .000     0
ELEMENT NO  12 IS A  WALL  ENTRANCE                  *
                  U/S DATA   STATION    INVERT  SECT             FP
                             1600.000 1262.480    4              .500
ELEMENT NO  13 IS A REACH            *         *     *
                  U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                             1605.000 1262.500    4              .014                           .000     .000      .000     0
ELEMENT NO  14 IS A SYSTEM HEADWORKS                 *                     *
                  U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                             1605.000 1262.500    4                                   1262.500
                                                    W S P G W                                                          PAGE NO   3
                         WATER SURFACE PROFILE - ELEMENT CARD LISTING
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Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-30-2014 Time: 5:34:52

Wildomar MDP
Lateral C-1 A - Updated RCFC&WCD Flows (less 15 cfs/ relocated outlet)
jcc 30SEP2014

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
1022.270	1249.700	12.500	1262.200	335.00	11.85	2.18	1264.38	.00	4.97	.00	6.000	.000	.00	1 .0
9.860	.1095					.0063	.06	12.50	.00	2.00	.013	.00	.00	PIPE
1032.130	1250.780	11.482	1262.262	335.00	11.85	2.18	1264.44	.00	4.97	.00	6.000	.000	.00	1 .0
28.380	.1085					.0063	.18	.00	.00	2.00	.013	.00	.00	PIPE
1060.510	1253.860	8.971	1262.831	335.00	11.85	2.18	1265.01	.00	4.97	.00	6.000	.000	.00	1 .0
363.870	.0127					.0063	2.28	8.97	.00	3.71	.013	.00	.00	PIPE
1424.380	1258.480	6.628	1265.108	335.00	11.85	2.18	1267.29	.00	4.97	.00	6.000	.000	.00	1 .0
36.110	.0127					.0063	.23	.00	.00	3.70	.013	.00	.00	PIPE
1460.490	1258.940	6.614	1265.554	335.00	11.85	2.18	1267.73	.00	4.97	.00	6.000	.000	.00	1 .0
42.790	.0126					.0063	.27	6.61	.00	3.71	.013	.00	.00	PIPE
1503.280	1259.480	6.342	1265.822	335.00	11.85	2.18	1268.00	.00	4.97	.00	6.000	.000	.00	1 .0
18.950	.0127					.0063	.12	.00	.00	3.71	.013	.00	.00	PIPE
1522.230	1259.720	6.380	1266.100	335.00	11.85	2.18	1268.28	.00	4.97	.00	6.000	.000	.00	1 .0
27.770	.0130					.0063	.17	6.38	.00	3.68	.013	.00	.00	PIPE
1550.000	1260.080	6.194	1266.274	335.00	11.85	2.18	1268.45	.00	4.97	.00	6.000	.000	.00	1 .0
TRANS STR	.0977					.0005	.01	6.19	.00		.014	.00	.00	PIPE
1573.430	1262.370	6.319	1268.689	335.00	3.99	.25	1268.94	.00	2.61	14.00	6.000	14.000	.00	0 .0
WALL EXIT														

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 9-30-2014 Time: 5:34:52

Wildomar MDP
Lateral C-1 A - Updated RCFC&WCD Flows (less 15 cfs/ relocated outlet)
jcc 30SEP2014

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
1573.430	1262.370	6.320	1268.690	335.00	8.53	1.13	1269.82	.00	3.71	.00	5.000	.000	.00	2 .0
26.570	.0041					.0041	.11	6.32	.00	4.10	.013	.00	.00	PIPE
1600.000	1262.480	6.320	1268.800	335.00	8.53	1.13	1269.93	.00	3.71	.00	5.000	.000	.00	2 .0
WALL ENTRANCE														
1600.000	1262.480	8.010	1270.490	335.00	.42	.00	1270.49	.00	.71	99.00	99.000	99.000	.00	0 .0
5.000	.0040					.0000	.00	8.01	.03	.67	.014	.00	.00	RECTANG
1605.000	1262.500	7.990	1270.490	335.00	.42	.00	1270.49	.00	.71	99.00	99.000	99.000	.00	0 .0

Lateral C-1.1

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T1 Wildomar MDP   - Lateral C-1.1                                          0
T2 Flow Rates from Rational Hydrology
T3 crc 3oct2014
SO   1003.6801226.270  1                          1229.420
R    1015.0501226.380  1      .013                                  .000    .000 0
WE   1015.0501226.380  4      .500
R    1018.0501226.480  4      .014                                  .000
SH   1018.0501226.480  4                          1226.480
CD   1  4   1    .000   2.500     .000  .000  .000   .00
CD   2  4   1    .000   1.500     .000  .000  .000   .00
CD   3  4   1    .000   1.500     .000  .000  .000   .00
CD   4  2   0    .000   8.600    7.000  .000  .000   .00
Q            39.300   .0
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FILE: LATC11.WSW                          W S P G W  - EDIT LISTING - Version 14.06              Date:10- 3-2014  Time:11:32:57
                                     WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                PAGE    1
  CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4      1            2.500
  CD      2    4      1            1.500
  CD      3    4      1            1.500
  CD      4    2      0     .000    8.600    7.000                   .00
                                          W S P G W                                                          PAGE NO   1
                            WATER SURFACE PROFILE - TITLE CARD LISTING
 HEADING LINE NO 1 IS -
                              Wildomar MDP   - Lateral C-1.1
 HEADING LINE NO 2 IS -
                              Flow Rates from Rational Hydrology
 HEADING LINE NO 3 IS -
                              crc 3oct2014
                                          W S P G W                                                          PAGE NO   2
                            WATER SURFACE PROFILE - ELEMENT CARD LISTING
  ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                       U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                  1003.680 1226.270    1                                      1229.420
  ELEMENT NO   2 IS A REACH             *         *     *
                       U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                                  1015.050 1226.380    1             .013                          .000     .000      .000     0
  ELEMENT NO   3 IS A  WALL  ENTRANCE                  *
                       U/S DATA   STATION    INVERT  SECT             FP
                                  1015.050 1226.380    4             .500
  ELEMENT NO   4 IS A REACH             *         *     *
                       U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                                  1018.050 1226.480    4             .014                          .000     .000      .000     0
  ELEMENT NO   5 IS A SYSTEM HEADWORKS                 *                       *
                       U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                  1018.050 1226.480    4                                     1226.48
```

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 3-2014 Time:11:32:58

Wildomar MDP - Lateral C-1.1
Flow Rates from Rational Hydrology
crc 3oct2014

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
1003.680	1226.270	3.150	1229.420	39.30	8.01	1.00	1230.42	.00	2.11	.00	2.500	.000	.00	1 .0
11.370	.0097					.0092	.10	3.15	.00	1.99	.013	.00	.00	PIPE
1015.050	1226.380	3.144	1229.524	39.30	8.01	1.00	1230.52	.00	2.11	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1015.050	1226.380	4.602	1230.982	39.30	1.22	.02	1231.01	.00	.99	7.00	8.600	7.000	.00	0 .0
3.000	.0333					.0001	.00	4.60	.10	.50	.014	.00	.00	RECTANG
1018.050	1226.480	4.502	1230.982	39.30	1.25	.02	1231.01	.00	.99	7.00	8.600	7.000	.00	0 .0

Lateral C-1.2

```
T1 Wildomar MDP   - Lateral C-1.2                                                0
T2 Flow Rates from Tract 21741 Improvement Plans
T3 jcc 2Oct2014
SO   1004.4601258.000  1                          1263.320
R    1036.3601259.230  1      .013                                  .000    .000 0
R    1100.4301261.700  1      .013                                -81.577    .000 0
JX   1105.4301261.900  3  2   .013    5.600         1261.820        -80.0          .936
R    1127.6001262.750  3      .013                                 4.151    .000 0
R    1181.7301264.840  3      .013                                  .000    .000 0
R    1206.6501265.800  3      .013                                31.729    .000 0
R    1249.4601266.100  3      .013                                  .000    .000 0
WE   1249.4601266.100  4      .500
R    1252.0001266.118  4      .014                                  .000
SH   1252.0001266.118  4                          1266.118
CD   1  4   1    .000   1.500     .000  .000  .000   .00
CD   2  4   1    .000   1.500     .000  .000  .000   .00
CD   3  4   1    .000   1.500     .000  .000  .000   .00
CD   4  2   0    .000  10.000    7.000  .000  .000   .00
Q            13.600   .0
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FILE: LatC12.WSW                          W S P G W  - EDIT LISTING - Version 14.06              Date:10- 2-2014  Time:11:47:54
                                     WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                              PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4      1            1.500
 CD      2    4      1            1.500
 CD      3    4      1            1.500
 CD      4    2      0     .000  10.000    7.000                  .00
                                          W S P G W                                                          PAGE NO   1
                           WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                             Wildomar MDP   - Lateral C-1.2
HEADING LINE NO 2 IS -
                             Flow Rates from Tract 21741 Improvement Plans
HEADING LINE NO 3 IS -
                             jcc 2Oct2014
                                          W S P G W                                                          PAGE NO   2
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               1004.460 1258.000    1                                      1263.320
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1036.360 1259.230    1              .013                           .000     .000      .000     0
 ELEMENT NO   3 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1100.430 1261.700    1              .013                         45.000  -81.577      .000     0
 ELEMENT NO   4 IS A JUNCTION          *         *     *     *                 *                  *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                               1105.430 1261.900    3     2     0   .013     5.600      .000  1261.820      .000 -80.000     .000
                                                                                                RADIUS    ANGLE
                                                                                               306.067    .936
 ELEMENT NO   5 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1127.600 1262.750    3              .013                        306.009    4.151      .000     0
 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1181.730 1264.840    3              .013                           .000     .000      .000     0
 ELEMENT NO   7 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1206.650 1265.800    3              .013                         45.000   31.729      .000     0
 ELEMENT NO   8 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1249.460 1266.100    3              .013                           .000     .000      .000     0
 ELEMENT NO   9 IS A  WALL  ENTRANCE                 *
                    U/S DATA   STATION    INVERT  SECT             FP
                               1249.460 1266.100    4              .500
 ELEMENT NO  10 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
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                              1252.000 1266.118    4               .014                          .000     .000      .000     0
ELEMENT NO  11 IS A SYSTEM HEADWORKS                  *                       *
                    U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                              1252.000 1266.118    4                                    1266.118
```

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 2-2014 Time:11:47:56

Wildomar MDP - Lateral C-1.2
Flow Rates from Tract 21741 Improvement Plans
jcc 2Oct2014

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
1004.460	1258.000	5.320	1263.320	19.20	10.86	1.83	1265.15	.00	1.46	.00	1.500	.000	.00	1 .0
31.900	.0386					.0334	1.07	5.32	.00	1.15	.013	.00	.00	PIPE
1036.360	1259.230	5.156	1264.386	19.20	10.86	1.83	1266.22	.00	1.46	.00	1.500	.000	.00	1 .0
64.070	.0386					.0334	2.14	.00	.00	1.15	.013	.00	.00	PIPE
1100.430	1261.700	5.175	1266.875	19.20	10.86	1.83	1268.71	.00	1.46	.00	1.500	.000	.00	1 .0
JUNCT STR	.0400					.0251	.13	.00	.00		.013	.00	.00	PIPE
1105.430	1261.900	6.873	1268.773	13.60	7.70	.92	1269.69	.00	1.37	.00	1.500	.000	.00	1 .0
22.170	.0383					.0168	.37	.00	.00	.89	.013	.00	.00	PIPE
1127.600	1262.750	6.434	1269.184	13.60	7.70	.92	1270.10	.00	1.37	.00	1.500	.000	.00	1 .0
54.130	.0386					.0168	.91	6.43	.00	.89	.013	.00	.00	PIPE
1181.730	1264.840	5.252	1270.092	13.60	7.70	.92	1271.01	.00	1.37	.00	1.500	.000	.00	1 .0
24.920	.0385					.0168	.42	.00	.00	.89	.013	.00	.00	PIPE
1206.650	1265.800	4.819	1270.619	13.60	7.70	.92	1271.54	.00	1.37	.00	1.500	.000	.00	1 .0
42.810	.0070					.0168	.72	4.82	.00	1.50	.013	.00	.00	PIPE
1249.460	1266.100	5.236	1271.336	13.60	7.70	.92	1272.26	.00	1.37	.00	1.500	.000	.00	1 .0
WALL	ENTRANCE													
1249.460	1266.100	6.615	1272.715	13.60	.29	.00	1272.72	.00	.49	7.00	10.000	7.000	.00	0 .0
2.540	.0071					.0000	.00	6.61	.02	.42	.014	.00	.00	RECTANG

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 2-2014 Time:11:47:56

Wildomar MDP - Lateral C-1.2
Flow Rates from Tract 21741 Improvement Plans
jcc 2Oct2014

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
1252.000	1266.118	6.597	1272.715	13.60	.29	.00	1272.72	.00	.49	7.00	10.000	7.000	.00	0 .0

Lateral C-1.2a

```
T1 Lateral C-1.2a                                                          0
T2 Flow Rates from Tract 21741 Improvement Plans
T3 jcc 2 OCT 2014
SO    101.7601261.820  1                          1268.800
R     114.6401265.000  1      .013                                  .000    .000 0
WE    114.6401265.000  2      .500
R     116.0001265.200  2      .014                                  .000
SH    116.0001265.200  2                          1265.200
CD   1  4   1    .000   1.500     .000  .000  .000   .00
CD   2  2   0    .000   7.000    7.000  .000  .000   .00
Q             5.600   .0
```

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

 CD      1    4      1            1.500
 CD      2    2      0     .000    7.000    7.000                  .00
                                                W S P G W                                                          PAGE NO   1
                           WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                             Lateral C-1.2a
HEADING LINE NO 2 IS -
                             Flow Rates from Tract 21741 Improvement Plans
HEADING LINE NO 3 IS -
                             jcc 2 OCT 2014
                                                W S P G W                                                          PAGE NO   2
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               101.760 1261.820    1                                       1268.800
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                               114.640 1265.000    1              .013                            .000     .000      .000     0
 ELEMENT NO   3 IS A  WALL  ENTRANCE                 *
                    U/S DATA   STATION    INVERT  SECT             FP
                               114.640 1265.000    2              .500
 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                               116.000 1265.200    2              .014                            .000     .000      .000     0
 ELEMENT NO   5 IS A SYSTEM HEADWORKS                *                       *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               116.000 1265.200    2                                      1265.200
```

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 2-2014 Time: 4: 2:33

Lateral C-1.2a
Flow Rates from Tract 21741 Improvement Plans
jcc 2 OCT 2014

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
101.760	1261.820	6.980	1268.800	5.60	3.17	.16	1268.96	.00	.91	.00	1.500	.000	.00	1 .0
12.880	.2469					.0028	.04	6.98	.00	.33	.013	.00	.00	PIPE
114.640	1265.000	3.837	1268.837	5.60	3.17	.16	1268.99	.00	.91	.00	1.500	.000	.00	1 .0
WALL	ENTRANCE													
114.640	1265.000	4.070	1269.070	5.60	.20	.00	1269.07	.00	.27	7.00	7.000	7.000	.00	0 .0
1.288	.1470					.0000	.00	4.07	.02	.10	.014	.00	.00	RECTANG
115.928	1265.189	3.881	1269.070	5.60	.21	.00	1269.07	.00	.27	7.00	7.000	7.000	.00	0 .0
.072	.1470					.0000	.00	3.88	.02	.10	.014	.00	.00	RECTANG
116.000	1265.200	3.871	1269.071	5.60	.21	.00	1269.07	.00	.27	7.00	7.000	7.000	.00	0 .0

Lateral CB.1

```
T1 Wildomar MDP                                                                0
T2 Lateral CB-1
T3 eth 2014-10-02
SO    103.4201262.250  1                          1262.250
R     108.9901262.290  1      .013                                  .000    .000 0
R     136.3201262.400  1      .013                                34.790    .000 0
R     186.2201262.590  1      .013                                  .000    .000 0
JX    190.2201262.600  2  2   .014    5.000         1262.60         -90.0    .000 0
R     208.5301262.680  2      .013                               -50.000    .000 0
R     232.4701262.780  2      .013                                  .000    .000 0
WE    232.4701262.780  3      .500
R     242.4701262.800  3      .014                                  .000
SH    242.4701262.800  3                          1262.800
CD   1  4   1    .000   1.500     .000  .000  .000   .00
CD   2  4   1    .000   1.500     .000  .000  .000   .00
CD   3  2   0    .000  10.000   10.000  .000  .000   .00
Q             5.000   .0
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 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4      1            1.500
 CD      2    4      1            1.500
 CD      3    2      0     .000   10.000   10.000                  .00
                                          W S P G W                                                          PAGE NO   1
                          WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                            Wildomar MDP
HEADING LINE NO 2 IS -
                            Lateral CB-1
HEADING LINE NO 3 IS -
                            eth 2014-10-02
                                          W S P G W                                                          PAGE NO   2
                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               103.420 1262.250    1                                      1262.250
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               108.990 1262.290    1              .013                           .000     .000      .000     0
 ELEMENT NO   3 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               136.320 1262.400    1              .013                         45.010   34.790      .000     0
 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               186.220 1262.590    1              .013                           .000     .000      .000     0
 ELEMENT NO   5 IS A JUNCTION          *         *     *     *                  *                  *                *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                               190.220 1262.600    2     2     0   .014     5.000      .000  1262.600      .000 -90.000     .000
                                                                                                 RADIUS    ANGLE
                                                                                                   .000    .000
 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               208.530 1262.680    2              .013                          20.982  -50.000      .000     0
 ELEMENT NO   7 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               232.470 1262.780    2              .013                           .000     .000      .000     0
 ELEMENT NO   8 IS A  WALL  ENTRANCE                 *
                    U/S DATA   STATION    INVERT  SECT             FP
                               232.470 1262.780    3              .500
 ELEMENT NO   9 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               242.470 1262.800    3              .014                           .000     .000      .000     0
 ELEMENT NO  10 IS A SYSTEM HEADWORKS                *                     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               242.470 1262.800    3                                      1262.800
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Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 3-2014 Time: 9:45:21

Wildomar MDP
Lateral CB-1
eth 2014-10-02

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
103.420	1262.250	1.219	1263.469	10.00	6.50	.66	1264.13	.00	1.22	1.17	1.500	.000	.00	1 .0
4.760	.0072					.0088	.04	1.22	1.00	1.50	.013	.00	.00	PIPE
108.180	1262.284	1.286	1263.570	10.00	6.20	.60	1264.17	.00	1.22	1.05	1.500	.000	.00	1 .0
.810	.0072					.0084	.01	1.29	.88	1.50	.013	.00	.00	PIPE
108.990	1262.290	1.291	1263.581	10.00	6.18	.59	1264.17	.01	1.22	1.04	1.500	.000	.00	1 .0
7.190	.0040					.0081	.06	1.30	.87	1.50	.013	.00	.00	PIPE
116.180	1262.319	1.374	1263.693	10.00	5.90	.54	1264.23	.01	1.22	.83	1.500	.000	.00	1 .0
20.140	.0040					.0085	.17	1.38	.73	1.50	.013	.00	.00	PIPE
136.320	1262.400	1.500	1263.900	10.00	5.66	.50	1264.40	.00	1.22	.00	1.500	.000	.00	1 .0
49.900	.0038					.0091	.45	1.50	.00	1.50	.013	.00	.00	PIPE
186.220	1262.590	1.762	1264.352	10.00	5.66	.50	1264.85	.00	1.22	.00	1.500	.000	.00	1 .0
JUNCT STR	.0025					.0066	.03	.00	.00		.014	.00	.00	PIPE
190.220	1262.600	2.524	1265.124	5.00	2.83	.12	1265.25	.00	.86	.00	1.500	.000	.00	1 .0
18.310	.0044					.0023	.04	.00	.00	.94	.013	.00	.00	PIPE
208.530	1262.680	2.504	1265.184	5.00	2.83	.12	1265.31	.00	.86	.00	1.500	.000	.00	1 .0
23.940	.0042					.0023	.05	2.50	.00	.96	.013	.00	.00	PIPE
232.470	1262.780	2.459	1265.239	5.00	2.83	.12	1265.36	.00	.86	.00	1.500	.000	.00	1 .0
WALL	ENTRANCE													

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 3-2014 Time: 9:45:21

Wildomar MDP
Lateral CB-1
eth 2014-10-02

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
232.470	1262.780	2.645	1265.425	5.00	.19	.00	1265.43	.00	.20	10.00	10.000	10.000	.00	0 .0
10.000	.0020					.0000	.00	2.65	.02	.26	.014	.00	.00	RECTANG
242.470	1262.800	2.625	1265.425	5.00	.19	.00	1265.43	.00	.20	10.00	10.000	10.000	.00	0 .0

Lateral CB-2

```
T1 Wildomar MDP                                                                0
T2 Lateral CB-2
T3 eth 2014-10-02
SO    200.4201262.610  1                          1265.120
R     247.5901262.800  1      .013                                36.870    .000 0
R     262.0701262.860  1      .013                                  .000    .000 0
WE    262.0701262.860  2      .500
R     272.0701262.870  2      .014                                  .000
SH    272.0701262.870  2                          1262.870
CD   1  4   1    .000   1.500     .000  .000  .000   .00
CD   2  2   0    .000  10.000   10.000  .000  .000   .00
Q             5.000   .0
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FILE: latcb2.WSW                          W S P G W  - EDIT LISTING - Version 14.06              Date:10- 3-2014  Time: 9:46:54
                                   WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4      1            1.500
 CD      2    2      0     .000   10.000   10.000                  .00
                                                W S P G W                                                          PAGE NO   1
                           WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                             Wildomar MDP
HEADING LINE NO 2 IS -
                             Lateral CB-2
HEADING LINE NO 3 IS -
                             eth 2014-10-02
                                                W S P G W                                                          PAGE NO   2
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               200.420 1262.610    1                                       1265.120
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               247.590 1262.800    1              .013                         73.302   36.870      .000     0
 ELEMENT NO   3 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               262.070 1262.860    1              .013                          .000     .000      .000     0
 ELEMENT NO   4 IS A  WALL  ENTRANCE                 *
                    U/S DATA   STATION    INVERT  SECT             FP
                               262.070 1262.860    2              .500
 ELEMENT NO   5 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               272.070 1262.870    2              .014                          .000     .000      .000     0
 ELEMENT NO   6 IS A SYSTEM HEADWORKS                *                     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               272.070 1262.870    2                                      1262.870
```

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date:10- 3-2014 Time: 9:46:57

Wildomar MDP
Lateral CB-2
eth 2014-10-02

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
200.420	1262.610	2.510	1265.120	5.00	2.83	.12	1265.24	.00	.86	.00	1.500	.000	.00	1 .0
47.170	.0040					.0023	.11	.00	.00	.97	.013	.00	.00	PIPE
247.590	1262.800	2.443	1265.243	5.00	2.83	.12	1265.37	.00	.86	.00	1.500	.000	.00	1 .0
14.480	.0041					.0023	.03	2.44	.00	.96	.013	.00	.00	PIPE
262.070	1262.860	2.416	1265.276	5.00	2.83	.12	1265.40	.00	.86	.00	1.500	.000	.00	1 .0
WALL	ENTRANCE													
262.070	1262.860	2.602	1265.462	5.00	.19	.00	1265.46	.00	.20	10.00	10.000	10.000	.00	0 .0
10.000	.0010					.0000	.00	2.60	.02	.33	.014	.00	.00	RECTANG
272.070	1262.870	2.592	1265.462	5.00	.19	.00	1265.46	.00	.20	10.00	10.000	10.000	.00	0 .0

Inlet Calculations

Weir Inlet
Ponding Depth Calculation

Designer:	C. Castaneda
Date:	10/3/2014
Project:	City of Wildomar Lateral C-1
Location:	Drop Inlet Structure near Palomar and Refa - Lateral C1.1

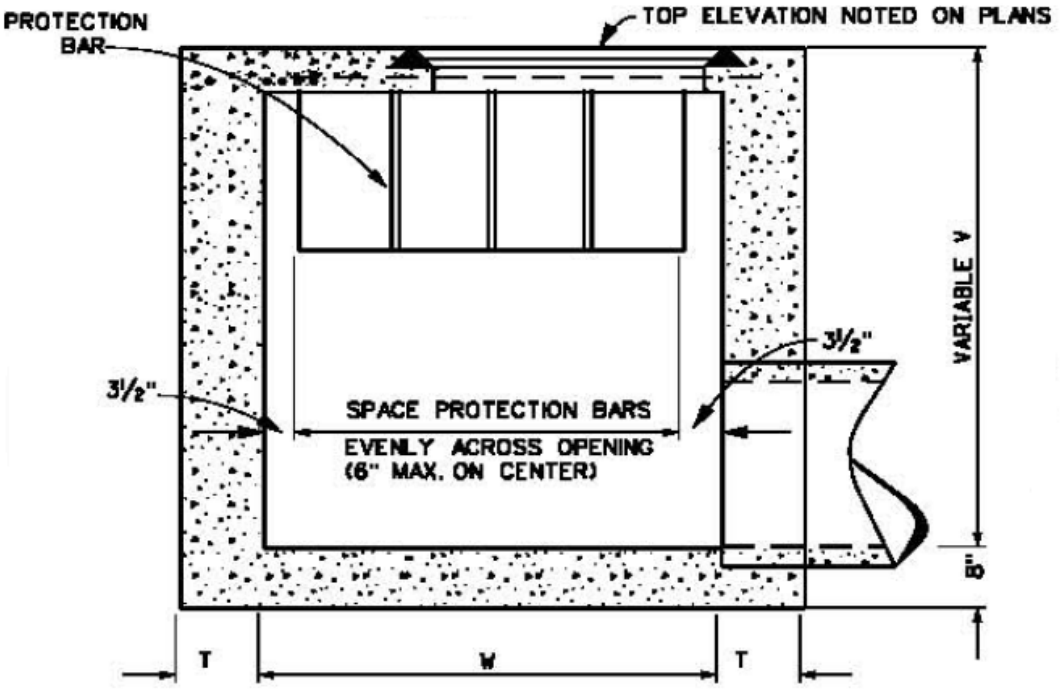
OUTLET STRUCTURE PONDING DEPTH RCFC&WCD CB110

Number of Windows	1
Height of Window Opening	24 in.
Length of Window Opening	96 in.

$$Q = CL(h)^{3/2}$$

WEIR COEFFICIENT	C	3.3	
WEIR LENGTH*	L	8.000	ft^2
HEAD	h	1.31	ft
Flow	Q	39.58	cfs

Top of Weir Elevation: 1231
Water Surface Elevation: 1232.31



**Based on Concrete Drop Inlet from RCFC WCD Standard Manual
Std. Dwg. No. CB110**

SECTION 4 - Lateral C/C-1 Junction

Overview

In the District's 2014 Hydrology study for Lateral C-1 there is some question as to the adequacy of the existing stubbed out junction for Lateral C-1 that ties into Lateral C. As part of this design effort further analysis was performed on this junction structure. WEBB prepared a memorandum documenting this analysis and outlining the way forward concerning this issue. A copy of WEBB"s memorandum, the District's Response, and all backup material are included in this section for reference.

Memorandum

To: Albert Martinez, Senior Engineer, City of Wildomar

From: Joseph C. Caldwell, Director – Stormwater Engineering

Date: September 29, 2014

Re: Wildomar MDP – Lateral C/C-1 Junction

The following memorandum is written to address the confluence of Lateral C and Lateral C-1 in the Wildomar MDP. Webb Associates (WEBB) is currently under contract with the City of Wildomar (City) to design the Lateral C-1 System along Refa Street. A key component to this design is the confluence of Lateral C-1 to Lateral C. This Memorandum is intended to document WEBB's design recommendation for this confluence.

Riverside County Flood Control and Water Conservation District (RCFC&WCD) recently prepared an updated hydrology study for Lateral C-1. A report titled "Hydrology Study for Wildomar MDP Lateral C-1" was prepared by RCFC&WCD in the January 2014. This report concluded that modifications to originally planned development densities in the City have resulted in higher 100-Year design flow rates than what was shown in the MDP for the Lateral C and Lateral C-1 Systems.

The existing Lateral C Channel was designed and constructed based upon the previous MDP flow rates. A stub out for Lateral C-1 (5'H x 9'W) was included as part of the Lateral C construction. This existing stub out connects to a two-cell 7'H x 12'W RCB that crosses Palomar St. A flow equalization window was not included as part of the design of the Lateral C/Lateral C-1 Junction Structure. This, combined with the increased design flow rates was of special concern during the planning level analysis by RCFC&WCD. Although it was not analyzed in detail, RCFC&WCD recommended in that alternative options be considered at the confluence of Lateral C and Lateral C-1.

As part of the design of Lateral C-1, WEBB has evaluated this confluence in more detail. The following was determined as part of the initial Lateral C/Lateral C-1 junction review:

1) The Lateral C Channel downstream of Palomar has adequate capacity to convey 3,620 cfs.
2) The Existing Lateral C crossing of Palomar has sufficient capacity to convey 3,620 cfs. This was modeled excluding the Lateral C-1 Junction.
3) The Lateral C Channel upstream of Palomar does have adequate capacity to convey the MDP design flow of 2,200 cfs. The Line C Channel Upstream of Palomar does not have capacity to convey updated flow rate of 2,950 cfs.
4) Using a rudimentary junction analysis
   a) The westerly cell of the Lateral C crossing of Palomar can convey at least 2,180 cfs
   b) The easterly cell of the Lateral C crossing of Palomar can convey at least 1,170 cfs (500 cfs from upstream and 670 cfs in Lateral C-1) – Note that 670 cfs is the confluence Lateral C-1 flow rate in the District's updated hydrology analysis.
   c) Based on this analysis there is at least 3,350 cfs of capacity when considering the junction
   d) The results of the easterly cell analysis are somewhat suspect since the lateral has more inflow than the main line.

Based upon junction analysis and the results outlined above, the three alternative design approaches were considered. The follow list describes each alternative and provides advantages and disadvantages of each alternative:

1) Use the existing Lateral C-1 Stub Out
   a) Pros
      i) Avoids multiple (10+) utilities in Palomar
      ii) Least Expensive
      iii) “Saved” Money can be put towards future drainage improvements
   b) Cons
2) Relies on future upstream basin to reduce Lateral C flow rate
3) Reconstruct a portion of Lateral C with a new junction and flow equalization windows
   a) Pros
4) Will allow junction to handle “new” 100-Year Flows
      (a) ii) Avoids multiple (10+) utilities in Palomar
   b) Cons
      i) More expensive than Alternative 1 (detailed cost estimates not prepared, but order of magnitude cost is $50k)
      ii) Does not solve the upstream capacity issue
5) Extend Line C across Palomar and Tie into Lateral C downstream of Palomar
   a) Pros
      i) Will allow junction to handle “new” 100-Year Flows
   b) Cons
      i) Most Expensive (detailed cost estimates not prepared, but order of magnitude cost is $250k+)
      ii) Coordination and possible relocation of multiple utilities in Palomar
      iii) Significant reconstruction of downstream transition structure
      iv) Does not solve the upstream capacity issue

In a Project Design Team Meeting held on September 18, 2014 the above alternatives were presented to both City of Wildomar and District Staff. There was strong support for Alternative 1. The City is well aware that future upstream development will be limited at some point without the construction of a detention basin to reduce Lateral C flow rates. The City felt that the best use of public funds would be to use the existing stub out and put the savings toward ultimate system upgrades.

Based upon WEBB’s review of the backup hydrology and the hydraulic analysis prepared of the system it is recommended that Alternative 1 be used as part of the current design. This approach is consistent with the current University Wash Storm Drain that WEBB is designing for the District. It is requested that the District officially support this proposed recommendation or provide feedback on an acceptable alternative.

APPENDICES

Appendix A – RCFCWCD Study

RIVERSIDE COUNTY FLOOD CONTOL
AND WATER CONSERVATION DISTRICT
RIVERSIDE, CALIFORNIA

HYDROLOGY STUDY

FOR

Wildomar MDP Lateral C-1

January 2014

Table of Contents

Introduction 1
2013 Planning Study Purpose and Scope 2
History 2
Hydrology Study 3
Methodology 3
Area of Study 3
Assumptions 3
Study Parameters 4
Rainfall 4
Land Use 5
Antecedent Moisture Conditions 6
Low Soil Loss Rate 6
Manning's n Values 6
S-Graph 6
Hydrology Study Results 7
Analysis of Results 8
Comparison with previous studies 8
Upstream Facility Capacity 8
Downstream Facility Capacity 10
Conclusion 11

Figure 1- Location Map 1
Figure 2- Drainage Areas 3
Figure 3- Proposed (Developed) Conditions 4
Figure 4- Rational Method 100 Year Flowrate (Recommended) 7
Figure 5- Freeway Culverts 9
Figure 6- Scenario 1 (MDP Q) 10
Figure 7- Scenario 2 (Updated Q, Alternative 0 "No Build") 10
Figure 8- Scenario 3 (Updated Q, Basin Alternative 3) 10

Table 1- Rainfall Comparison 5
Table 2- Land Use Designations 5
Table 3- Hydrology Study Results 7

Introduction

Wildomar MDP Lateral C-1 is a proposed underground facility located along Refa Street which will carry flows from existing developments to Palomar Road, where it will connect to the District's existing Wildomar MDP Lateral C channel. These flows then continue to Wildomar Channel, and Murrieta Creek.

Figure 1- Location Map

2013 Planning Study Purpose and Scope

As requested by the City of Wildomar, the Planning Division conducted a detailed study of the flows entering Lateral C-1 at multiple points along the proposed alignment.

The areas in this hydrology study were determined by investigating existing flow patterns and existing drainage facilities within the area. The watershed is divided by the Interstate 15 freeway which runs in the northeasterly-southwesterly direction. Currently, the northerly portion of the watershed includes foothill areas that drain southwesterly toward several freeway culverts. The area south of the freeway includes a number of residential subdivisions. Storm drains constructed with the tracts collect the culvert flows south of the freeway and convey those flows to outlet points just south of Charles Street.

History

The Wildomar Master Drainage Plan (MDP) was adopted in August 1980. All of the MPD facilities are planned to collect and covey runoff generated by a 100-year storm event. Over the past 33 years, many MDP facilities have been constructed, including a portion of Lateral C, which this project will tie into.

Since the adoption of the Wildomar MDP, several tracts have been constructed upstream of the proposed Lateral C-1. The first, Tract No. 21085, was built between 1987 and 1988. It was followed by Tracts Nos. 21741, 23192, 23195, 23196, and 21947 in 1989 and 1990, Graham Elementary School in 1991, and Tract No. 29163 in 2002.

All of these subdivisions were reviewed by the County of Riverside prior to Wildomar's incorporation as a City. The tracts that include the two main facilities were approved by the Road Commissioner. Hence, most of the storm drain facilities constructed by these tracts are now City maintained. District maintained facilities constructed in the area include: Wildomar Valley - Jasmine Avenue Storm Drain (Project No. 7-0-00250); and Wildomar Valley - Frederick Street Storm Drain (Project No. 7-0-00252).

Plans for all existing facilities associated with Lateral C-1 are provided in the Appendix.

Hydrology Study

Methodology

Rational and Synthetic Unit Hydrograph (SUH) methods were both used in the course of this study. Generally, the Rational Method is used for determining peak discharge from relatively small drainage areas, while the SUH Method is used for areas larger than 300 to 500 acres. A total of 423 acres contribute flow to Lateral C-1, which indicates that either method can be applied to this study.

The results of both methods were compared to determine which methodology would provide the more appropriate flow rates for the design of Lateral C-1.

Area of Study

This study includes all drainage areas tributary to the proposed Lateral C-1. Runoff drains from the mountains to the north, across Baxter Road, through the culverts under Interstate 15, and through the storm drain facilities constructed within the housing tracts; outleting at three points between Billie Anne Road and Woshka Lane, just southwesterly of Charles Street.

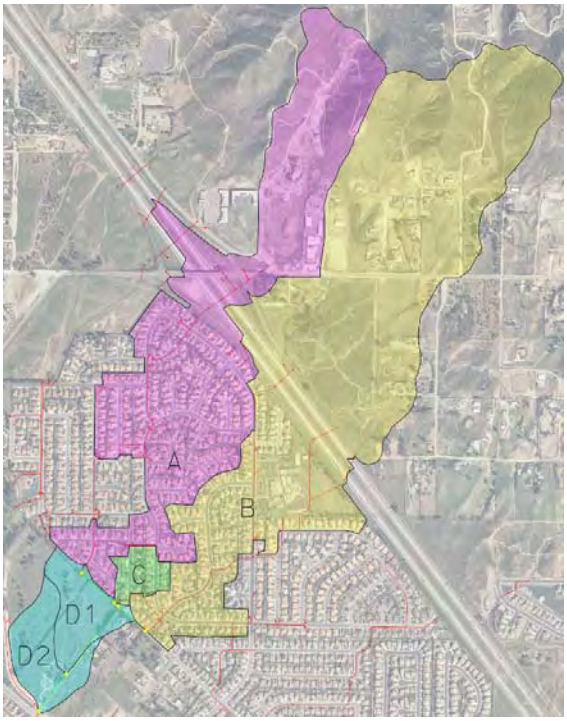


Figure 2- Drainage Areas

Assumptions

Review of previous studies, as well as culvert capacities, indicated that the existing system downstream of the freeway was sized based on the assumption that a 53 acre portion of the watershed north of Baxter Road would ultimately be conveyed by a proposed road south of Kilarney Lane to the freeway culvert at node 233 (Culvert #2), as shown in Figure 3. Based on an analysis of freeway culvert capacities, this study agrees with and has been prepared following the

same assumption as in previous studies. Therefore, **future development in the area should be conditioned to construct a road that will convey the flows as indicated in this report.**

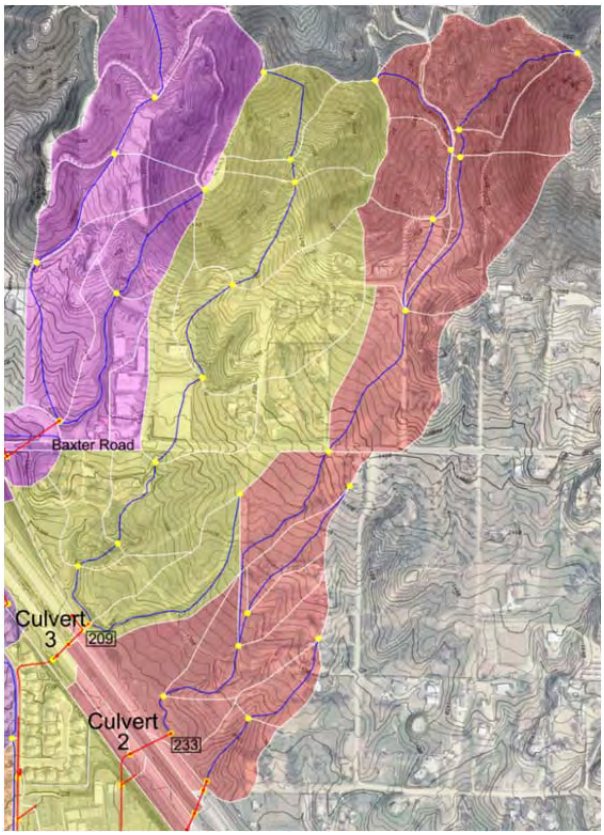


Figure 3- Proposed (Developed) Conditions

Study Parameters

Rainfall

The rainfall data used in this study was obtained from the District Hydrology Manual, which is based on NOAA Atlas 2. A brief study was conducted to compare rainfall data provided by NOAA Atlas 14, District Gages and values used in the Wildomar MDP.

The rainfall comparison summarized in Table 1 showed NOAA Atlas 14 values lower than those provided by the Manual and District Gages. The District's Wildomar Gage provided values that were generally similar or less than those in the Manual. The Wildomar La Cresta Gage provided 3-hour and 6-hour precipitation values which were 6% and 9% higher than NOAA 2, respectively. However, due to the significant difference in elevation between the area of study and the La Crest Gage, the values from this gage may not be representative of the area draining to Lateral C-1 and should not be used in this hydrology study.

Table 1- Rainfall Comparison

Study		100-Year Precipitation (Inches)								Slope of Intensity-Duration Curve
		1-Hour		3-Hour		6-Hour		24-Hour		
		100-Year	% diff.	100-Year	% diff.	100-Year	% diff.	100-Year	% diff.	
District Manual Plates*		**1.45**	**-**	**2.65**	**-**	**3.75**	**-**	**7.8**	**-**	**0.49**
District Manual Chart		1.5	3%	-	-	-	-	-	-	0.48
Wildomar MDP		1.45	0%	2.55	-4%	-	-	-	-	-
District Gages	Wildomar (13 years of record. E=1251 ft.)	1.33	-8%	2.69	2%	3.9	4%	6.32	-19%	-
	Wildomar La Cresta (23 years of record. E=2305 ft.)	1.46	1%	2.82	6%	4.07	9%	7.17	-8%	-
NOAA Atlas 14	Point in Lat C-1 Watershed	1.39	-4%	2.26	-15%	3.14	-16%	6	-23%	-
	Elsinore Gage	1.28	-12%	2.14	-19%	3.07	-18%	6.7	-14%	-

*To be used in this study

Land Use

Ultimate land conditions were defined by the 2003 Riverside County General Plan. The following table shows the percent impervious area and cover type which was assigned to each land use type. Soils and Land Use maps are provided in the appendix.

Table 2- Land Use Designations

Abbreviation	Description	Equivalent RCFC Hydrology Manual	Cover Type	% Impervious
MDR	Medium Density Residential	1/4 acre lots	Urban	50
VLDR-RC	Very Low Density Residential	1 acre lots	Open Brush, Poor	20
EDR-RC	Estate Density Residential	2 acre lots	Open Brush, Poor	10
RM	Rural Mountainous	Natural	Open Brush, Poor	0
CR	Commercial Retail	Commercial	Urban	80
CO	Commercial Office	Commercial	Urban	80
LI	Light Industrial	Commercial	Urban	90
FWY	Freeway	Commercial	Urban	90

The upper portion of the watershed included large amounts of open space, which were assumed to be covered with poor open brush. Areas slated for more dense development were assigned urban cover. The impervious area percentages were inferred from the District Hydrology Manual.

When hydrology studies were conducted for the MDP and the tract facilities, the area north of the freeway was zoned such that it produced significantly less runoff (e.g. low density residential, open space). In the 2003 general plan, much of the area is designated for industrial and commercial use, resulting in more runoff than the previous studies anticipated.

Antecedent Moisture Conditions

As recommended in the District's hydrology manual for 100-year recurrence events, AMC II was used for all areas in this study.

Low Soil Loss Rate

The District's hydrology manual recommends a low loss rate between 80 and 90 percent. This study uses 90%, as previous studies have indicated this to be a reasonable value.

Manning's n Values

The average n value for each drainage area was evaluated according the criteria provided in CivilD and based on the District Hydrology Manual:

> N=0.015: drainage area has fairly uniform slopes, watercourses along improved or paved streets; large percentage of area is impervious.
> N=0.020 Drainage area has some graded and non-uniform, gentle slopes. ½ the area watercourses are improved or paved.
> N=0.025 Drainage area is generally rolling with gentle side slopes. Some drainage improvements in the area-streets.

The majority of the area which drains to Lateral C-1 is zoned for dense development. Approximately 80% is expected to include improved water courses, with a manning's value of 0.015. A small portion of the upper watershed, which is expected to have very little development, is assigned a manning's value of 0.025. The average for the entire watershed is 0.017.

S-Graph

The District's Hydrology Manual provides S-graphs for Valley, Foothill, Mountain, and Desert conditions. The areas considered in this report include both mountainous and flat regions. The study area was divided such that the foothill S-graph was applied to the area located north of the 15 freeway, and the valley S-graph was applied to the area south of the freeway.

Hydrology Study Results

The results of both the Rational Method and the Unit Hydrograph are shown in the table and figures below. **The flowrates obtained through the Rational Method in this study are recommended for the design of Lateral C-1.**

Table 3- Hydrology Study Results

Area Studied (Refer to Hydrology Map)	Concentration Point #	Area (acres)	100- Year Peak Flowrate (CFS)	
			Rational Method (Recommended for Design)	Unit Hydrograph
A	60	148	**335**	294
B	270	238	**545**	456
C	304	7	**20**	-
D1	401	15	**30**	-
D2	402	15	**30**	-
A+C	304	155	**350**	-
A+B+C	400	393	**860**	747
A+B+C+D1	401	407	**885**	-
A+B+C+D1+D2	402	423	**920**	777

* This study does not account for hydraulic capacities of upstream facilities.

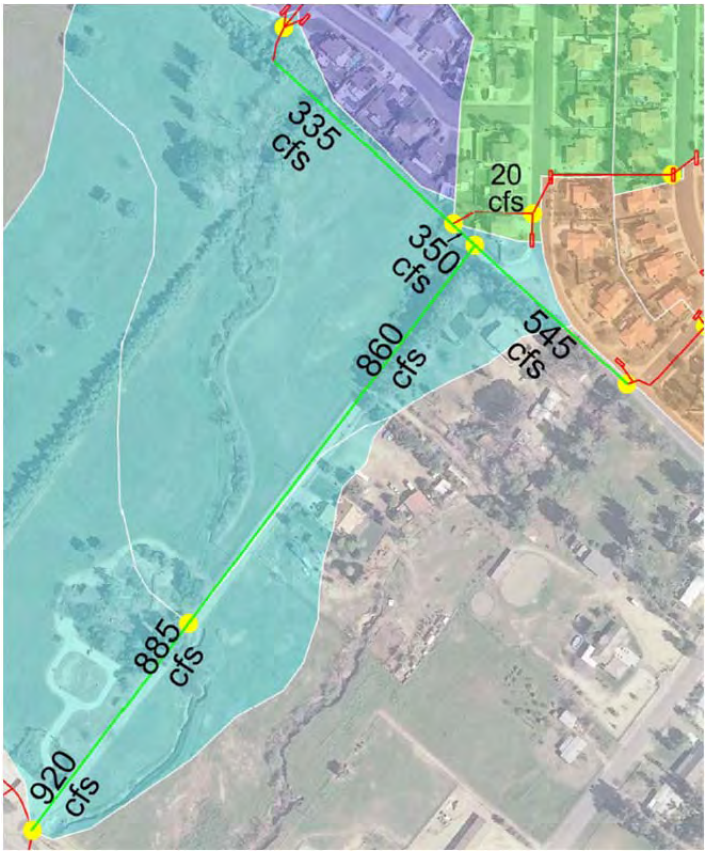


Figure 4- Rational Method 100 Year Flowrate (Recommended)

Analysis of Results

Comparison with previous studies

The 1980 Wildomar MDP indicates that the flowrate at the downstream end of Lateral C-1 is 740 cfs. A review of the MDP hydrology study revealed that the difference can be explained by significant differences found within the studies:

1. Land Use (n, Lag, Ai, & F) - The original MDP study assumed that the area north of the freeway would consist of open space and ½ acre residences. However, the current general plan indicates that the proposed land-use has changed such that the area will now have a large commercial and industrial areas and much less open space. The correlating change in the manning's value and impervious area resulted in a shorter lag time and a lower loss rate.
2. Study Method - The original MDP hydrology study was prepared using the SUH Method using a 1-hour storm duration. The District Hydrology Manual only provides guidance for the 3, 6, and 24 hour storms using the unit hydrograph method. The Rational Method is recommended for analysis flows resulting from the 1-hour storm.
    a. S-graph - The MDP study used the valley S-graph for the entire study instead of using the foothill S-graph for the upper portion of the watershed. The District Hydrology Manual states that the use of the Foothill S-graph will result in a higher flowrate than the Valley S-graph.
    b. Upstream Elevation- The original MDP study used an upstream elevation of 1575 ft; nearly 300 feet less than the actual elevation of 1840 ft indicated by current topography. There is no indication why this was done, however it would have caused the MDP study to have a longer lag time and lower peak flowrate.

Upstream Facility Capacity

The Wildomar MDP was planned to provide protection from the 100-year flood. The facility downstream of Lateral C-1 (Lateral C, stage 1) is capable of handling the 100-year flood, even when updated land use is applied, resulting in higher flows from both Lateral C-1 and Lateral C, Stage 2.

The facilities located in the development upstream of Lateral C-1 were designed to handle 100-year flows based on land use which was proposed at that time. However, some sections of the existing storm drain may not be able to handle the excess flow resulting from changes in ultimate condition land use (in most cases, this excess flow would likely be conveyed by the streets to Lateral C-1). There are no hydraulic calculations available for the culverts under Interstate 15. Most likely these culverts were designed for the 50-year flood, based on existing land use conditions at the time of construction, which would have consisted mostly of open space.

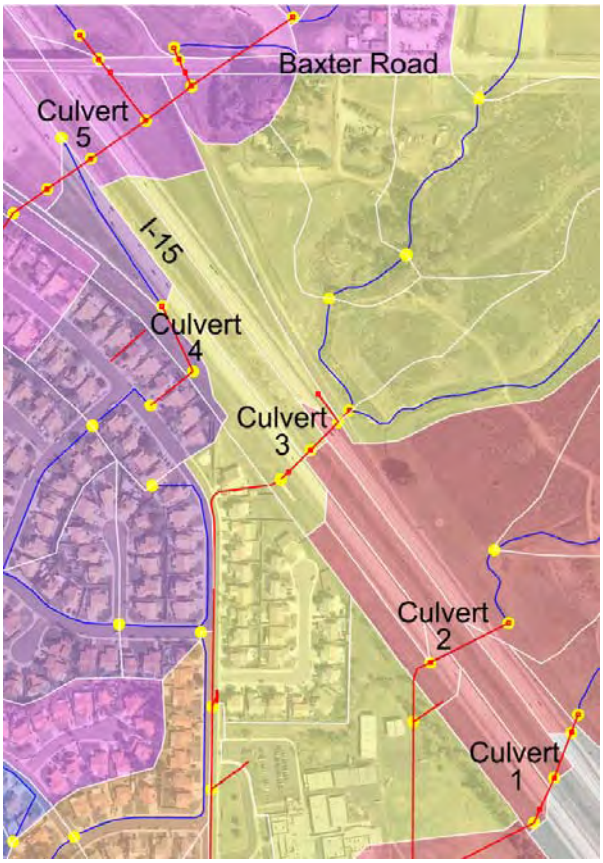


Figure 5- Freeway Culverts

A comparison of the estimated capacities and the calculated runoff indicated that the culverts may not be able to convey the 100-year flows. Up to 70 cfs could overtop the culverts. Based on existing topography, much of this excess flow would likely continue southeasterly down the freeway, and would never reach Lateral C-1.

The amount of flow which actually reaches Lateral C-1 during a 100-year storm may yield a design flowrate that is less than what has been calculated in this study. Determining the flowrates conveyed by the system to Lateral C-1 would require a much more extensive hydraulic study, and an understanding of what facilities may be implemented at the upstream end of the culverts, or if any additional culverts are to be constructed. The possible difference is small enough to justify use of the 100-year flows for design.

It is recommended that Lateral C-1 be designed to convey flows produced by the 100-year storm, as determined by the rational method.

Downstream Facility Capacity

Lateral C-1 ties into the existing Wildomar MDP Lateral C system that was constructed in two phases; the downstream portion (Stage 1) in 1988, and the upstream portion (Stage 2) in 1993. Both of these stages were designed to convey the flowrates established per the adopted MDP. In 2004, the District determined that changes in land-use within the Lateral C watershed would result in a much higher "ultimate" flowrate reaching the channel. Since then, several alternatives have been studied to reduce the flows to the rate for which the channel was designed. At this time, the most feasible option for the Line C system appears to be "Alternative 3", which proposes a basin upstream of Central Street at the northeast corner of Grove Street and Cherry Street.

A routing study was conducted to determine how the increased flows from Lateral C-1 would impact the downstream portion of the channel (Stage 1).

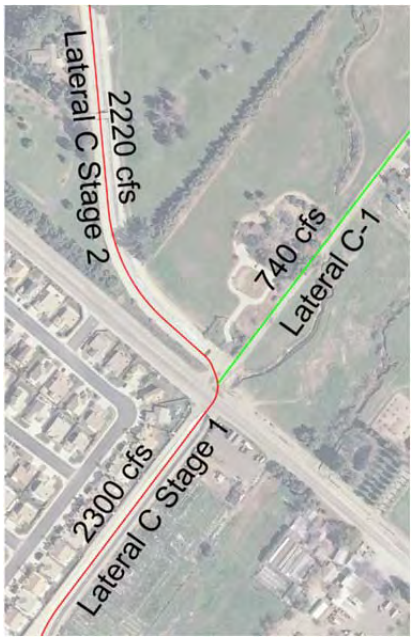


Figure 6- Scenario 1 (MDP Q)

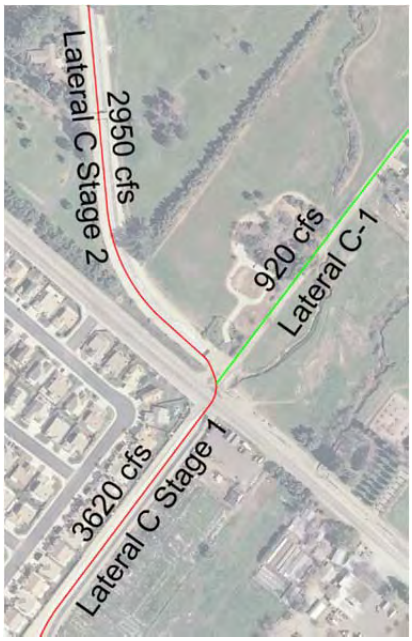


Figure 7- Scenario 2 (Updated Q, Alternative 0 "No Build")

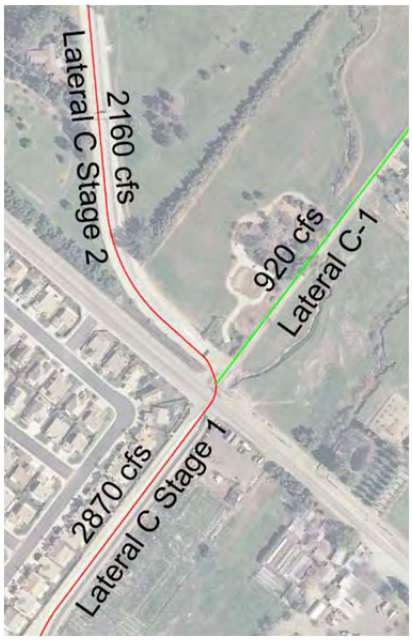


Figure 8- Scenario 3 (Updated Q, Basin Alternative 3)

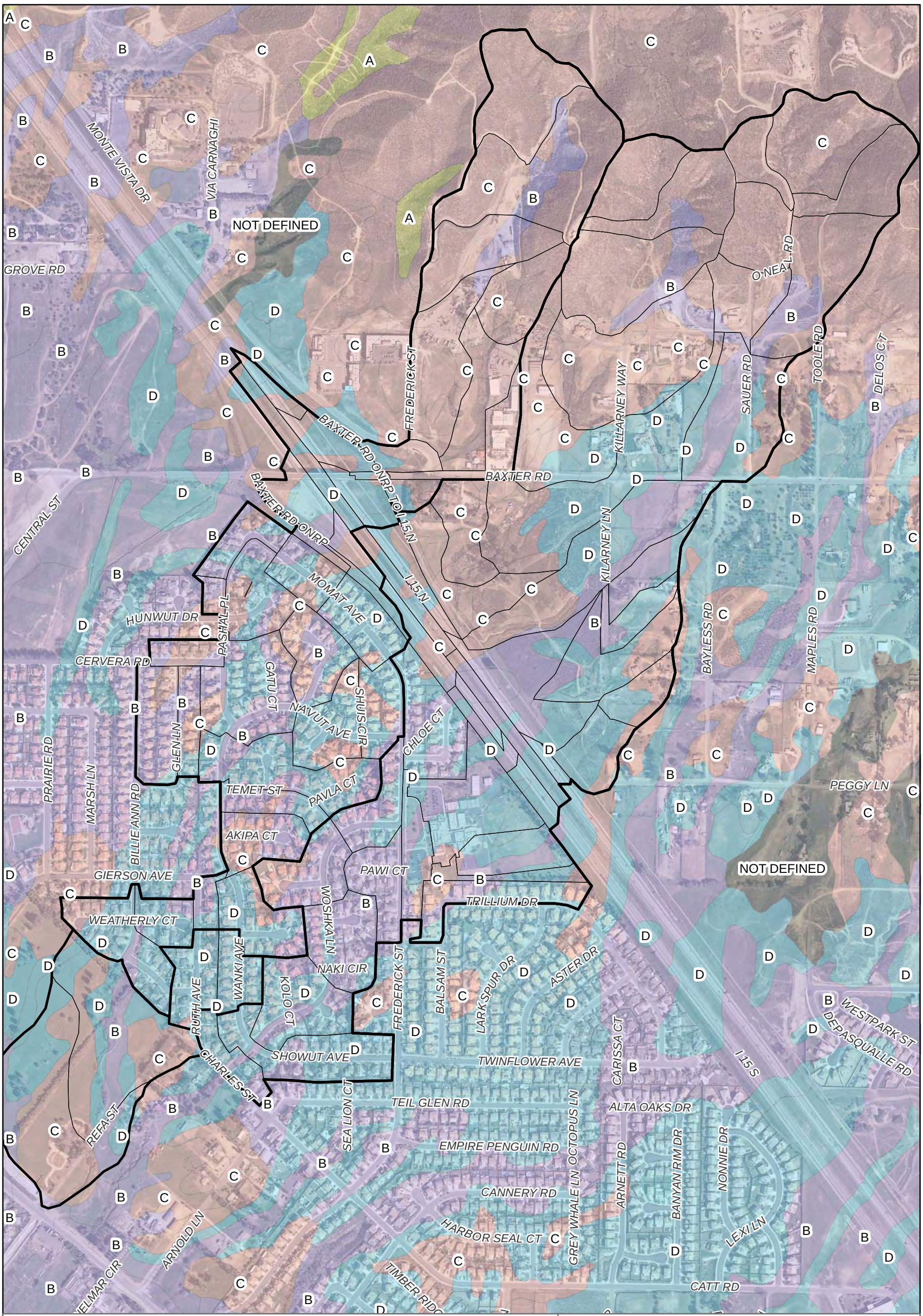
The As-Built drawings for Lateral C, Stage 1 indicate that the upstream flows from Lateral C, Stage 2 are conveyed under Palomar by a double box culvert, and flows from Lateral C-1 would enter into one of the boxes. A hydraulic study found that the Stage 1 channel provides adequate capacity and freeboard for the worst-case-scenario (Scenario 2 above).

Lateral C was constructed with a 9'x5' inlet on one of the 12'x7' box culverts for Lateral C-1 flows to enter. Preliminary analysis indicates that this design may not be adequately sized to convey flows from both laterals. **It is recommended that other options be considered for conveying flows from Lateral C-1 to Lateral C.**

Conclusion

This study has yielded the following recommendations:

1) At a point south of Baxter Road and Kilarney Lane, future development in the area should be conditioned to construct a road with curb and gutter that will convey the flows as indicated in the hydrology map.
2) Lateral C-1 should be designed to convey flows produced by the 100-year storm, as determined by the rational method.
3) The design of this facility should consider other options for the confluence of Lateral C and Lateral C-1.



L□□□□d

SOILS□SOILS□CA□□□□

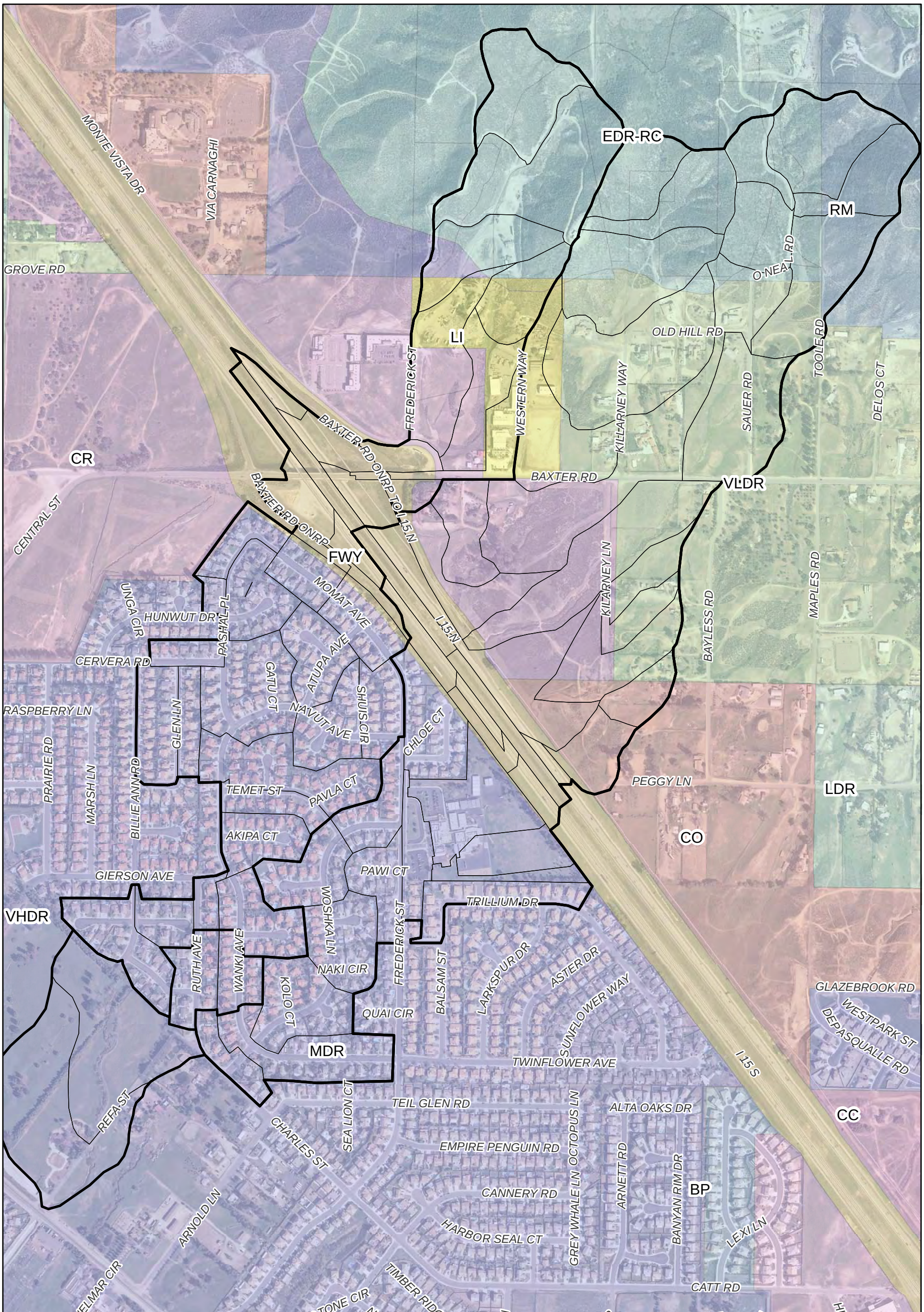
HYDGR□DCD

- A
- B
- C
- D
- NOT DEFINED

Wildomar MDP Lateral C-1 Soils Map

Feet

0 600 1200



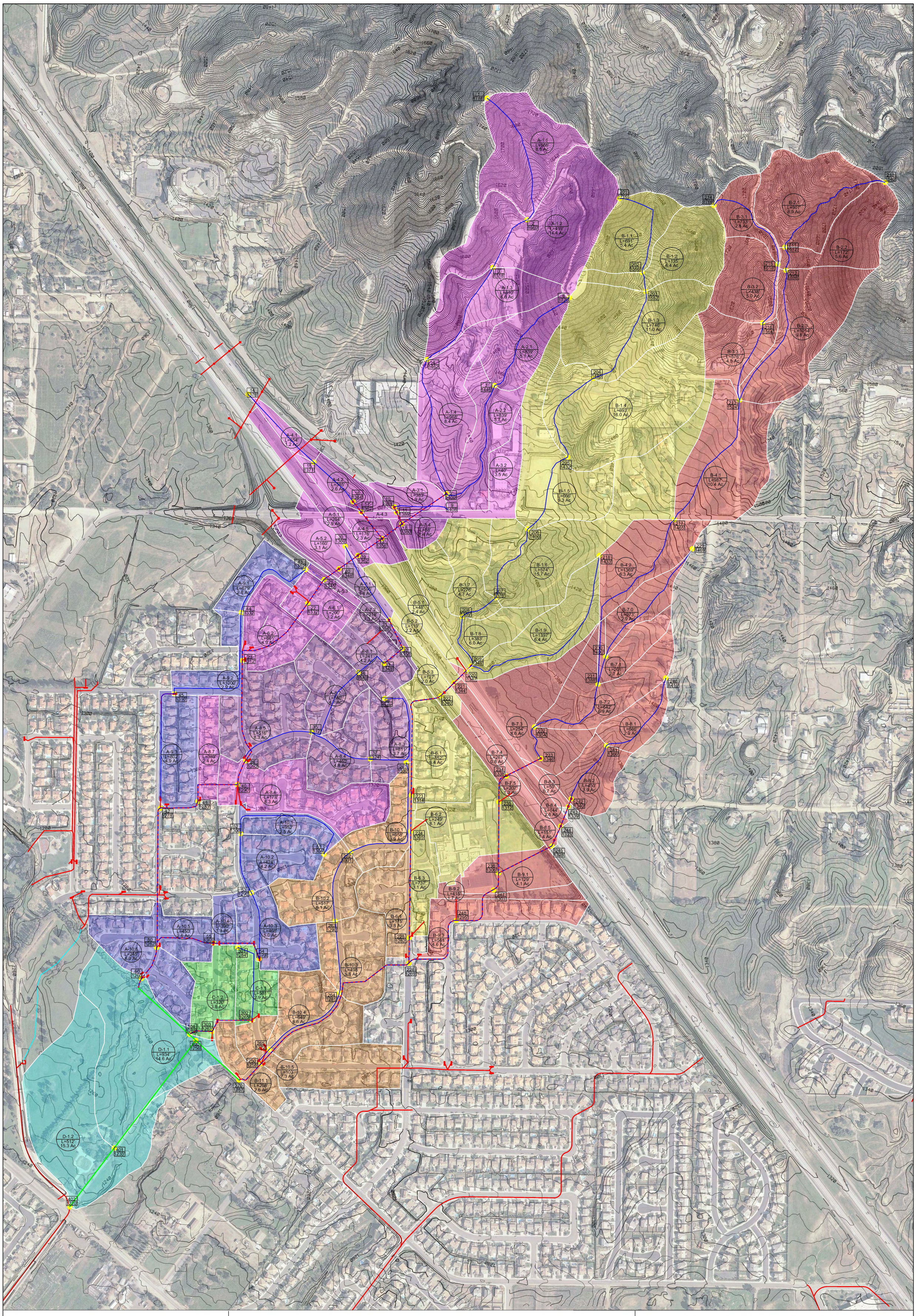
L□□□□d

RCI□G□0□100□	CO	LDR	VHDR
LAND□SE	CR	LI	VLDR
BP	EDR-RC	MDR	
CC	FWY	RM	

Wildomar MDP Lateral C-1 Land Use Map

Feet

0 600 1200



1"=300'
OCT 2013

300 0 300 600

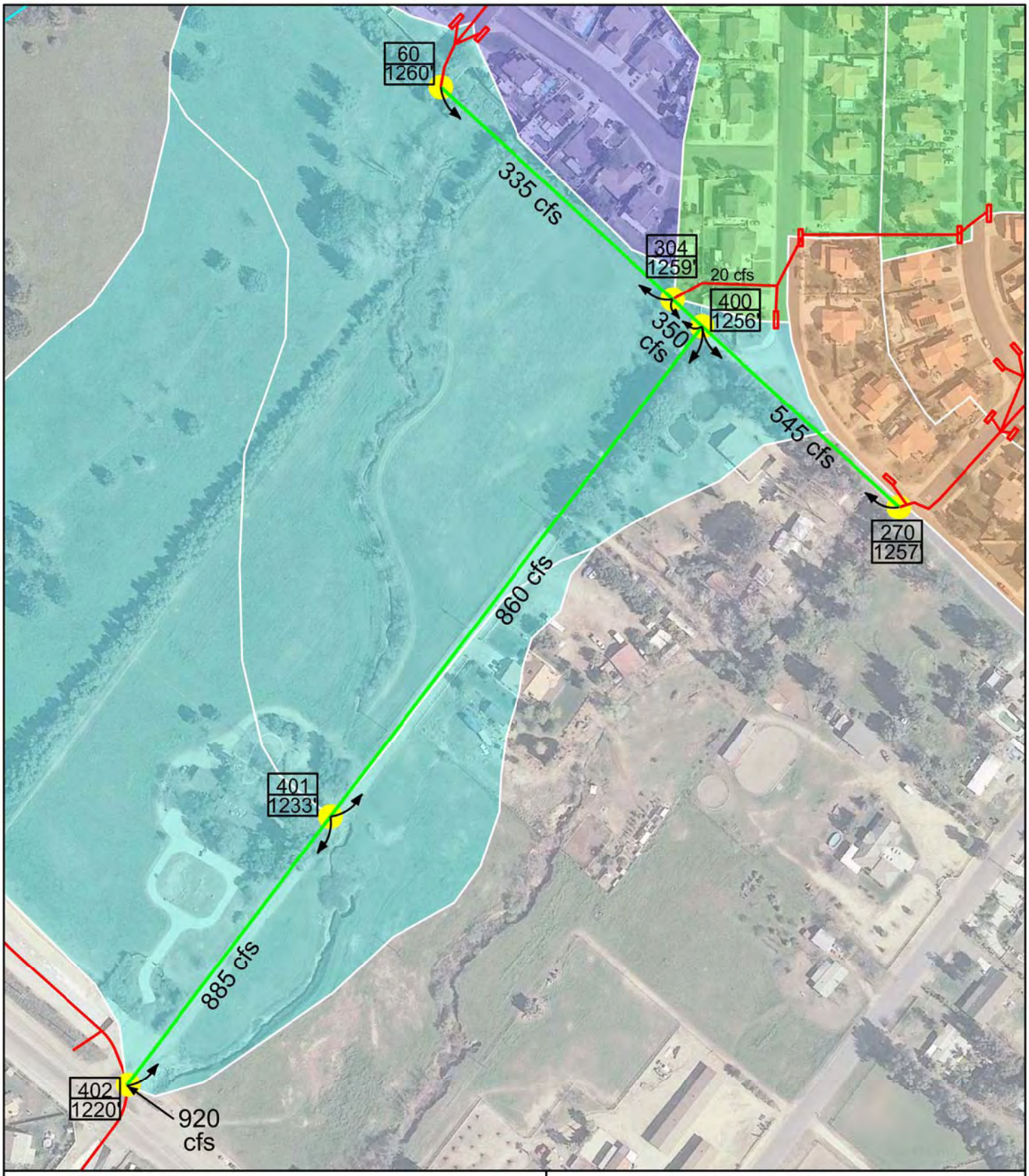
N

LEGEND

- EXISTING FACILITIES
- PROPOSED LATERAL C-1
- FLOW LINE
- FLOW LINE IN PIPE
- SUBAREA
- NODE
- B-9.3 L=561' 4.6 Ac — AREA DESIGNATION LENGTH (FT) AREA (ACRES)
- 226 1269 — NODE NUMBER NODE ELEVATION

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

WILDOMAR MDP
LATERAL C-1
RATIONAL HYDROLOGY MAP



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JAN 2014

200 0 200

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

WILDOMAR MDP

LATERAL C-1

RECOMMENDED FLOWRATES
100 YEAR - RATIONAL METHOD

CivilD Rational Method

This portion of the study was analyzed in two files.

“WildomarLatC1v910AC”- Study of flows to point 60 (Area A) and point 304 (Area C). These flows are combined and routed to point 400.

“WildomarLatC1v11BD”- Study of flows to point 270 (Area B), which is then routed to point 400 and combined with results from “WildomarLatC1v9AC”. Flows are then routed and combined at point 401 (Area D1) and point 402 (Area D2).

Riverside County Rational Hydrology Program

```
CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
        Rational Hydrology Study        Date: 01/07/14  File:WildomarLatC1v11BD.out
------------------------------------------------------------------------
Wildomar MDP Lateral C-1
Rational Study part 2 of 2
Area B (Woshka Ln) and Area D (Refa St)
changed land use option for initial areas
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------


Program License Serial Number 433

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.600(In.)
100 year, 1 hour precipitation =  1.450(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.450(In/Hr)
Slope of intensity duration curve = 0.4900




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   691.000(Ft.)
Top (of initial area) elevation =  1766.000(Ft.)
Bottom (of initial area) elevation =  1566.000(Ft.)
Difference in elevation =   200.000(Ft.)
Slope =    0.28944  s(percent)=      28.94
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.284 min.
Rainfall intensity =      3.618(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  86.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     16.588(CFS)
Total initial stream area =        5.400(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1566.000(Ft.)
End of natural channel elevation =   1552.000(Ft.)
Length of natural channel  =   135.000(Ft.)
Estimated mean flow rate at midpoint of channel =     26.418(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   5.29(Ft/s)
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```
Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.1037
Corrected/adjusted channel slope =  0.1037
Travel time =    0.43 min.     TC =    9.71  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.120
Decimal fraction soil group C = 0.880
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  83.00
Pervious area fraction =  0.900; Impervious fraction =  0.100
Rainfall intensity =      3.539(In/Hr) for a   100.0 year storm
Subarea runoff =     19.073(CFS) for      6.400(Ac.)
Total runoff =     35.661(CFS)  Total area =      11.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1552.000(Ft.)
End of natural channel elevation =   1485.000(Ft.)
Length of natural channel  =   746.000(Ft.)
Estimated mean flow rate at midpoint of channel =     52.283(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   6.18(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0898
Corrected/adjusted channel slope =  0.0898
Travel time =    2.01 min.     TC =   11.72  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.836
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.230
Decimal fraction soil group C = 0.770
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  82.00
Pervious area fraction =  0.860; Impervious fraction =  0.140
Rainfall intensity =      3.227(In/Hr) for a   100.0 year storm
Subarea runoff =     29.667(CFS) for     11.000(Ac.)
Total runoff =     65.328(CFS)  Total area =      22.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1485.000(Ft.)
End of natural channel elevation =   1432.000(Ft.)
Length of natural channel  =   693.000(Ft.)
Estimated mean flow rate at midpoint of channel =     88.250(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   6.79(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0765
Corrected/adjusted channel slope =  0.0765
Travel time =    1.70 min.     TC =   13.42  min.


 Adding area flow to channel
```

```
USER INPUT of soil data for subarea
Runoff Coefficient = 0.840
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.090
Decimal fraction soil group C = 0.880
Decimal fraction soil group D = 0.030
RI index for soil(AMC 2)  =  82.00
Pervious area fraction =  0.760; Impervious fraction =  0.240
Rainfall intensity =      3.020(In/Hr) for a   100.0 year storm
Subarea runoff =     40.567(CFS) for     16.000(Ac.)
Total runoff =    105.895(CFS)  Total area =      38.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1432.000(Ft.)
End of natural channel elevation =   1400.000(Ft.)
Length of natural channel  =   606.000(Ft.)
Estimated mean flow rate at midpoint of channel =    118.586(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  11.48(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0528
Corrected/adjusted channel slope =  0.0528
Travel time =    0.88 min.     TC =   14.30  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.860
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.650
Decimal fraction soil group D = 0.350
RI index for soil(AMC 2)  =  76.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Rainfall intensity =      2.927(In/Hr) for a   100.0 year storm
Subarea runoff =     23.425(CFS) for      9.300(Ac.)
Total runoff =    129.319(CFS)  Total area =      48.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1400.000(Ft.)
End of natural channel elevation =   1376.000(Ft.)
Length of natural channel  =   574.000(Ft.)
Estimated mean flow rate at midpoint of channel =    150.290(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  10.98(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0418
Corrected/adjusted channel slope =  0.0418
Travel time =    0.87 min.     TC =   15.17  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.010
Decimal fraction soil group C = 0.320
Decimal fraction soil group D = 0.670
RI index for soil(AMC 2)  =  79.00
Pervious area fraction =  0.450; Impervious fraction =  0.550
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```
Rainfall intensity =      2.844(In/Hr) for a   100.0 year storm
Subarea runoff =     37.937(CFS) for     15.600(Ac.)
Total runoff =    167.256(CFS)  Total area =      63.700(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      208.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1376.000(Ft.)
End of natural channel elevation =   1359.000(Ft.)
Length of natural channel  =   276.000(Ft.)
Estimated mean flow rate at midpoint of channel =    173.427(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  13.93(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0616
Corrected/adjusted channel slope =  0.0616
Travel time =    0.33 min.     TC =   15.51  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.868
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Rainfall intensity =      2.814(In/Hr) for a   100.0 year storm
Subarea runoff =     11.486(CFS) for      4.700(Ac.)
Total runoff =    178.742(CFS)  Total area =      68.400(Ac.)


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Process from Point/Station      208.000 to Point/Station      209.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1359.000(Ft.)
End of natural channel elevation =   1348.000(Ft.)
Length of natural channel  =   383.000(Ft.)
Estimated mean flow rate at midpoint of channel =    186.581(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   9.73(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0287
Corrected/adjusted channel slope =  0.0287
Travel time =    0.66 min.     TC =   16.16  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.871
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.030
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.180; Impervious fraction =  0.820
Rainfall intensity =      2.757(In/Hr) for a   100.0 year storm
Subarea runoff =     14.412(CFS) for      6.000(Ac.)
Total runoff =    193.154(CFS)  Total area =      74.400(Ac.)


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Process from Point/Station      208.000 to Point/Station      209.000
**** CONFLUENCE OF MAIN STREAMS ****
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The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     74.400(Ac.)
Runoff from this stream =    193.154(CFS)
Time of concentration =   16.16 min.
Rainfall intensity =     2.757(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      218.000 to Point/Station      209.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =  1397.000(Ft.)
Top (of initial area) elevation =  1433.000(Ft.)
Bottom (of initial area) elevation =  1348.000(Ft.)
Difference in elevation =    85.000(Ft.)
Slope =    0.06084  s(percent)=       6.08
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.243 min.
Rainfall intensity =      3.448(In/Hr) for a   100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.875
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.050
Decimal fraction soil group C = 0.600
Decimal fraction soil group D = 0.350
RI index for soil(AMC 2)  =  70.45
Pervious area fraction =  0.200; Impervious fraction =  0.800
Initial subarea runoff =     19.305(CFS)
Total initial stream area =        6.400(Ac.)
Pervious area fraction = 0.200


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Process from Point/Station      218.000 to Point/Station      209.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.400(Ac.)
Runoff from this stream =     19.305(CFS)
Time of concentration =   10.24 min.
Rainfall intensity =     3.448(In/Hr)
Summary of stream data:

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


1      193.154     16.16                 2.757
2       19.305     10.24                 3.448
Largest stream flow has longer time of concentration
Qp =    193.154 + sum of
          Qb         Ia/Ib
          19.305 *    0.800 =     15.440
Qp =    208.593

Total of 2 main streams to confluence:
Flow rates before confluence point:
     193.154      19.305
Area of streams before confluence:
       74.400        6.400


Results of confluence:
Total flow rate =    208.593(CFS)
Time of concentration =    16.161 min.
Effective stream area after confluence  =     80.800(Ac.)


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Process from Point/Station      209.000 to Point/Station      220.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1348.000(Ft.)
Downstream point/station elevation =  1347.000(Ft.)
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```
Pipe length  =    48.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   208.593(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   208.593(CFS)
Normal flow depth in pipe =   50.63(In.)
Flow top width inside pipe =   43.57(In.)
Critical Depth =   49.36(In.)
Pipe flow velocity =     11.80(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    16.23 min.


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Process from Point/Station      209.000 to Point/Station      220.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.610
Decimal fraction soil group D = 0.390
RI index for soil(AMC 2)  =  71.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    16.23 min.
Rainfall intensity =      2.752(In/Hr) for a   100.0 year storm
Subarea runoff =      5.846(CFS) for      2.400(Ac.)
Total runoff =    214.439(CFS)  Total area =      83.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      221.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1347.000(Ft.)
Downstream point/station elevation =  1344.000(Ft.)
Pipe length  =   119.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   214.439(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   214.439(CFS)
Normal flow depth in pipe =   47.06(In.)
Flow top width inside pipe =   49.35(In.)
Critical Depth =   49.92(In.)
Pipe flow velocity =     12.99(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    16.38 min.


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Process from Point/Station      220.000 to Point/Station      221.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.570
Decimal fraction soil group D = 0.430
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    16.38 min.
Rainfall intensity =      2.739(In/Hr) for a   100.0 year storm
Subarea runoff =      5.337(CFS) for      2.200(Ac.)
Total runoff =    219.776(CFS)  Total area =      85.400(Ac.)


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Process from Point/Station      221.000 to Point/Station      222.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1344.000(Ft.)
Downstream point/station elevation =  1340.000(Ft.)
Pipe length  =   127.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   219.776(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   219.776(CFS)
Normal flow depth in pipe =   43.59(In.)
Flow top width inside pipe =   53.49(In.)
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Critical Depth =   50.48(In.)
Pipe flow velocity =     14.38(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    16.53 min.


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Process from Point/Station      221.000 to Point/Station      222.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.100
Decimal fraction soil group C = 0.460
Decimal fraction soil group D = 0.440
RI index for soil(AMC 2)  =  70.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    16.53 min.
Rainfall intensity =      2.727(In/Hr) for a   100.0 year storm
Subarea runoff =      4.824(CFS) for      2.000(Ac.)
Total runoff =    224.600(CFS)  Total area =      87.400(Ac.)


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Process from Point/Station      222.000 to Point/Station      223.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1340.000(Ft.)
Downstream point/station elevation =  1314.000(Ft.)
Pipe length  =   852.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   224.600(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   224.600(CFS)
Normal flow depth in pipe =   29.77(In.)
Flow top width inside pipe =   60.00(In.)
Critical Depth =   50.95(In.)
Pipe flow velocity =     23.09(Ft/s)
Travel time through pipe =    0.61 min.
Time of concentration (TC) =    17.14 min.


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Process from Point/Station      222.000 to Point/Station      223.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.818
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.420
Decimal fraction soil group C = 0.040
Decimal fraction soil group D = 0.540
RI index for soil(AMC 2)  =  67.00
Pervious area fraction =  0.460; Impervious fraction =  0.540
Time of concentration =    17.14 min.
Rainfall intensity =      2.679(In/Hr) for a   100.0 year storm
Subarea runoff =     14.033(CFS) for      6.400(Ac.)
Total runoff =    238.633(CFS)  Total area =      93.800(Ac.)


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Process from Point/Station      223.000 to Point/Station      224.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1314.000(Ft.)
Downstream point/station elevation =  1305.000(Ft.)
Pipe length  =   249.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   238.633(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   238.633(CFS)
Normal flow depth in pipe =   34.73(In.)
Flow top width inside pipe =   42.93(In.)
Critical depth could not be calculated.
Pipe flow velocity =     24.49(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    17.31 min.
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Process from Point/Station      223.000 to Point/Station      224.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.822
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.050
Decimal fraction soil group D = 0.650
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.470; Impervious fraction =  0.530
Time of concentration =    17.31 min.
Rainfall intensity =      2.666(In/Hr) for a   100.0 year storm
Subarea runoff =     17.759(CFS) for      8.100(Ac.)
Total runoff =    256.392(CFS)  Total area =     101.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      224.000 to Point/Station      225.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1305.000(Ft.)
Downstream point/station elevation =  1282.000(Ft.)
Pipe length  =   737.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   256.392(CFS)
Given pipe size =     54.00(In.)
Calculated individual pipe flow  =   256.392(CFS)
Normal flow depth in pipe =   34.50(In.)
Flow top width inside pipe =   51.87(In.)
Critical depth could not be calculated.
Pipe flow velocity =     23.89(Ft/s)
Travel time through pipe =    0.51 min.
Time of concentration (TC) =    17.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      224.000 to Point/Station      225.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.810
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.340
Decimal fraction soil group C = 0.200
Decimal fraction soil group D = 0.460
RI index for soil(AMC 2)  =  67.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    17.83 min.
Rainfall intensity =      2.628(In/Hr) for a   100.0 year storm
Subarea runoff =      6.599(CFS) for      3.100(Ac.)
Total runoff =    262.991(CFS)  Total area =     105.000(Ac.)


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Process from Point/Station      225.000 to Point/Station      226.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1282.000(Ft.)
Downstream point/station elevation =  1269.000(Ft.)
Pipe length  =   175.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   262.991(CFS)
Given pipe size =     72.00(In.)
Calculated individual pipe flow  =   262.991(CFS)
Normal flow depth in pipe =   23.37(In.)
Flow top width inside pipe =   67.42(In.)
Critical Depth =   53.27(In.)
Pipe flow velocity =     33.07(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    17.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      225.000 to Point/Station      226.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.772
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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.990
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.010
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    17.92 min.
Rainfall intensity =      2.622(In/Hr) for a   100.0 year storm
Subarea runoff =      7.686(CFS) for      3.800(Ac.)
Total runoff =    270.678(CFS)  Total area =     108.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      225.000 to Point/Station      226.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    108.800(Ac.)
Runoff from this stream =    270.678(CFS)
Time of concentration =   17.92 min.
Rainfall intensity =     2.622(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   907.000(Ft.)
Top (of initial area) elevation =  1840.000(Ft.)
Bottom (of initial area) elevation =  1612.000(Ft.)
Difference in elevation =   228.000(Ft.)
Slope =    0.25138  s(percent)=      25.14
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.648 min.
Rainfall intensity =      3.383(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.846
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  86.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     25.464(CFS)
Total initial stream area =        8.900(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      211.000 to Point/Station      212.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1612.000(Ft.)
End of natural channel elevation =   1598.000(Ft.)
Length of natural channel  =   172.000(Ft.)
Estimated mean flow rate at midpoint of channel =     33.476(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   5.08(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0814
Corrected/adjusted channel slope =  0.0814
Travel time =    0.56 min.     TC =   11.21  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.836
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
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RI index for soil(AMC 2)  =  84.00
Pervious area fraction =  0.990; Impervious fraction =  0.010
Rainfall intensity =      3.299(In/Hr) for a   100.0 year storm
Subarea runoff =     15.448(CFS) for      5.600(Ac.)
Total runoff =     40.912(CFS)  Total area =      14.500(Ac.)


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Process from Point/Station      212.000 to Point/Station      213.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1598.000(Ft.)
End of natural channel elevation =   1524.000(Ft.)
Length of natural channel  =  1014.000(Ft.)
Estimated mean flow rate at midpoint of channel =     54.738(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   5.66(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0730
Corrected/adjusted channel slope =  0.0730
Travel time =    2.98 min.     TC =   14.20  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.826
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.260
Decimal fraction soil group C = 0.740
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  82.00
Pervious area fraction =  0.907; Impervious fraction =  0.093
Rainfall intensity =      2.938(In/Hr) for a   100.0 year storm
Subarea runoff =     23.787(CFS) for      9.800(Ac.)
Total runoff =     64.699(CFS)  Total area =      24.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      213.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     24.300(Ac.)
Runoff from this stream =     64.699(CFS)
Time of concentration =   14.20 min.
Rainfall intensity =     2.938(In/Hr)


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Process from Point/Station      214.000 to Point/Station      215.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   733.000(Ft.)
Top (of initial area) elevation =  1766.000(Ft.)
Bottom (of initial area) elevation =  1618.000(Ft.)
Difference in elevation =   148.000(Ft.)
Slope =    0.20191  s(percent)=      20.19
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.216 min.
Rainfall intensity =      3.452(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  86.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      8.185(CFS)
Total initial stream area =        2.800(Ac.)
Pervious area fraction = 1.000
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Process from Point/Station      215.000 to Point/Station      216.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1618.000(Ft.)
End of natural channel elevation =   1564.000(Ft.)
Length of natural channel  =   438.000(Ft.)
Estimated mean flow rate at midpoint of channel =     15.493(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   4.83(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.1233
Corrected/adjusted channel slope =  0.1233
Travel time =    1.51 min.     TC =   11.73  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.841
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  84.00
Pervious area fraction =  0.900; Impervious fraction =  0.100
Rainfall intensity =      3.227(In/Hr) for a   100.0 year storm
Subarea runoff =     13.567(CFS) for      5.000(Ac.)
Total runoff =     21.752(CFS)  Total area =       7.800(Ac.)


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Process from Point/Station      216.000 to Point/Station      213.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1564.000(Ft.)
End of natural channel elevation =   1524.000(Ft.)
Length of natural channel  =   576.000(Ft.)
Estimated mean flow rate at midpoint of channel =     28.027(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   4.43(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0694
Corrected/adjusted channel slope =  0.0694
Travel time =    2.17 min.     TC =   13.89  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.837
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.150
Decimal fraction soil group C = 0.850
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  83.00
Pervious area fraction =  0.828; Impervious fraction =  0.172
Rainfall intensity =      2.970(In/Hr) for a   100.0 year storm
Subarea runoff =     11.188(CFS) for      4.500(Ac.)
Total runoff =     32.941(CFS)  Total area =      12.300(Ac.)


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Process from Point/Station      216.000 to Point/Station      213.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     12.300(Ac.)
Runoff from this stream =     32.941(CFS)
Time of concentration =   13.89 min.
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Rainfall intensity =     2.970(In/Hr)
Summary of stream data:

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


1       64.699     14.20                 2.938
2       32.941     13.89                 2.970
Largest stream flow has longer time of concentration
Qp =     64.699 + sum of
          Qb         Ia/Ib
          32.941 *    0.989 =     32.594
Qp =     97.294

Total of 2 streams to confluence:
Flow rates before confluence point:
      64.699      32.941
Area of streams before confluence:
       24.300       12.300
Results of confluence:
Total flow rate =     97.294(CFS)
Time of concentration =    14.196 min.
Effective stream area after confluence =     36.600(Ac.)


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Process from Point/Station      213.000 to Point/Station      217.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1524.000(Ft.)
End of natural channel elevation =   1465.000(Ft.)
Length of natural channel  =   987.000(Ft.)
Estimated mean flow rate at midpoint of channel =    111.117(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  11.98(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0598
Corrected/adjusted channel slope =  0.0598
Travel time =    1.37 min.     TC =   15.57  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.832
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.410
Decimal fraction soil group C = 0.270
Decimal fraction soil group D = 0.320
RI index for soil(AMC 2)  =  82.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Rainfall intensity =      2.808(In/Hr) for a   100.0 year storm
Subarea runoff =     24.302(CFS) for     10.400(Ac.)
Total runoff =    121.595(CFS)  Total area =      47.000(Ac.)


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Process from Point/Station      217.000 to Point/Station      231.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1465.000(Ft.)
End of natural channel elevation =   1388.000(Ft.)
Length of natural channel  =  1369.000(Ft.)
Estimated mean flow rate at midpoint of channel =    129.745(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  12.18(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0562
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Corrected/adjusted channel slope =  0.0562
Travel time =    1.87 min.     TC =   17.44  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.824
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.600
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.400
RI index for soil(AMC 2)  =  81.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Rainfall intensity =      2.656(In/Hr) for a   100.0 year storm
Subarea runoff =     13.792(CFS) for      6.300(Ac.)
Total runoff =    135.387(CFS)  Total area =      53.300(Ac.)


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Process from Point/Station      217.000 to Point/Station      231.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     53.300(Ac.)
Runoff from this stream =    135.387(CFS)
Time of concentration =   17.44 min.
Rainfall intensity =     2.656(In/Hr)


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Process from Point/Station      229.000 to Point/Station      230.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   973.000(Ft.)
Top (of initial area) elevation =  1469.000(Ft.)
Bottom (of initial area) elevation =  1400.000(Ft.)
Difference in elevation =    69.000(Ft.)
Slope =    0.07091  s(percent)=       7.09
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.774 min.
Rainfall intensity =      3.094(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.749
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.690
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.310
RI index for soil(AMC 2)  =  61.89
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      6.721(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.800


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Process from Point/Station      230.000 to Point/Station      231.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1400.000(Ft.)
End of natural channel elevation =   1388.000(Ft.)
Length of natural channel  =   201.000(Ft.)
Estimated mean flow rate at midpoint of channel =      9.850(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   6.08(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0597
Corrected/adjusted channel slope =  0.0597
Travel time =    0.55 min.     TC =   13.33  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.844
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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.260
Decimal fraction soil group C = 0.080
Decimal fraction soil group D = 0.660
RI index for soil(AMC 2)  =  81.00
Pervious area fraction =  0.670; Impervious fraction =  0.330
Rainfall intensity =      3.031(In/Hr) for a   100.0 year storm
Subarea runoff =      6.904(CFS) for      2.700(Ac.)
Total runoff =     13.625(CFS)  Total area =       5.600(Ac.)


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Process from Point/Station      230.000 to Point/Station      231.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      5.600(Ac.)
Runoff from this stream =     13.625(CFS)
Time of concentration =   13.33 min.
Rainfall intensity =     3.031(In/Hr)
Summary of stream data:

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


1      135.387     17.44                 2.656
2       13.625     13.33                 3.031
Largest stream flow has longer time of concentration
Qp =    135.387 + sum of
          Qb         Ia/Ib
          13.625 *    0.876 =     11.941
Qp =    147.328

Total of 2 streams to confluence:
Flow rates before confluence point:
     135.387      13.625
Area of streams before confluence:
       53.300        5.600
Results of confluence:
Total flow rate =    147.328(CFS)
Time of concentration =    17.442 min.
Effective stream area after confluence =     58.900(Ac.)


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Process from Point/Station      231.000 to Point/Station      232.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1388.000(Ft.)
End of natural channel elevation =   1354.000(Ft.)
Length of natural channel  =   642.000(Ft.)
Estimated mean flow rate at midpoint of channel =    155.957(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =  12.50(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0530
Corrected/adjusted channel slope =  0.0530
Travel time =    0.86 min.     TC =   18.30  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.841
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.240
Decimal fraction soil group C = 0.340
Decimal fraction soil group D = 0.420
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.450; Impervious fraction =  0.550
Rainfall intensity =      2.595(In/Hr) for a   100.0 year storm
Subarea runoff =     15.052(CFS) for      6.900(Ac.)
Total runoff =    162.380(CFS)  Total area =      65.800(Ac.)
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Process from Point/Station      232.000 to Point/Station      233.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1354.000(Ft.)
End of natural channel elevation =   1346.000(Ft.)
Length of natural channel  =   254.000(Ft.)
Estimated mean flow rate at midpoint of channel =    172.992(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   9.95(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0315
Corrected/adjusted channel slope =  0.0315
Travel time =    0.43 min.     TC =   18.72  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.650
Decimal fraction soil group C = 0.040
Decimal fraction soil group D = 0.310
RI index for soil(AMC 2)  =  62.00
Pervious area fraction =  0.180; Impervious fraction =  0.820
Rainfall intensity =      2.566(In/Hr) for a   100.0 year storm
Subarea runoff =     18.994(CFS) for      8.600(Ac.)
Total runoff =    181.374(CFS)  Total area =      74.400(Ac.)


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Process from Point/Station      233.000 to Point/Station      234.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1346.000(Ft.)
Downstream point/station elevation =  1338.000(Ft.)
Pipe length  =   267.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   181.374(CFS)
Given pipe size =     48.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
    11.356(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =     14.504(Ft.)
 Minor friction loss =      4.852(Ft.)  K-factor =   1.50
Pipe flow velocity =     14.43(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    19.03 min.


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Process from Point/Station      233.000 to Point/Station      234.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.800
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.200
RI index for soil(AMC 2)  =  60.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    19.03 min.
Rainfall intensity =      2.545(In/Hr) for a   100.0 year storm
Subarea runoff =      1.785(CFS) for      0.800(Ac.)
Total runoff =    183.159(CFS)  Total area =      75.200(Ac.)


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Process from Point/Station      234.000 to Point/Station      235.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
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Upstream point/station elevation =  1338.000(Ft.)
Downstream point/station elevation =  1312.000(Ft.)
Pipe length  =   207.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   183.159(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   183.159(CFS)
Normal flow depth in pipe =   19.90(In.)
Flow top width inside pipe =   47.29(In.)
Critical Depth =   45.47(In.)
Pipe flow velocity =     37.19(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    19.12 min.


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Process from Point/Station      234.000 to Point/Station      235.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.620
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.380
RI index for soil(AMC 2)  =  63.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    19.12 min.
Rainfall intensity =      2.539(In/Hr) for a   100.0 year storm
Subarea runoff =      2.901(CFS) for      1.300(Ac.)
Total runoff =    186.060(CFS)  Total area =      76.500(Ac.)


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Process from Point/Station      235.000 to Point/Station      236.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1312.000(Ft.)
Downstream point/station elevation =  1306.000(Ft.)
Pipe length  =   492.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   186.060(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   186.060(CFS)
Normal flow depth in pipe =   35.11(In.)
Flow top width inside pipe =   59.12(In.)
Critical Depth =   46.83(In.)
Pipe flow velocity =     15.57(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    19.65 min.


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Process from Point/Station      235.000 to Point/Station      236.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     76.500(Ac.)
Runoff from this stream =    186.060(CFS)
Time of concentration =   19.65 min.
Rainfall intensity =     2.506(In/Hr)


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Process from Point/Station      240.000 to Point/Station      241.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   686.000(Ft.)
Top (of initial area) elevation =  1410.000(Ft.)
Bottom (of initial area) elevation =  1366.000(Ft.)
Difference in elevation =    44.000(Ft.)
Slope =    0.06414  s(percent)=       6.41
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.736 min.
Rainfall intensity =      3.728(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.600
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Decimal fraction soil group D = 0.400
RI index for soil(AMC 2)  =  71.40
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      9.302(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      241.000 to Point/Station      242.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1366.000(Ft.)
End of natural channel elevation =   1340.000(Ft.)
Length of natural channel  =   450.000(Ft.)
Estimated mean flow rate at midpoint of channel =     15.557(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   6.74(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0578
Corrected/adjusted channel slope =  0.0578
Travel time =    1.11 min.     TC =    9.85  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.260
Decimal fraction soil group D = 0.740
RI index for soil(AMC 2)  =  73.00
Pervious area fraction =  0.190; Impervious fraction =  0.810
Rainfall intensity =      3.515(In/Hr) for a   100.0 year storm
Subarea runoff =     12.048(CFS) for      3.900(Ac.)
Total runoff =     21.350(CFS)  Total area =       6.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      242.000 to Point/Station      243.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1340.000(Ft.)
Downstream point/station elevation =  1339.000(Ft.)
Pipe length  =    59.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    21.350(CFS)
Given pipe size =     24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.866(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.791(Ft.)
 Minor friction loss =      1.076(Ft.)  K-factor =   1.50
Pipe flow velocity =      6.80(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     9.99 min.


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Process from Point/Station      242.000 to Point/Station      243.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.060
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.940
RI index for soil(AMC 2)  =  74.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.99 min.
Rainfall intensity =      3.490(In/Hr) for a   100.0 year storm
Subarea runoff =      2.172(CFS) for      0.700(Ac.)
Total runoff =     23.523(CFS)  Total area =       7.500(Ac.)
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Process from Point/Station      243.000 to Point/Station      244.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1339.000(Ft.)
Downstream point/station elevation =  1333.000(Ft.)
Pipe length  =   144.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    23.523(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    23.523(CFS)
Normal flow depth in pipe =   18.52(In.)
Flow top width inside pipe =   20.15(In.)
Critical Depth =   20.64(In.)
Pipe flow velocity =      9.05(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =    10.26 min.


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Process from Point/Station      243.000 to Point/Station      244.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
RI index for soil(AMC 2)  =  65.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.26 min.
Rainfall intensity =      3.445(In/Hr) for a   100.0 year storm
Subarea runoff =      7.923(CFS) for      2.600(Ac.)
Total runoff =     31.446(CFS)  Total area =      10.100(Ac.)


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Process from Point/Station      244.000 to Point/Station      245.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1333.000(Ft.)
Downstream point/station elevation =  1328.000(Ft.)
Pipe length  =   151.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    31.446(CFS)
Given pipe size =     24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     7.274(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      9.941(Ft.)
 Minor friction loss =      2.334(Ft.)  K-factor =   1.50
Pipe flow velocity =     10.01(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =    10.51 min.


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Process from Point/Station      244.000 to Point/Station      245.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.030
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.970
RI index for soil(AMC 2)  =  74.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.51 min.
Rainfall intensity =      3.405(In/Hr) for a   100.0 year storm
Subarea runoff =      4.238(CFS) for      1.400(Ac.)
Total runoff =     35.684(CFS)  Total area =      11.500(Ac.)


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Process from Point/Station      245.000 to Point/Station      236.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
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Upstream point/station elevation =  1328.000(Ft.)
Downstream point/station elevation =  1306.000(Ft.)
Pipe length  =   414.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    35.684(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    35.684(CFS)
Normal flow depth in pipe =   14.58(In.)
Flow top width inside pipe =   23.44(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.87(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =    10.90 min.


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Process from Point/Station      245.000 to Point/Station      236.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     11.500(Ac.)
Runoff from this stream =     35.684(CFS)
Time of concentration =   10.90 min.
Rainfall intensity =     3.345(In/Hr)
Summary of stream data:

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


1      186.060     19.65                 2.506
2       35.684     10.90                 3.345
Largest stream flow has longer time of concentration
Qp =    186.060 + sum of
          Qb         Ia/Ib
          35.684 *    0.749 =     26.729
Qp =    212.789

Total of 2 streams to confluence:
Flow rates before confluence point:
     186.060      35.684
Area of streams before confluence:
       76.500       11.500
Results of confluence:
Total flow rate =    212.789(CFS)
Time of concentration =    19.651 min.
Effective stream area after confluence =     88.000(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      236.000 to Point/Station      247.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1306.000(Ft.)
Downstream point/station elevation =  1301.000(Ft.)
Pipe length  =   129.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   212.789(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   212.789(CFS)
Normal flow depth in pipe =   26.95(In.)
Flow top width inside pipe =   59.69(In.)
Critical Depth =   49.78(In.)
Pipe flow velocity =     24.90(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    19.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      236.000 to Point/Station      247.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.812
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.350
Decimal fraction soil group C = 0.020
Decimal fraction soil group D = 0.630
RI index for soil(AMC 2)  =  68.00
```

```
Pervious area fraction =  0.490; Impervious fraction =  0.510
Time of concentration =    19.74 min.
Rainfall intensity =      2.500(In/Hr) for a   100.0 year storm
Subarea runoff =      8.319(CFS) for      4.100(Ac.)
Total runoff =    221.108(CFS)  Total area =      92.100(Ac.)


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Process from Point/Station      247.000 to Point/Station      248.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1301.000(Ft.)
Downstream point/station elevation =  1295.000(Ft.)
Pipe length  =   415.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   221.108(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   221.108(CFS)
Normal flow depth in pipe =   37.22(In.)
Flow top width inside pipe =   58.24(In.)
Critical Depth =   50.58(In.)
Pipe flow velocity =     17.29(Ft/s)
Travel time through pipe =    0.40 min.
Time of concentration (TC) =    20.14 min.


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Process from Point/Station      247.000 to Point/Station      248.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.817
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.160
Decimal fraction soil group C = 0.400
Decimal fraction soil group D = 0.440
RI index for soil(AMC 2)  =  70.00
Pervious area fraction =  0.490; Impervious fraction =  0.510
Time of concentration =    20.14 min.
Rainfall intensity =      2.476(In/Hr) for a   100.0 year storm
Subarea runoff =      3.440(CFS) for      1.700(Ac.)
Total runoff =    224.547(CFS)  Total area =      93.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      248.000 to Point/Station      226.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1295.000(Ft.)
Downstream point/station elevation =  1269.000(Ft.)
Pipe length  =   561.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   224.547(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   224.547(CFS)
Normal flow depth in pipe =   26.41(In.)
Flow top width inside pipe =   59.57(In.)
Critical Depth =   50.95(In.)
Pipe flow velocity =     26.98(Ft/s)
Travel time through pipe =    0.35 min.
Time of concentration (TC) =    20.48 min.


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Process from Point/Station      248.000 to Point/Station      226.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.812
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.260
Decimal fraction soil group C = 0.240
Decimal fraction soil group D = 0.500
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    20.48 min.
Rainfall intensity =      2.455(In/Hr) for a   100.0 year storm
Subarea runoff =      9.167(CFS) for      4.600(Ac.)
Total runoff =    233.715(CFS)  Total area =      98.400(Ac.)
```

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Process from Point/Station      248.000 to Point/Station      226.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     98.400(Ac.)
Runoff from this stream =    233.715(CFS)
Time of concentration =   20.48 min.
Rainfall intensity =     2.455(In/Hr)
Summary of stream data:

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


1      270.678     17.92                 2.622
2      233.715     20.48                 2.455
Largest stream flow has longer or shorter time of concentration
Qp =    270.678 + sum of
          Qa          Tb/Ta
         233.715 *    0.875 =    204.405
Qp =    475.083

Total of 2 main streams to confluence:
Flow rates before confluence point:
     270.678     233.715
Area of streams before confluence:
      108.800       98.400


Results of confluence:
Total flow rate =    475.083(CFS)
Time of concentration =    17.916 min.
Effective stream area after confluence  =    207.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      226.000 to Point/Station      250.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1269.000(Ft.)
Downstream point/station elevation =  1258.000(Ft.)
Pipe length  =  1339.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   475.083(CFS)
Given pipe size =     84.00(In.)
Calculated individual pipe flow  =   475.083(CFS)
Normal flow depth in pipe =   57.94(In.)
Flow top width inside pipe =   77.72(In.)
Critical Depth =   68.58(In.)
Pipe flow velocity =     16.79(Ft/s)
Travel time through pipe =    1.33 min.
Time of concentration (TC) =    19.24 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      226.000 to Point/Station      250.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    207.200(Ac.)
Runoff from this stream =    475.083(CFS)
Time of concentration =   19.24 min.
Rainfall intensity =     2.531(In/Hr)


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Process from Point/Station      261.000 to Point/Station      262.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   958.000(Ft.)
Top (of initial area) elevation =  1330.000(Ft.)
Bottom (of initial area) elevation =  1301.000(Ft.)
Difference in elevation =    29.000(Ft.)
Slope =    0.03027  s(percent)=       3.03
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.229 min.
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```
Rainfall intensity =      3.161(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.812
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.600
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.400
RI index for soil(AMC 2)  =  63.60
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =     10.017(CFS)
Total initial stream area =        3.900(Ac.)
Pervious area fraction = 0.500


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Process from Point/Station      262.000 to Point/Station      263.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1301.000(Ft.)
End of street segment elevation =  1290.000(Ft.)
Length of street segment  =   517.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     16.009(CFS)
Depth of flow =   0.402(Ft.), Average velocity =   3.948(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.787(Ft.)
Flow velocity =   3.95(Ft/s)
Travel time =    2.18 min.     TC =   14.41  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.795
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.700
Decimal fraction soil group C = 0.270
Decimal fraction soil group D = 0.030
RI index for soil(AMC 2)  =  60.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.917(In/Hr) for a   100.0 year storm
Subarea runoff =     11.824(CFS) for      5.100(Ac.)
Total runoff =     21.841(CFS)  Total area =       9.000(Ac.)
Street flow at end of street =     21.841(CFS)
Half street flow at end of street =     10.920(CFS)
Depth of flow =   0.439(Ft.), Average velocity =   4.254(Ft/s)
Flow width (from curb towards crown)=  15.621(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      263.000 to Point/Station      264.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1290.000(Ft.)
End of street segment elevation =  1281.000(Ft.)
Length of street segment  =   498.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
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Estimated mean flow rate at midpoint of street =     28.214(CFS)
Depth of flow =   0.484(Ft.), Average velocity =   4.256(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.855(Ft.)
Flow velocity =   4.26(Ft/s)
Travel time =    1.95 min.     TC =   16.36  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.790
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.790
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.210
RI index for soil(AMC 2)  =  60.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.741(In/Hr) for a   100.0 year storm
Subarea runoff =     12.555(CFS) for      5.800(Ac.)
Total runoff =     34.396(CFS)  Total area =      14.800(Ac.)
Street flow at end of street =     34.396(CFS)
Half street flow at end of street =     17.198(CFS)
Depth of flow =   0.515(Ft.), Average velocity =   4.403(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    0.61(Ft.)
Flow width (from curb towards crown)=  19.429(Ft.)


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Process from Point/Station      264.000 to Point/Station      265.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1281.000(Ft.)
End of street segment elevation =  1272.000(Ft.)
Length of street segment  =   649.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     41.284(CFS)
Depth of flow =   0.570(Ft.), Average velocity =   4.026(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    2.78(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.000(Ft.)
Flow velocity =   4.03(Ft/s)
Travel time =    2.69 min.     TC =   19.05  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.814
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.320
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.670
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.544(In/Hr) for a   100.0 year storm
Subarea runoff =     13.672(CFS) for      6.600(Ac.)
Total runoff =     48.067(CFS)  Total area =      21.400(Ac.)
Street flow at end of street =     48.067(CFS)
Half street flow at end of street =     24.034(CFS)
Depth of flow =   0.592(Ft.), Average velocity =   4.219(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    3.69(Ft.)
Flow width (from curb towards crown)=  22.000(Ft.)


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Process from Point/Station      265.000 to Point/Station      250.000
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**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Top of street segment elevation =  1272.000(Ft.)
End of street segment elevation =  1258.000(Ft.)
Length of street segment  =   103.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     55.756(CFS)
Depth of flow =   0.440(Ft.), Average velocity =  10.778(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  15.684(Ft.)
Flow velocity =  10.78(Ft/s)
Travel time =    0.16 min.     TC =   19.21  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.824
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.150
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.850
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.534(In/Hr) for a   100.0 year storm
Subarea runoff =     15.232(CFS) for      7.300(Ac.)
Total runoff =     63.300(CFS)  Total area =      28.700(Ac.)
Street flow at end of street =     63.300(CFS)
Half street flow at end of street =     31.650(CFS)
Depth of flow =   0.457(Ft.), Average velocity =  11.115(Ft/s)
Flow width (from curb towards crown)=  16.495(Ft.)


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Process from Point/Station      265.000 to Point/Station      250.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     28.700(Ac.)
Runoff from this stream =     63.300(CFS)
Time of concentration =   19.21 min.
Rainfall intensity =     2.534(In/Hr)
Summary of stream data:

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


1      475.083     19.24                 2.531
2       63.300     19.21                 2.534
Largest stream flow has longer time of concentration
Qp =    475.083 + sum of
          Qb         Ia/Ib
          63.300 *    0.999 =     63.241
Qp =    538.324

Total of 2 streams to confluence:
Flow rates before confluence point:
     475.083      63.300
Area of streams before confluence:
      207.200       28.700
Results of confluence:
Total flow rate =    538.324(CFS)
Time of concentration =    19.244 min.
Effective stream area after confluence =    235.900(Ac.)


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Process from Point/Station      250.000 to Point/Station      270.000
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**** PIPEFLOW TRAVEL TIME (User specified size) ****
____________________________________________________________________
Upstream point/station elevation =  1258.000(Ft.)
Downstream point/station elevation =  1257.000(Ft.)
Pipe length  =   208.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   538.324(CFS)
Given pipe size =     84.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     5.034(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.477(Ft.)
 Minor friction loss =      4.557(Ft.)  K-factor =   1.50
Pipe flow velocity =     13.99(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =    19.49 min.


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Process from Point/Station      250.000 to Point/Station      270.000
**** SUBAREA FLOW ADDITION ****
____________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.813
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    19.49 min.
Rainfall intensity =      2.516(In/Hr) for a   100.0 year storm
Subarea runoff =      5.320(CFS) for      2.600(Ac.)
Total runoff =    543.645(CFS)  Total area =     238.500(Ac.)


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Process from Point/Station      270.000 to Point/Station      400.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________
Upstream point/station elevation =  1257.000(Ft.)
Downstream point/station elevation =  1256.000(Ft.)
Pipe length  =   318.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   543.645(CFS)
Nearest computed pipe diameter  =     96.00(In.)
Calculated individual pipe flow  =   543.645(CFS)
Normal flow depth in pipe =   85.88(In.)
Flow top width inside pipe =   58.97(In.)
Critical Depth =   71.33(In.)
Pipe flow velocity =     11.46(Ft/s)
Travel time through pipe =    0.46 min.
Time of concentration (TC) =    19.95 min.


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Process from Point/Station      270.000 to Point/Station      400.000
**** CONFLUENCE OF MAIN STREAMS ****
____________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    238.500(Ac.)
Runoff from this stream =    543.645(CFS)
Time of concentration =   19.95 min.
Rainfall intensity =     2.487(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station        1.000 to Point/Station      400.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
____________________________________________________________________
Rainfall intensity =      2.358(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.807
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.200
Decimal fraction soil group C = 0.470
Decimal fraction soil group D = 0.330
RI index for soil(AMC 2)  =  68.38
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Pervious area fraction =  0.500; Impervious fraction =  0.500
User specified values are as follows:
TC =  22.25 min.  Rain intensity =       2.36(In/Hr)
Total area =       154.20(Ac.)  Total runoff =    349.71(CFS)


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Process from Point/Station        1.000 to Point/Station      400.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    154.200(Ac.)
Runoff from this stream =    349.708(CFS)
Time of concentration =   22.25 min.
Rainfall intensity =     2.358(In/Hr)
Summary of stream data:

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


1      543.645     19.95                 2.487
2      349.708     22.25                 2.358
Largest stream flow has longer or shorter time of concentration
Qp =    543.645 + sum of
          Qa          Tb/Ta
         349.708 *    0.897 =    313.633
Qp =    857.278

Total of 2 main streams to confluence:
Flow rates before confluence point:
     543.645     349.708
Area of streams before confluence:
      238.500      154.200


Results of confluence:
Total flow rate =    857.278(CFS)
Time of concentration =    19.955 min.
Effective stream area after confluence  =    392.700(Ac.)


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Process from Point/Station      400.000 to Point/Station      401.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1256.000(Ft.)
Downstream point/station elevation =  1233.000(Ft.)
Pipe length  =   934.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   857.278(CFS)
Nearest computed pipe diameter  =     78.00(In.)
Calculated individual pipe flow  =   857.278(CFS)
Normal flow depth in pipe =   67.31(In.)
Flow top width inside pipe =   53.64(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.15(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =    20.51 min.


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Process from Point/Station      400.000 to Point/Station      401.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.812
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.330
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    20.51 min.
Rainfall intensity =      2.454(In/Hr) for a   100.0 year storm
Subarea runoff =     29.078(CFS) for     14.600(Ac.)
Total runoff =    886.356(CFS)  Total area =     407.300(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1233.000(Ft.)
Downstream point/station elevation =  1220.000(Ft.)
Pipe length  =   512.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   886.356(CFS)
Nearest computed pipe diameter  =     78.00(In.)
Calculated individual pipe flow  =   886.356(CFS)
Normal flow depth in pipe =   69.38(In.)
Flow top width inside pipe =   48.92(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.40(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =    20.81 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.811
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.330
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    20.81 min.
Rainfall intensity =      2.436(In/Hr) for a   100.0 year storm
Subarea runoff =      30.237(CFS) for     15.300(Ac.)
Total runoff =    916.593(CFS)  Total area =     422.600(Ac.)
End of computations, total study area =          422.60 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.542
Area averaged RI index number =  72.0
```

Riverside County Rational Hydrology Program

```
CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
        Rational Hydrology Study        Date: 01/07/14  File:WildomarLatC1v10AC.out
------------------------------------------------------------------------
Wildomar MDP Lateral C-1
Rational study part 1 of 2
Area A (Billie Ann Rd) and Area C
changed land use option for initial areas
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------


Program License Serial Number 433

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.600(In.)
100 year, 1 hour precipitation =  1.450(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.450(In/Hr)
Slope of intensity duration curve = 0.4900




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   966.000(Ft.)
Top (of initial area) elevation =  1788.000(Ft.)
Bottom (of initial area) elevation =  1560.000(Ft.)
Difference in elevation =   228.000(Ft.)
Slope =    0.23602  s(percent)=      23.60
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.058 min.
Rainfall intensity =      3.321(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.844
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.030
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  85.76
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     24.098(CFS)
Total initial stream area =        8.600(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1560.000(Ft.)
End of natural channel elevation =   1518.000(Ft.)
Length of natural channel  =   419.000(Ft.)
Estimated mean flow rate at midpoint of channel =     44.272(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   6.17(Ft/s)
```

```
Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.1002
Corrected/adjusted channel slope =  0.1002
Travel time =    1.13 min.     TC =   12.19  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.836
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.190
Decimal fraction soil group C = 0.810
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  83.00
Pervious area fraction =  0.900; Impervious fraction =  0.100
Rainfall intensity =      3.166(In/Hr) for a   100.0 year storm
Subarea runoff =     38.101(CFS) for     14.400(Ac.)
Total runoff =     62.199(CFS)  Total area =      23.000(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1518.000(Ft.)
End of natural channel elevation =   1462.000(Ft.)
Length of natural channel  =   810.000(Ft.)
Estimated mean flow rate at midpoint of channel =     71.123(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   6.01(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0691
Corrected/adjusted channel slope =  0.0691
Travel time =    2.25 min.     TC =   14.43  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.823
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.220
Decimal fraction soil group C = 0.780
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  77.00
Pervious area fraction =  0.710; Impervious fraction =  0.290
Rainfall intensity =      2.914(In/Hr) for a   100.0 year storm
Subarea runoff =     15.834(CFS) for      6.600(Ac.)
Total runoff =     78.033(CFS)  Total area =      29.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1462.000(Ft.)
End of natural channel elevation =   1400.000(Ft.)
Length of natural channel  =   968.000(Ft.)
Estimated mean flow rate at midpoint of channel =     89.105(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   6.24(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0640
Corrected/adjusted channel slope =  0.0640
Travel time =    2.59 min.     TC =   17.02  min.


 Adding area flow to channel
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```
USER INPUT of soil data for subarea
Runoff Coefficient = 0.870
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.040
Decimal fraction soil group C = 0.960
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.180; Impervious fraction =  0.820
Rainfall intensity =      2.688(In/Hr) for a   100.0 year storm
Subarea runoff =     19.657(CFS) for      8.400(Ac.)
Total runoff =     97.690(CFS)  Total area =      38.000(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     38.000(Ac.)
Runoff from this stream =     97.690(CFS)
Time of concentration =   17.02 min.
Rainfall intensity =     2.688(In/Hr)


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Process from Point/Station        6.000 to Point/Station        7.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   839.000(Ft.)
Top (of initial area) elevation =  1720.000(Ft.)
Bottom (of initial area) elevation =  1448.000(Ft.)
Difference in elevation =   272.000(Ft.)
Slope =    0.32420  s(percent)=      32.42
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.552 min.
Rainfall intensity =      4.655(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     21.121(CFS)
Total initial stream area =        5.100(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        5.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1448.000(Ft.)
End of natural channel elevation =   1400.000(Ft.)
Length of natural channel  =   948.000(Ft.)
Estimated mean flow rate at midpoint of channel =     32.923(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   7.73(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0506
Corrected/adjusted channel slope =  0.0506
Travel time =    2.04 min.     TC =    7.60  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.882
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
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Pervious area fraction =  0.150; Impervious fraction =  0.850
Rainfall intensity =      3.992(In/Hr) for a   100.0 year storm
Subarea runoff =     20.078(CFS) for      5.700(Ac.)
Total runoff =     41.199(CFS)  Total area =      10.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     10.800(Ac.)
Runoff from this stream =     41.199(CFS)
Time of concentration =    7.60 min.
Rainfall intensity =     3.992(In/Hr)
Summary of stream data:

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


1       97.690     17.02                 2.688
2       41.199      7.60                 3.992
Largest stream flow has longer time of concentration
Qp =     97.690 + sum of
          Qb          Ia/Ib
          41.199 *    0.673 =     27.744
Qp =    125.434

Total of 2 streams to confluence:
Flow rates before confluence point:
      97.690      41.199
Area of streams before confluence:
       38.000       10.800
Results of confluence:
Total flow rate =    125.434(CFS)
Time of concentration =    17.021 min.
Effective stream area after confluence =     48.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1400.000(Ft.)
Downstream point/station elevation =  1380.000(Ft.)
Pipe length  =   370.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   125.434(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   125.434(CFS)
Normal flow depth in pipe =   29.39(In.)
Flow top width inside pipe =   46.77(In.)
Critical Depth =   40.31(In.)
Pipe flow velocity =     15.54(Ft/s)
Travel time through pipe =    0.40 min.
Time of concentration (TC) =    17.42 min.


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Process from Point/Station        5.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     48.800(Ac.)
Runoff from this stream =    125.434(CFS)
Time of concentration =   17.42 min.
Rainfall intensity =     2.658(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   383.000(Ft.)
Top (of initial area) elevation =  1408.000(Ft.)
Bottom (of initial area) elevation =  1388.000(Ft.)
Difference in elevation =    20.000(Ft.)
Slope =    0.05222  s(percent)=       5.22
```

```
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.846 min.
Rainfall intensity =      4.539(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.750
Decimal fraction soil group D = 0.250
RI index for soil(AMC 2)  =  70.50
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      7.676(CFS)
Total initial stream area =        1.900(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1388.000(Ft.)
Downstream point/station elevation =  1386.000(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =     7.676(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     7.676(CFS)
Normal flow depth in pipe =    8.68(In.)
Flow top width inside pipe =   23.07(In.)
Critical Depth =   11.83(In.)
Pipe flow velocity =      7.48(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     5.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.113; Impervious fraction =  0.887
Time of concentration =     5.93 min.
Rainfall intensity =      4.505(In/Hr) for a   100.0 year storm
Subarea runoff =     12.002(CFS) for      3.000(Ac.)
Total runoff =     19.678(CFS)  Total area =       4.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1386.000(Ft.)
Downstream point/station elevation =  1380.000(Ft.)
Pipe length  =    88.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    19.678(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    19.678(CFS)
Normal flow depth in pipe =   13.61(In.)
Flow top width inside pipe =   23.78(In.)
Critical Depth =   19.13(In.)
Pipe flow velocity =     10.71(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     6.07 min.


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Process from Point/Station       11.000 to Point/Station        8.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
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Decimal fraction soil group C = 0.650
Decimal fraction soil group D = 0.350
RI index for soil(AMC 2)  =  71.00
Pervious area fraction =  0.150; Impervious fraction =  0.850
Time of concentration =     6.07 min.
Rainfall intensity =      4.455(In/Hr) for a   100.0 year storm
Subarea runoff =      5.521(CFS) for      1.400(Ac.)
Total runoff =     25.199(CFS)  Total area =       6.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.300(Ac.)
Runoff from this stream =     25.199(CFS)
Time of concentration =    6.07 min.
Rainfall intensity =     4.455(In/Hr)
Summary of stream data:

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


1      125.434     17.42                 2.658
2       25.199      6.07                 4.455
Largest stream flow has longer time of concentration
Qp =    125.434 + sum of
          Qb         Ia/Ib
          25.199 *    0.597 =     15.036
Qp =    140.471

Total of 2 streams to confluence:
Flow rates before confluence point:
     125.434      25.199
Area of streams before confluence:
       48.800        6.300
Results of confluence:
Total flow rate =    140.471(CFS)
Time of concentration =    17.417 min.
Effective stream area after confluence =     55.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1380.000(Ft.)
Downstream point/station elevation =  1356.000(Ft.)
Pipe length  =   172.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   140.471(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   140.471(CFS)
Normal flow depth in pipe =   23.53(In.)
Flow top width inside pipe =   47.99(In.)
Critical Depth =   42.19(In.)
Pipe flow velocity =     22.93(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    17.54 min.


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Process from Point/Station        8.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     55.100(Ac.)
Runoff from this stream =    140.471(CFS)
Time of concentration =   17.54 min.
Rainfall intensity =     2.649(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   654.000(Ft.)
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Top (of initial area) elevation =  1376.000(Ft.)
Bottom (of initial area) elevation =  1371.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.00765  s(percent)=       0.76
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.633 min.
Rainfall intensity =      3.385(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.460
Decimal fraction soil group D = 0.540
RI index for soil(AMC 2)  =  72.24
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.608(CFS)
Total initial stream area =        1.200(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       15.000 to Point/Station       16.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of natural channel elevation =   1371.000(Ft.)
End of natural channel elevation =   1364.000(Ft.)
Length of natural channel  =   385.000(Ft.)
Estimated mean flow rate at midpoint of channel =      7.517(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   3.14(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0182
Corrected/adjusted channel slope =  0.0182
Travel time =    2.04 min.     TC =   12.68  min.


 Adding area flow to channel
USER INPUT of soil data for subarea
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.320
Decimal fraction soil group D = 0.680
RI index for soil(AMC 2)  =  73.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      3.106(In/Hr) for a   100.0 year storm
Subarea runoff =      7.168(CFS) for      2.600(Ac.)
Total runoff =     10.776(CFS)  Total area =       3.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1364.000(Ft.)
Downstream point/station elevation =  1362.000(Ft.)
Pipe length  =    93.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    10.776(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    10.776(CFS)
Normal flow depth in pipe =   13.39(In.)
Flow top width inside pipe =   23.84(In.)
Critical Depth =   14.12(In.)
Pipe flow velocity =      5.98(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =    12.94 min.


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Process from Point/Station       16.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
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Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.550
Decimal fraction soil group D = 0.450
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.94 min.
Rainfall intensity =      3.075(In/Hr) for a   100.0 year storm
Subarea runoff =      0.818(CFS) for      0.300(Ac.)
Total runoff =     11.594(CFS)  Total area =       4.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1362.000(Ft.)
Downstream point/station elevation =  1356.000(Ft.)
Pipe length  =   233.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    11.594(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    11.594(CFS)
Normal flow depth in pipe =   13.25(In.)
Flow top width inside pipe =   23.87(In.)
Critical Depth =   14.68(In.)
Pipe flow velocity =      6.52(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =    13.53 min.


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Process from Point/Station       17.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.100
Decimal fraction soil group D = 0.900
RI index for soil(AMC 2)  =  74.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    13.53 min.
Rainfall intensity =      3.008(In/Hr) for a   100.0 year storm
Subarea runoff =      6.143(CFS) for      2.300(Ac.)
Total runoff =     17.737(CFS)  Total area =       6.400(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.400(Ac.)
Runoff from this stream =     17.737(CFS)
Time of concentration =   13.53 min.
Rainfall intensity =     3.008(In/Hr)
Summary of stream data:

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


1      140.471     17.54                 2.649
2       17.737     13.53                 3.008
Largest stream flow has longer time of concentration
Qp =    140.471 + sum of
          Qb         Ia/Ib
          17.737 *    0.881 =     15.619
Qp =    156.090

Total of 2 streams to confluence:
Flow rates before confluence point:
     140.471      17.737
Area of streams before confluence:
       55.100        6.400
Results of confluence:
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Total flow rate =    156.090(CFS)
Time of concentration =    17.542 min.
Effective stream area after confluence =     61.500(Ac.)


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Process from Point/Station       13.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1356.000(Ft.)
Downstream point/station elevation =  1352.000(Ft.)
Pipe length  =   204.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   156.090(CFS)
Given pipe size =     48.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     7.801(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      8.207(Ft.)
 Minor friction loss =      3.594(Ft.)  K-factor =   1.50
Pipe flow velocity =     12.42(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =    17.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       19.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.580
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    17.82 min.
Rainfall intensity =      2.629(In/Hr) for a   100.0 year storm
Subarea runoff =      6.748(CFS) for      2.900(Ac.)
Total runoff =    162.838(CFS)  Total area =      64.400(Ac.)


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Process from Point/Station       19.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1352.000(Ft.)
Downstream point/station elevation =  1348.000(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   162.838(CFS)
Given pipe size =     54.00(In.)
Calculated individual pipe flow  =   162.838(CFS)
Normal flow depth in pipe =   42.75(In.)
Flow top width inside pipe =   43.86(In.)
Critical Depth =   44.76(In.)
Pipe flow velocity =     12.06(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    18.04 min.


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Process from Point/Station       19.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.320
Decimal fraction soil group D = 0.510
RI index for soil(AMC 2)  =  70.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    18.04 min.
Rainfall intensity =      2.613(In/Hr) for a   100.0 year storm
Subarea runoff =      7.159(CFS) for      3.100(Ac.)
Total runoff =    169.997(CFS)  Total area =      67.500(Ac.)
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Process from Point/Station       20.000 to Point/Station       21.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1348.000(Ft.)
Downstream point/station elevation =  1345.000(Ft.)
Pipe length  =   126.00(Ft.)   Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =   169.997(CFS)
Given pipe size =     54.00(In.)
Calculated individual pipe flow  =   169.997(CFS)
Normal flow depth in pipe =   46.13(In.)
Flow top width inside pipe =   38.12(In.)
Critical Depth =   45.56(In.)
Pipe flow velocity =     11.75(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =    18.22 min.


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Process from Point/Station       20.000 to Point/Station       21.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.380
Decimal fraction soil group D = 0.050
RI index for soil(AMC 2)  =  62.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    18.22 min.
Rainfall intensity =      2.600(In/Hr) for a   100.0 year storm
Subarea runoff =      1.371(CFS) for      0.600(Ac.)
Total runoff =    171.368(CFS)  Total area =      68.100(Ac.)


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Process from Point/Station       21.000 to Point/Station       22.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1345.000(Ft.)
Downstream point/station elevation =  1332.000(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   171.368(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   171.368(CFS)
Normal flow depth in pipe =   23.09(In.)
Flow top width inside pipe =   47.97(In.)
Critical Depth =   44.81(In.)
Pipe flow velocity =     28.66(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    18.33 min.


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Process from Point/Station       21.000 to Point/Station       22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.826
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.220
Decimal fraction soil group C = 0.300
Decimal fraction soil group D = 0.480
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.440; Impervious fraction =  0.560
Time of concentration =    18.33 min.
Rainfall intensity =      2.592(In/Hr) for a   100.0 year storm
Subarea runoff =      6.849(CFS) for      3.200(Ac.)
Total runoff =    178.217(CFS)  Total area =      71.300(Ac.)


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Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1332.000(Ft.)
Downstream point/station elevation =  1312.000(Ft.)
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Pipe length  =   661.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   178.217(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   178.217(CFS)
Normal flow depth in pipe =   29.95(In.)
Flow top width inside pipe =   46.50(In.)
Critical Depth =   45.19(In.)
Pipe flow velocity =     21.60(Ft/s)
Travel time through pipe =    0.51 min.
Time of concentration (TC) =    18.84 min.


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Process from Point/Station       22.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.811
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.230
Decimal fraction soil group C = 0.380
Decimal fraction soil group D = 0.390
RI index for soil(AMC 2)  =  68.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    18.84 min.
Rainfall intensity =      2.558(In/Hr) for a   100.0 year storm
Subarea runoff =     10.168(CFS) for      4.900(Ac.)
Total runoff =    188.386(CFS)  Total area =      76.200(Ac.)


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Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1312.000(Ft.)
Downstream point/station elevation =  1292.000(Ft.)
Pipe length  =   722.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   188.386(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   188.386(CFS)
Normal flow depth in pipe =   32.11(In.)
Flow top width inside pipe =   45.18(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.08(Ft/s)
Travel time through pipe =    0.57 min.
Time of concentration (TC) =    19.41 min.


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Process from Point/Station       23.000 to Point/Station       24.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     76.200(Ac.)
Runoff from this stream =    188.386(CFS)
Time of concentration =   19.41 min.
Rainfall intensity =     2.521(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       30.000 to Point/Station       31.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   595.000(Ft.)
Top (of initial area) elevation =  1360.000(Ft.)
Bottom (of initial area) elevation =  1354.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01008  s(percent)=       1.01
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.687 min.
Rainfall intensity =      3.543(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.230
Decimal fraction soil group C = 0.510
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Decimal fraction soil group D = 0.260
RI index for soil(AMC 2)  =  67.57
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      4.396(CFS)
Total initial stream area =        1.400(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       31.000 to Point/Station       32.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1354.000(Ft.)
Downstream point/station elevation =  1350.000(Ft.)
Pipe length  =   218.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.396(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.396(CFS)
Normal flow depth in pipe =    6.14(In.)
Flow top width inside pipe =   20.94(In.)
Critical Depth =    8.83(In.)
Pipe flow velocity =      6.93(Ft/s)
Travel time through pipe =    0.52 min.
Time of concentration (TC) =    10.21 min.


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Process from Point/Station       31.000 to Point/Station       32.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.090
Decimal fraction soil group C = 0.190
Decimal fraction soil group D = 0.720
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.21 min.
Rainfall intensity =      3.453(In/Hr) for a   100.0 year storm
Subarea runoff =      3.987(CFS) for      1.300(Ac.)
Total runoff =      8.384(CFS)  Total area =       2.700(Ac.)


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Process from Point/Station       32.000 to Point/Station       33.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1350.000(Ft.)
Downstream point/station elevation =  1348.000(Ft.)
Pipe length  =   166.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.384(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     8.384(CFS)
Normal flow depth in pipe =    9.61(In.)
Flow top width inside pipe =   23.52(In.)
Critical Depth =   12.38(In.)
Pipe flow velocity =      7.13(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =    10.60 min.


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Process from Point/Station       33.000 to Point/Station       34.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1348.000(Ft.)
End of street segment elevation =  1340.000(Ft.)
Length of street segment  =   241.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
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Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     14.300(CFS)
Depth of flow =   0.367(Ft.), Average velocity =   4.554(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.014(Ft.)
Flow velocity =   4.55(Ft/s)
Travel time =    0.88 min.     TC =   11.48  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.851
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.020
Decimal fraction soil group C = 0.050
Decimal fraction soil group D = 0.930
RI index for soil(AMC 2)  =  74.00
Pervious area fraction =  0.430; Impervious fraction =  0.570
Rainfall intensity =      3.260(In/Hr) for a   100.0 year storm
Subarea runoff =     11.658(CFS) for      4.200(Ac.)
Total runoff =     20.042(CFS)  Total area =       6.900(Ac.)
Street flow at end of street =     20.042(CFS)
Half street flow at end of street =     10.021(CFS)
Depth of flow =   0.403(Ft.), Average velocity =   4.934(Ft/s)
Flow width (from curb towards crown)=  13.800(Ft.)


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Process from Point/Station       34.000 to Point/Station       35.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1340.000(Ft.)
End of street segment elevation =  1312.000(Ft.)
Length of street segment  =   580.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     25.978(CFS)
Depth of flow =   0.411(Ft.), Average velocity =   6.054(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.209(Ft.)
Flow velocity =   6.05(Ft/s)
Travel time =    1.60 min.     TC =   13.08  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.817
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.380
Decimal fraction soil group C = 0.390
Decimal fraction soil group D = 0.230
RI index for soil(AMC 2)  =  66.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      3.059(In/Hr) for a   100.0 year storm
Subarea runoff =     11.752(CFS) for      4.700(Ac.)
Total runoff =     31.794(CFS)  Total area =      11.600(Ac.)
Street flow at end of street =     31.794(CFS)
Half street flow at end of street =     15.897(CFS)
Depth of flow =   0.435(Ft.), Average velocity =   6.355(Ft/s)
Flow width (from curb towards crown)=  15.410(Ft.)


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Process from Point/Station       34.000 to Point/Station       35.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     11.600(Ac.)
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Runoff from this stream =     31.794(CFS)
Time of concentration =   13.08 min.
Rainfall intensity =     3.059(In/Hr)


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Process from Point/Station       36.000 to Point/Station       37.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   811.000(Ft.)
Top (of initial area) elevation =  1348.000(Ft.)
Bottom (of initial area) elevation =  1324.000(Ft.)
Difference in elevation =    24.000(Ft.)
Slope =    0.02959  s(percent)=       2.96
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.493 min.
Rainfall intensity =      3.259(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.834
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.160
Decimal fraction soil group C = 0.260
Decimal fraction soil group D = 0.580
RI index for soil(AMC 2)  =  70.40
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =     10.055(CFS)
Total initial stream area =        3.700(Ac.)
Pervious area fraction = 0.500


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Process from Point/Station       37.000 to Point/Station       35.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1324.000(Ft.)
End of street segment elevation =  1312.000(Ft.)
Length of street segment  =   460.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     16.207(CFS)
Depth of flow =   0.393(Ft.), Average velocity =   4.279(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.294(Ft.)
Flow velocity =   4.28(Ft/s)
Travel time =    1.79 min.     TC =   13.28  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.837
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.330
Decimal fraction soil group D = 0.670
RI index for soil(AMC 2)  =  73.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      3.035(In/Hr) for a   100.0 year storm
Subarea runoff =     12.197(CFS) for      4.800(Ac.)
Total runoff =     22.252(CFS)  Total area =       8.500(Ac.)
Street flow at end of street =     22.252(CFS)
Half street flow at end of street =     11.126(CFS)
Depth of flow =   0.429(Ft.), Average velocity =   4.617(Ft/s)
Flow width (from curb towards crown)=  15.110(Ft.)


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Process from Point/Station       37.000 to Point/Station       35.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
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Along Main Stream number: 2 in normal stream number 2
Stream flow area =      8.500(Ac.)
Runoff from this stream =     22.252(CFS)
Time of concentration =   13.28 min.
Rainfall intensity =     3.035(In/Hr)
Summary of stream data:

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


1       31.794     13.08                 3.059
2       22.252     13.28                 3.035
Largest stream flow has longer or shorter time of concentration
Qp =     31.794 + sum of
          Qa          Tb/Ta
          22.252 *    0.984 =     21.906
Qp =     53.701

Total of 2 streams to confluence:
Flow rates before confluence point:
      31.794      22.252
Area of streams before confluence:
       11.600        8.500
Results of confluence:
Total flow rate =     53.701(CFS)
Time of concentration =    13.079 min.
Effective stream area after confluence =     20.100(Ac.)


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Process from Point/Station       35.000 to Point/Station       24.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1312.000(Ft.)
End of street segment elevation =  1292.000(Ft.)
Length of street segment  =   516.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     63.610(CFS)
Depth of flow =   0.556(Ft.), Average velocity =   6.628(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    2.24(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  21.469(Ft.)
Flow velocity =   6.63(Ft/s)
Travel time =    1.30 min.     TC =   14.38  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.811
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.490
Decimal fraction soil group C = 0.140
Decimal fraction soil group D = 0.370
RI index for soil(AMC 2)  =  65.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.920(In/Hr) for a   100.0 year storm
Subarea runoff =     19.662(CFS) for      8.300(Ac.)
Total runoff =     73.362(CFS)  Total area =      28.400(Ac.)
Street flow at end of street =     73.362(CFS)
Half street flow at end of street =     36.681(CFS)
Depth of flow =   0.578(Ft.), Average velocity =   6.858(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    3.14(Ft.)
Flow width (from curb towards crown)=  22.000(Ft.)
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Process from Point/Station       35.000 to Point/Station       24.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     28.400(Ac.)
Runoff from this stream =     73.362(CFS)
Time of concentration =   14.38 min.
Rainfall intensity =     2.920(In/Hr)
Summary of stream data:

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


1      188.386     19.41                 2.521
2       73.362     14.38                 2.920
Largest stream flow has longer time of concentration
Qp =    188.386 + sum of
          Qb         Ia/Ib
          73.362 *    0.863 =     63.321
Qp =    251.707

Total of 2 main streams to confluence:
Flow rates before confluence point:
     188.386      73.362
Area of streams before confluence:
       76.200       28.400


Results of confluence:
Total flow rate =    251.707(CFS)
Time of concentration =    19.413 min.
Effective stream area after confluence  =    104.600(Ac.)


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Process from Point/Station       24.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1292.000(Ft.)
Downstream point/station elevation =  1290.000(Ft.)
Pipe length  =   178.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   251.707(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   251.707(CFS)
Normal flow depth in pipe =   45.00(In.)
Flow top width inside pipe =   51.96(In.)
Critical Depth =   53.20(In.)
Pipe flow velocity =     15.94(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    19.60 min.


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Process from Point/Station       24.000 to Point/Station       40.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.810
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.330
Decimal fraction soil group C = 0.090
Decimal fraction soil group D = 0.580
RI index for soil(AMC 2)  =  68.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    19.60 min.
Rainfall intensity =      2.509(In/Hr) for a   100.0 year storm
Subarea runoff =     16.866(CFS) for      8.300(Ac.)
Total runoff =    268.573(CFS)  Total area =     112.900(Ac.)


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Process from Point/Station       40.000 to Point/Station       41.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
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Upstream point/station elevation =  1290.000(Ft.)
Downstream point/station elevation =  1283.000(Ft.)
Pipe length  =   389.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   268.573(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   268.573(CFS)
Normal flow depth in pipe =   39.47(In.)
Flow top width inside pipe =   56.93(In.)
Critical Depth =   54.33(In.)
Pipe flow velocity =     19.62(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    19.93 min.


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Process from Point/Station       40.000 to Point/Station       41.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.799
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.410
Decimal fraction soil group C = 0.390
Decimal fraction soil group D = 0.200
RI index for soil(AMC 2)  =  65.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    19.93 min.
Rainfall intensity =      2.488(In/Hr) for a   100.0 year storm
Subarea runoff =      4.773(CFS) for      2.400(Ac.)
Total runoff =    273.346(CFS)  Total area =     115.300(Ac.)


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Process from Point/Station       41.000 to Point/Station       42.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1283.000(Ft.)
Downstream point/station elevation =  1278.000(Ft.)
Pipe length  =   285.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   273.346(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   273.346(CFS)
Normal flow depth in pipe =   40.31(In.)
Flow top width inside pipe =   56.34(In.)
Critical Depth =   54.61(In.)
Pipe flow velocity =     19.49(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =    20.17 min.


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Process from Point/Station       41.000 to Point/Station       42.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    115.300(Ac.)
Runoff from this stream =    273.346(CFS)
Time of concentration =   20.17 min.
Rainfall intensity =     2.474(In/Hr)


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Process from Point/Station       43.000 to Point/Station       44.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   679.000(Ft.)
Top (of initial area) elevation =  1352.000(Ft.)
Bottom (of initial area) elevation =  1332.000(Ft.)
Difference in elevation =    20.000(Ft.)
Slope =    0.02946  s(percent)=       2.95
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.715 min.
Rainfall intensity =      3.373(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.814
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.600
Decimal fraction soil group C = 0.150
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Decimal fraction soil group D = 0.250
RI index for soil(AMC 2)  =  62.70
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      7.690(CFS)
Total initial stream area =        2.800(Ac.)
Pervious area fraction = 0.500


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Process from Point/Station       44.000 to Point/Station       45.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1332.000(Ft.)
End of street segment elevation =  1310.000(Ft.)
Length of street segment  =  1000.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     11.078(CFS)
Depth of flow =   0.362(Ft.), Average velocity =   3.664(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.768(Ft.)
Flow velocity =   3.66(Ft/s)
Travel time =    4.55 min.     TC =   15.26  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.803
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.460
Decimal fraction soil group C = 0.540
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  63.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.836(In/Hr) for a   100.0 year storm
Subarea runoff =      6.601(CFS) for      2.900(Ac.)
Total runoff =     14.291(CFS)  Total area =       5.700(Ac.)
Street flow at end of street =     14.291(CFS)
Half street flow at end of street =      7.145(CFS)
Depth of flow =   0.388(Ft.), Average velocity =   3.891(Ft/s)
Flow width (from curb towards crown)=  13.075(Ft.)


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Process from Point/Station       45.000 to Point/Station       42.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1310.000(Ft.)
End of street segment elevation =  1278.000(Ft.)
Length of street segment  =   802.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     19.403(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   5.251(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.118(Ft.)
Flow velocity =   5.25(Ft/s)
Travel time =    2.55 min.     TC =   17.81  min.
```

```
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.783
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.760
Decimal fraction soil group C = 0.180
Decimal fraction soil group D = 0.060
RI index for soil(AMC 2)  =  59.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.629(In/Hr) for a   100.0 year storm
Subarea runoff =     10.085(CFS) for      4.900(Ac.)
Total runoff =     24.375(CFS)  Total area =      10.600(Ac.)
Street flow at end of street =     24.375(CFS)
Half street flow at end of street =     12.188(CFS)
Depth of flow =   0.414(Ft.), Average velocity =   5.545(Ft/s)
Flow width (from curb towards crown)=  14.391(Ft.)


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Process from Point/Station       45.000 to Point/Station       42.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     10.600(Ac.)
Runoff from this stream =     24.375(CFS)
Time of concentration =   17.81 min.
Rainfall intensity =     2.629(In/Hr)
Summary of stream data:

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


1      273.346     20.17                 2.474
2       24.375     17.81                 2.629
Largest stream flow has longer time of concentration
Qp =    273.346 + sum of
          Qb         Ia/Ib
          24.375 *    0.941 =     22.931
Qp =    296.277

Total of 2 streams to confluence:
Flow rates before confluence point:
     273.346      24.375
Area of streams before confluence:
      115.300       10.600
Results of confluence:
Total flow rate =    296.277(CFS)
Time of concentration =    20.174 min.
Effective stream area after confluence =    125.900(Ac.)


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Process from Point/Station       42.000 to Point/Station       50.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1278.000(Ft.)
Downstream point/station elevation =  1262.000(Ft.)
Pipe length  =   972.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   296.277(CFS)
Given pipe size =     66.00(In.)
Calculated individual pipe flow  =   296.277(CFS)
Normal flow depth in pipe =   40.22(In.)
Flow top width inside pipe =   64.40(In.)
Critical Depth =   56.87(In.)
Pipe flow velocity =     19.55(Ft/s)
Travel time through pipe =    0.83 min.
Time of concentration (TC) =    21.00 min.


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Process from Point/Station       42.000 to Point/Station       50.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    125.900(Ac.)
Runoff from this stream =    296.277(CFS)
Time of concentration =   21.00 min.
```

Rainfall intensity = 2.425(In/Hr)

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Process from Point/Station 51.000 to Point/Station 52.000
**** INITIAL AREA EVALUATION ****
_____
Initial area flow distance = 952.000(Ft.)
Top (of initial area) elevation = 1304.000(Ft.)
Bottom (of initial area) elevation = 1300.000(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00420 s(percent)= 0.42
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.107 min.
Rainfall intensity = 2.608(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.801
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.510
Decimal fraction soil group C = 0.120
Decimal fraction soil group D = 0.370
RI index for soil(AMC 2) = 64.59
Pervious area fraction = 0.500; Impervious fraction = 0.500
Initial subarea runoff = 5.226(CFS)
Total initial stream area = 2.500(Ac.)
Pervious area fraction = 0.500

++
Process from Point/Station 52.000 to Point/Station 53.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____
Top of street segment elevation = 1300.000(Ft.)
End of street segment elevation = 1290.000(Ft.)
Length of street segment = 424.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 22.000(Ft.)
Distance from crown to crossfall grade break = 18.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 10.000(Ft.)
Slope from curb to property line (v/hz) = 0.025
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150
Estimated mean flow rate at midpoint of street = 9.432(CFS)
Depth of flow = 0.343(Ft.), Average velocity = 3.624(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 10.837(Ft.)
Flow velocity = 3.62(Ft/s)
Travel time = 1.95 min. TC = 20.06 min.
Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.420
Decimal fraction soil group C = 0.480
Decimal fraction soil group D = 0.100
RI index for soil(AMC 2) = 64.00
Pervious area fraction = 0.500; Impervious fraction = 0.500
Rainfall intensity = 2.481(In/Hr) for a 100.0 year storm
Subarea runoff = 8.288(CFS) for 4.200(Ac.)
Total runoff = 13.514(CFS) Total area = 6.700(Ac.)
Street flow at end of street = 13.514(CFS)
Half street flow at end of street = 6.757(CFS)
Depth of flow = 0.379(Ft.), Average velocity = 3.943(Ft/s)
Flow width (from curb towards crown)= 12.597(Ft.)

++
Process from Point/Station 53.000 to Point/Station 54.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____
Top of street segment elevation = 1290.000(Ft.)
End of street segment elevation = 1273.000(Ft.)

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Length of street segment  =   468.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     18.466(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   5.007(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.105(Ft.)
Flow velocity =   5.01(Ft/s)
Travel time =    1.56 min.     TC =   21.61  min.
 Adding area flow to street
USER INPUT of soil data for subarea
Runoff Coefficient = 0.813
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.210
Decimal fraction soil group C = 0.150
Decimal fraction soil group D = 0.640
RI index for soil(AMC 2)  =  70.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.391(In/Hr) for a   100.0 year storm
Subarea runoff =      9.723(CFS) for      5.000(Ac.)
Total runoff =     23.238(CFS)  Total area =      11.700(Ac.)
Street flow at end of street =     23.238(CFS)
Half street flow at end of street =     11.619(CFS)
Depth of flow =   0.414(Ft.), Average velocity =   5.290(Ft/s)
Flow width (from curb towards crown)=  14.386(Ft.)


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Process from Point/Station       54.000 to Point/Station       55.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1273.000(Ft.)
Downstream point/station elevation =  1265.000(Ft.)
Pipe length  =   390.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.238(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    23.238(CFS)
Normal flow depth in pipe =   15.05(In.)
Flow top width inside pipe =   23.21(In.)
Critical Depth =   20.57(In.)
Pipe flow velocity =     11.22(Ft/s)
Travel time through pipe =    0.58 min.
Time of concentration (TC) =    22.19 min.


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Process from Point/Station       54.000 to Point/Station       55.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.799
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
RI index for soil(AMC 2)  =  66.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    22.19 min.
Rainfall intensity =      2.361(In/Hr) for a   100.0 year storm
Subarea runoff =      2.451(CFS) for      1.300(Ac.)
Total runoff =     25.688(CFS)  Total area =      13.000(Ac.)


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Process from Point/Station       55.000 to Point/Station       50.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
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Upstream point/station elevation =  1265.000(Ft.)
Downstream point/station elevation =  1262.000(Ft.)
Pipe length  =   450.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.688(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    25.688(CFS)
Normal flow depth in pipe =   17.39(In.)
Flow top width inside pipe =   35.98(In.)
Critical Depth =   19.63(In.)
Pipe flow velocity =      7.59(Ft/s)
Travel time through pipe =    0.99 min.
Time of concentration (TC) =    23.18 min.


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Process from Point/Station       55.000 to Point/Station       50.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.814
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.220
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.780
RI index for soil(AMC 2)  =  71.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    23.18 min.
Rainfall intensity =      2.311(In/Hr) for a   100.0 year storm
Subarea runoff =      4.891(CFS) for      2.600(Ac.)
Total runoff =     30.579(CFS)  Total area =      15.600(Ac.)


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Process from Point/Station       55.000 to Point/Station       50.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     15.600(Ac.)
Runoff from this stream =     30.579(CFS)
Time of concentration =   23.18 min.
Rainfall intensity =     2.311(In/Hr)
Summary of stream data:

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


1      296.277     21.00                 2.425
2       30.579     23.18                 2.311
Largest stream flow has longer or shorter time of concentration
Qp =    296.277 + sum of
          Qa          Tb/Ta
          30.579 *    0.906 =     27.705
Qp =    323.982

Total of 2 streams to confluence:
Flow rates before confluence point:
     296.277      30.579
Area of streams before confluence:
      125.900       15.600
Results of confluence:
Total flow rate =    323.982(CFS)
Time of concentration =    21.002 min.
Effective stream area after confluence =    141.500(Ac.)


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Process from Point/Station       50.000 to Point/Station       60.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1262.000(Ft.)
Downstream point/station elevation =  1260.000(Ft.)
Pipe length  =   245.00(Ft.)   Manning's N = 0.013
No. of pipes = 2  Required pipe flow  =   323.982(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =   161.991(CFS)
Normal flow depth in pipe =   36.56(In.)
Flow top width inside pipe =   58.55(In.)
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Critical Depth =   43.78(In.)
Pipe flow velocity =     12.92(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    21.32 min.


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Process from Point/Station       50.000 to Point/Station       60.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.820
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.080
Decimal fraction soil group C = 0.160
Decimal fraction soil group D = 0.760
RI index for soil(AMC 2)  =  72.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    21.32 min.
Rainfall intensity =      2.408(In/Hr) for a   100.0 year storm
Subarea runoff =     11.849(CFS) for      6.000(Ac.)
Total runoff =    335.830(CFS)  Total area =     147.500(Ac.)


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Process from Point/Station       60.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1260.000(Ft.)
Downstream point/station elevation =  1259.000(Ft.)
Pipe length  =   477.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   335.830(CFS)
Nearest computed pipe diameter  =     87.00(In.)
Calculated individual pipe flow  =   335.830(CFS)
Normal flow depth in pipe =   75.56(In.)
Flow top width inside pipe =   58.80(In.)
Critical Depth =   57.37(In.)
Pipe flow velocity =      8.82(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =    22.22 min.


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Process from Point/Station       60.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    147.500(Ac.)
Runoff from this stream =    335.830(CFS)
Time of concentration =   22.22 min.
Rainfall intensity =     2.359(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   581.000(Ft.)
Top (of initial area) elevation =  1284.000(Ft.)
Bottom (of initial area) elevation =  1265.000(Ft.)
Difference in elevation =    19.000(Ft.)
Slope =    0.03270  s(percent)=       3.27
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.859 min.
Rainfall intensity =      3.513(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      8.654(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.500
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1265.000(Ft.)
Downstream point/station elevation =  1263.000(Ft.)
Pipe length  =   320.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.654(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     8.654(CFS)
Normal flow depth in pipe =   18.00(In.)
Flow top width inside pipe =    0.00(In.)
Critical Depth =   13.67(In.)
Pipe flow velocity =      4.70(Ft/s)
Travel time through pipe =    1.13 min.
Time of concentration (TC) =    10.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
USER INPUT of soil data for subarea
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.030
Decimal fraction soil group D = 0.970
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Time of concentration =    10.99 min.
Rainfall intensity =      3.330(In/Hr) for a   100.0 year storm
Subarea runoff =     10.720(CFS) for      3.800(Ac.)
Total runoff =     19.374(CFS)  Total area =       6.700(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =  1263.000(Ft.)
Downstream point/station elevation =  1259.000(Ft.)
Pipe length  =   166.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.374(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.445(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      5.645(Ft.)
 Minor friction loss =      2.800(Ft.)  K-factor =   1.50
Pipe flow velocity =     10.96(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =    11.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.700(Ac.)
Runoff from this stream =     19.374(CFS)
Time of concentration =   11.25 min.
Rainfall intensity =     3.294(In/Hr)
Summary of stream data:

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


1      335.830     22.22                 2.359
2       19.374     11.25                 3.294
Largest stream flow has longer time of concentration
Qp =    335.830 + sum of
          Qb         Ia/Ib
```

```
          19.374 *    0.716 =     13.877
Qp =    349.708

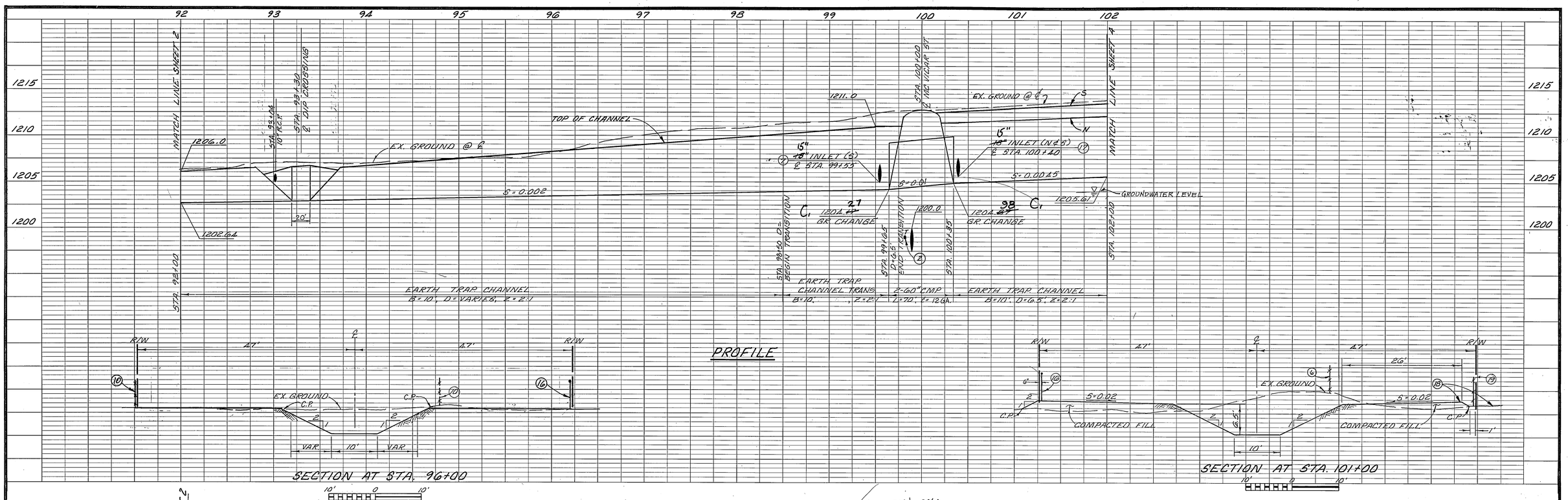
Total of 2 main streams to confluence:
Flow rates before confluence point:
     335.830      19.374
Area of streams before confluence:
      147.500        6.700

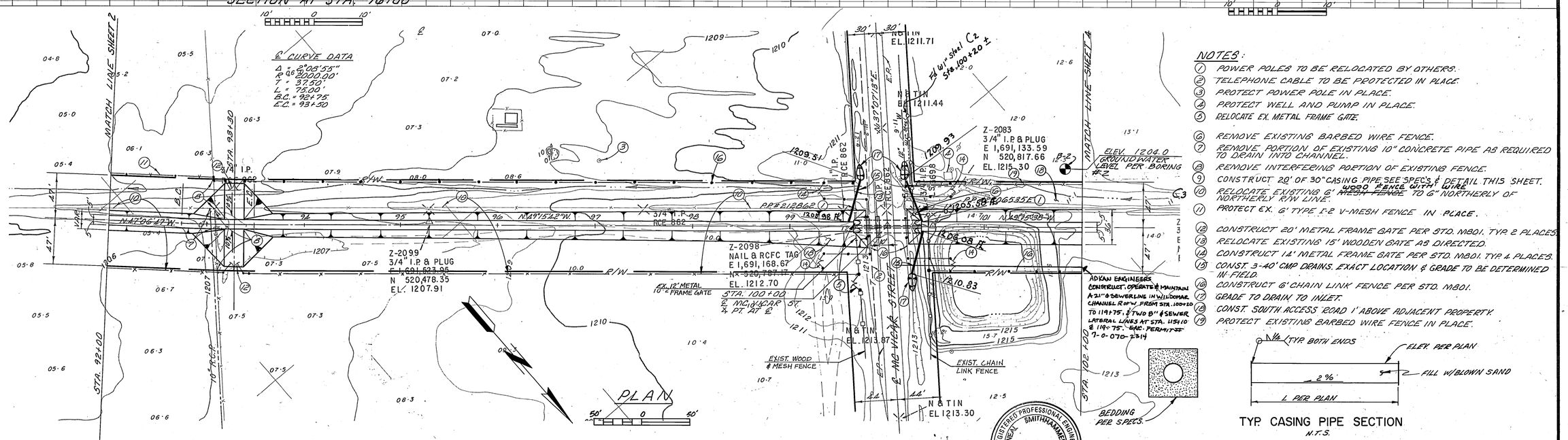

Results of confluence:
Total flow rate =    349.708(CFS)
Time of concentration =    22.220 min.
Effective stream area after confluence  =    154.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      400.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1259.000(Ft.)
Downstream point/station elevation =  1256.000(Ft.)
Pipe length  =    61.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   349.708(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =   349.708(CFS)
Normal flow depth in pipe =   39.09(In.)
Flow top width inside pipe =   43.15(In.)
Critical depth could not be calculated.
Pipe flow velocity =     30.00(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    22.25 min.
End of computations, total study area =          154.20 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.471
Area averaged RI index number =  71.4
```

Appendix B – Reference Plans





NOTES:

1. POWER POLES TO BE RELOCATED BY OTHERS.
2. TELEPHONE CABLE TO BE PROTECTED IN PLACE.
3. PROTECT POWER POLE IN PLACE.
4. PROTECT WELL AND PUMP IN PLACE.
5. RELOCATE EX. METAL FRAME GATE.
6. REMOVE EXISTING BARBED WIRE FENCE.
7. REMOVE PORTION OF EXISTING 10" CONCRETE PIPE AS REQUIRED TO DRAIN INTO CHANNEL.
8. REMOVE INTERFERING PORTION OF EXISTING FENCE.
9. CONSTRUCT 20' OF 30" CASING PIPE. SEE SPEC'S & DETAIL THIS SHEET.
10. RELOCATE EXISTING 6' ~~MESH FENCE~~ WOOD FENCE WITH WIRE TO 6' NORTHERLY OF NORTHERLY R/W LINE.
11. PROTECT EX. 6' TYPE I-2 V-MESH FENCE IN PLACE.
12. CONSTRUCT 20' METAL FRAME GATE PER STD. M801. TYP. 2 PLACES.
13. RELOCATE EXISTING 15' WOODEN GATE AS DIRECTED.
14. CONSTRUCT 14' METAL FRAME GATE PER STD. M801. TYP. 4 PLACES.
15. CONST. 3-40' CMP DRAINS. EXACT LOCATION & GRADE TO BE DETERMINED IN FIELD.
16. CONSTRUCT 6' CHAIN LINK FENCE PER STD. M801.
17. GRADE TO DRAIN TO INLET.
18. CONST. SOUTH ACCESS ROAD 1' ABOVE ADJACENT PROPERTY.
19. PROTECT EXISTING BARBED WIRE FENCE IN PLACE.

TYP. CASING PIPE SECTION
N.T.S.

BENCH MARK

CUT "2" ON CONC. PUMP STAND ± ℄ STA. 100+70 ± 30' S.W. OF ℄ FOR T.B.M. 3 ELEV. 1212.50.

REVISIONS

REF.	DESCRIPTION	APPR.	DATE
C3	Note (10) Change	D.L.P.	7/22/88
C2	Fd. W/" & A Changes As Shown	D.L.P.	7/22/88
C1	Elev. Changes	D.L.P.	7/22/88

AS BUILT

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

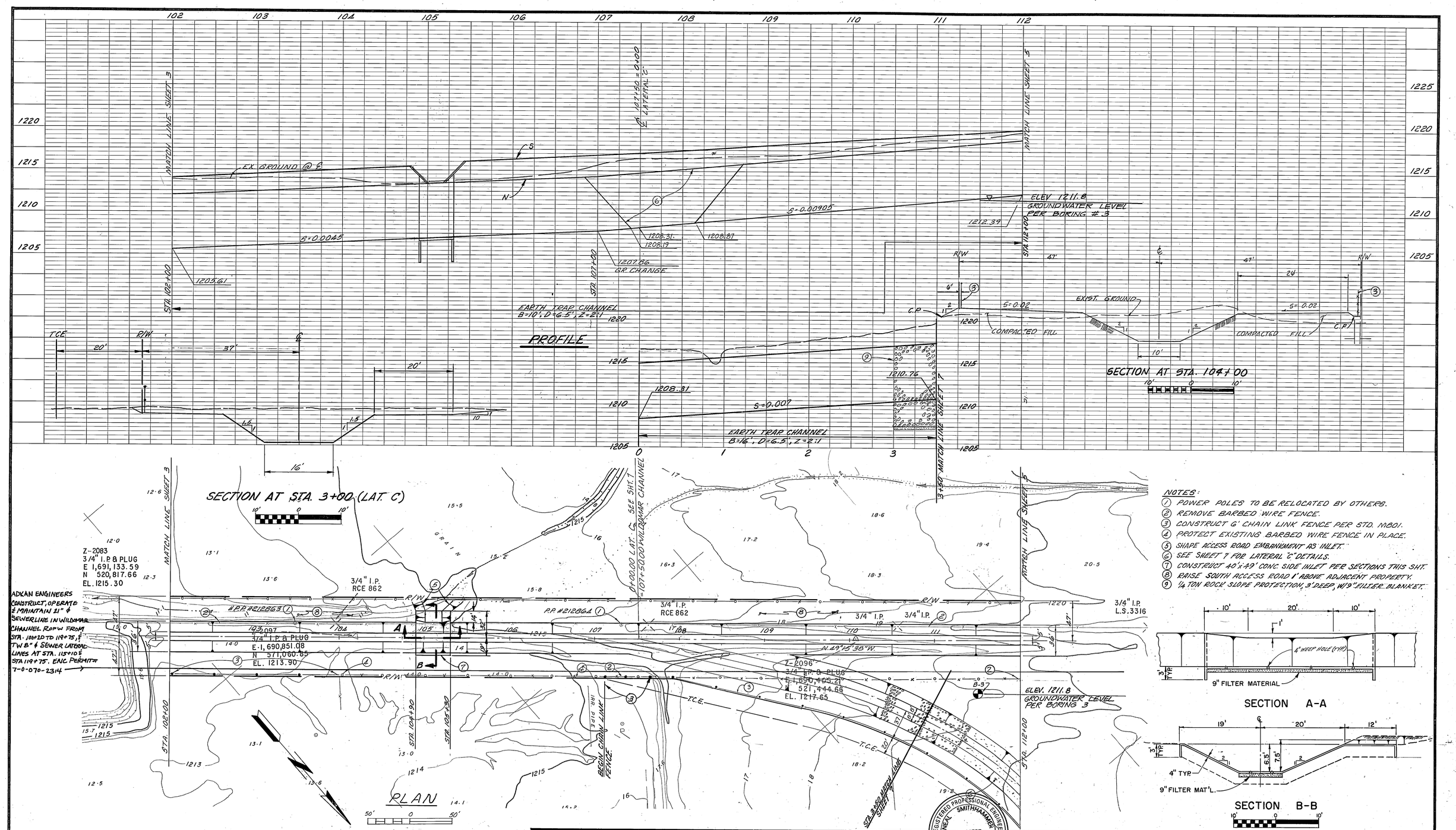
DESIGNED BY: M.D.R.
DRAWN BY: D.L.P.
DATE DRAWN: 11-84
CHECKED BY: AFA

RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757 DATE: 10/8/87

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 10-9-87

WILDOMAR CHANNEL
INTERIM
STAGE 3
STA. 92+00 TO STA. 102+00

PROJECT NO. 7-0-070
DRAWING NO. 7-94
SHEET NO. 3 OF 17



BENCH MARK	REVISIONS			
SET CDT BOX ON CONC. STAND FOR RUNO ± 2. STA. 107+30 ± 100 FT. NLY. OF ℄ TBM 1 ELEV. = 1217.626.	REF.	DESCRIPTION	APPR.	DATE
		No Change		

AS BUILT

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: M.D.R.
DRAWN BY: D.L.P.
DATE DRAWN: 11-84
CHECKED BY: A.F.R.

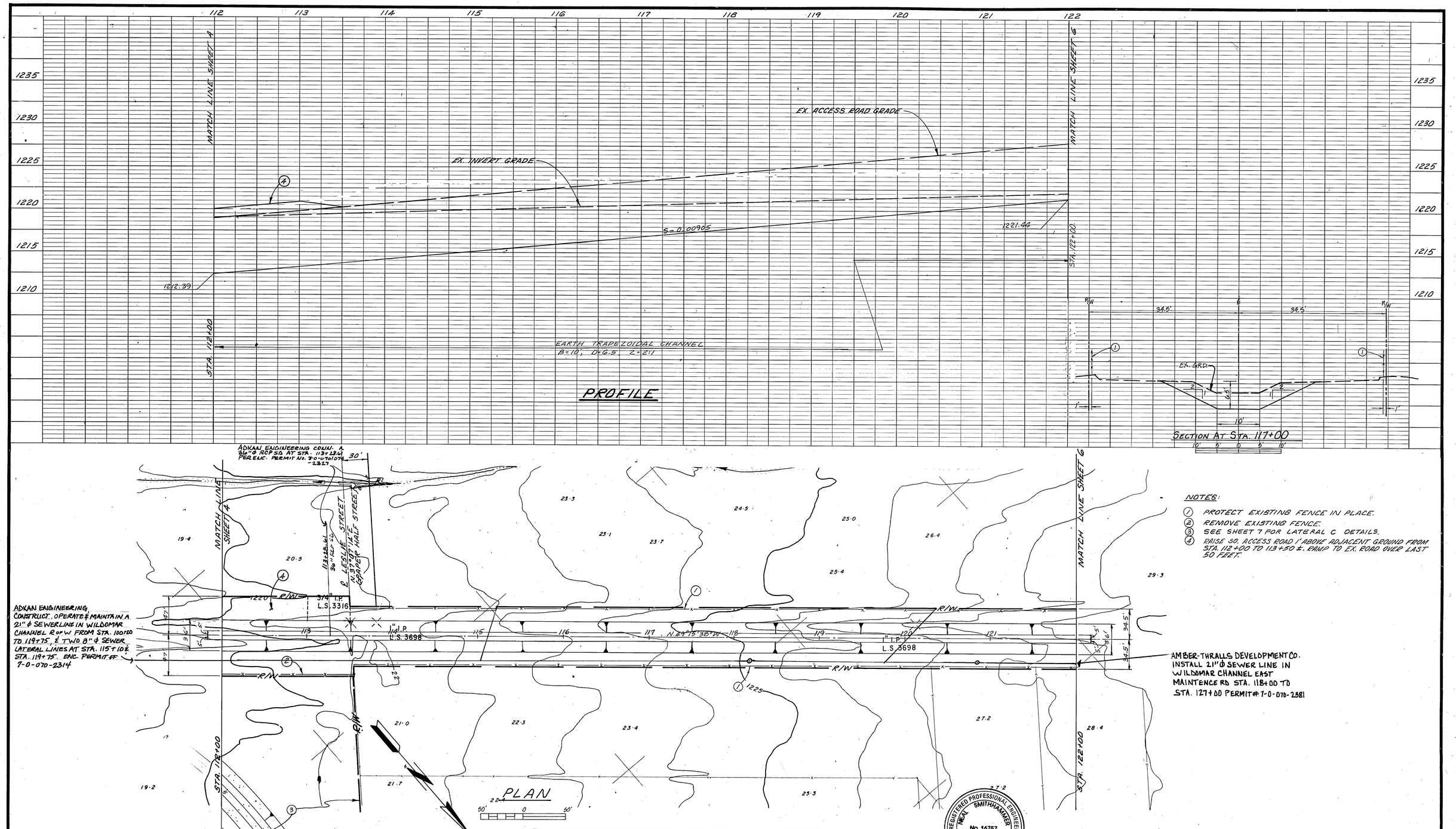
RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757
DATE: 10/8/87

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400
DATE: 10-9-87

REGISTERED PROFESSIONAL ENGINEER — NEAL SMITHHAMMER — No. 16757

WILDOMAR CHANNEL
INTERIM
STAGE 3
STA. 102+00 TO STA. 112+00

PROJECT NO. 7-0-070
DRAWING NO. 7-94
SHEET NO. 4 OF 17



NOTES:

1. PROTECT EXISTING FENCE IN PLACE.
2. REMOVE EXISTING FENCE.
3. SEE SHEET 7 FOR LATERAL C DETAILS.
4. RAISE SO. ACCESS ROAD 1' ABOVE ADJACENT GROUND FROM STA. 112+00 TO 113+50 ±. RAMP TO EX. ROAD OVER LAST 50 FEET.

BENCH MARK:
SET CUT BOX ON CONC. STAND FOR PUMP ± @ STA. 101+30 ± 100 FT. NLY. OF ℄ TBM 4 ELEV. = 1217.626.

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE
	No Change		

AS BUILT

REGISTERED PROFESSIONAL ENGINEER NEAL SMITHHAMMER No. 16757 STATE OF CALIFORNIA

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

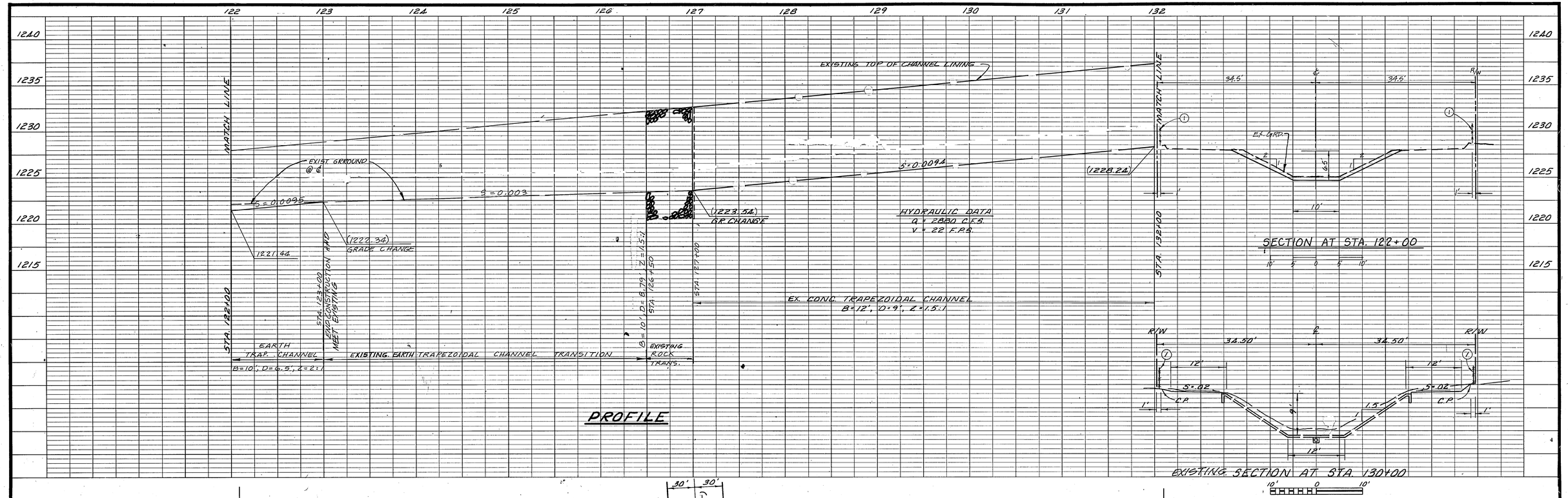
DESIGNED BY: M.D.R.
DRAWN BY: D.L.P.
DATE DRAWN: 9-84
CHECKED BY: A.F.R.

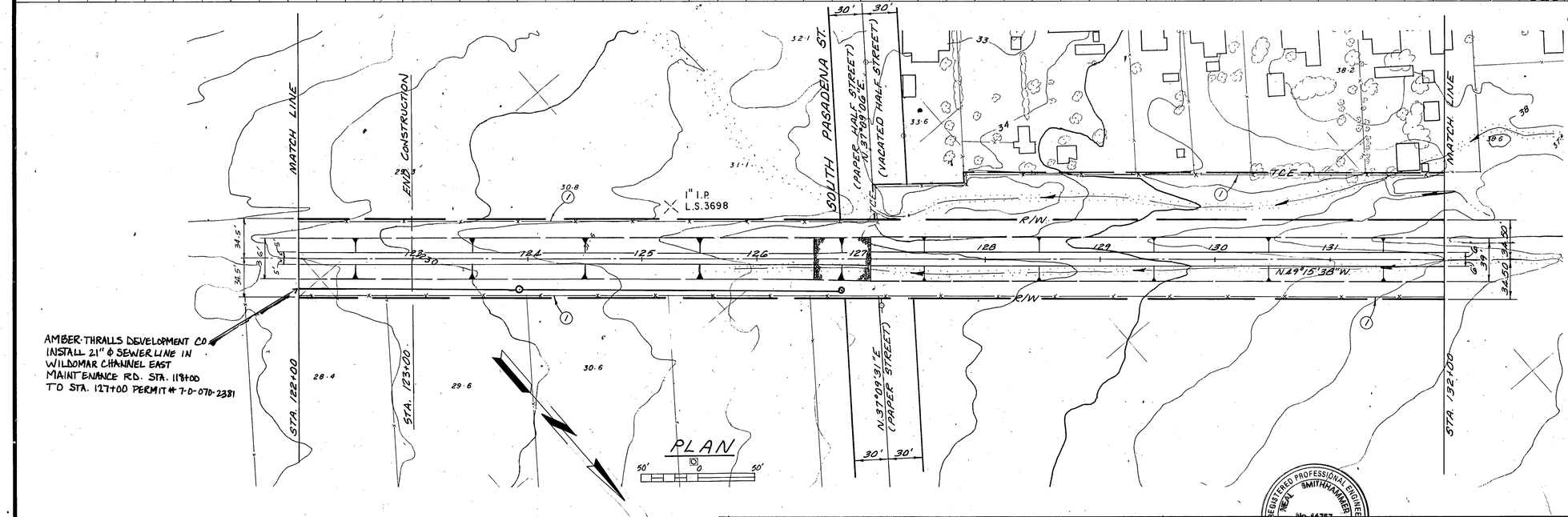
RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757
DATE: 10/8/87

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400
DATE: 10-9-87

WILDOMAR CHANNEL
INTERIM
STAGE 3
STA. 112+00 TO STA. 122+00

PROJECT NO. 7-0-070
DRAWING NO. 7-94
SHEET NO. 5 OF 17





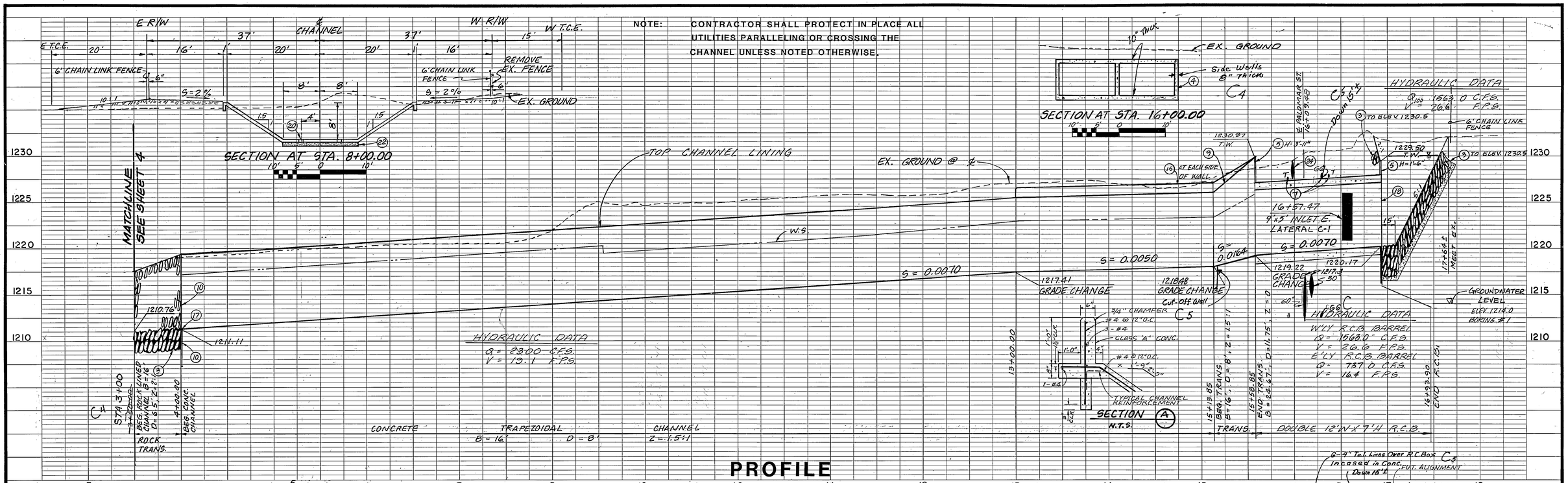
NOTES:

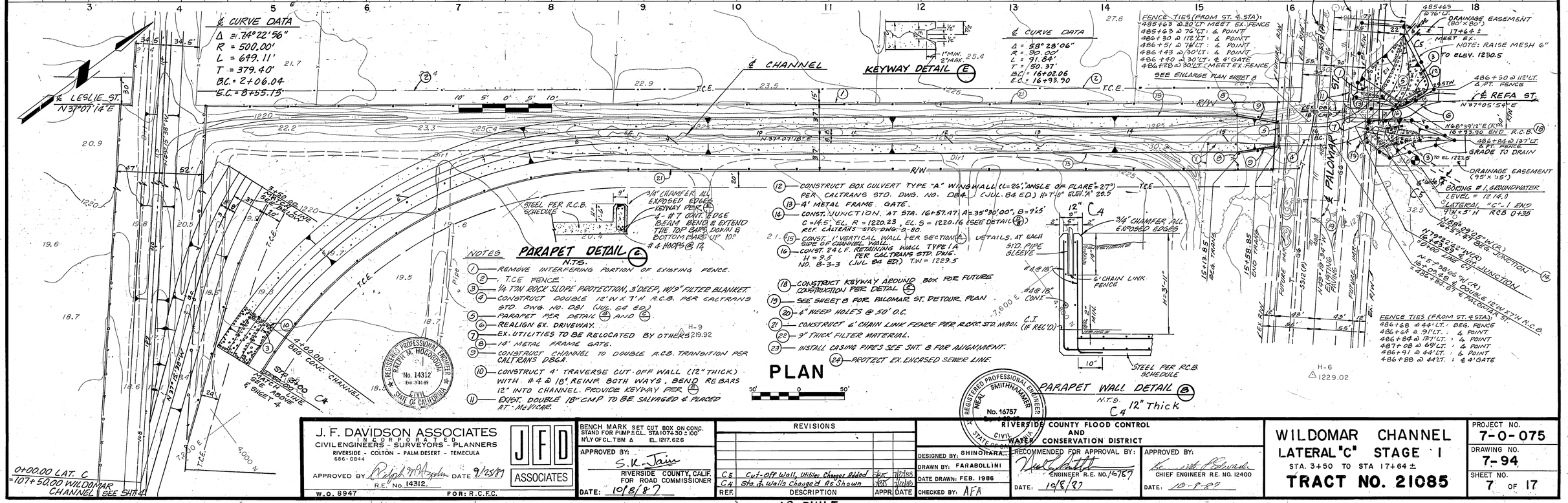
(1) PROTECT EXISTING FENCE IN PLACE.

BENCH MARK	REVISIONS				RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT			WILDOMAR CHANNEL STAGE 3	PROJECT NO. 7-0-070
SET CUT BOX ON CONC. STAND FOR PUMP ± ℄ STA. 107+30 ± 100 FT. NLY. OF ℄ TBM 4 ELEV. = 1247.626.					DESIGNED BY: M.D.R.	RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757	APPROVED BY: CHIEF ENGINEER R.E. NO. 12400	STA. 122+00 TO END	DRAWING NO. 7-94
	REF.	DESCRIPTION	APPR.	DATE	DRAWN BY: D.L.R.	DATE: 10/8/87	DATE: 10-8-87		SHEET NO. 6 OF 17
		No Change			DATE DRAWN: 8-84				
					CHECKED BY: AFA				

AS BUILT

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES PARALLELING OR CROSSING THE CHANNEL UNLESS NOTED OTHERWISE.





J. F. DAVIDSON ASSOCIATES
INCORPORATED
CIVIL ENGINEERS - SURVEYORS - PLANNERS
RIVERSIDE - COLTON - PALM DESERT - TEMECULA
686-0844

APPROVED BY Ralph McHaffie DATE 9/25/87
R.E. No. 14312
W.O. 8947 FOR: R.C.F.C.

JFD ASSOCIATES

BENCH MARK SET CUT BOX ON CONC. STAND FOR PUMP ± CL. STA 107+50 ± 100' N'LY OF CL. TBM Δ EL. 1217.626

APPROVED BY: S. K. Jain
RIVERSIDE COUNTY, CALIF. FOR ROAD COMMISSIONER
DATE: 10/8/87

REVISIONS			
C5	Cut-Off Wall, Utilities Changes Added		7/7/88
C4	Sta. & Walls Changed As Shown		7/21/90
REF.	DESCRIPTION	APPR.	DATE

AS BUILT

DESIGNED BY: SHINOHARA
DRAWN BY: FARABOLLINI
DATE DRAWN: FEB. 1986
CHECKED BY: AFA

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: ENGINEER R.E. NO. 16757
DATE: 10/8/87

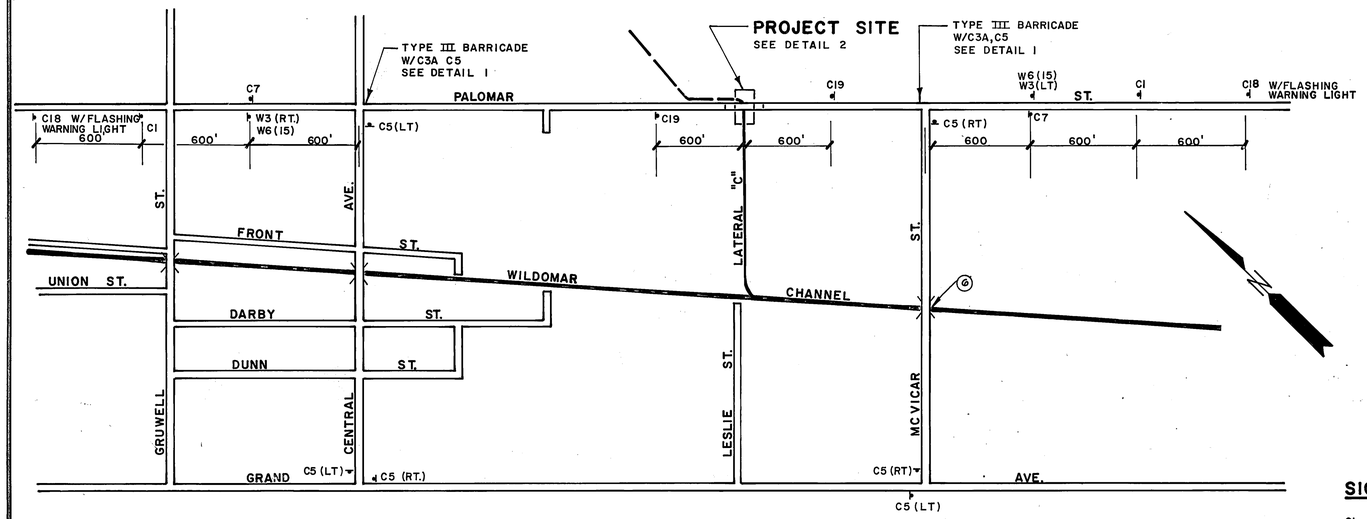
APPROVED BY: CHIEF ENGINEER R.E. NO. 12400
DATE: 10-8-87

WILDOMAR CHANNEL LATERAL "C" STAGE I

STA. 3+50 TO STA 17+64 ±

TRACT NO. 21085

PROJECT NO. 7-0-075
DRAWING NO. 7-94
SHEET NO. 7 OF 17



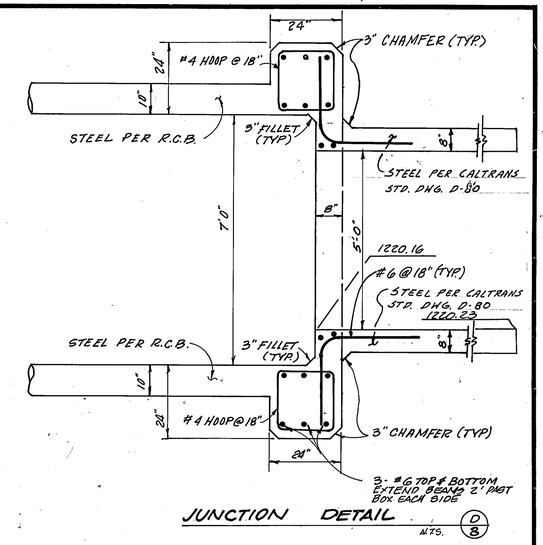
DETOUR PLAN

1" = 500'

GENERAL NOTES

1. ALL MATERALS AND DETAILS TO BE PROVIDED BY CONTRACTORS IN ACCORDANCE WITH CALTRANS MANUAL OF OF TRAFFIC CONTROLS.
2. THESE ARE MINIMUM SIGNING REQUIREMENTS; ADDITIONAL SIGNS MAY BE REQUIRED TO FACILITATE PUBLIC SAFTY AND TRAFFIC FLOW IF DEEMED NECESSARY BY THE ENGINEER.
3. ALL CONFLICTING STRIPING, SIGNING AND PAVENENT MARKINGS SHALL BE REMOVED BY THE CONTRATOR UPON COMPLETION OF CONSTRUCTION. PAYMENT MARKINGS SHALL BE REMOVED BY SANDBLASTING.
4. UPON COMPLETION OF WORK WITHIN PALOMAR STREET. THE CONTRACTOR SHALL RESTORE THE MEDIAN TO ORIGINAL GRADES AND CONDITION INCLUDING REPLACING ALL EX. SIGNS.
5. RIP-RAP 2:1 SLOPES AS SHOWN.
6. WORK AT McVICAR ST. CROSSING WILL NOT BE PERMITTED WHILE PALOMAR ST. DETOUR IS IN EFFECT.

(7) POLE & ANCHOR TO BE RELOCATED BY OTHERS
(8) PROVIDE TEMPORARY DRIVEWAY DURING BOX CONSTRUCTION.
(9) PROTECT EX. POLES IN PLACE.
(10) 30" & 60" CASING PIPES FOR FUTURE WATE LINES, 32' LONG, SEE SPECS, & DETAIL SHEET No. 3.

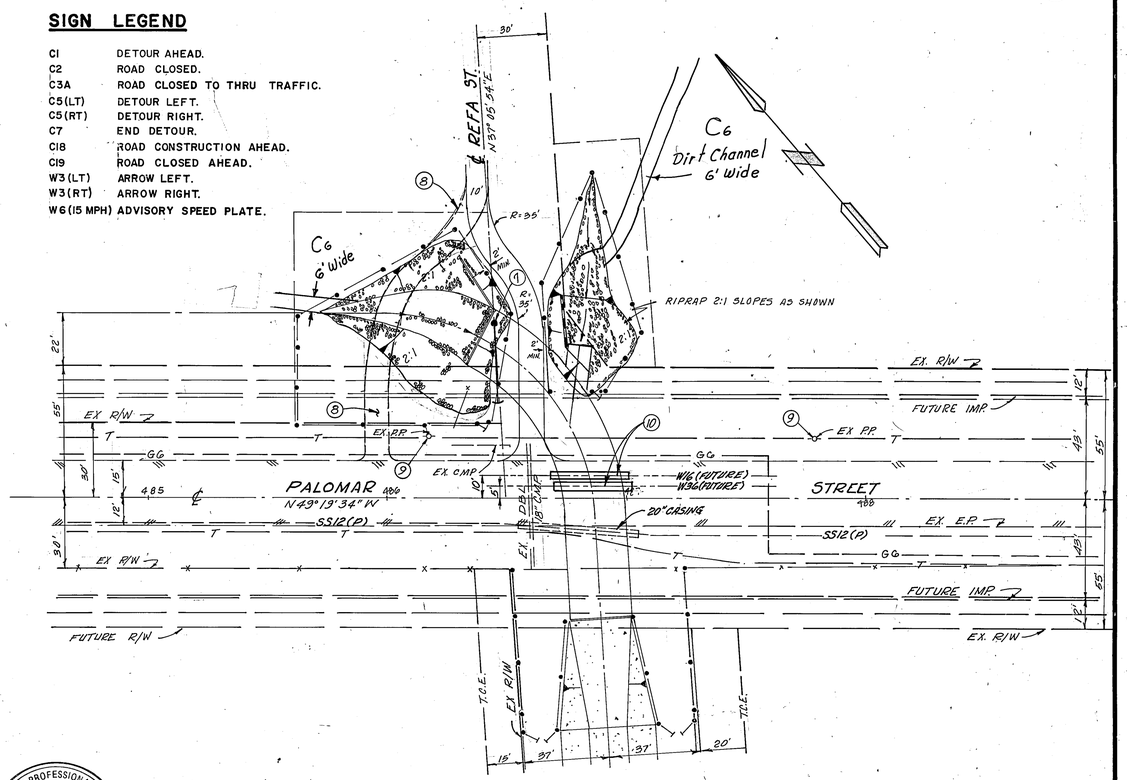


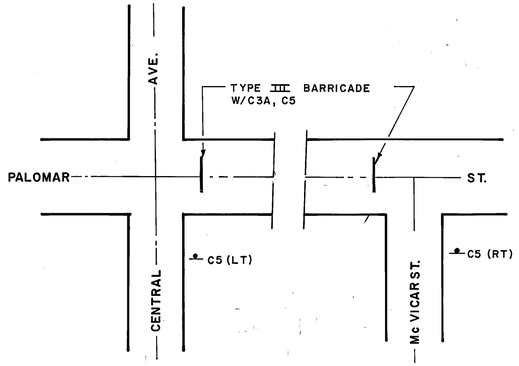
JUNCTION DETAIL (D/8)

NTS.

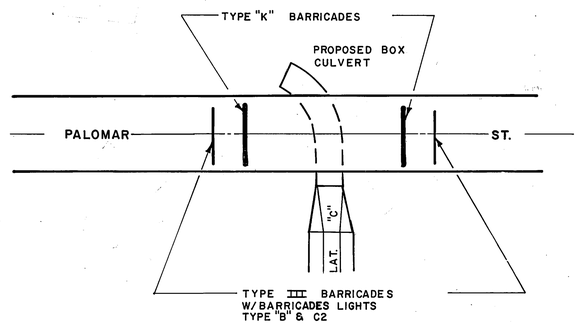
SIGN LEGEND

C1	DETOUR AHEAD.
C2	ROAD CLOSED.
C3A	ROAD CLOSED TO THRU TRAFFIC.
C5(LT)	DETOUR LEFT.
C5(RT)	DETOUR RIGHT.
C7	END DETOUR.
C18	ROAD CONSTRUCTION AHEAD.
C19	ROAD CLOSED AHEAD.
W3(LT)	ARROW LEFT.
W3(RT)	ARROW RIGHT.
W6(15 MPH)	ADVISORY SPEED PLATE.





DETAIL 1



DETAIL 2

30 20 10 0 30
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER HELMUT SCHUMANN No. 14312 Exp. 3-31-89 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER REAL SMITHHAMMER No. 16757 Exp. 6-30-89 CIVIL STATE OF CALIFORNIA

J.F. DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS SURVEYORS PLANNER
RIVERSIDE - COLTON - PALM DESERT - TEMECULA
APPROVED BY Helmut Schumann DATE 9/28/87
R.E. No. 14312 EXP 3-31-89

BENCH MARK
SEE SHEET 1

REVISIONS			
C6	Change Width of Dirt Channel	JDS	7/27/88
REF.	DESCRIPTION	APPR.	DATE

AS BUILT

RIVERSIDE COUNTY FLOOD CONTROL AND CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Real Smithhammer
R.E. NO. 16757
DATE: 10/8/87
APPROVED BY: Kenneth L. Edwards
CHIEF ENGINEER R.E. NO. 12400
DATE: 10-7-87

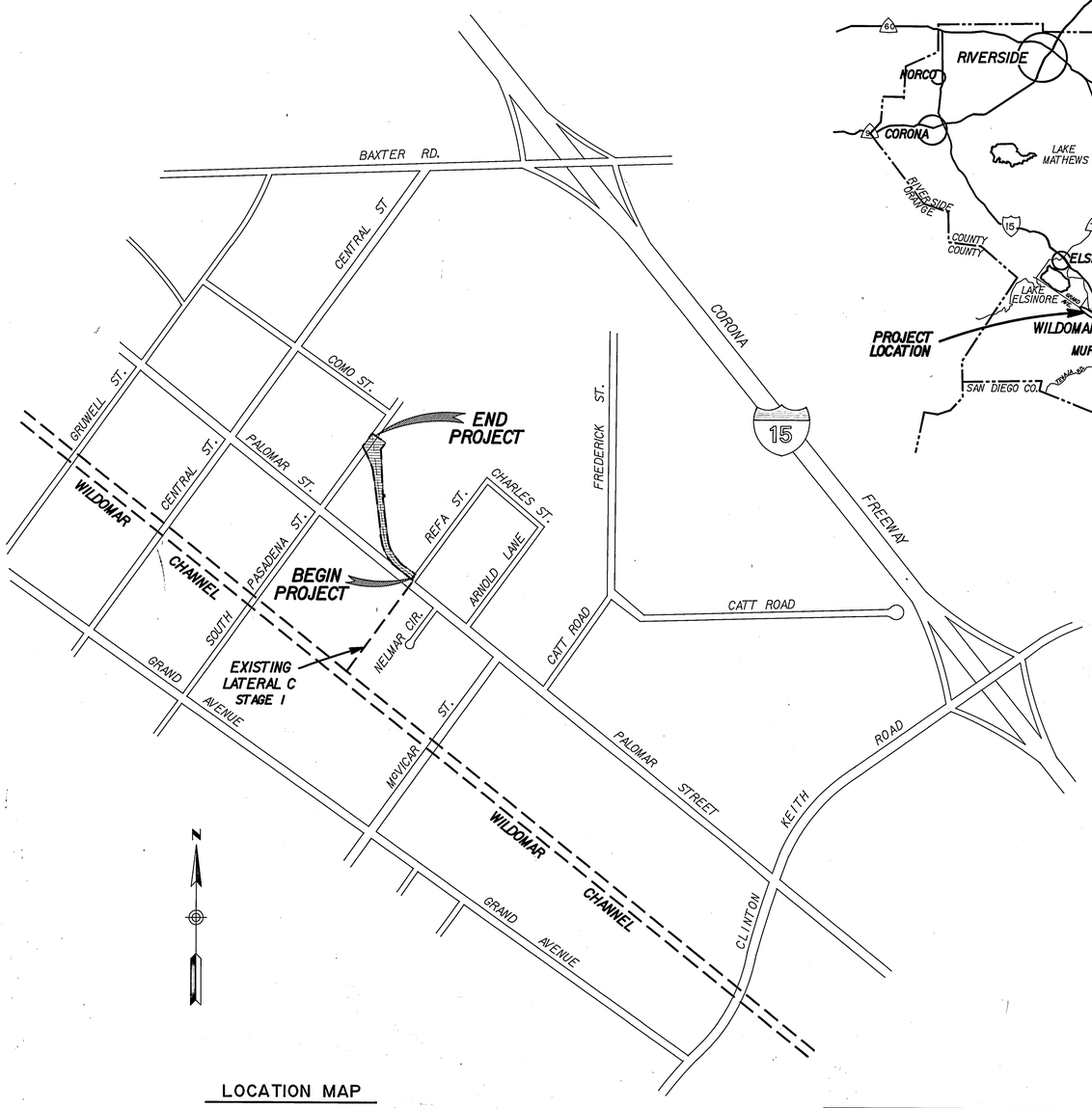
County of Riverside
APPROVED BY: S. K. Jain
FOR ROAD COMMISSIONER
RIVERSIDE COUNTY, CALIF.
DATE: 10/8/87

WILDOMAR CHANNEL
LATERAL "C"
PALOMAR STREET
DETOUR PLAN

PROJECT NO. 7-0-075
DRAWING NO. 7-94
SHEET NO. 8 OF 17

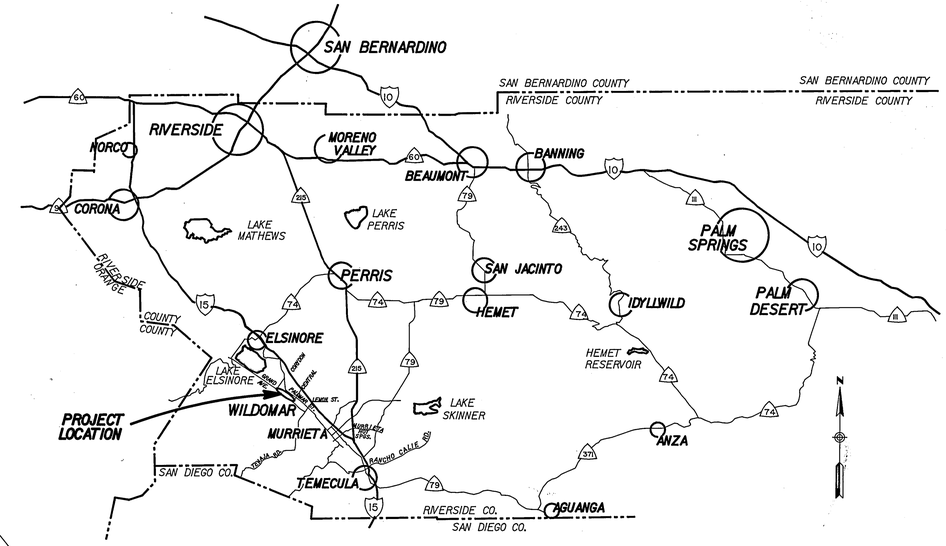
NOTE Save This Sheet Because of Detail Changes

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT



LOCATION MAP

800' 0 800'



VICINTIY MAP

NO SCALE

INDEX

	SHEET No.
TITLE SHEET	1
PLAN AND PROFILES	2-4
VEHICULAR BRIDGE CROSSING	5
PEDESTRIAN BRIDGE FOOTING DETAILS	6

R.C.F.C. & W.C.D. STANDARD DRAWINGS

CB 103	CATCH BASIN MANHOLE FRAME & COVER	7
CB 106	CATCH BASIN REINFORCEMENT	8
CB 110	CONCRETE DROP INLET	9
JS 228	JUNCTION STRUCTURE No. 3	10
JS 231	JUNCTION STRUCTURE No. 6	11
MH 259	STANDARD DROP STEP	12
CH 326	TRAPEZOIDAL CHANNEL DETAILS	13
CH 329	TRANSITION STRUCTURAL DETAILS	14
CH 332	SUBDRAIN DETAILS	15
M 801	CHAIN LINK FENCE DETAILS	16
M 814	ABBREVIATIONS AND SYMBOLS	17
M 818	WIRE FENCE DETAILS	18
M 819	MAXIMUM CHORD LENGTHS FOR CURVED SECTIONS	19

CALTRANS STANDARD DRAWINGS

D-81	DOUBLE REINFORCED CONCRETE BOX	20
D-83	BOX CULVERT MISCELLANEOUS DETAILS	21
B11-53	CONCRETE BARRIER TYPE 25	22

CITY OF RIVERSIDE-WATER DIVISION

CWD 030	THRUST BLOCK DETAILS	23

GENERAL NOTES

1. ALL ELEVATIONS ARE SHOWN IN FEET, BASED ON U.S.G. & G.S. DATUM.
2. ALL CHANNEL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
3. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION.
4. TOPOGRAPHIC FEATURES, BOTH CONTOURS AND CULTURE SHOWN ON SHEET 3 ARE BASED ON FIELD SURVEYS CONDUCTED ON MARCH 14, 1990.
5. EXISTING UTILITIES SHALL BE PROTECTED IN PLACE BY THE CONTRACTOR UNLESS OTHERWISE NOTED.
6. ELEVATIONS AND LOCATIONS OF UTILITIES ARE SHOWN APPROXIMATELY ON PLANS. 48 HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT AT 1-800-422-4133. ALL UTILITIES SHALL BE PROTECTED IN PLACE EXCEPT AS NOTED ON PLANS AND SPECIFICATIONS.
7. FOR ADDITIONAL INFORMATION ON THE EXISTING WILDOMAR CHANNEL LATERAL C STAGE 1 PROJECT, SEE R.C.F.C. DWGS. 7-94.
8. APPLY HYDRO-SEEDING TO THE AREAS SPECIFIED IN SECTION 29.1 OF THE SPECIFICATIONS.

REGISTERED PROFESSIONAL ENGINEER KENNETH L. EDWARDS NO. 12400 5-13-31-93 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER SCOTT C. SMITHHAMMER No. 16757 5-31-93 CIVIL STATE OF CALIFORNIA

BENCH MARK

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

DESIGNED BY: S. Mc KIBBIN
DRAWN BY: N. CULLEN
DATE DRAWN: JUNE 1992
CHECKED BY: SCT

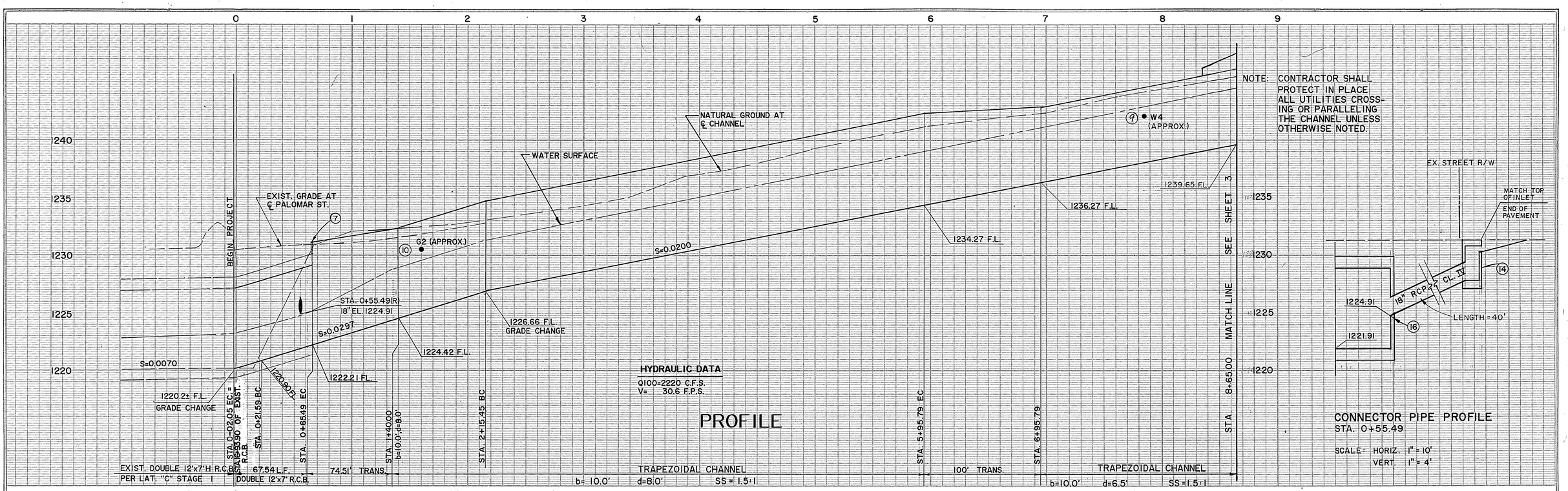
RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. No. 16757 DATE: 8/10/92

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 8-11-92

WILDOMAR CHANNEL
LATERAL C
STAGE 2

TITLE SHEET

PROJECT NO. 7-0-075
DRAWING NO. 7-153
SHEET NO. 1 OF 23



HYDRAULIC DATA

Q100=2220 C.F.S.
V= 30.6 F.P.S.

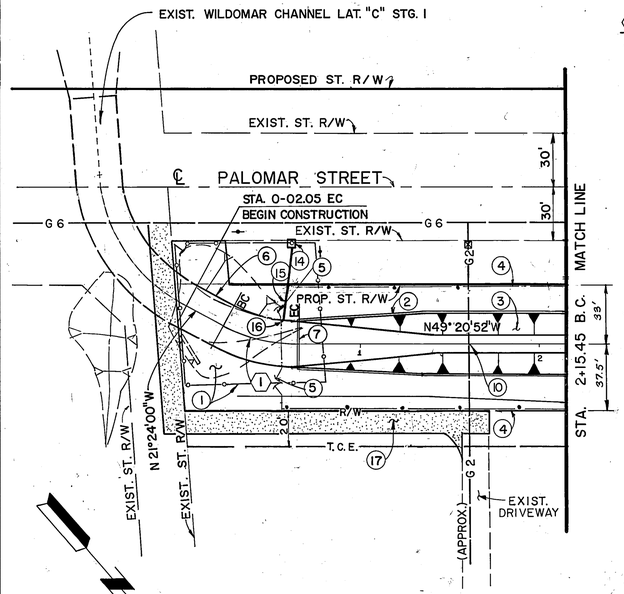
PROFILE

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES CROSSING OR PARALLELING THE CHANNEL UNLESS OTHERWISE NOTED.

CONNECTOR PIPE PROFILE

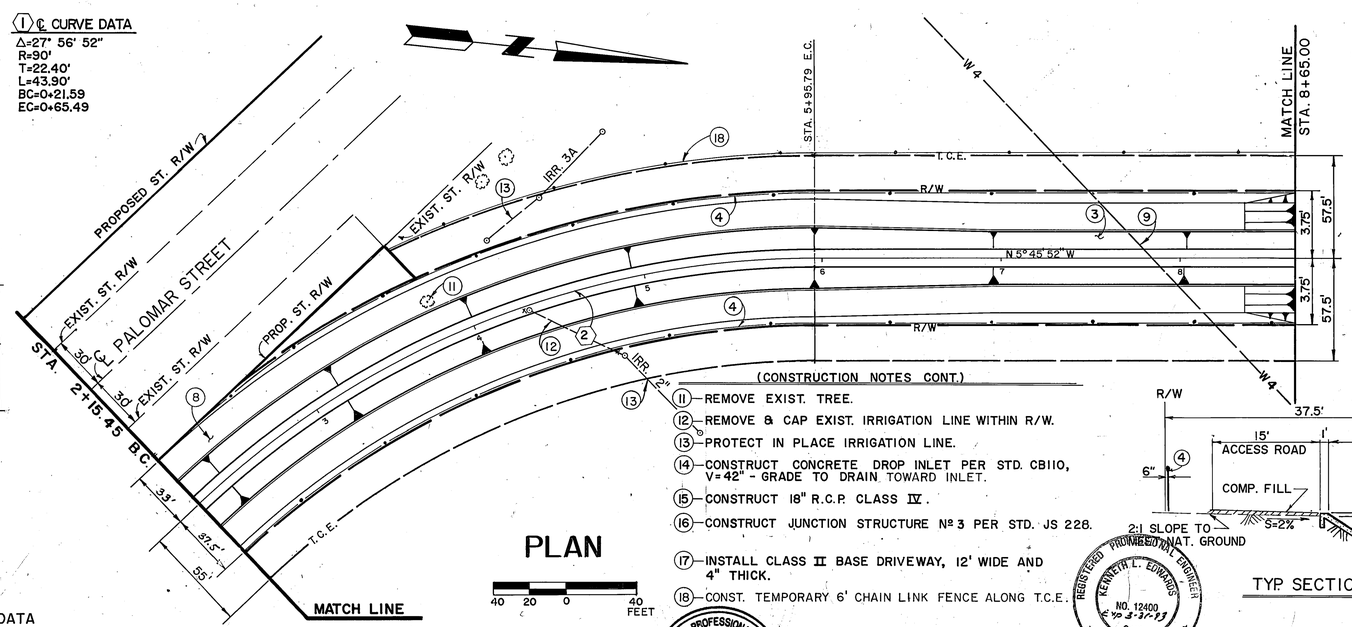
STA. 0+55.49

SCALE: HORIZ. 1" = 10'
VERT. 1" = 4'



① ℄ CURVE DATA

Δ=27° 56' 52"
R=90'
T=22.40'
L=43.90'
BC=0+21.59
EC=0+65.49



PLAN

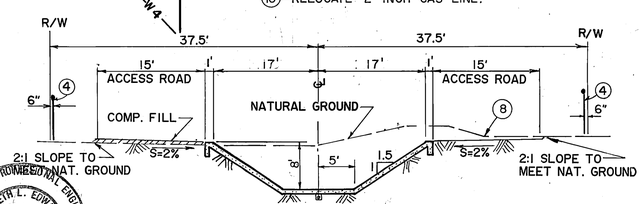
40 20 0 40 FEET

CONSTRUCTION NOTES

1. REMOVE EXIST. PARAPET WALL, EXIST. ROCK SLOPE PROTECTION, WINGWALL, & FENCE. ROCK, FENCING & 4' GATE SHOULD BE SALVAGED & REUSED.
2. CONSTRUCT CHANNEL TRANSITION PER R.C.F.C. STD. CH 329 AND JOIN DOUBLE R.C.B.
3. CONSTRUCT TRAP. CHANNEL PER R.C.F.C. STD. CH. 326.
4. CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. M 801.
5. INSTALL 14' DOUBLE DRIVE GATE PER R.C.F.C. STD. M 801.
6. CONSTRUCT DOUBLE 12'x7' R.C.B. PER CALTRANS STD. D81 COVER=10'.
7. CONSTRUCT R.C.B. PARAPET PER CALTRANS STD. D83, H=1'
8. ~~NARROW ACCESS ROAD TO 12' FROM STA. 1+40 TO STA. 3+00.~~
9. RELOCATE 4 INCH WATERLINE TO A MAX. TOP OF PIPE ELEV. OF 1236.0 INSTALL 45° BEND TYP. AND INSTALL THRUST BLOCKS PER STD. CWD-030.
10. RELOCATE 2 INCH GAS LINE.

(CONSTRUCTION NOTES CONT.)

11. REMOVE EXIST. TREE.
12. REMOVE & CAP EXIST. IRRIGATION LINE WITHIN R/W.
13. PROTECT IN PLACE IRRIGATION LINE.
14. CONSTRUCT CONCRETE DROP INLET PER STD. CB110, V=42" - GRADE TO DRAIN TOWARD INLET.
15. CONSTRUCT 18" R.C.P. CLASS IV.
16. CONSTRUCT JUNCTION STRUCTURE Nº 3 PER STD. JS 228.
17. INSTALL CLASS II BASE DRIVEWAY, 12' WIDE AND 4" THICK.
18. CONST. TEMPORARY 6' CHAIN LINK FENCE ALONG T.C.E.



TYP. SECTION AT STA. 3+20 TO STA. 5+95.79

NTS

② ℄ CURVE DATA

Δ = 43°35'00"
R = 500'
T = 199.90'
L = 380.34'
B.C.= 2+15.45
E.C.= 5+95.79

BENCH MARK ELEV. 1255.33
STD. DISK E-21 (USGS) S.W. COR. OF PALOMAR AND CENTRAL, BASE OF BELL TOWER AT WILDOMAR SCHOOL

REVISIONS			
REF.	DESCRIPTION	APPR	DATE

REGISTERED PROFESSIONAL ENGINEER NEAL SMITH (R.L. EDWARDS) No. 16757 Exp. 6-30-93 CIVIL STATE OF CALIFORNIA

RIVERSIDE COUNTY FLOOD CONTROL AND CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: DEPUTY DIRECTOR OF PUBLIC WORKS R.E. NO. 16757 DATE: 8/10/92

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 8-11-92

County of Riverside

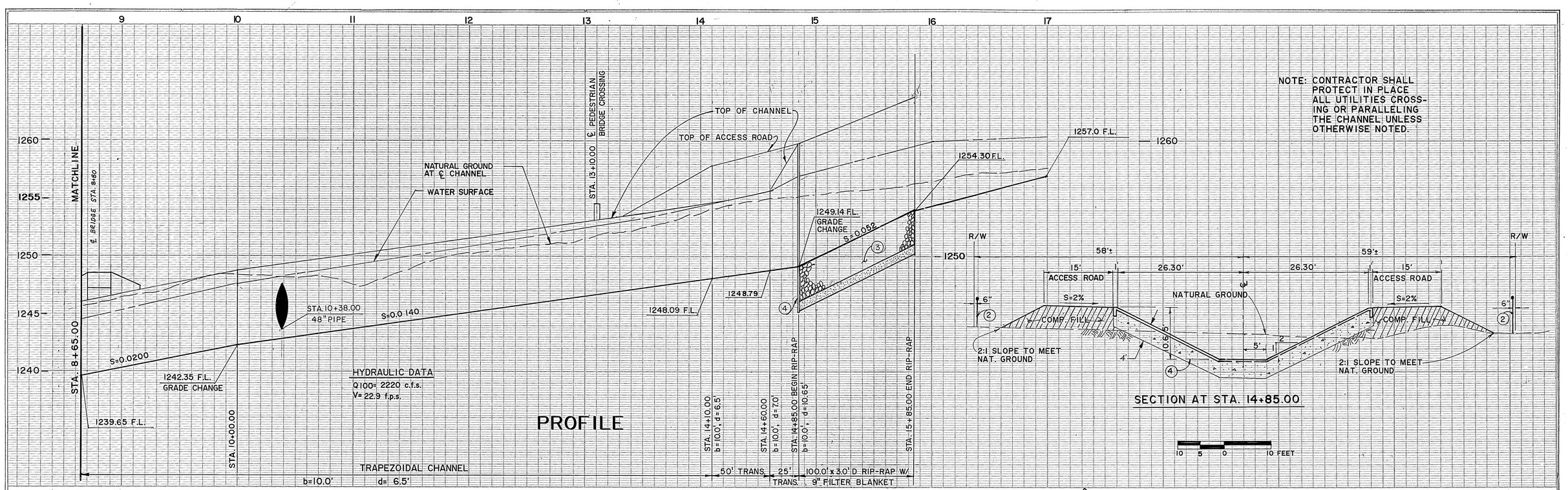
APPROVED BY:
FOR ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. DATE:

REGISTERED PROFESSIONAL ENGINEER KENNETH L. EDWARDS NO. 12400 Exp. 3-31-93 CIVIL STATE OF CALIFORNIA

WILDOMAR CHANNEL LATERAL "C" STAGE 2

STA. 0+00.00 TO STA. 8+65.00

PROJECT NO. 7-0-075
DRAWING NO. 7-153
SHEET NO. 2 OF 23



(CONSTRUCTION NOTES CONT.)

(18)—PROTECT EXIST. TREE WITHIN T.C.E.

(19)—CONST. TEMPORARY 6' CHAIN LINK FENCE ALONG T.C.E.

CONSTRUCTION NOTES

(1)—CONSTRUCT TRAP. CHANNEL PER R.C.F.C. STD. CH. 326

(2)—CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. M801.

(3)—CONSTRUCT 1/4 TON ROCK RIP-RAP, 3' DEEP WITH 9" FILTER BLANKET.

(4)—CONSTRUCT 4' CUT-OFF WALL, 6" THICK, WITH #4 BARS @ 18 O.C.

(5)—CONSTRUCT LEVEE W/ROCK SLOPE PROTECTION ON INSIDE SLOPE (SEE LEVEE PROFILES ON SHEET 4)

(6)—INSTALL 4' METAL GATE

(7)—INSTALL PREFABRICATED METAL BRIDGE CROSSING W/ CONC. FOOTINGS (SEE SHT. 6)

(8)—CONSTRUCT CONCRETE SIDE INLET SEE CONNECTOR PIPE PROFILE AND DETAIL "B", SHT. 4

(9)—CONSTRUCT J.S. NO. 6 PER R.C.F.C. STD. JS231 STA. "X"= 10+38.00, A= 45°, D= 48", C= 8'-6", L= 20'-0" EL. "R"= 1244.1, EL. "S"= 1243.63

(10)—CONST. J.S. Nº 6 PER STD. JS231, STA. "X" = 10+80.75, A= 45°, D= 48", C= 0'-0", L= 15'-0", EL. "R"= 1244.30, EL. "S"= 1244.15

(11)—CONST. CONC. VEHICULAR BRIDGE, SEE SHEET 5.

(12)—CONST. 3-WIRE FENCE PER STD. M818.

(13)—REMOVE INTERFERING EXIST. EUCULYPTUS TREES WITHIN T.C.E. LIMITS.

(14)—REMOVE EXIST. WIRE FENCE WITHIN R/W LIMITS.

(15)—INSTALL 14 FOOT DOUBLE DRIVE GATES PER STD. M801.

(16)—REMODEL 2 INCH IRRIGATION LINE WITHIN PROJECT LIMITS, SALVAGE RAINBIRDS AS COVERED UNDER SECT. 27.4 IN SPECS.

(17)—REMOVE EXIST. TREES WITHIN R/W.

BENCH MARK ELEV. 1255.33
STD. DISK E-21 (USGS) S.W. COR. OF PALOMAR AND CENTRAL, BASE OF BELL TOWER AT WILDOMAR SCHOOL

REVISIONS			
1	REVISED BEARINGS PER R/W MAP	SCT	9-1-92
REF.	DESCRIPTION	APPR.	DATE

RECOMMENDED FOR APPROVAL: DESIGN ENGINEER R.E. NO. 16757 DATE: 8/1/92

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 8-11-92

County of Riverside

APPROVED BY:

FOR ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. DATE:

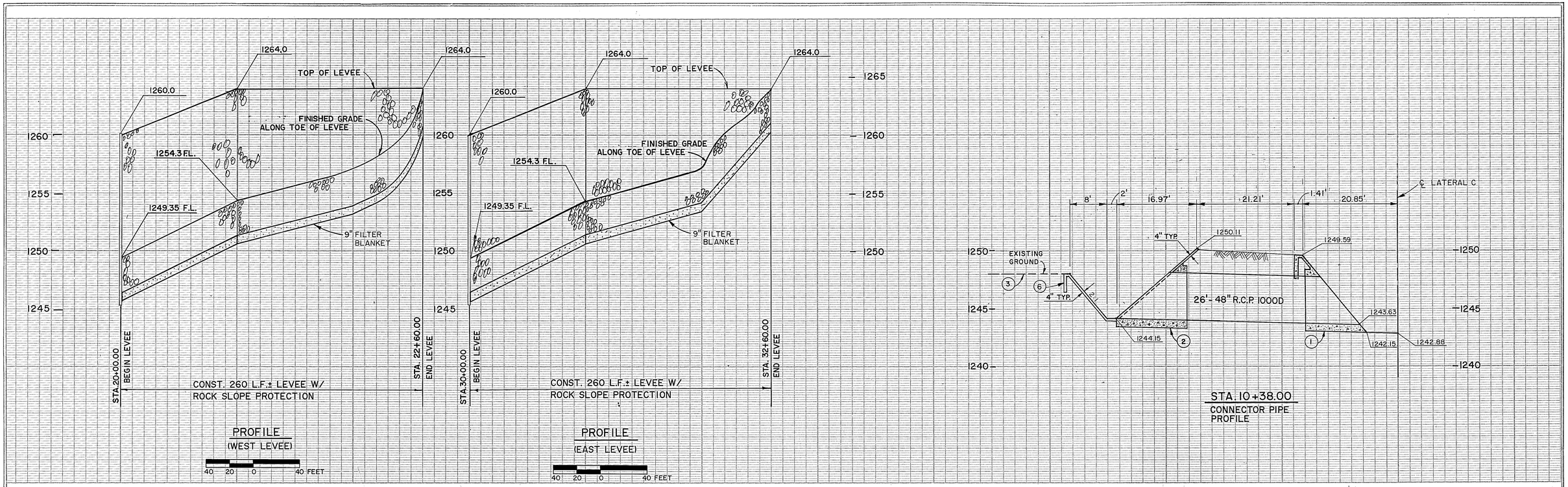
WILDOMAR CHANNEL LATERAL "C" STAGE 2

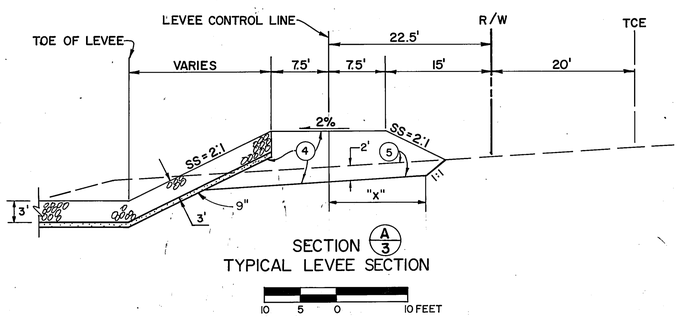
STA. 8+50.00 TO STA. 15+00.00

PROJECT NO. 7-0-075

DRAWING NO. 7-153

SHEET NO. 3 OF 23

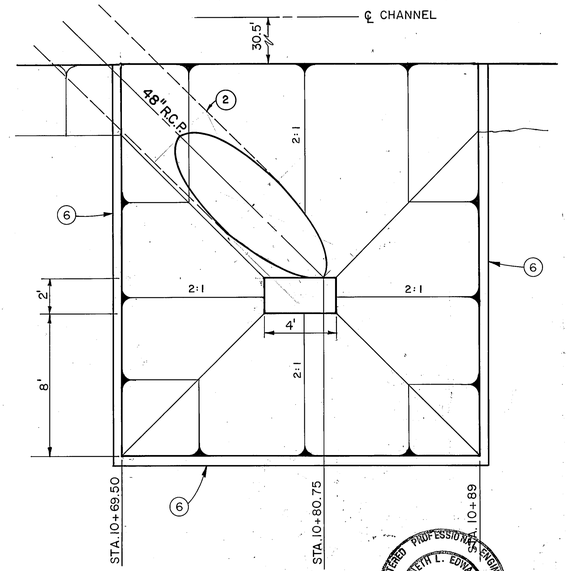




SECTION A/3
TYPICAL LEVEE SECTION

10 5 0 10 FEET

STA.	"x"	PROFILE ELEV.
20+00	11.5'	1260.0
20+50	15.5'	1262.0
21+00	17.5'	1264.0
21+50	11.5'	1264.0
22+00	7.5'	1264.0
22+50	7.5'	1264.0
30+00	13.5'	1260.0
30+50	15.5'	1262.0
31+00	17.5'	1264.0
31+50	13.5'	1264.0
32+00	7.5'	1264.0
32+50	7.5'	1264.0



DETAIL 'B'
SCALE: 1" = 4'0"

NOTES:

1. CONST. JS NO. 6 PER STD. JS231. STA. "x" = 10+38.00, A=45°, D=48", C=8'-6", L=20', EL"R"=1243.74, EL"S"=1243.63
2. CONST. JS NO. 6 PER STD. JS231. STA."x"=10+80.75, A=45°, D=48", C=0'-0", L=15'-0", EL"R"=1244.30, EL"S"=1244.15
3. GRADE EXIST. GROUND AROUND INLET TO DRAIN.
4. EMBANKMENT PAYLINES
5. CHANNEL EXCAVATION PAYLINES
6. CONST. CHANNEL CUTOFF WALL PER STD. CH326 (3 SIDES).

BENCH MARK ELEV. 1255.33
STD. DISK E-21 (USGS) S.W. COR. OF PALOMAR AND CENTRAL, BASE OF BELL TOWER AT WILDOMAR SCHOOL

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

REGISTERED PROFESSIONAL ENGINEER NEAL SMITHHAMER No. 16757 Exp. 6-30-93 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER KENNETH L. EDWARDS NO. 12400 Exp. 12-31-92 CIVIL STATE OF CALIFORNIA

COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757 DATE: 8/10/92

APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 8-11-92

County of Riverside

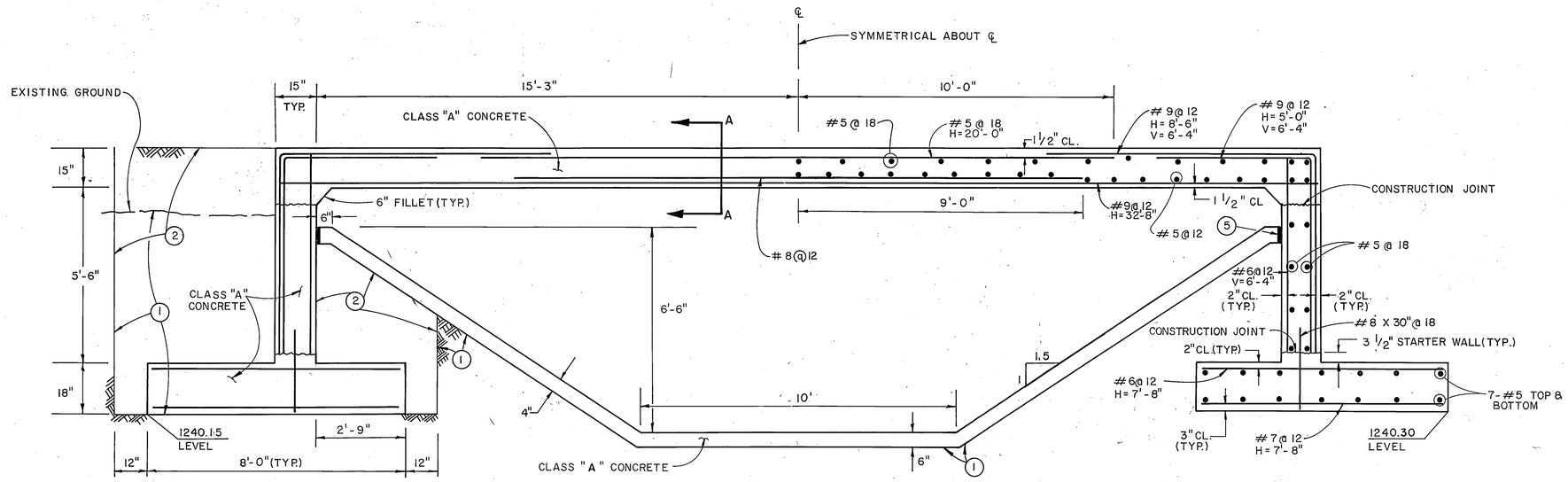
APPROVED BY:

FOR ROAD COMMISSIONER
RIVERSIDE COUNTY, CALIF. DATE:

WILDOMAR CHANNEL LATERAL "C" STAGE 2

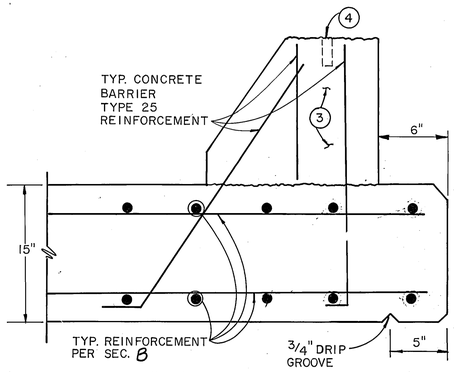
LEVEE & CONNECTOR PIPE PROFILES

PROJECT NO. 7-0-075
DRAWING NO. 7-153
SHEET NO. 4 OF 23

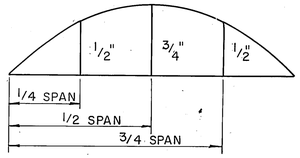


SECTION B / 3
STA. 8+80.00

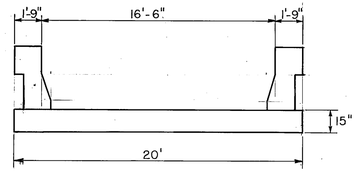
2' 0 2'



TYPICAL EDGE BEAM DETAIL

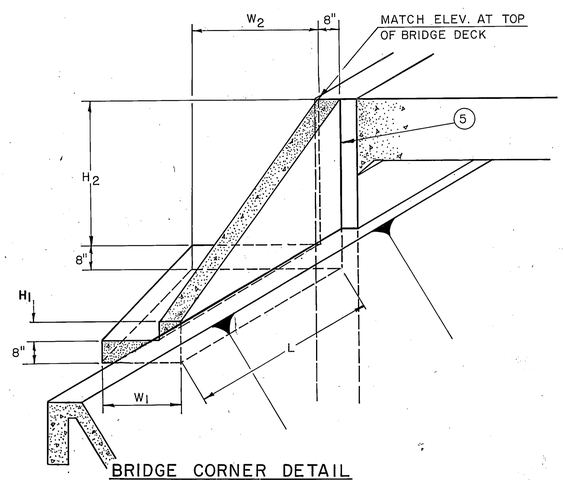


CAMBER DIAGRAM

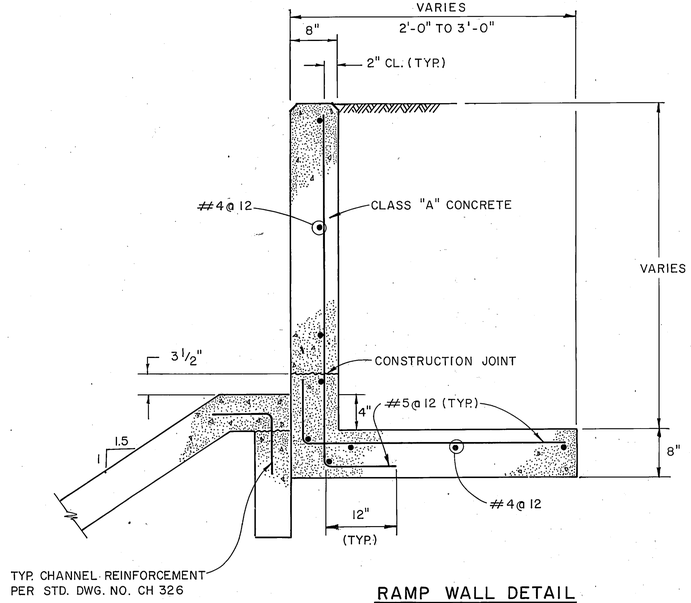


SECTION A-A
N.T.S.

RAMP WALL HEIGHT				
CORNER	NW	NE	SW	SE
W_1	2'	2'	2'	2'
W_2	2'-6"	2'-6"	3'	3'
H_1	9 1/2"	9 1/2"	9 1/2"	9 1/2"
H_2	1'-11"	1'-9"	2'-4"	2'-2"
L	25'	25'	35'	35'



BRIDGE CORNER DETAIL
N.T.S.



RAMP WALL DETAIL
N.T.S.

NOTES:

1. CHANNEL EXCAVATION PAYLINES
2. STRUCTURE BACKFILL PAYLINES
3. CONSTRUCT CONCRETE BARRIER TYPE 25 PER CALTRANS STD. DWG. B11-53.
4. INSTALL PIPE SLEEVES & 4' FENCING PER STD. M801
5. INSTALL 1/2" EXPANSION JOINT MATERIAL
6. ALL EXPOSED CONCRETE CORNERS SHALL BE FINISHED WITH A 3/4" CHAMFER.
7. STEEL IS DIMENSIONED TO BACK OF BAR BEND.
8. BRIDGE REINFORCEMENT IS SYMMETRICAL ABOUT CHANNEL ℄.
9. CONSTRUCT CONCRETE BARRIER TYPE 25 PER CALTRANS STD. B11-53.

BENCH MARK ELEV. 1255.33
STD. DISK E-21 (USGS) S.W. COR. OF PALOMAR AND CENTRAL BASE OF BELL TOWER AT WILDOMAR SCHOOL

REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S.THOMAS
DRAWN BY:
DATE DRAWN:
CHECKED BY: SCT

RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757
DATE: 7/10/92

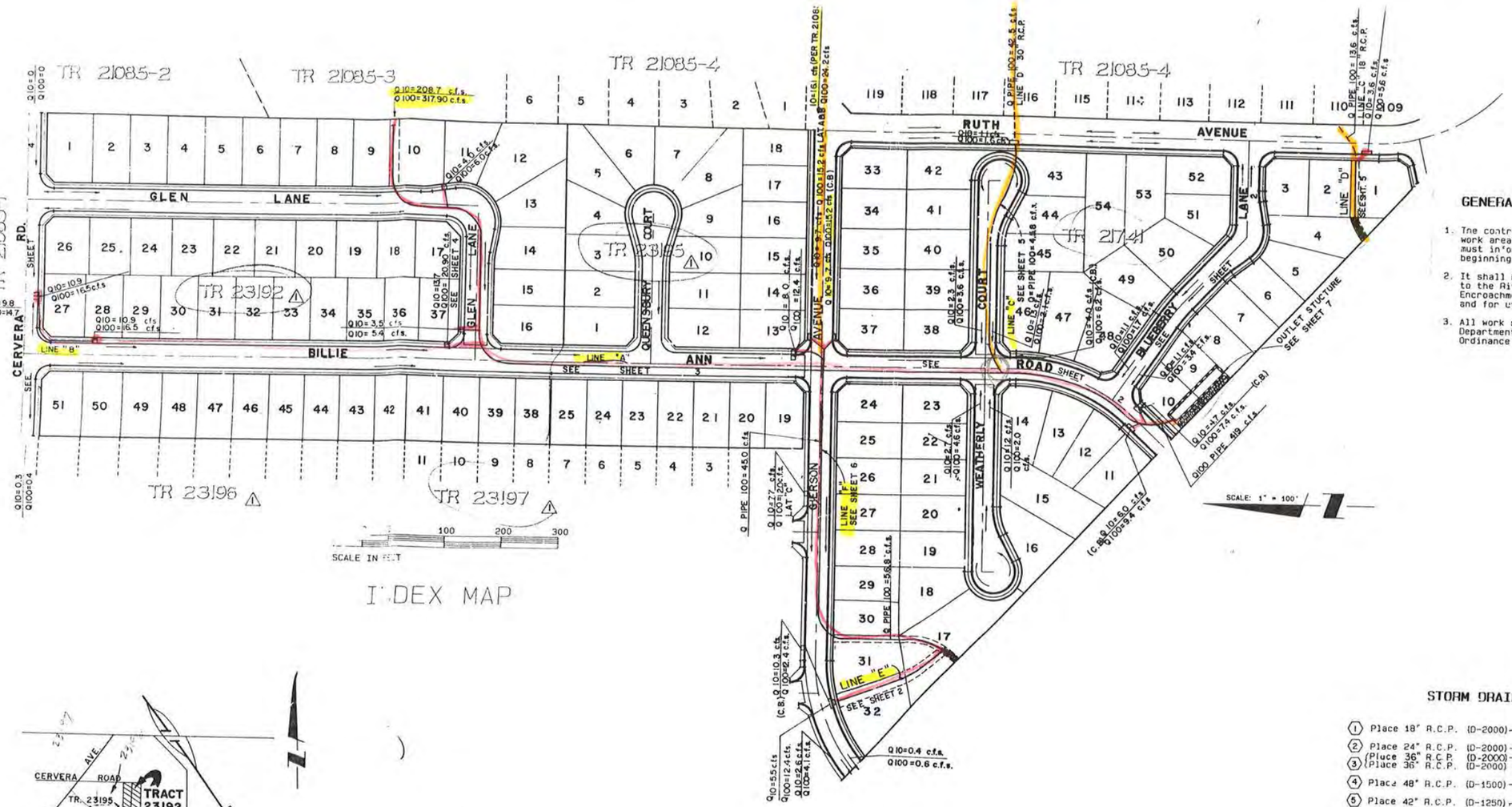
APPROVED BY: CHIEF ENGINEER R.E. NO. 12400
DATE: 8-11-92

REGISTERED PROFESSIONAL ENGINEER KENNETH L. EDWARDS NO. 12400 Exp 3-31-93 CIVIL STATE OF CALIFORNIA

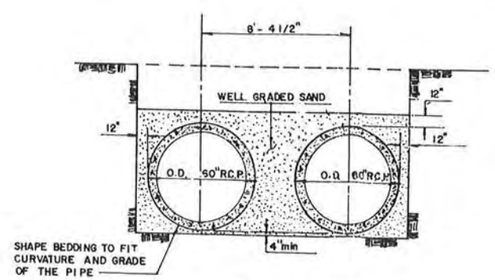
WILDOMAR CHANNEL
LATERAL "C" STAGE 2
VEHICULAR BRIDGE DETAILS

PROJECT NO. 7-0-075
DRAWING NO. 7-153
SHEET NO. 5 OF 23

Microfiche
TR 23195 (1/4)



INDEX MAP



TYPICAL BEDDING DETAILS
LINE "A" STA. 0100.00 TO STA. 4150.02

GENERAL NOTES

1. The contractor shall be responsible for the clearing of the proposed work area, and relocation costs of all existing utilities. Permittee must inform County of construction schedule at least 48 hours prior to beginning of construction at (714) 787-2031.
2. It shall be the responsibility of the developer or contractor to apply to the Riverside County Road Department, Permit Section, for an Encroachment Permit for all work on existing County maintained roads, and for utility work within offers of dedication for public use.
3. All work shall conform to the requirements of the Riverside County Road Department Improvement Standards and Specifications, dated 1982, County Ordinance No. 461.

STORM DRAIN CONSTRUCTION NOTES

1	Place 18" R.C.P. (D-2000)	251 L.F.
2	Place 24" R.C.P. (D-2000)	384 L.F.
3	Place 36" R.C.P. (D-2000)	207 L.F.
3	Place 36" R.C.P. (D-2000) or C.I.P.P.	403 L.F.
4	Place 48" R.C.P. (D-1500)	413 L.F
5	Place 42" R.C.P. (D-1250)	296 L.F.
5	Place 60" R.C.P.	900 L.F
5	Place 60" R.C.P. (D-1250) or C.I.P.P.	487 L.F.
7	Place 66" R.C.P. (D-1250) or C.I.P.P.	773 L.F.
8	Construct catch basin #1 per R.C.F.C. Std. CB100	15 EA.
9	Construct manhole #2 per R.C.F.C. Std. MH252	4 EA.
10	Construct junction structure #2 per R.C.F.C. Std. JS227	3 EA.
11	Construct junction structure #4 per R.C.F.C. Std. JS229	4 EA.
12	Construct headwall per Caltrans Std. D-89	3 EA.
13	Place 1/4 ton rip-rap 3' deep minimum	170 C.Y.
14	Construct local depression #2 per R.C.F.C. Std. LD201	15 EA.
15	Remove existing rip-rap and headwall	2 EA.
16	Construct transition per detail sht. 10	1 EA.
17	Construct outlet structure per detail sht. 10	1 EA.
18	Construct curb outlet per City of Riverside Std. 410	1 EA.
19	Construct transition structure #3 per R.C.F.C. Std. TS303	1 EA.

RECEIVED
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Talk to ART - Riv. About Hydraulics.

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)
CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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

MARK	REVISIONS	APPD	DATE
1	CHANGED TR.#'S TO VESTING TR.#'S	EJB	11/23/88

DESIGNED BY | DRAWN BY | CHECKED BY

PREPARED UNDER THE DIRECTION OF:
REGISTERED CIVIL ENGINEER NO. 17550
EXPIRATION DATE 6-30-89 DATE:
APPROVED BY:
RIVERSIDE COUNTY, CALIF.
DATE 6/20/88

J F DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
P.O. BOX 493, RIVERSIDE CA 92502, (714) 686-0844
11200 SO. MT. VERNON AVE. #D, COLTON, CA 92324, (714) 825-1082
73-080 EL PASEO, #103, PALM DESERT CA 92260, (619) 346-5691
JFD ASSOCIATES

SCALE: HORIZ. 1" = 40' VERT. 1" = 4'
DATE: OCTOBER 1987

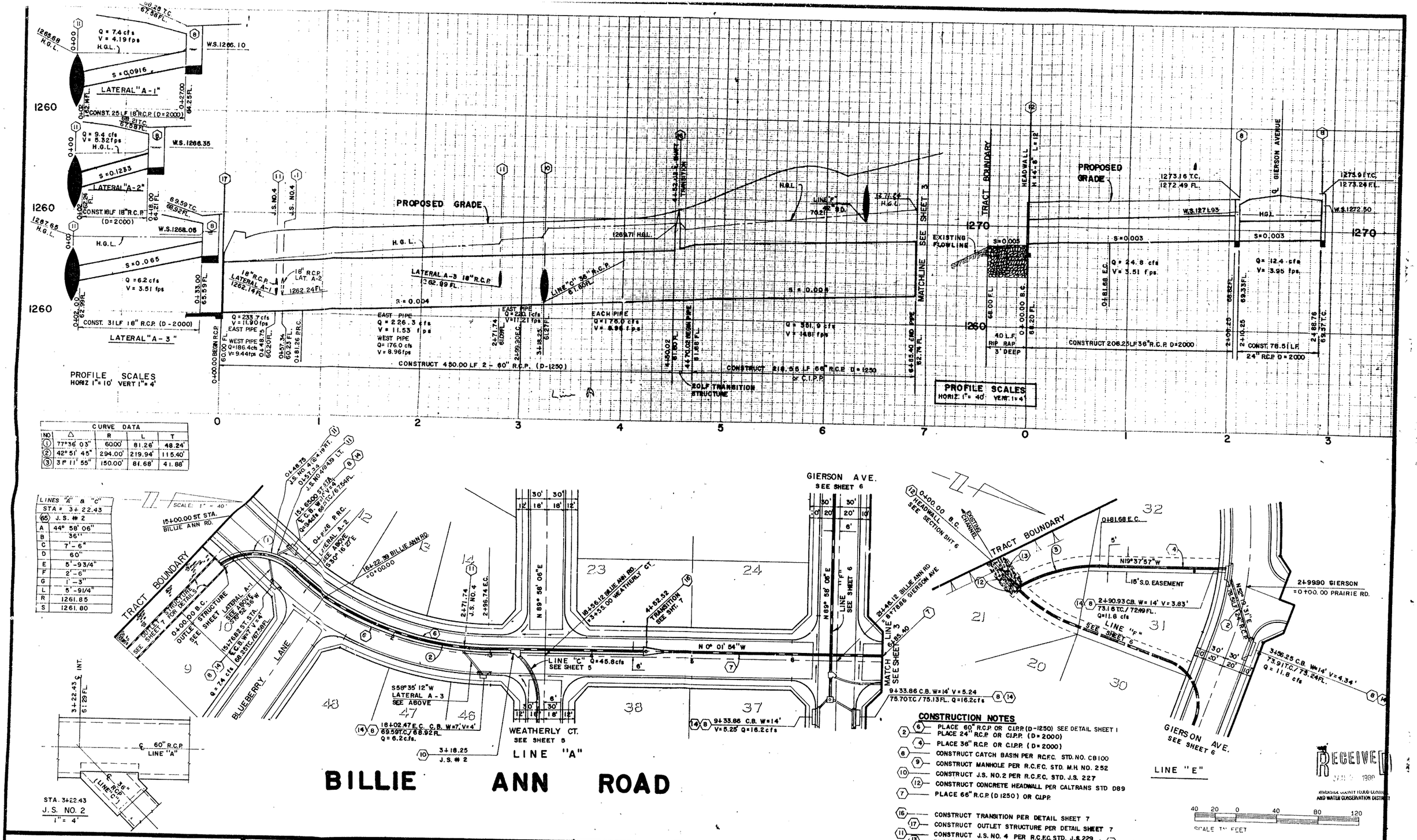
BENCH MARK-21 (USGS) 1254 RESET 1.94 ELV.1255.326 STD DISK IN BASE OF WILDOMAR SCHOOL BENCHMER 6'N OF NW COR. IN WILDOMAR AT SW COR. OF CENTRAL ST. & PALOMAR ST. 55' S OF CL OF CENTRAL ST., 79' W OF CL OF PALOMAR ST. 142' NE OF WILDOMAR SCHOOL, APP. 1[illegible]' S OF POST OFFICE.

IN THE COUNTY OF RIVERSIDE CALIFORNIA

STORM DRAIN
TRACTS 21741, 23195 & 23192
SCHEDULE "A"

FOR: STERLING BUILDERS
WO FB FILE NO. 870962

1 OF 7 SHEETS



CURVE DATA				
NO.	Δ	R	L	T
1	77°36' 03"	60.00'	81.26'	48.24'
2	42° 51' 45"	294.00'	219.94'	115.40'
3	31° 11' 55"	150.00'	81.68'	41.88'

LINES "A" & "C"	
STA = 3+22.43	
(65) J.S. # 2	
A	44° 58' 06"
B	36"
C	7'-6"
D	60"
E	5'-9 3/4"
F	2'-6"
G	1'-3"
L	5'-9 1/4"
R	1261.85
S	1261.80

CONSTRUCTION NOTES

- (6) PLACE 60" R.C.P. OR C.I.P.P. (D-1250) SEE DETAIL SHEET 1
- (2) PLACE 24" R.C.P. OR C.I.P.P. (D=2000)
- (4) PLACE 36" R.C.P. OR C.I.P.P. (D=2000)
- (8) CONSTRUCT CATCH BASIN PER R.C.F.C. STD. NO. CB100
- (9) CONSTRUCT MANHOLE PER R.C.F.C. STD. M.H. NO. 252
- (10) CONSTRUCT J.S. NO. 2 PER R.C.F.C. STD. J.S. 227
- (12) CONSTRUCT CONCRETE HEADWALL PER CALTRANS STD D89
- (7) PLACE 66" R.C.P. (D 1250) OR C.I.P.P.
- (16) CONSTRUCT TRANSITION PER DETAIL SHEET 7
- (17) CONSTRUCT OUTLET STRUCTURE PER DETAIL SHEET 7
- (11) CONSTRUCT J.S. NO. 4 PER R.C.F.C. STD. J.S. 229
- (13) PLACE 1/4 TON RIP-RAP 3' DEEP MIN.
- (14) CONSTRUCT LOCAL DEPRESSION PER RCFC STD LD 201

RECEIVED JUL 5 1988 RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

SCALE IN FEET: 40 20 0 40 80 120

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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

MARK	REVISIONS	APPD	DATE

DESIGNED BY N. S. DRAWN BY T. F. E. CHECKED BY N. H.

REGISTERED PROFESSIONAL ENGINEER — NORMAN W. CANTY — No. 17550 — CIVIL — STATE OF CALIFORNIA

PREPARED UNDER THE DIRECTION OF: Norman W. Canty
REGISTERED CIVIL ENGINEER NO. 17550
EXPIRATION DATE 6-30-89 DATE: 10/20/87

APPROVED BY: Thomas F. Bourgeault
RIVERSIDE COUNTY ROAD COMMISSIONER
RIVERSIDE COUNTY, CALIF. DATE: 10/27/87

J F DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
P.O. BOX 493 RIVERSIDE, CA 92502 (714) 686-0844
11200 SO. MT VERNON AVE. #D COLTON, CA 92324 (714) 825-9062
73-080 EL PASEO #103 PALM DESERT, CA 92260 (619) 346-5991
JFD ASSOCIATES

SCALE HORIZ.: 1" = 40 VERT.: 1" = 4
DATE OCTOBER 1987

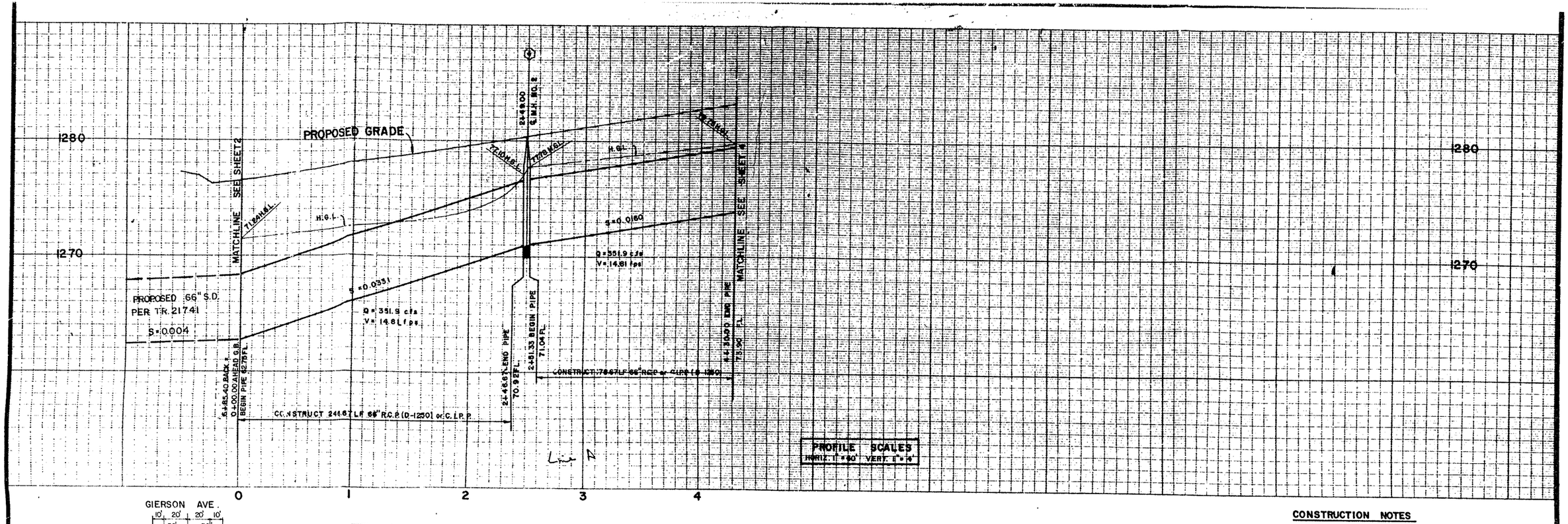
BENCH MARK: E-24 (USGS) 1254 RESET 1970 EL. 1255.326 STD DISK IN BASE OF WILDOMAR SCHOOL BELLTOWER 6'W OF NW COR. IN WILDOMAR AT SW COR. OF CENTRAL ST. & PALOMAR ST. 55' S OF CL OF CENTRAL ST., 79' W OF CL OF PALOMAR ST. 142' NE OF WILDOMAR SCHOOL. APP. 125' S OF POST OFFICE.

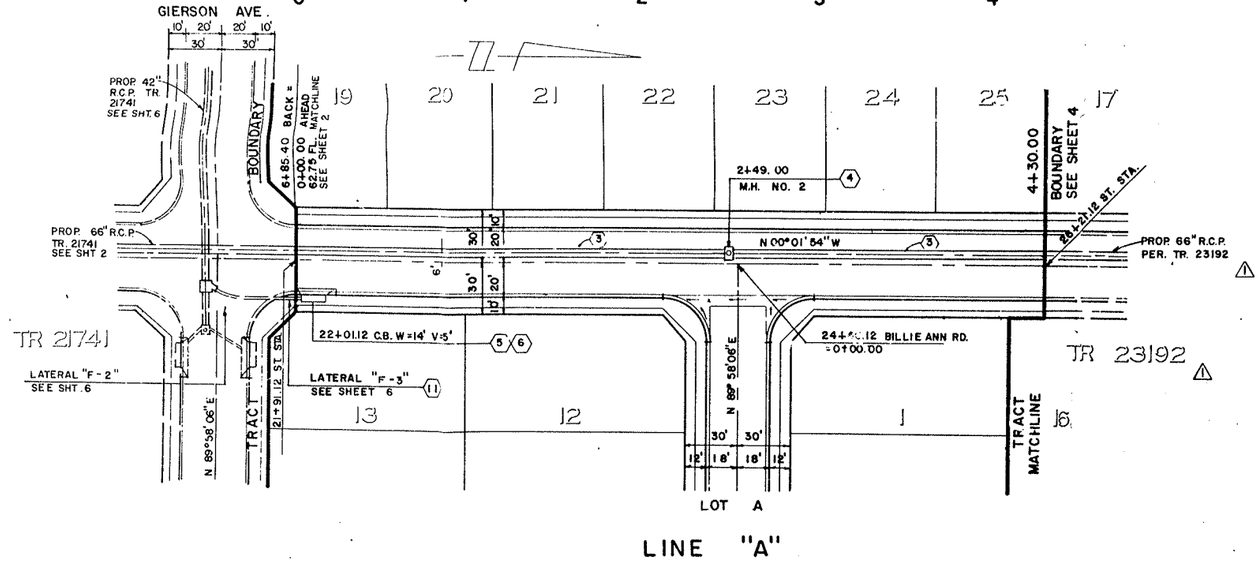
IN THE COUNTY OF RIVERSIDE CALIFORNIA
STORM DRAIN PLAN AND PROFILE
TRACT 21741
SCHEDULE "A"
LINE "A" & "E"

2 OF 7 SHEETS

FOR STERLING BUILDERS

WO FB FILE NO. 87-9762





BILLIE ANN ROAD

CONSTRUCTION NOTES

(3) — PLACE 66" R.C.P. or C.I.P.P. (D-1250)
(4) — CONSTRUCT MANHOLE # 2 PER R.C.F.C. STD. MH 252
(5) — CONSTRUCT CATCH BASIN # 1 PER R.C.F.C. STD. CB 100
(6) — CONSTRUCT LOCAL DEPRESSION PER R.C.F.C. STD. LD 201

NOTE: A MINIMUM COVER DEPTH OF 3.0 FEET SHOULD BE MAINTAINED IF C.I.P.P. IS TO BE USED

RECEIVED 1989

40 20 0 40 80 RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER JOHN W. CARTY No. 17550 Exp. 06-30-89 CIVIL STATE OF CALIFORNIA

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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

MARK	REVISIONS	APPD.	DATE
1	CHANGED TR#'S TO VESTING TR.#'S		6/27/88

DESIGNED BY N.S. DRAWN BY T.F.E. CHECKED BY N.M.

PREPARED UNDER THE DIRECTION OF: John W. Carty
REGISTERED CIVIL ENGINEER NO. 17550
EXPIRATION DATE 6-30-89 DATE: 11/4/87
APPROVED BY: Thomas F. Blumenthal
FOR ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. DATE 6/27/88

J. F. DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
P.O. BOX 493 RIVERSIDE, CA 92502 (714) 686-0844
11200 SO. MT. VERNON AVE., #D COLTON, CA 92324 (714) 825-1082
73-080 E. PASEO, #103 PALM DESERT, CA 92260 (619) 346-5691
JFD ASSOCIATES

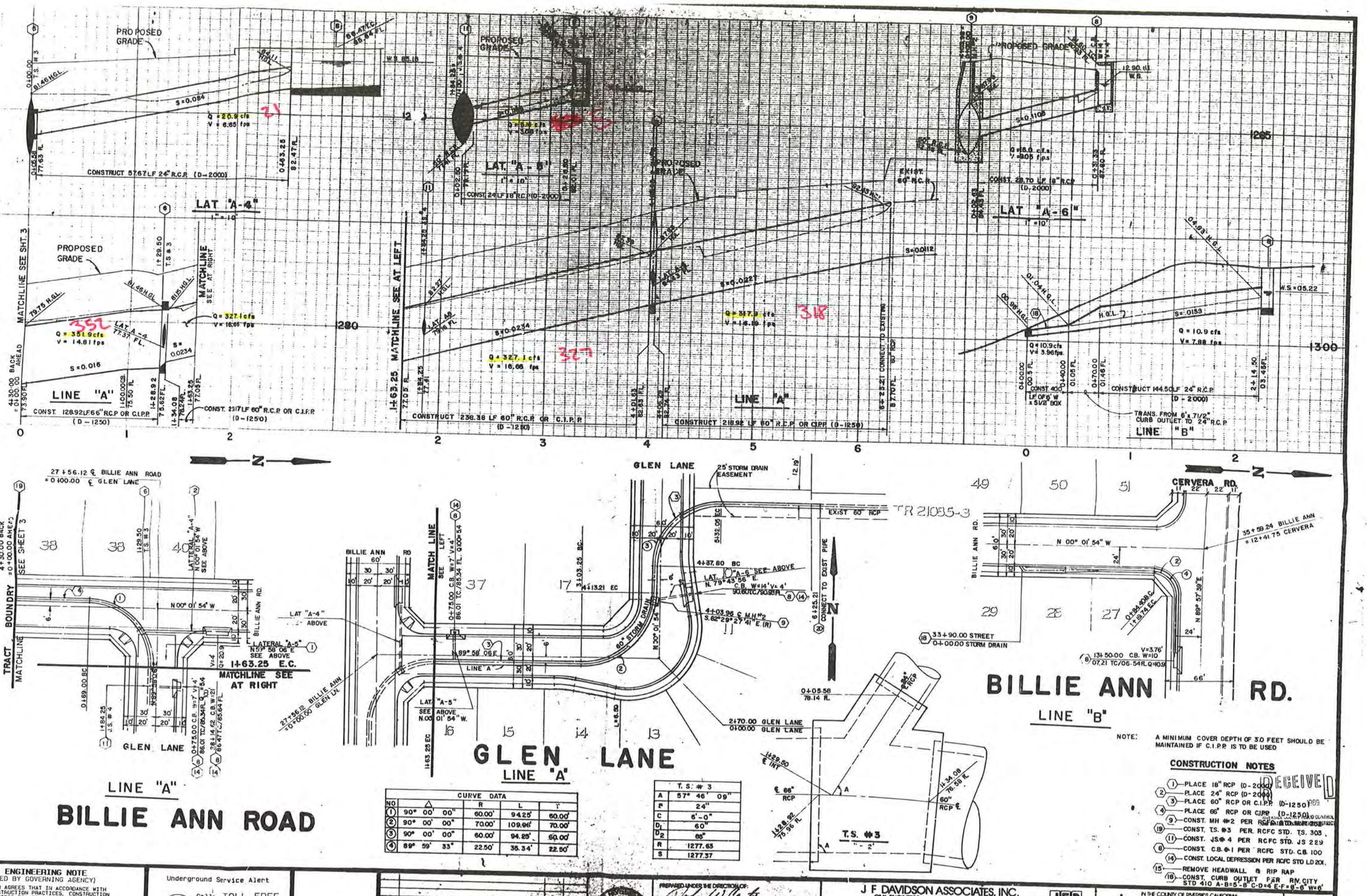
SCALE HORIZ.: 1" = 40' VERT.: 1" = 4'
DATE OCTOBER 1987

BENCH MARK: E-21 (USGS) 1254 RESET 1964 EL. 1255.326 STD DISK IN BASE OF WILDOMAR SCHOOL BELLTOWER 6'W OF NW COR. IN WILDOMAR AT SW COR. OF CENTRAL ST. & PALOMAR ST. 55' S OF CL OF CENTRAL ST., 79' W OF CL OF PALOMAR ST. 142' NE OF WILDOMAR SCHOOL, APP. 125' S OF POST OFFICE.

IN THE COUNTY OF RIVERSIDE CALIFORNIA
STORM DRAIN PLAN AND PROFILE
TRACT 23195 ⚠
SCHEDULE "A"
LINE "A"

3 OF 7 SHEETS

FOR STERLING BUILDERS
WO & FB FILE NO. 87-9762



NOTE: A MINIMUM COVER DEPTH OF 3.0 FEET SHOULD BE MAINTAINED IF C.I.P.P. IS TO BE USED

CONSTRUCTION NOTES

1. PLACE 18" RCP (D-2000)
2. PLACE 24" RCP (D-2000)
3. PLACE 60" RCP OR C.I.P.P. (D-1250)
4. PLACE 66" RCP OR C.I.P.P. (D-1250)
9. CONST. MH #2 PER RCFC & WCWCD STD. MH 103
19. CONST. TS. #3 PER. RCFC STD. TS. 303
11. CONST. JS #4 PER RCFC STD. JS 229
8. CONST. C.B. #1 PER RCFC STD. C.B. 100
14. CONST. LOCAL DEPRESSION PER RCFC STD LD 201.
15. REMOVE HEADWALL & RIP RAP
18. CONST. CURB OUTLET PER RIV. CITY STD 410 A-B=5'-8" C-D=4' E-F=8'-6" W=6'

CURVE DATA				
NO	Δ	R	L	T
1	90° 00' 00"	60.00'	94.25'	60.00'
2	90° 00' 00"	70.00'	109.96'	70.00'
3	90° 00' 00"	60.00'	94.25'	60.00'
4	89° 59' 33"	22.50'	35.34'	22.50'

T.S. #3	
A	57° 46' 09"
R	24"
C	6'-0"
D_1	60"
D_2	66"
R	1277.63
S	1277.37

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)

CONSTRUCTION. CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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TWO WORKING DAYS BEFORE YOU DIG

MARK | REVISIONS | BY | APP.
1 CHANGED TR#'S TO VESTING TR#'S

DESIGNED BY S.N. | DRAWN BY D.D. | CHECKED BY H.M.

PREPARED UNDER THE DIRECTION OF:
REGISTERED CIVIL ENGINEER NO. 17680
EXPIRATION DATE 6-30-89 DATE 11/4/87
APPROVED BY: DATE 11/23/87
RECORD COMMISSIONER RIVERSIDE COUNTY, CALIF.

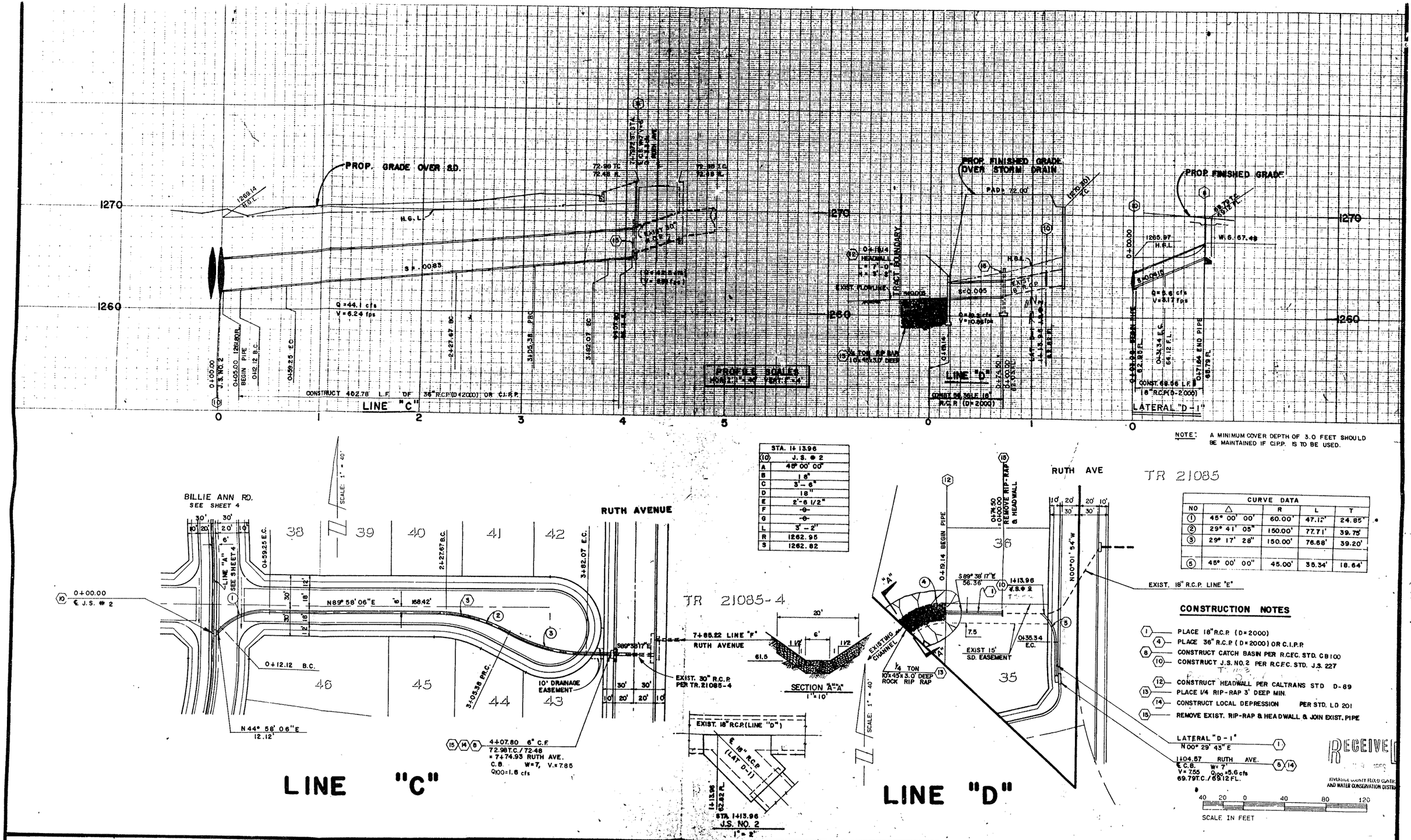
J F DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
P.O. BOX 493, RIVERSIDE, CA 92502, (714) 686-0844
11200 SO. MT. VERNON AVE. #D, COLTON, CA 92324, (714) 825-1082
73-080 EL PASEO, #103, PALM DESERT, CA 92260, (619) 346-5591
JFD ASSOCIATES

SCALE HORIZ.: 1" = 40' VERT.: 1" = 4'
DATE OCTOBER 1987
BENCH MARK: SEE SHEET 1

IN THE COUNTY OF RIVERSIDE, CALIFORNIA
STORM DRAIN PLAN AND PROFILE
TRACT 23192 △
SCHEDULE "A"
LINES "A" & "B"
FOR STERLING BUILDERS
WO F.B. FILE NO. 87-9762

4 OF 7 SHEETS

RECEIVED 1989 RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT



NOTE: A MINIMUM COVER DEPTH OF 3.0 FEET SHOULD BE MAINTAINED IF CI.P.P. IS TO BE USED.

STA. 14+13.96	
(10)	J.S. # 2
A	48° 00' 00"
B	18"
C	3'-6"
D	18"
E	2'-6 1/2"
F	-0-
G	-0-
L	3'-2"
R	1262.95
S	1262.82

CURVE DATA				
NO	△	R	L	T
(1)	45° 00' 00"	60.00'	47.12'	24.85'
(2)	29° 41' 05"	150.00'	77.71'	39.75'
(3)	29° 17' 28"	150.00'	76.68'	39.20'
(5)	45° 00' 00"	45.00'	35.34'	18.64'

CONSTRUCTION NOTES

1. PLACE 18" R.C.P. (D=2000)
4. PLACE 36" R.C.P. (D=2000) OR C.I.P.P.
8. CONSTRUCT CATCH BASIN PER R.C.F.C. STD. CB100
10. CONSTRUCT J.S. NO. 2 PER R.C.F.C. STD. J.S. 227
12. CONSTRUCT HEADWALL PER CALTRANS STD D-89
13. PLACE 1/4 RIP-RAP 3' DEEP MIN.
14. CONSTRUCT LOCAL DEPRESSION PER STD. LD 201
15. REMOVE EXIST. RIP-RAP & HEADWALL & JOIN EXIST. PIPE

LATERAL "D-1" N 00° 29' 43" E (1)

1104.57 RUTH AVE. (9)(14)
℄ C.B. W=7'
V=7.55 Q100=5.6 cfs
69.79 T.C. / 68.12 F.L.

RECEIVED
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

40 20 0 40 80 120
SCALE IN FEET

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APP	DATE

DESIGNED BY N.S. DRAWN BY T.F.E. CHECKED BY J.W.

REGISTERED PROFESSIONAL ENGINEER No. 17850 Exp. 6-30-89 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE DIRECTION OF:
REGISTERED CIVIL ENGINEER NO. 17850
EXPIRATION DATE 6-30-89 DATE 10/26/87
APPROVED BY:
BOARD OF SUPERVISORS RIVERSIDE COUNTY, CALIF. DATE 4/26/88

J F DAVIDSON ASSOCIATES, INC.
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73-080 EL PASEO, #103, PALM DESERT, CA 92260, (619) 346-5691
JFD ASSOCIATES

SCALE HORIZ. 1" = 40' VERT. 1" = 4'
DATE OCTOBER 1987

BENCH MARK: E-21 (USGS) 1254 BESET 1920 EL. 1255.326
STD DISK IN BASE OF WILDOMAR SCHOOL BELLTOWER 5'W OF NW COR. TN WILDOMAR AT SW COR. OF CENTRAL ST. & PALOMAR ST. 55' S OF CL OF CENTRAL ST., 79' W OF CL OF PALOMAR ST. 142' NE OF WILDOMAR SCHOOL, APP. 420' S OF POST OFFICE.

IN THE COUNTY OF RIVERSIDE CALIFORNIA

STORM DRAIN PLAN AND PROFILE

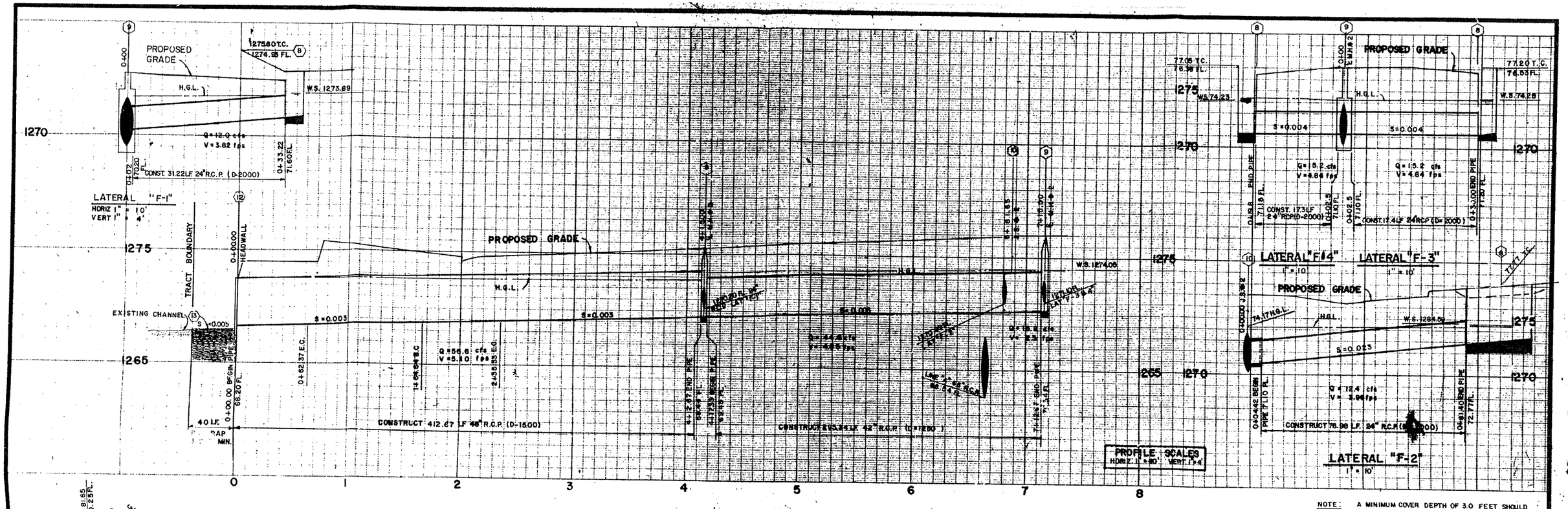
TRACT 21741

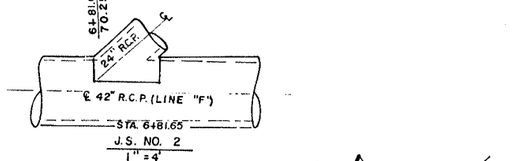
SCHEDULE "A"
LINES "C" & "D"

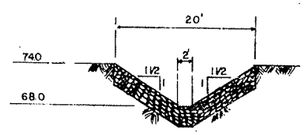
FOR STERLING BUILDERS

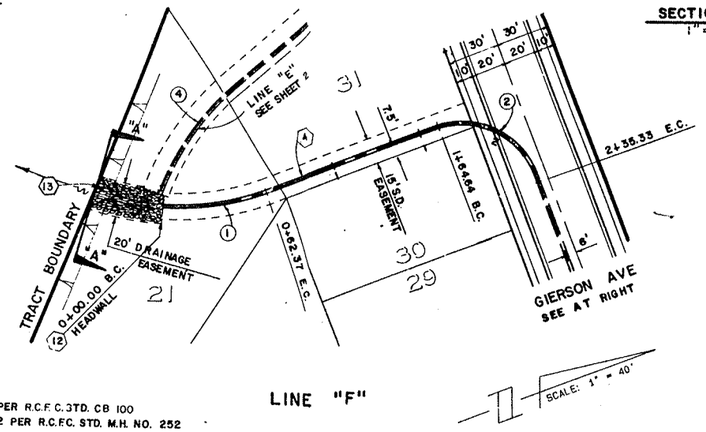
WO FB FILE NO. 87-9762

5 OF 7 SHEETS





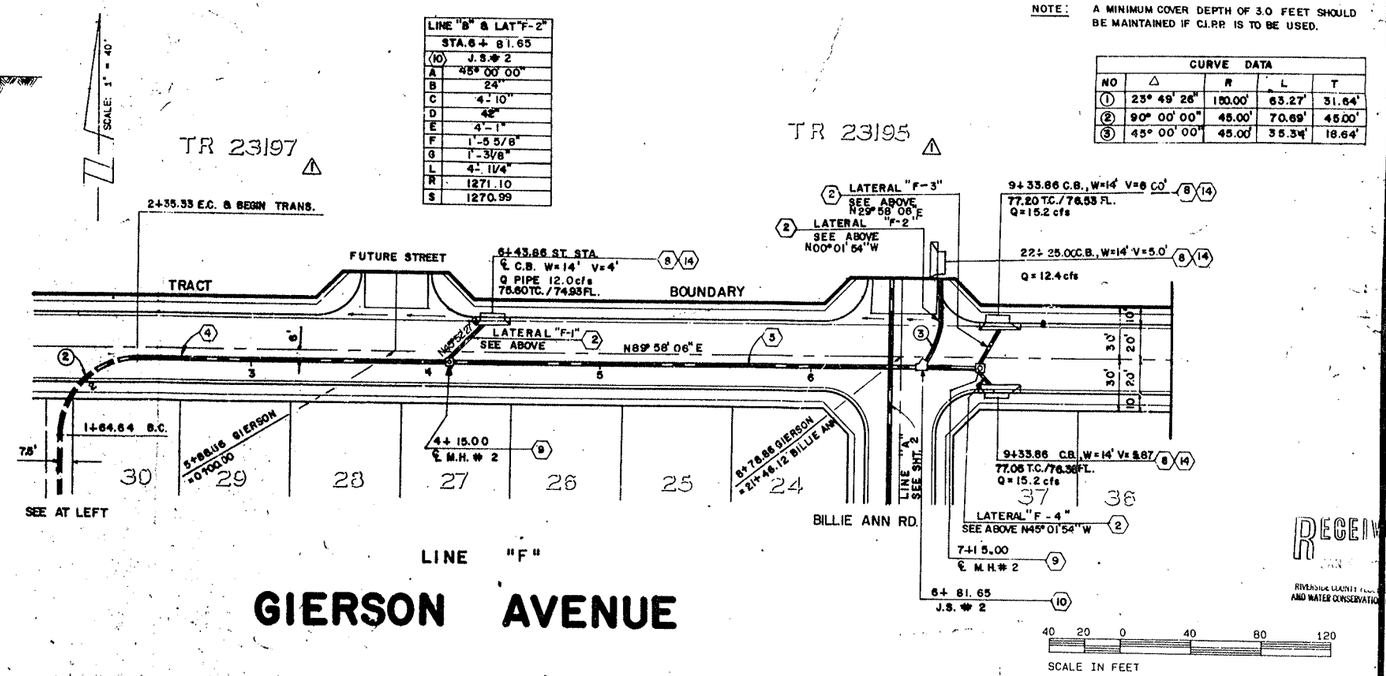




LINE "B" & LAT "F-2"
STA. 6 + 81.65
(10) J.S. # 2
A 45° 00' 00"
B 24"
C 4'-10"
D 48"
E 4'-1"
F 1'-5 5/8"
G 1'-3 1/8"
L 4'-11/4"
R 1271.10
S 1270.99

CURVE DATA				
NO	Δ	R	L	T
(1)	23° 49' 26"	180.00'	83.27'	31.64'
(2)	90° 00' 00"	45.00'	70.69'	45.00'
(3)	45° 00' 00"	45.00'	35.34'	18.64'

NOTE: A MINIMUM COVER DEPTH OF 3.0 FEET SHOULD BE MAINTAINED IF C.I.P.P. IS TO BE USED.



CONSTRUCTION NOTES

(8) CONSTRUCT CATCH BASIN PER R.C.F.C.&D.T.D. CB 100
(9) CONSTRUCT MANHOLE NO. 2 PER R.C.F.C. STD. M.H. NO. 252
(10) CONSTRUCT J.S. NO. 2 PER R.C.F.C. STD. J.S. 227
(12) CONSTRUCT CONCRETE HEADWALL PER CALTRANS. STD. D89
(13) PLACE 1/4 TON ROCK RIP-RAP (3' MIN. DEPTH)
(14) CONSTRUCT LOCAL DEPRESSION R.C.F.C. STD NO LD201

(4) PLACE 48" R.C.P. (D-1500)
(5) PLACE 42" R.C.P. (D-1250)
(2) PLACE 24" R.C.P. (D-2000)

PRIVATE ENGINEERING NOTE
(NOT REQUIRED BY GOVERNING AGENCY)

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

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MARK	REVISIONS	BY	DATE
1	CHANGED TR.#'S TO VESTING TR.#'S		

DESIGNED BY N.S. DRAWN BY T.F.E. CHECKED BY N.M.

REGISTERED PROFESSIONAL ENGINEER JOHN W. CASEY No. 17550 Exp. 06-30-89 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE DIRECTION OF: John W. Casey
REGISTERED CIVIL ENGINEER NO. 17550
EXPIRATION DATE 6-30-89 DATE 10/20/89
APPROVED BY: [signature] 10/23/89
FOR ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. DATE

J. F. DAVIDSON ASSOCIATES, INC.
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11200 SO. MT. VERNON AVE. #D □ COLTON, CA 92324 (714) 826-1082
73-080 EL PASEO, #103 □ PALM DESERT, CA 92260 (619) 346-5091
JFD ASSOCIATES

SCALE HORIZ.: 1" = 40' VERT.: 1" = 4'
DATE OCTOBER 1987

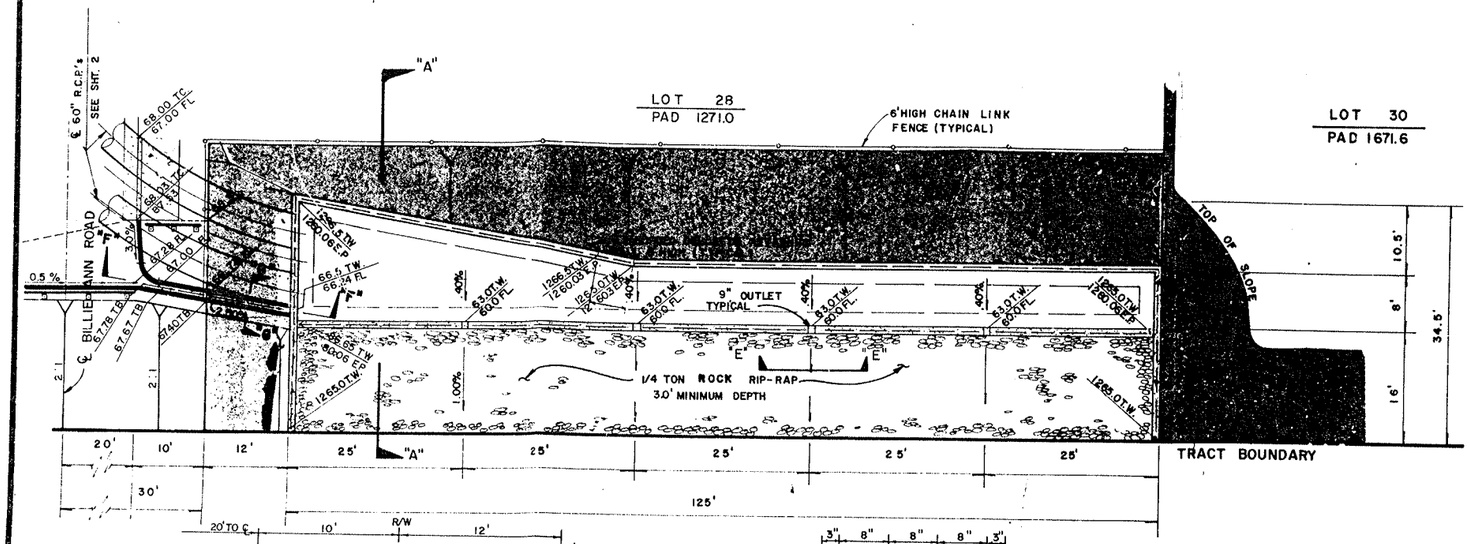
BENCH MARK: E-21 (USGS) 1254 RESET 1970 EL. 1255.326 STD DISK IN BASE OF WILDOMAR SCHOOL BELLTOWER 6"W OF NW COR. IN WILDOMAR AT SW COR. OF CENTRAL ST. & PALOMAR ST. 55' S OF CL OF CENTRAL ST., 78' W OF CL OF PALOMAR ST. 142' NE OF WILDOMAR SCHOOL, APP. 125' S OF POST OFFICE.

IN THE COUNTY OF RIVERSIDE, CALIFORNIA
STORM DRAIN PLAN AND PROFILE
TRACT 21741
SCHEDULE "A"
LINE "F"

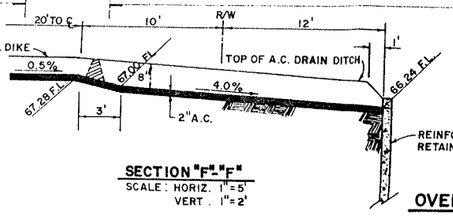
FOR STERLING BUILDERS
W.O. & B. FILE NO. 87-9762

6 OF 7 SHEETS

RECEIVED
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

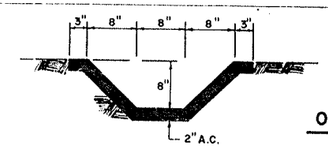


PLAN
1" = 10'



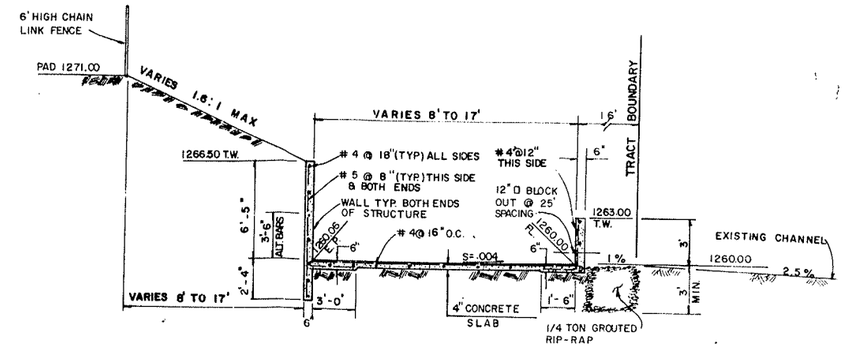
SECTION "F"-"F"
SCALE: HORIZ. 1" = 5'
VERT. 1" = 2'

OVERSIDE DRAIN DETAIL
SCALE AS SHOWN

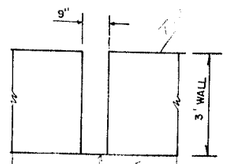


SECTION "G"-"G"
1" = 1'

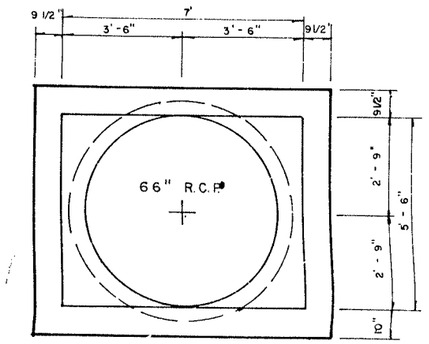
OUTLET STRUCTURE DETAIL
SCALE AS SHOWN



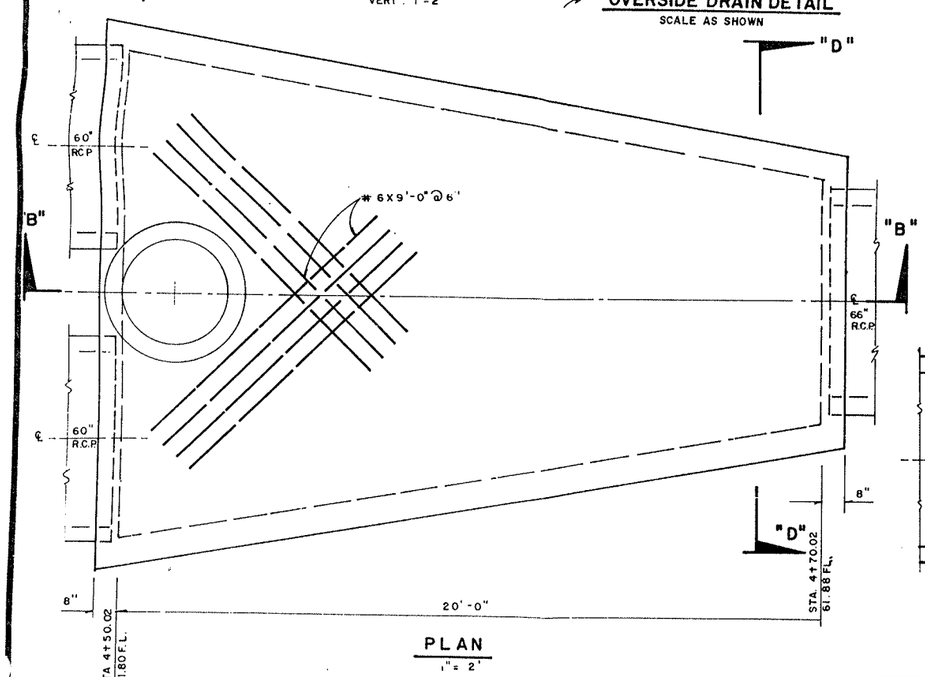
SECTION "A" - "A"
1" = 4'



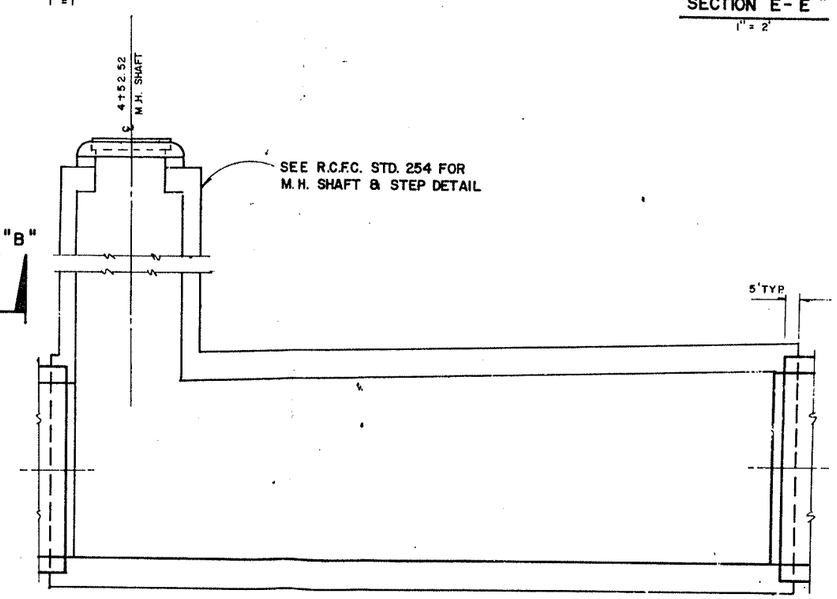
SECTION "E-E"
1" = 2'



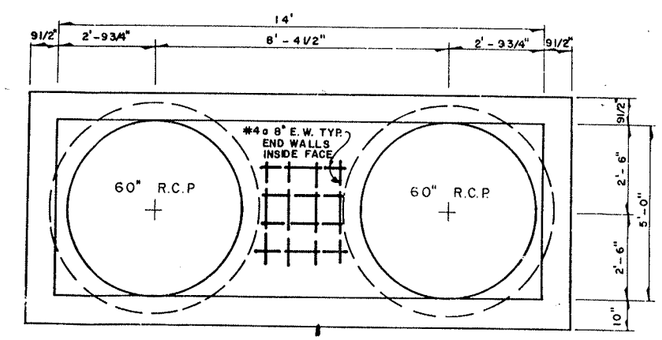
SECTION "D"-"D"
1" = 2'



PLAN
1" = 2'



SECTION "B"-"B"
1" = 2'



SECTION "C"-"C"
1" = 2'

TRANSITION DETAIL

CONSTRUCT TRANSITION PER DETAILS SHOWN IN CALTRANS STD D-80 FOR BOX 14' X 7' 1984 EDITION

RECEIVED
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

MARK	REVISIONS	APPR.	DATE

DESIGNED BY N.M. DRAWN BY T.F.E. CHECKED BY N.M.

PREPARED UNDER THE DIRECTION OF: John W. Carty
REGISTERED CIVIL ENGINEER NO. 17550
EXPIRATION DATE 6-30-89 DATE: 10/20/87
APPROVED: Thomas J. Thompson
FOR ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. DATE: 6/23/88

J F DAVIDSON ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
P.O. BOX 493, RIVERSIDE, CA 92502, (714) 686-0844
11230 30 MT. VERNON AVE., #D, COLTON, CA 92324, (714) 825-1062
73-080 EL PASEO, #103, PALM DESERT, CA 92260, (619) 346-5691
JFD ASSOCIATES

SCALE: AS SHOWN
DATE: OCT 1987
BENCH MARK: SEE SHEET 1

IN THE COUNTY OF RIVERSIDE CALIFORNIA
STORM DRAIN DETAILS
TRACT 21741
OUTLET STRUCTURE AND TRANSITION
FOR STERLING
W.O. FB FILE NO. 870-9762

7 OF 7 SHEETS

Appendix C – Geotechnical Analysis

GEOTECHNICAL INVESTIGATION

WILDOMAR MASTER DRAINAGE PLAN
LATERAL C-1
STORM DRAIN
(AKA BILLIE ANN ROAD STORM DRAIN)
WILDOMAR, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

ALBERT A. WEBB ASSOCIATES
RIVERSIDE, CALIFORNIA

PROJECT NO. T2599-22-01
SEPTEMBER 4, 2014

GEOCON
WEST, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. T2599-22-01
September 4, 2014

Albert A. Webb Associates
3788 McCray Street
Riverside, California 92506

Attention: Mr. Joseph Caldwell, PE

Subject: GEOTECHNICAL INVESTIGATION
WILDOMAR MASTER DRAINAGE PLAN
LATERAL C-1 STORM DRAIN
(aka BILLIE ANN ROAD STORM DRAIN)
WILDOMAR, CALIFORNIA

Dear Mr. Caldwell:

In accordance with your authorization of our Proposal IE-1261 dated May 29, 2013, we have performed a geotechnical investigation for the proposed Wildomar Master Drainage Plan, Lateral C-1 Storm Drain (aka Billie Ann Road Storm Drain). The accompanying report presents the findings of our study and our conclusions and recommendations pertaining to the geotechnical aspects of proposed storm drain design. Based on the results of our investigation, it is our opinion that the project is feasible as proposed, provided the recommendations of this report are followed and implemented during design and construction.

If you have any questions regarding this report, or if we may be of further service, please contact the undersigned.

Very truly yours,

GEOCON WEST, INC.

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TABLE OF CONTENTS

1. PURPOSE AND SCOPE 1
2. PROJECT DESCRIPTION 1
3. GEOLOGIC SETTING 2
4. GEOLOGIC MATERIALS 2
   - 4.1 Undocumented Fill 2
   - 4.2 Quaternary Alluvial Deposits 3
   - 4.3 Pauba Formation 3
   - 4.4 Unnamed Sandstone 3
5. GROUNDWATER 3
6. GEOLOGIC HAZARDS 4
   - 6.1 Surface Fault Rupture 4
   - 6.2 Seismic Design Criteria 4
   - 6.3 Liquefaction Potential and Seismic Settlement 5
   - 6.4 Earthquake-Induced Flooding 6
   - 6.5 Tsunamis, Seiches and Flooding 6
   - 6.6 Subsidence 6
7. CONCLUSIONS AND RECOMMENDATIONS 8
   - 7.1 General 8
   - 7.2 Soil and Excavation Characteristics 8
   - 7.3 Minimum Resistivity, pH and Water-Soluble Sulfate 9
   - 7.4 Grading 10
   - 7.5 Shrinkage 12
   - 7.6 Preliminary Pavement Recommendations 12
   - 7.7 Temporary Excavations 14
   - 7.8 Temporary Shoring 14
   - 7.9 Plan Review 16

LIMITATIONS AND UNIFORMITY OF CONDITIONS

LIST OF REFERENCES

MAPS AND ILLUSTRATIONS
- Figure 1, Vicinity Map
- Figure 2, Boring Location Map

APPENDIX A
- FIELD INVESTIGATION
- Figures A-1 through A-7, Boring Logs

APPENDIX B
- LABORATORY TESTING
- Figures B1 to B2, Laboratory Test Results
- Figures B3 to B6, Direct Shear Test Results
- Figures B7 and B8, Grain Size Distribution

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed Wildomar Master Drainage Plan, Lateral C-1 Storm Drain (aka Billie Ann Road Storm Drain) [storm drain] improvements in Wildomar, California (see *Vicinity Map*, Figure 1). The purpose of the investigation was to evaluate subsurface soil and geologic conditions underlying the proposed storm drain alignment, and to provide conclusions and recommendations pertaining to the geotechnical aspects of the existing conditions, and proposed design and construction, based on the conditions encountered. The current design for the storm drain includes construction of a storm drain within Refa Street from Palomar Street to Charles Street, continuing southwesterly along Charles Street to Woshka Lane. A 500 foot lateral will extend northeasterly from the intersection of Charles and Refa and connect to the existing storm drain at the southern terminus of Billie Anne Road.

The scope of this investigation included a site reconnaissance, field meeting with the design team, a field exploration program, laboratory testing, engineering analysis, and the preparation of this report. The site exploration was performed on July 17, 2014 by excavating seven 8-inch diameter borings utilizing a truck mounted hollow-stem auger drilling machine. The borings were advanced to depths between about 20½ and 51½ feet below the existing ground surface. One pavement core was taken on the southwest side of Palomar Street at the channel. The approximate locations of the borings and core sample are indicated on the *Boring Location Map*, Figure 2. A detailed discussion of the field investigation, including the boring logs, is presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to determine pertinent physical and chemical soil properties. Appendix B presents a summary of the laboratory test results.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section. If project details vary significantly from those described herein, Geocon West, Inc. (Geocon) should be contacted to determine the necessity for review and possible revision of this report.

2. PROJECT DESCRIPTION

The project includes the design and construction of approximately 2,400 feet of an underground storm drain that will be designed to safely carry the 100-year storm drain runoff. The storm drain is anticipated to be 84-inch diameter, and the lateral is anticipated to be 66-inch diameter.

Approximately five feet of cover is anticipated over the storm drains. An undetermined number of inlet and manhole structures are anticipated to be constructed.

Once the design phase proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of the improvements, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

3. GEOLOGIC SETTING

The site is located within the Peninsular Ranges Geomorphic Province, characterized by northwest trending alluviated valleys and geologic structures such as the nearby Elsinore Fault Zone and Santa Ana Mountains. The Peninsular Ranges are bounded on the north by the Santa Monica, Hollywood, Raymond, Cucamonga, and Sierra Madre Fault Zones, the east by the San Jacinto Fault, and the west by the Pacific Ocean. The Peninsular Ranges extend southward into Mexico.

Locally, the site is located on the eastern edge of the Elsinore Trough, a graben which formed as a result of a left step over from the Wildomar to the Willard faults on the eastern and western sides of Lake Elsinore, respectively. Ground fissures have been documented south of the site in the Elsinore Trough since the 1980s. The ground fissures have generally developed along pre-existing fault traces as a result of groundwater withdrawal (Kupferrmann, 1998).

4. GEOLOGIC MATERIALS

Based on the field exploration and published geologic maps of the areas, the subsurface conditions along the storm drain alignment consists of undocumented fill underlain by Pauba Formation. Some alluvium may be encountered in the drainages, and near Palomar Street. Unnamed Sandstone may be encountered along the proposed alignment near Palomar Street. Nomenclature generally follows that of Kennedy (see *List of References*). Individual units are described below. Detailed stratigraphic profiles are provided in the boring logs in Appendix A.

4.1 Undocumented Fill

Undocumented fill was encountered in the areas of previously constructed roadways to depths of 7 feet along Charles Street, and on the order of 0.5 feet along Refa Street. The fill materials encountered consist of asphaltic concrete, aggregate base, and what appeared to be locally derived silty sands. A lesser amount gravelly sands and sandy silt were also observed within Refa Street. The soils were dry to moist and medium dense.

4.2 Quaternary Alluvial Deposits

Quaternary-age alluvial deposits were not encountered during our subsurface investigation. However; some alluvium should be anticipated near the southern terminus of Billie Ann Road. Alluvium should consist primarily of silty and poorly graded sands with occasional thin layers of silt and clay. Saturated surface conditions were encountered at the northwest end of the project (near Billie Ann Road), and they should be anticipated during construction.

4.3 Pauba Formation

Pleistocene-age Pauba Formation was encountered in all our borings during the subsurface investigation. The Pauba Formation generally consisted of silty sandstone with minor amounts sandy siltstone and claystone, that were generally damp to moist, medium dense to very dense and hard, and brown to reddish brown. Pauba formation is a sedimentary unit whose geotechnical properties are more of a soil than a rock. Therefore, we have used soil descriptions in our boring logs. Pauba Formation is generally considered suitable for the placement of settlement sensitive structures and compacted fill.

4.4 Unnamed Sandstone

Pleistocene-age Unnamed Sandstone was not encountered during our field exploration, but is geologically mapped within Refa Street near Palomar Road. This unit is expected to consist primarily of yellow brown silty sandstone that is damp to moist, pale yellow, friable, and carbonate-rich.

5. GROUNDWATER

Groundwater was encountered at a depth of 35.5 feet BGS, and rose to a depth of 31.3 feet BGS at the completion of drilling. Based on our experience in the vicinity of the site, groundwater is on the order of 35 feet BGS near the site. Shallower groundwater was found on the northeast side of the fault, deeper groundwater on the southwest side. Fluctuations in groundwater level may occur due to infiltration of water during and after precipitation events or due to irrigation, variations in ground surface topography, subsurface geologic conditions and structure, rainfall, irrigation, and other factors.

6. GEOLOGIC HAZARDS

A detailed summary of our evaluation of the geologic hazards that may affect the site is presented below.

6.1 Surface Fault Rupture

The numerous faults in southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (formerly known as California Division of Mines and Geology (CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (Hart, 1999). By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years), but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

According to the Riverside County Land Information System, three splays of the Wildomar fault (the Temecula segment) of the Elsinore fault zone cross the site at approximately 150, 300, and 550 feet northeast of Palomar Street across Refa Street. These splays are considered active. An annual slip rate postulated by Dawson, et al. is 5±2 mm/year. Considering a reoccurrence interval of 600±150 years, the slip rate per event is anticipated to be on the order of 3 (+2.25/-1.65) m. The last event on the Temecula segment of the Elsinore fault was between 1655 and 1810 AD. Based on these considerations the risk of surface ground rupture occurring at the subject site during the lifespan of the structure is possible. However, mitigation of the possible offset may not be economically practical. The site is located in the seismically active southern California region, and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active southern California faults.

6.2 Seismic Design Criteria

We used the computer program *U.S. Seismic Design Maps*, provided by the USGS to evaluate the seismic design parameters. The following tables summarize site-specific design criteria obtained from the 2013 California Building Code (CBC; Based on the 2012 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The improvements should be designed using a Site Class D for this project. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2013 CBC and Table 20.3-1 of ASCE 7-10. The values presented in the following tables are for the risk-targeted maximum considered earthquake (MCE_R).

CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2013 CBC Reference
Site Class	D	Table 1613.5.2
Spectral Response – Class B (short), S_S	2.315g	Figure 1613.5(3)
Spectral Response – Class B (1 sec), S_1	0.939g	Figure 1613.5(4)
Site Coefficient, F_a	1.0	Table 1613.5.3(1)
Site Coefficient, F_v	1.5	Table 1613.5.3(2)
Maximum Considered Earthquake Spectral Response Acceleration (short), S_{MS}	2.315g	Section 1613.5.3 (Eqn 16-36)
Maximum Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	1.408g	Section 1613.5.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.544g	Section 1613.5.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.939g	Section 1613.5.4 (Eqn 16-39)

The table below presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

2013 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.926	Figure 22-7
Site Coefficient, F_{PGA}	1.000	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.926g	Section 11.8.3 (Eqn 11.8-1)

Conformance to the criteria in tables above for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.3 Liquefaction Potential and Seismic Settlement

The site is located with a Riverside County Zone of Moderate Liquefaction Potential. Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the "Recommended Procedures for Implementation of DMG Special Publication 117A, Guidelines for Analyzing and Mitigating Liquefaction in California" requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The site is underlain by Pauba Formation bedrock. The dense bedrock is not subject to liquefaction. Therefore, the potential for liquefaction and associated ground deformations beneath the site is considered to very low. Further, no surface manifestations of liquefaction are expected at the subject site.

Seismically induced settlement may occur whether the potential for liquefaction exists or not. Typically, settlements occur in thick beds of granular soil. Based on the dense nature of the geologic units at the site, seismically-induced settlement is not anticipated to occur at the site.

6.4 Earthquake-Induced Flooding

Earthquake-induced flooding is inundation caused by failure of dams or other water-retaining structures located upstream of the site due to earthquakes. There are no retaining structures upstream of the site, therefore, earthquake induced flooding is not a design consideration for this project.

6.5 Tsunamis, Seiches and Flooding

The site is not located within a coastal area. Therefore, tsunamis, seismic sea waves, are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. The site is located approximately 5 miles south of and at a higher elevation than Lake Elsinore. The potential for flooding from a seismically induced seiche is considered low.

6.6 Subsidence

Subsidence and associated ground fissuring has been well documented in Riverside County Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. Areas subject to subsidence and fissuring are primarily alluviated structural

valleys such as the San Jacinto Valley and Elsinore Trough that are bound by active faults that offset unconsolidated Holocene age alluvium. The location of ground fissures are typically controlled by underlying geologic structure and typically coincide with pre-existing fault traces.

In southerly portion of the Elsinore Trough, ground subsidence and associated ground fissuring related to changes in groundwater levels has occurred from Murrieta on the north to the upper Wolf Valley on the south near Temecula's Redhawk area. The documented subsidence and fissuring has been confined to the area between fault traces where significant groundwater pumping has occurred.

The site is within an area that is considered susceptible to subsidence per Riverside County and active faults cross the alignment just northeast of Palomar Road. Therefore, in the event groundwater withdrawal occurred within the valley there is a possibility for ground subsidence and fissuring to occur on the site.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 It is our opinion that neither soil nor geologic conditions were encountered during this site investigation that would preclude the construction of the proposed storm drain provided the recommendations presented herein are followed and implemented during design and construction of the project.

7.1.2 Based on the borings, it is anticipated that undocumented fill and Pauba Formation will be exposed in the site excavation walls and bottom. Due to the anticipated density of these materials at the proposed trench sidewalls and bottoms, additional removals are not anticipated; however should soft or unsuitable soils be encountered, they will have to be excavated and properly compacted. The trench bottoms should be observed by a representative of Geocon prior the installation of the storm drain.

7.1.3 It is anticipated that the storm drain will be installed beneath the existing roadways with conventional cut-and-cover methods. Excavations for construction of the storm drain may encounter cohesionless, sloughing soils. Sloping and/or shoring measures will be required in order to provide stable excavations. Recommendations for temporary excavations are provided in Section 7.7 of this report.

7.1.4 Groundwater was encountered during our site exploration at a depth of 31.3 feet BGS in Boring B-4 along Refa Street. Groundwater is anticipated to be deeper southwest of the fault. It is not expected that groundwater will be a construction consideration during excavation for the storm drain, but perched water may be a nuisance during construction particularly during the rainy season.

7.1.5 Any changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

7.2 Soil and Excavation Characteristics

7.2.1 The in-situ material can be excavated with moderate effort using conventional excavation equipment. Some caving or sloughing should be anticipated where loose, granular, or cohessionless soil is encountered.

7.2.2 It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of existing adjacent improvements.

7.2.3 Onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping or shoring. Excavation recommendations are provided in the *Temporary Excavations* section of this report (see Section 7.7).

7.2.4 Based on the soil classifications, the existing granular site soils are generally expected to have a "low" to "medium" expansive potential as defined by ASTM International (ASTM) D4829. Based on laboratory testing of the clayey soils, the existing fine-grained site soils are generally considered to have a "medium" expansive potential. Based on the 2013 California Building Code (CBC) Section 1803.5.3, soils with an expansive potential of less than 20 are classified as "non-expansive," and greater than 20 are classified as "expansive."

7.3 Minimum Resistivity, pH and Water-Soluble Sulfate

7.3.1 Potential of Hydrogen (pH) and resistivity testing, as well as chloride content testing, was performed on representative soil samples encountered during the exploration to generally evaluate the corrosion potential to subsurface utilities. The results for the tested samples are provided in Appendix B.

7.3.2 The test results indicated chloride contents between 36 and 71 parts per million, water-soluble sulfate between 0.002% and 0.003%, pH between 7.94 and 8.33, and resistivity measurements between 581 and 697 ohm centimeters. Caltrans Corrosion Guidelines (Caltrans, 2012) define corrosive soils as having chloride content greater than 500 parts per million, water-soluble sulfate greater than 0.2%, pH less than 5.5 or resistivity less than 1,000 ohm centimeters. Based on the test results, the potential for corrosion of buried ferrous metals is high at the site. The results should be considered for design of underground structures.

7.3.3 Laboratory tests were performed on representative samples of the site materials to measure the percentage of water-soluble sulfate content. Results from laboratory water-soluble sulfate tests indicate that the on-site materials possess "negligible" sulfate exposure to concrete structures as defined by 2013 CBC Section 1904.3 and ACI 318-11 Section 4.2 and 4.3. The table below presents a summary of concrete requirements set forth by 2013 CBC Section

1904.3 and ACI 318. Given the lack of sulfate exposure, no special considerations are needed for cement, provided the concrete has a 28-day compressive strength of 2,500 pounds per square inch or more.

REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Exposure	Exposure Class	Water-Soluble Sulfate Percent by Weight	Cement Type	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
Negligible	S0	0.00-0.10	--	--	2,500
Moderate	S1	0.10-0.20	II	0.50	4,000
Severe	S2	0.20-2.00	V	0.45	4,500
Very Severe	S3	> 2.00	V+Pozzolan or Slag	0.45	4,500

7.3.4 The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities along the access roads or from nearby developments (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

7.3.5 Geocon does not practice in the field of corrosion engineering and mitigation. It is recommended that a corrosion engineer be retained to evaluate corrosion test results and incorporate the necessary precautions to avoid premature corrosion of buried metal pipes and concrete structures in direct contact with the soils.

7.4 Earthwork for Utility Installation and Soil Backfill

7.4.1 Earthwork is anticipated to include excavation of site soils and backfill for utility trenches. Utility trenches should be constructed in accordance with County of Riverside Standard Drawing No. 818 (Utility Trench Backfill), the Standard Specifications for Public Works Construction (Greenbook), and the following recommendations.

7.4.2 Earthwork should be observed, and compacted fill tested by representatives of Geocon. The existing soils encountered during our exploration are considered suitable for use as engineered fill, provided any encountered oversize material (greater than 6 inches) and any encountered deleterious debris are removed.

7.4.3 A preconstruction conference should be held at the site prior to the beginning of installation of the storm drain with the contractor, civil engineer, geotechnical engineer, and City of Wildomar representative in attendance. Special soil handling requirements can be discussed at that time.

7.4.4 The storm drain trench excavation bottoms should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon). Deleterious debris such as wood and root structures should be exported from the site and should not be mixed with the backfill soils.

7.4.5 Any encountered deeper artificial fill or loose, soft, unsuitable soil should be completely removed from the excavation bottom or stabilized as necessary at the direction of the Geotechnical Engineer.

7.4.6 The storm drain lines should be properly backfilled in accordance with the requirements of the latest edition of the Standard Specifications for Public Works Construction (Greenbook). The pipes should be bedded with clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The use of gravel is not acceptable unless used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of 2-sack slurry is also acceptable. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions. Prior to placing any bedding materials or pipes, the excavation bottom must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon).

7.4.7 Fill soils should be placed in horizontal loose layers approximately 6 to 8 inches thick, moisture conditioned, and properly compacted. If soils are granular and confirmed to be non-expansive by the geotechnical engineer, soils should be moisture conditioned to near or slightly above optimum moisture content. If soils are fine-grained or expansive, soils should be moisture conditioned to 2 to 3 percent above optimum moisture content. Fill should be compacted to a minimum 90 percent of the maximum dry density as evaluated by ASTM D 1557.

7.4.8 Where new or replacement paving is to be constructed, the upper twelve inches of fill or backfill should be compacted to at least 95 percent of the maximum dry density as evaluated by ASTM D1557.

7.4.9 If imported soils are required, representative samples of the imported fill should be tested and approved by Geocon prior to bringing soil to the site. Rocks larger than six inches in diameter should not be used in the fill. If necessary, import soils used as structural fill should have an expansion index less than 20 and corrosivity properties that are equally or less detrimental to that of the existing onsite soils.

7.4.10 All excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding materials.

7.5 Shrinkage

7.5.1 Shrinkage results when a volume of material removed at one density is compacted to a higher density. A shrinkage factor of between 5 and 10 percent should be anticipated when excavating and compacting the existing upper site soils to an average relative compaction of 92 percent (92 percent is the average relative compaction of fill placed at 90 percent or greater of the maximum dry density as evaluated by ASTM D1557).

7.6 Preliminary Pavement Recommendations

7.6.1 The proposed storm drain and any inlet structures within Charles and Palomar Streets, cross roadways. Construction in this area will require placing new asphalt concrete pavements where the storm drain is constructed beneath existing roadways. Roadway improvements should be constructed in accordance with the requirements of the City of Wildomar and the current edition of the Greenbook. The City of Wildomar uses the Riverside County Design Standards & Guidelines (Wildomar, 2014).

7.6.2 The core sample taken on the southwestern side of Palomar (east bound lane) revealed 5.5 inches of base with 6.5 inches of asphalt. The roadway appeared to be in good condition with some weathering observed. The pavement section along Charles Street, as revealed in Boring B-1, consisted of 3 inches of base and 4 inches of asphaltic concrete.

7.6.3 In areas to receive new pavements, the upper 12 inches of soil at the pavement subgrade should be moisture conditioned to near or slightly above optimum moisture content and property compacted to at least 95 percent of the maximum dry density as evaluated by ASTM D1557. Where placing and compacting fine-grained soils, the upper 12 inches of soil should be moisture conditioned to near 2 to 3 percent above optimum moisture content.

7.6.4 The following pavement sections are based on an estimated R-Value of 30. Once site grading activities are complete an R-Value tests should be performed on soil samples from

the street subgrade areas to confirm soil properties prior to placing pavement. Pavement thicknesses were determined following procedures outlined in the *California Highway Design Manual* (Caltrans).

7.6.5 The traffic index to be used for pavement section design should be confirmed by the project civil engineer and approved by the City of Wildomar prior to finalization of the pavement section design. If other traffic indices apply to the roadways, Geocon should be contacted to revise the recommended pavement sections.

PRELIMINARY PAVEMENT DESIGN SECTIONS

Roadway	Street Classification and Traffic Index (TI)*	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Refa Street	Local – 5.5	3.5	6
Charles Street	Collector – 7.0	4.0	9.5
Palomar Street	Secondary Highway – 8.5	5.0	12

*Based on County of Riverside Ordinance No. 461, Standard 114. Minimum thicknesses are based on assumed R-Value of 30, greater thickness may be required based on testing performed during construction or by County requirements.

7.6.6 In place of using the preliminary pavement design sections provided above, the streets may be reconstructed using the minimum pavement sections in Riverside County Standard No. 818 (Utility Trench Backfill) and placing asphalt concrete and aggregate base thicknesses at least 1 inch greater than what was removed for installation of the storm drain line.

7.6.7 Asphalt concrete should conform to Section 203-6 of the Green Book. Class 2 aggregate base materials should conform to Section 26-1.02A of the Caltrans *Standard Specifications*. Crushed Miscellaneous Base should conform to Section 200-2.4 of the Greenbook.

7.6.8 Unless specifically designed by a qualified structural engineer, where concrete paving will be utilized for support of vehicles, it is recommended that the concrete be a minimum of 5 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions. Concrete paving supporting vehicular traffic should be underlain by a minimum of 4 inches of aggregate base and a properly compacted subgrade. The subgrade should be compacted to at least 95 percent of the maximum dry density as evaluated by ASTM D1557. The base material should be compacted to at least 95 percent of their maximum dry density as evaluated by ASTM D1557.

7.6.9 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the

pavement will likely result in saturation of the subgrade materials and subsequent cracking, subsidence and pavement distress. If planters are planned adjacent to paving, it is recommended that the perimeter curb be extended at least 12 inches below the bottom of the aggregate base to minimize the introduction of water beneath the paving.

7.7 Temporary Excavations

7.7.1 Excavations on the order of 10 to 15 feet below the existing ground surface are anticipated for construction of the storm drain; and it is anticipated that the proposed inlet structures and storm drain lines will be installed with conventional cut-and-cover methods.

7.7.2 The excavations are expected to expose material which is suitable for vertical excavations of up to five feet where loose soils or caving sands are not present and where not surcharged by adjacent traffic or structures.

7.7.3 Vertical excavations greater than five feet will require sloping measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments could be sloped back at a uniform 1:1 slope gradient or flatter.

7.7.4 Where there is insufficient space for sloped excavations, shoring or trench shields should be used to support excavations. Shoring may also be necessary where sloped excavation could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. Recommendations for temporary shoring are provided in the following section.

7.7.5 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. Geocon personnel should inspect the soils exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur.

7.8 Temporary Shoring

7.8.1 Where there is insufficient space to perform sloped excavations, shoring may be implemented. It is anticipated that braced shoring, such as conventionally braced shields or cross-braced hydraulic shoring, will be utilized; however the selection of the shoring system

is the responsibility of the contractor. Shoring systems should be designed by a California licensed civil or structural engineer with experience in designing shoring systems.

7.8.2 It is recommended that an equivalent fluid pressure based on the table below, be utilized for design of shoring. These pressures are based on the assumption that the shoring is supporting a level backfill and there are no hydrostatic pressures above the bottom of the excavation.

HEIGHT OF SHORED EXCAVATION (FEET)	EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot) (ACTIVE PRESSURE)	EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot) (AT-REST PRESSURE)
Up to 15	31	51

7.8.3 It is very important to note that active pressures can only be achieved when movement in the soil (earth wall) occurs. If movement in the soil is not acceptable, such as adjacent to an existing structure or where braced shoring will be utilized the at-rest pressure should be considered for design purposes.

7.8.4 Additional active pressure should be added for a surcharge condition due to sloping ground, construction equipment, vehicular traffic, or adjacent structures and should be designed for each condition as the project progresses.

7.8.5 In addition to the recommended earth pressure, the upper ten feet of the shoring adjacent to the street or driveway areas should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the shoring due to normal street traffic. If the traffic is kept back at least ten feet from the shoring, the traffic surcharge may be neglected.

7.8.6 Prior to excavation, it is recommended that existing improvements near the proposed excavation be inspected to document the present condition. For documentation purposes, photographs should be taken of preconstruction distress conditions and level surveys of adjacent grade and pavement should be considered. Preconstruction documentation is not the responsibility of the geotechnical engineer.

7.8.7 Because of the depth of the excavation, some means of monitoring the performance of the shoring system is suggested. Adjacent structures and pavement should be periodically inspected for signs of distress. In the event that distress or settlement is noted, an

investigation should be performed and corrective measures taken sot that continued or worsened distress or settlement is mitigated.

7.9 Plan Review

7.9.1 Plans should be reviewed by the Geotechnical Engineer (a representative of Geocon), prior to finalization to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon West, Inc. should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon West, Inc.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

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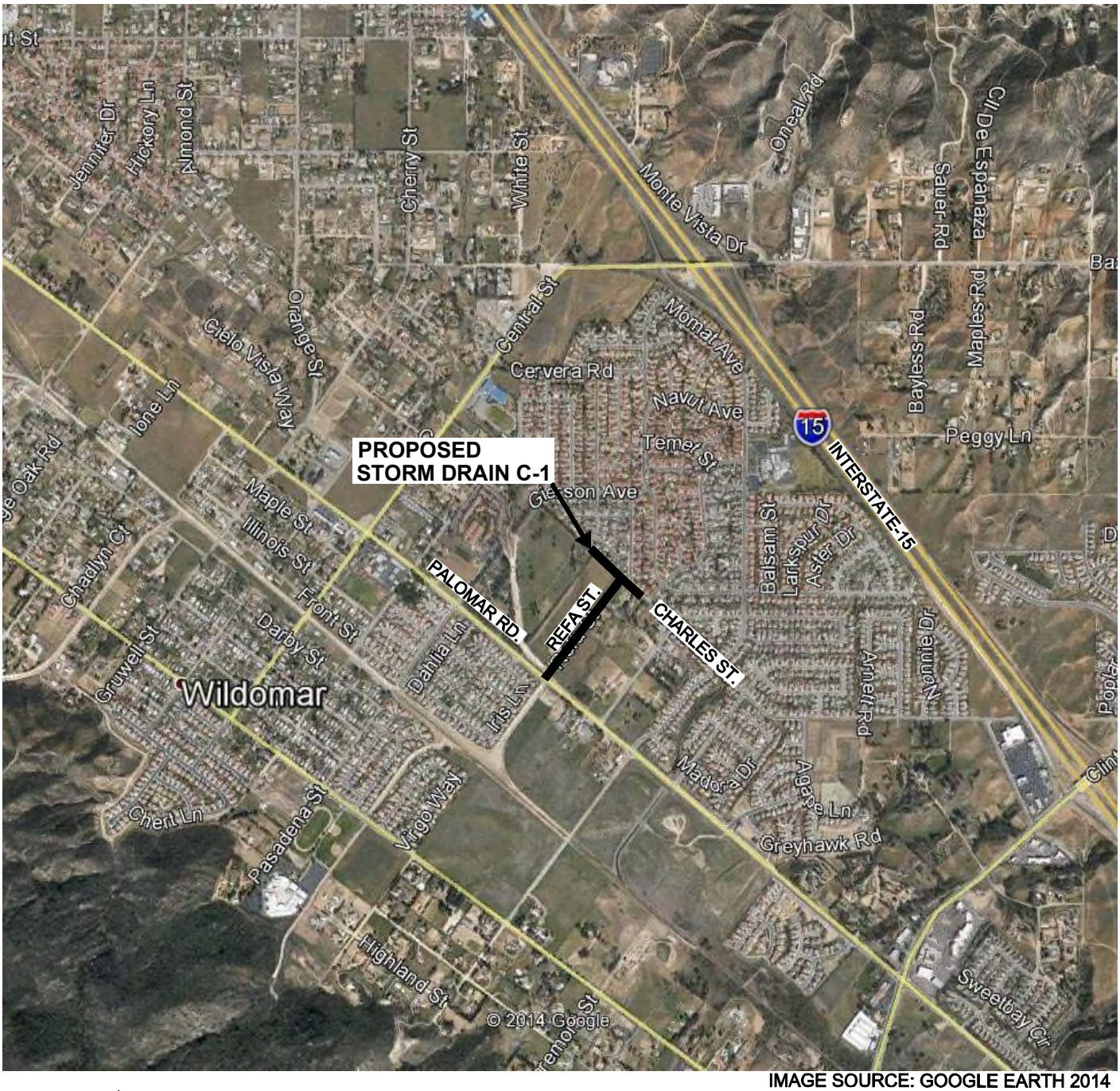

IMAGE SOURCE: GOOGLE EARTH 2014

NO SCALE

GEOCON WEST, INC.

ENVIRONMENTAL GEOTECHNICAL MATERIALS
41571 CORNING PLACE - SUITE 101 - MURRIETA, CA 92562
PHONE (951) 304-2300 - FAX (951) 304-2392

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VICINITY MAP

WILDOMAR MASTER DRAINAGE PLAN
LATERAL C-1 STORM DRAIN
(AKA BILLIE ANN ROAD STORM DRAIN)
WILDOMAR, CALIFORNIA

SEPTEMBER, 2014	PROJECT NO. T2599 - 22 - 01	FIG. 1

IMAGE SOURCE: GOOGLE EARTH 2014

LEGEND

B-6 APPROXIMATE BORING LOCATION

C-1 APPROXIMATE CORING LOCATION

APPROXIMATE LOCATION OF PROPOSED STORM DRAIN C-1

APPROXIMATE SCALE

0 350' 700'

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BORING LOCATION MAP

WILDOMAR MASTER DRAINAGE PLAN
LATERAL C-1 STORM DRAIN
(AKA BILLIE ANN ROAD STORM DRAIN)
WILDOMAR, CALIFORNIA

SEPTEMBER, 2014	PROJECT NO. T2599 - 22 - 01	FIG. 2

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The site exploration was performed on July 17, 2014 by excavating seven 8-inch diameter borings utilizing a truck mounted hollow-stem auger drilling machine and one pavement core. The borings were advanced to depths between about 20½ and 51½ feet below the existing ground surface. Representative disturbed and relatively undisturbed samples were obtained by driving both a 2 inch outside diameter (O. D.) standard penetration test sampler and a 3 inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by $2^{3}/_{8}$-inch diameter brass sampler rings to facilitate removal and testing. Bulk samples of disturbed soils were placed in plastic bags and sealed.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-7. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the borings and core sample are indicated the *Boring Location Map*, Figure 2.

PROJECT NO. T2599-22-01

BORING B-1

ELEV. (MSL.) **1271** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**Asphalt Concrete** 4" thick			
	B-1@1'-4'			SM	**Base** 3" thick			
2					**UNDOCUMENTED FILL (udf)**			
	B-1@2.5'				Silty SAND, dense, damp, reddish brown; sand is fine- to medium-grained; some coarse-grained sand; trace clay (EI=44)	48	129.8	9.6
4								
	B-1@5.0'				-Becomes moist	48	114.2	8.1
6								
				SM	**PAUBA FORMATION (Qps)**			
8	B-1@7.5'				Silty SANDSTONE, dense, moist, reddish brown; sand is fine- to medium-grained; trace clay	51		
10	B-1@10.0'				-Increase in silt	48	122.7	6.7
12								
14								
	B-1@15.0'				-Becomes very dense, brown; increase in clay; weakly cemented	93/11"	124.7	7.7
16								
18								
20	B-1@20.0'				-Becomes moderately cemented	85	125.3	10.1
22								
				ML	Sandy SILTSTONE, hard, moist, brown; sand is fine-grained; some medium-grained sand; trace coarse-grained sand; some clay; well indurated			
24								
	B-1@25.0'					50/6"		

TOTAL DEPTH 25.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-1,
Log of Boring B-1, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2599-22-01

BORING B-2

ELEV. (MSL.) **1269** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**PAUBA FORMATION (Qps)** Sandy SILTSTONE, hard, damp, brown; sand is fine- to medium-grained; surface grasses			
2	B-2@2.5'				-Becomes moist, reddish brown; some clay; moderately indurated	50/5"	122.0	6.8
4				SM	Silty SANDSTONE, very dense, damp, yellowish brown; sand is fine- to coarse-grained; trace fine gravel; moderately cemented			
6	B-2@5.0'					50/6"	111.0	5.7
8	B-2@7.5'				-Becomes dense, moist, reddish brown; sand is fine- to medium-grained; trace coarse-grained sand; some mottling	71		
10	B-2@10.0'			SC	Clayey SANDSTONE, dense, moist, dark brown; sand is fine-grained; some medium-grained sand	67	119.7	12.8
12								
14				SM	Silty SANDSTONE, very dense, moist, reddish brown; sand is fine- to medium-grained; some clay; moderately cemented; some mottling			
16	B-2@15.0' B-2@15'-18'					50/6"	117.8	8.7
18								
20	B-2@20.0'				-Some mafic staining	50/5"		

TOTAL DEPTH 20.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-2,
Log of Boring B-2, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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PROJECT NO. T2599-22-01

BORING B-3

ELEV. (MSL.) **1254** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SP	**UNDOCUMENTED FILL (udf)**			
				CL	Gravelly SAND, very dense, dry, gray; sand is fine to coarse; Refa Street (dirt road)			
2					**PAUBA FORMATION (Qps)**			
	B-3@2.5'			SM	Sandy CLAYSTONE, hard, moist, dark brown; sand is fine-grained; trace medium-grained sand	79/11.5"	121.6	11.6
4					Silty SANDSTONE, very dense, damp, strong brown; sand is fine- to medium-grained; some clay; moderately cemented; some mafic staining			
	B-3@5.0'					50/6"	116.2	8.0
6								
				CL	CLAYSTONE, very stiff, moist, brown; sand is fine-grained			
8	B-3@7.5'					55	101.5	22.0
				SM	Silty SANDSTONE, dense, damp, strong brown; sand is fine- to medium-grained; some clay; moderately cemented; some mafic staining; some carbonate stringers			
10	B-3@10.0				-Increase in clay	44	101.8	21.9
12								
14								
	B-3@15.0					35	103.7	8.6
16				CL	CLAYSTONE, very stiff, moist, brown; some fine- to medium-grained sand			
18								
				SM	Silty SANDSTONE, medium dense, brown; sand is fine- to medium-grained; some coarse-grained sand; some clay; weakly cemented			
20	B-3@20.0					42		

TOTAL DEPTH 20.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-3,
Log of Boring B-3, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2599-22-01

BORING B-4

ELEV. (MSL.) **1250** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SP	**UNDOCUMENTED FILL (udf)**			
	B-4@1'-5'			SM	Gravelly SAND, very dense, dry, gray; sand is fine to coarse; poorly graded; dirt road			
2					**PAUBA FORMATION (Qps)** Silty SANDSTONE, very dense, damp, yellow brown; sand is fine- to medium-grained			
4								
	B-4@5.0'					81	113.1	13.6
6				CL	CLAYSTONE, stiff, moist, yellow brown; some fine-grained sand			
8								
				SC	Clayey SANDSTONE, medium dense, moist, yellowish brown; sand is fine- to medium- grained; trace coarse-grained sand			
10	B-4@10.0'					26		
12								
14								
	B-4@15.0'				-Becomes dense, brown	49	124.2	8.9
16								
18								
20	B-4@20.0'					65		
22								
24								
	B-4@25.0'				-Becomes medium dense	15		
26								
28								

Figure A-4,
Log of Boring B-4, Page 1 of 2

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2599-22-01

BORING B-4

ELEV. (MSL.) **1250** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-4@30.0		▼	SC		20		
32				CL	Sandy CLAYSTONE, very stiff, moist, brown; sand is fine- to medium-grained			
34								
	B-4@35.0		▽			23		
36				SC	Clayey SANDSTONE, medium dense, saturated, brown; sand is fine- to coarse-grained			
38								
40	B-4@40.0					23		
42				CL	Sandy CLAYSTONE, very stiff, moist, yellow brown, trace mica; some reddish brown mottling			
44								
46	B-4@45.0					23		
48				SC-SM	Clayey to Silty SANDSTONE, medium dense, moist, reddish brown; sand is fine- to medium-grained; some mica			
50	B-4@50.0					27		

TOTAL DEPTH 51.5 FEET
Groundwater encountered at 35.5', settled at 31.3'
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-4,
Log of Boring B-4, Page 2 of 2

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2599-22-01

BORING B-5

ELEV. (MSL.) **1248** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**UNDOCUMENTED FILL (udf)** Sandy SILT, hard, damp, dark brown; sand is fine to medium; Refa Street (dirt road)			
2	B-5@2.5'			SC	**PAUBA FORMATION (Qps)** Clayey SANDSTONE, very dense, damp, dark reddish brown; sand is fine- to coarse-grained; some silt; moderately cemented	88	127.3	7.7
4								
6				SM	Silty SANDSTONE, very dense, moist, brown; sand is fine- to medium-grained; some coarse-grained sand; trace clay; some mica; weakly cemented			
8	B-5@7.5'					80		
10								
12								
14				CL	CLAYSTONE, hard, moist, brown; some fine-grained sand			
16	B-5@15.0'			ML	SILTSTONE, hard, moist, olive; some fine-grained sand; some clay; some mica	62	84.3	37.0
18								
20	B-5@20.0'					53		

TOTAL DEPTH 20.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-5,
Log of Boring B-5, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2599-22-01

BORING B-6

ELEV. (MSL.) **1240** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**UNDOCUMENTED FILL (udf)**			
				ML	Sandy SILT, hard, dry, light brown; sand is fine- to coarse-grained; Refa Street (dirt road)			
2					**PAUBA FORMATION (Qps)**			
					Sandy SILTSTONE, hard, damp, dark brown; sand is fine-grained			
4					-Becomes olive; some carbonates; trace fine-grained sand; trace clay			
	B-6@5.0'				-Becomes moist	50/4"	73.5	34.3
6								
8								
10	B-6@10.0'					69	105.1	20.1
12								
14				SM	Silty SANDSTONE, medium dense, moist, brown; sand is fine- to medium-grained; some clay			
	B-6@15.0'					40	111.8	18.2
16				CL	Sandy CLAYSTONE, very stiff, moist, brown, some fine-grained sand; some mica; weakly indurated			
18								
20	B-6@20.0'					55	109.7	17.3

TOTAL DEPTH 20.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-6,
Log of Boring B-6, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2599-22-01

BORING B-7

ELEV. (MSL.) **1264** DATE COMPLETED **07/17/2014**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM/ML	**PAUBA FORMATION (Qps)** Silty SANDSTONE to Sandy SILTSTONE, medium dense to stiff, damp, dark brown; sand is fine-grained; some medium-grained sand; grass at surface			
	B-7@1'-5'							
2				SM	Silty SANDSTONE, medium dense, damp, reddish brown; sand is fine- to coarse-grained			
	B-7@2.5'					23		
4					-Becomes dark brown, sand is fine- to medium-grained			
	B-7@5.0'				-Some clay	33	119.8	7.3
6								
8	B-7@7.5'			CL	Sandy CLAYSTONE, very stiff, damp, dark brown; sand is fine- to medium-grained; trace coarse-grained sand; moderately indurated	49		
10	B-7@10.0'				-Becomes stiff	32	115.1	10.5
12								
14				SM	Silty SANDSTONE, very dense, damp, olive; sand is fine- to medium-grained; some clay			
	B-7@15.0'					83	110.5	9.9
16				SC	Clayey SANDSTONE, very dense, damp, dark brown; sand is fine- to coarse-grained			
18					-Becomes olive; sand is fine- to medium-grained			
20	B-7@20.0'					89/3"		

TOTAL DEPTH 20.5 FEET
No Groundwater
No Caving
Backfilled with soil cuttings 07/17/2014
*Penetration resistance for 140 lb. hammer falling 30 in. by auto-hammer

Figure A-7,
Log of Boring B-7, Page 1 of 1

T2599-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of ASTM International, or other suggested procedures. Selected samples were tested for direct shear strength, grain size distribution, collapse potential, expansion index, water soluble sulfate content, corrosion, maximum density/optimum moisture, sand equivalent, and in-place dry density and moisture content. The results of the laboratory tests are summarized in Figures B1 through B8. The in-place dry density and moisture content of the samples tested are presented in the boring logs in Appendix A.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
B-4@1'-5'	Clayey fine to medium SAND with little silt and trace gravel (SC), dark yellow brown	119.8	13.3
B-5@1'-5'	Clayey SAND with trace gravel (SC), dark brown	134.5	8.0

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D4829

Sample No.	Moisture Content		Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B-1@1'-5'	8.5	17.0	116.4	44
B-7@7.5'	9.8	20.6	109.3	62

SUMMARY OF CHEMICAL TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm centimeters)
B-1@1'-5'	71	0.003	8.33	697
B-5@1'-5'	36	0.002	7.94	581

Resistivity and pH determined by Cal Trans Test 532.
Chloride content determined by California Test 422.
Water-soluble sulfate determined by California Test 417.

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LABORATORY TEST RESULTS

WILDOMAR MASTER DRAINAGE PLAN
LATERAL C-1 STORM DRAIN
(AKA BILLIE ANN ROAD STORM DRAIN)
WILDOMAR, CALIFORNIA

SEPTEMBER, 2014 | PROJECT NO. T2599 - 22 - 01 | FIG. B1

SUMMARY OF SAND EQUIVALENT VALUE TEST RESULTS
ASTM D2419

Sample No.	Description	Sand Equivalent Value
B-1@2.5’	Clayey SAND (SC), brown	13
B-2@7.5’	Clayey SAND (SC), brown	13
B-3@10.0’	Silty CLAY (CL), light grayish brown	8
B-4@5.0’	Silty Clayey SAND (SC-SM), olive brown	14
B-5@7.5’	Silty Clayey SAND (SC-SM), dark yellowish brown	14
B-7@2.5’	Silty SAND (SM), very dark brown	17

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LABORATORY TEST RESULTS

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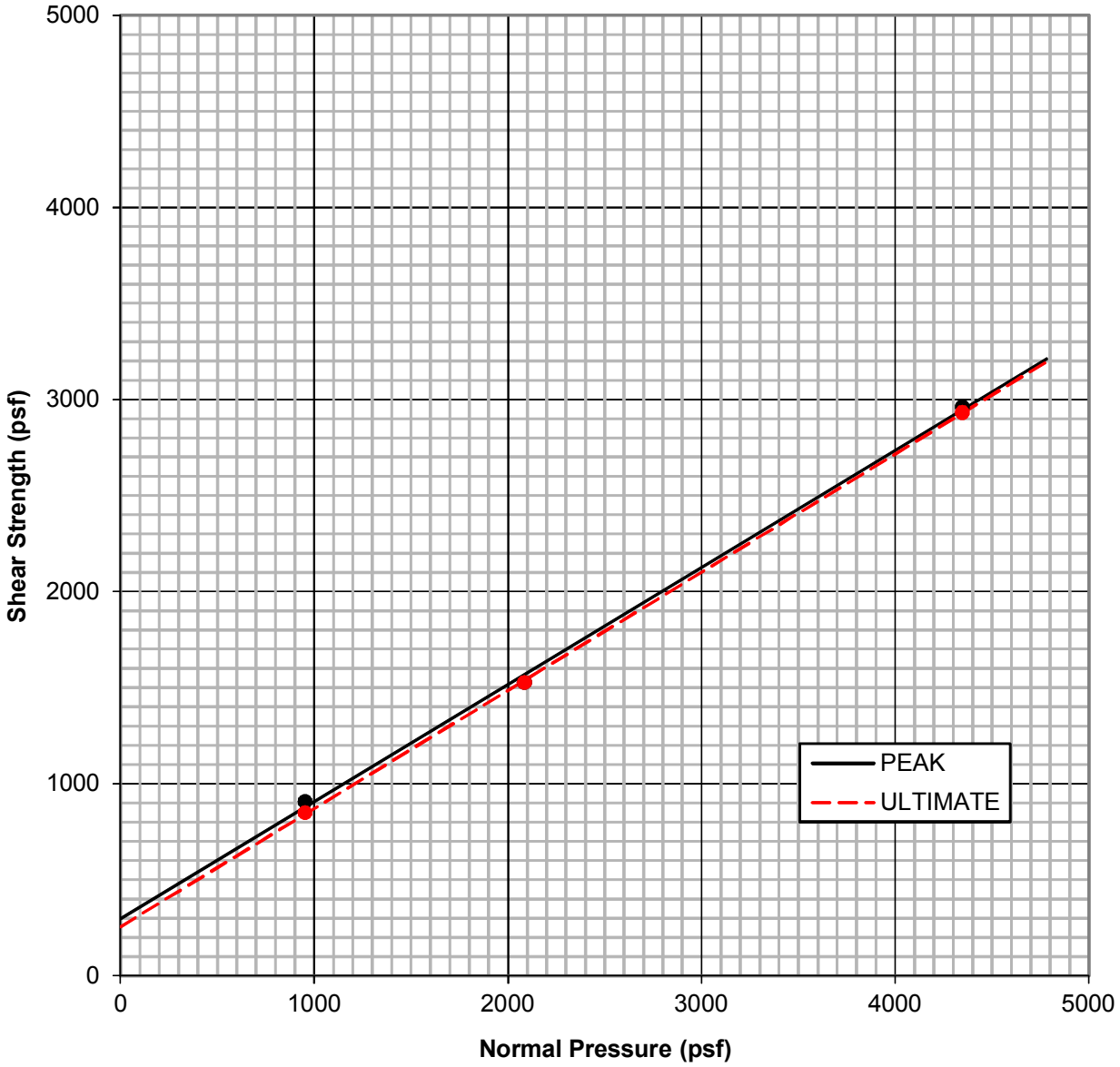
SEPTEMBER, 2014 | PROJECT NO. T2599 - 22 - 01 | FIG. B2



SAMPLE NO.	SOIL TYPE	DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	"C" PEAK [ULTIMATE] (psf)	"ϕ" PEAK [ULTIMATE] (degree)
*B-4@1-5'	CL	108.7	12.6	21.1	299 [255]	31 [32]

*sample remolded to approximately 90% of the maximum dry density

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DIRECT SHEAR TEST RESULTS

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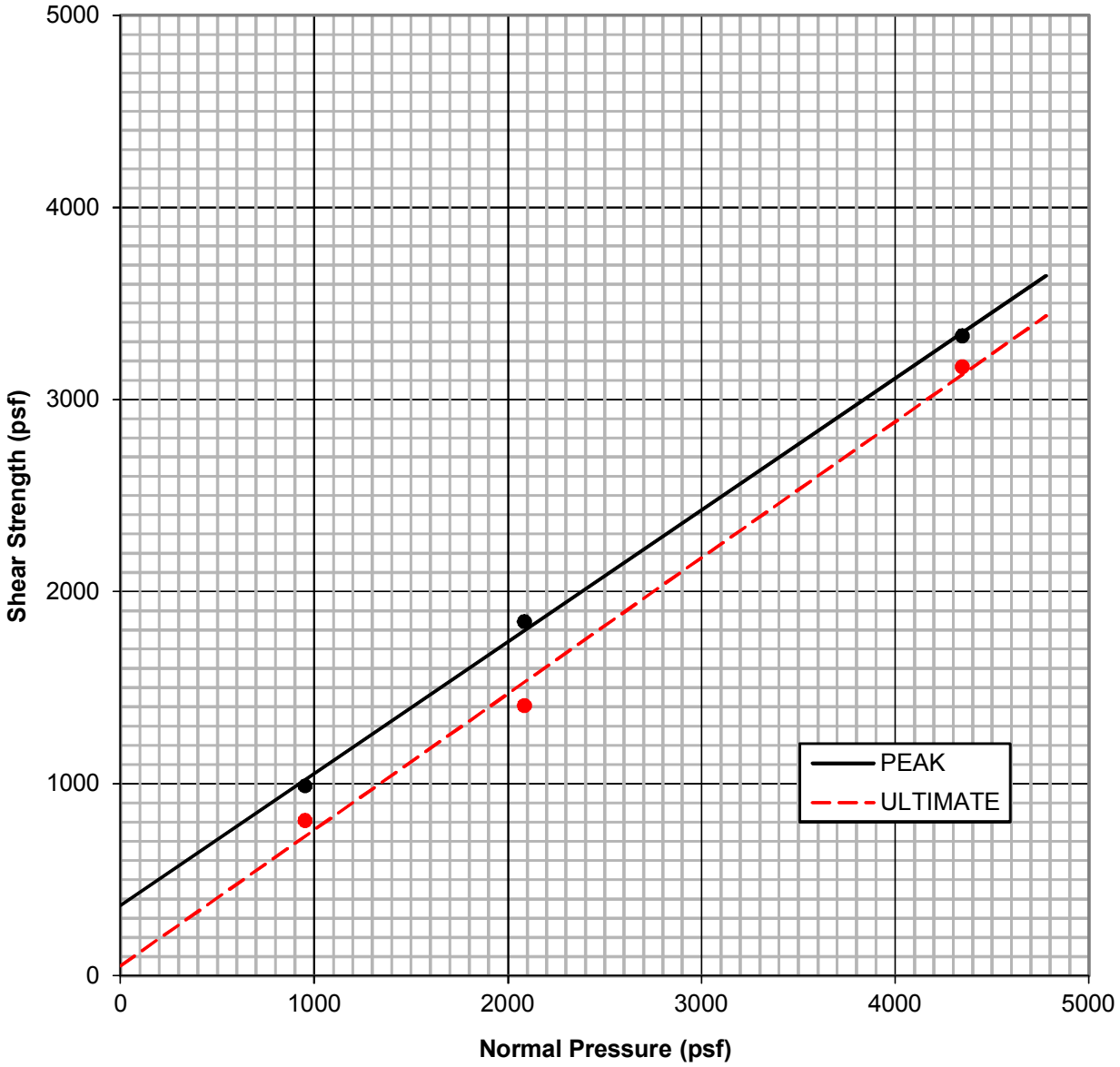
SEPTEMBER, 2014	PROJECT NO. T2599 - 22 - 01	FIG. B4



SAMPLE NO.	SOIL TYPE	DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	"C" PEAK [ULTIMATE] (psf)	"ϕ" PEAK [ULTIMATE] (degree)
B-3@10'	SC	102.4	22.2	28.6	367 [52]	34 [35]

*sample remolded to approximately 90% of the maximum dry density

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DIRECT SHEAR TEST RESULTS

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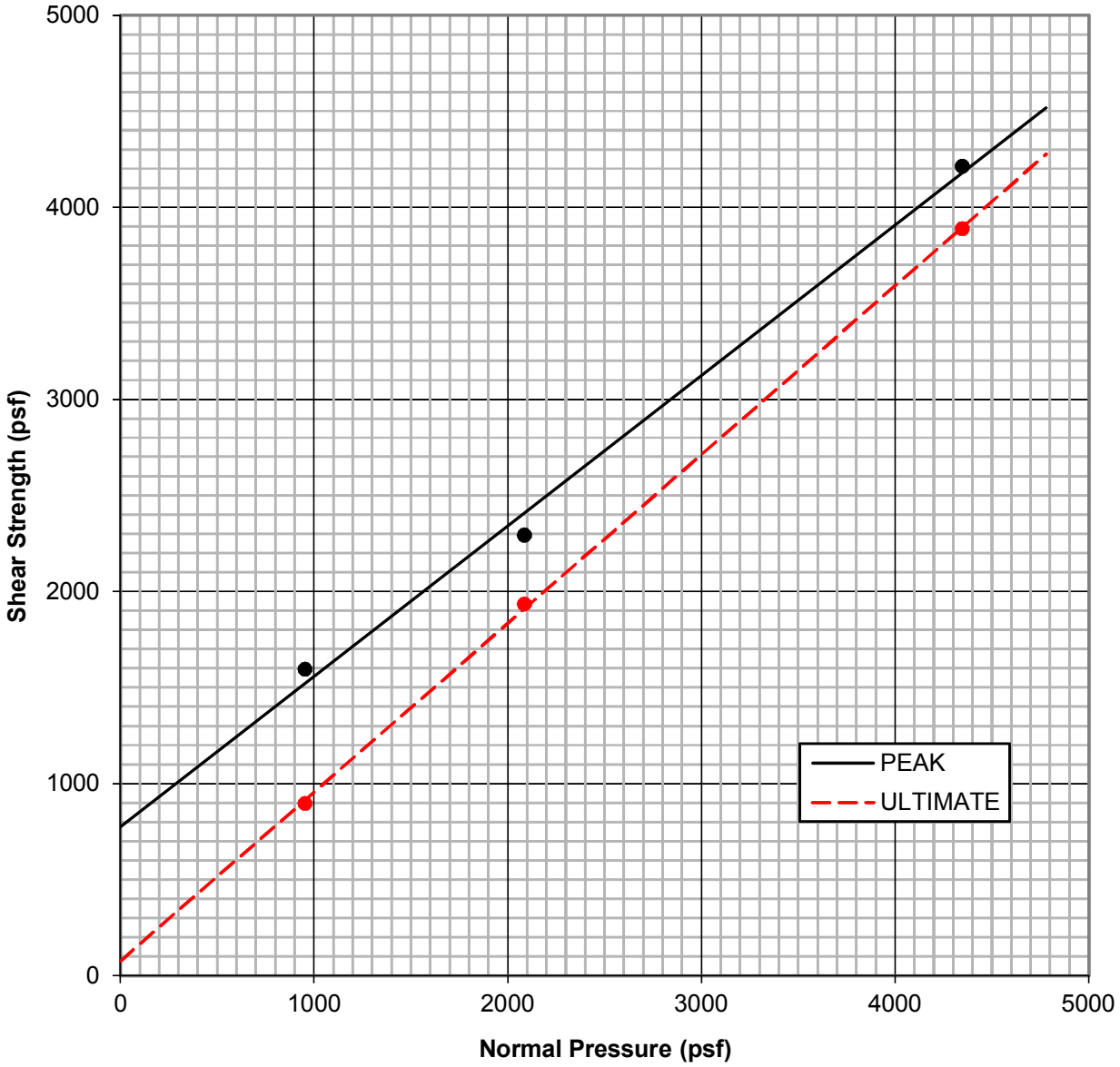

SAMPLE NO.	SOIL TYPE	DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	"C" PEAK [ULTIMATE] (psf)	"ϕ" PEAK [ULTIMATE] (degree)
B-4@15'	SC	123.9	9.3	11.7	775 [78]	38 [41]

*sample remolded to approximately 90% of the maximum dry density

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DIRECT SHEAR TEST RESULTS

WILDOMAR MASTER DRAINAGE PLAN
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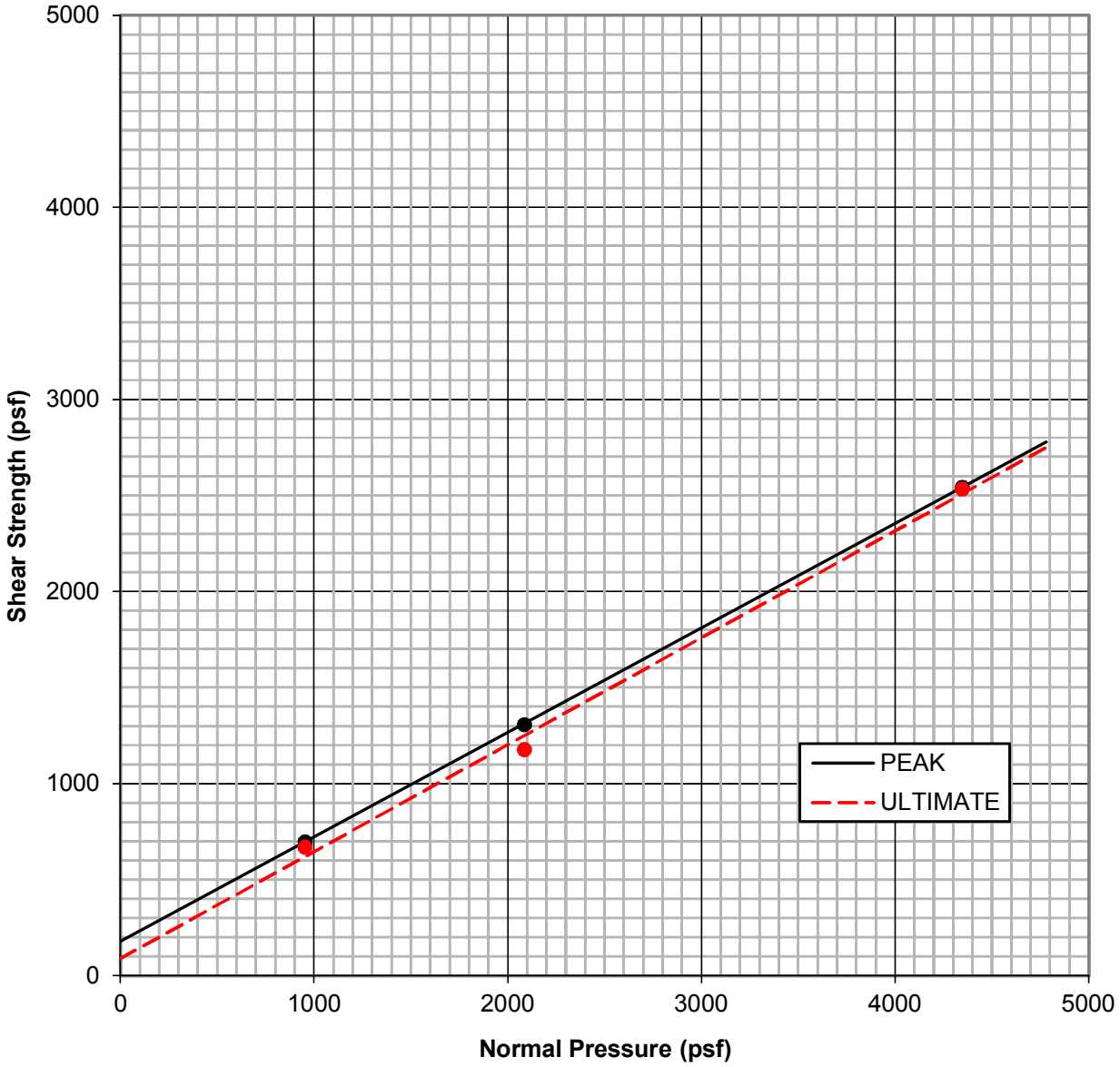

SAMPLE NO.	SOIL TYPE	DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	"C" PEAK [ULTIMATE] (psf)	"ϕ" PEAK [ULTIMATE] (degree)
B-7@10'	SC	113.6	10.6	20.0	177 [90]	29 [29]

*sample remolded to approximately 90% of the maximum dry density

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DIRECT SHEAR TEST RESULTS

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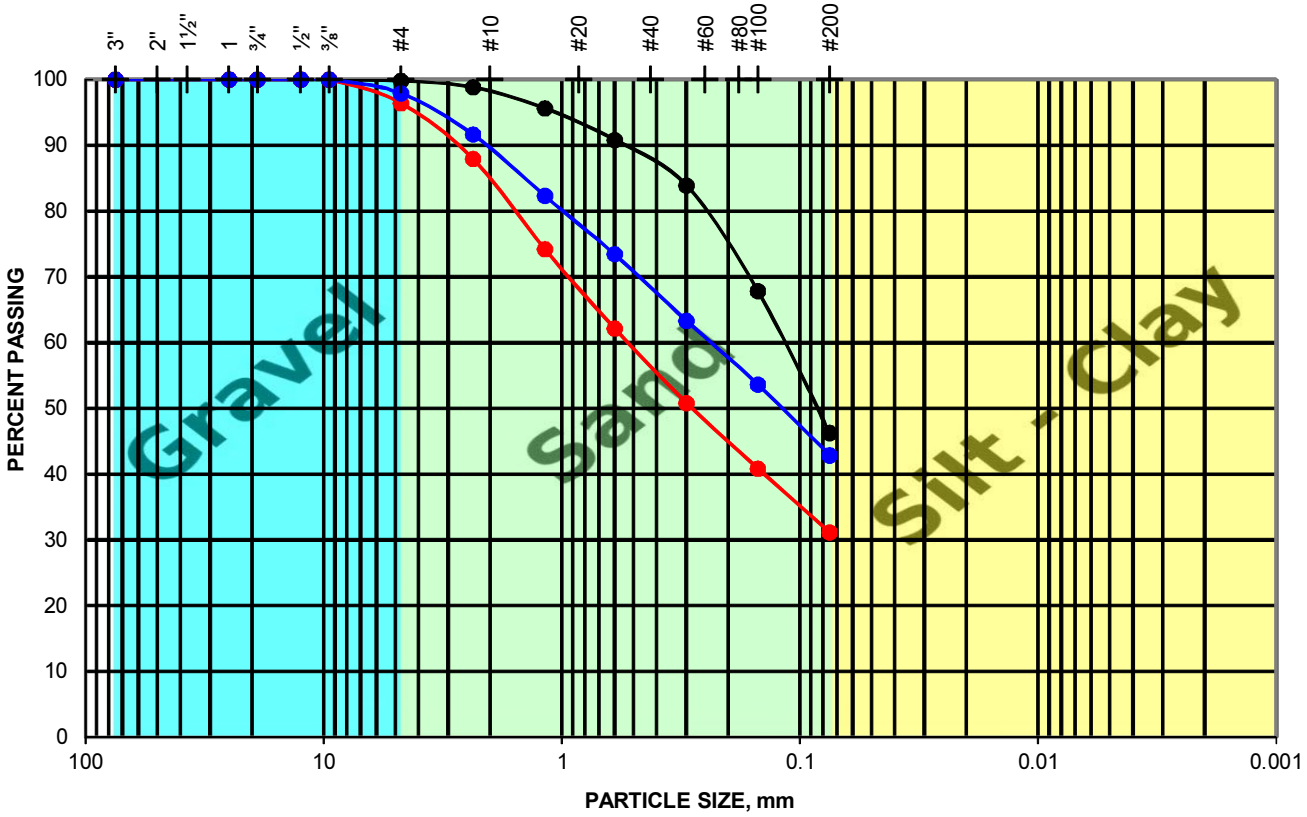

SAMPLE ID	SAMPLE DESCRIPTION
B-4@10.0'	Clayey SAND with trace gravel (SC), yellowish brown
B-4@20.0'	Clayey SAND with trace gravel (SC), grayish brown
B-4@30.0'	Clayey SAND with trace gravel (SC), reddish brown

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GRAIN SIZE DISTRIBUTION

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LATERAL C-1 STORM DRAIN
(AKA BILLIE ANN ROAD STORM DRAIN)
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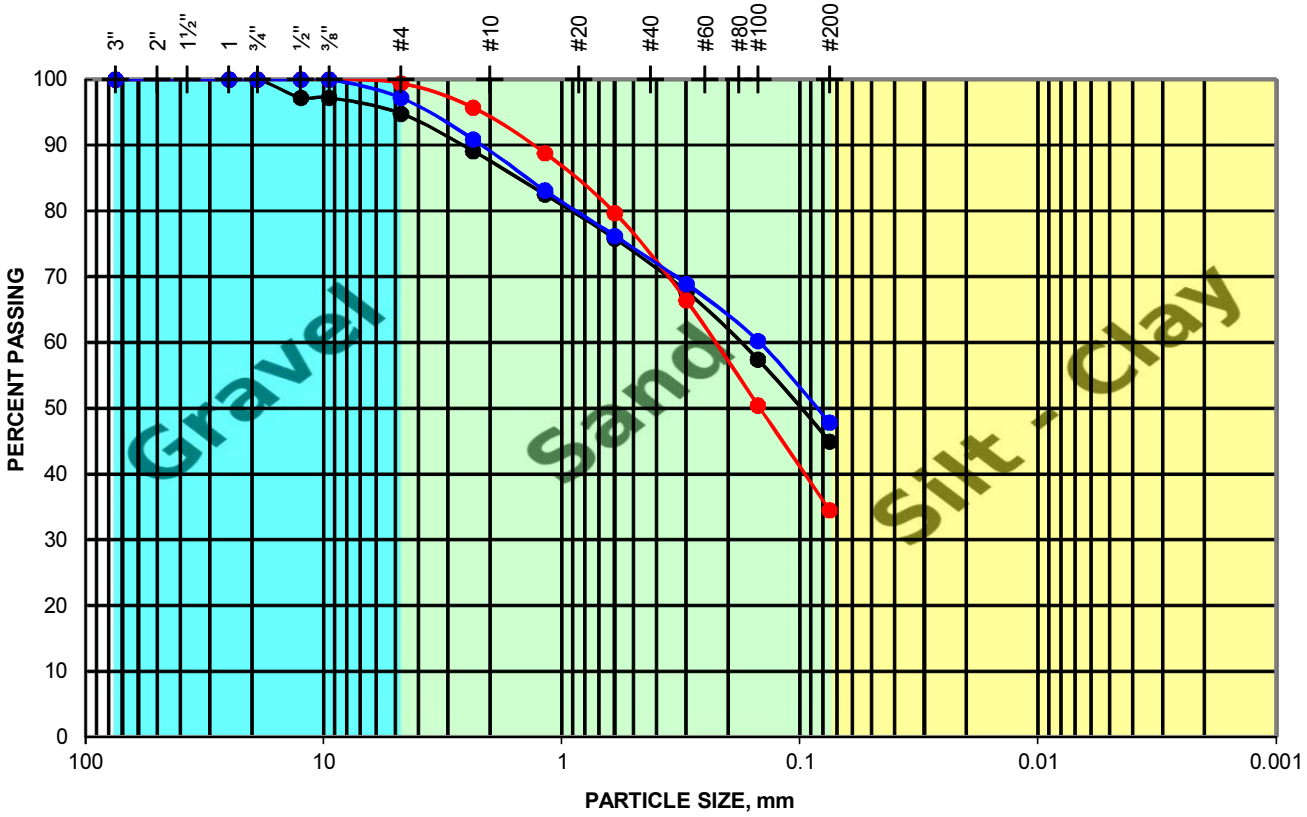

SAMPLE ID	SAMPLE DESCRIPTION
B-4@40.0'	Clayey SAND with few gravel (SC), reddish brown
B-4@50.0'	Silty Clayey SAND with trace gravel (SC-SM), yellowish brown
B-7@1-5'	Silty SAND with trace gravel (SM), brown

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SEPTEMBER, 2014 | PROJECT NO. T2599 - 22 - 01 | FIG. B8