

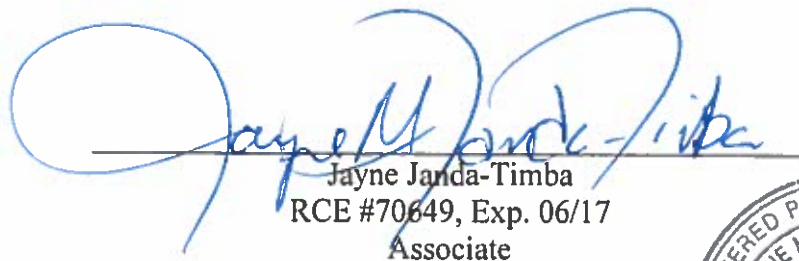
**SUMMARY OF FINDINGS FOR THE
ANNUAL DRAINAGE CHANNEL FIELD
ASSESSMENT AND MAINTENANCE PRIORITIZATION
PROJECT (PHASE 1)
FOR
THE CITY OF SAN DIEGO – MASTER STORM WATER
SYSTEM MAINTENANCE PROGRAM (MMP) 4300
MISSION BAY DRIVE**

**Job Number 17204-D
August 4, 2015**

RICK
RICK ENGINEERING COMPANY
ENGINEERING COMPANY
RICK ENGINEERING CO

**SUMMARY OF FINDINGS FOR THE
ANNUAL DRAINAGE CHANNEL FIELD
ASSESSMENT AND MAINTENANCE PRIORITIZATION PROJECT (PHASE 1)
FOR
THE CITY OF SAN DIEGO – MASTER STORM WATER SYSTEM MAINTENANCE
PROGRAM (MMP) 4300 MISSION BAY DRIVE**

Job Number 17204-D


Jayne Janda-Timba
RCE #70649, Exp. 06/17
Associate



Prepared For:
City of San Diego
2781 Caminito Chollas
San Diego, California 92105

Prepared By:
Rick Engineering Company
Water Resources Division
5620 Friars Road
San Diego, California 92110-2596
(619) 291-0707

August 4, 2015

TABLE OF CONTENTS

1.0 Executive Summary1

2.0 Introduction.....1

3.0 Desktop Channel Maintenance Prioritization Analysis1

4.0 Hydrologic Summary.....2

5.0 Hydraulic Analysis.....3

6.0 Other Channel Prioritization Factors4

7.0 Summary of Findings and Recommendations4

Tables

Table 1: Channel Prioritization Assessment Factors and Weighting2

Table 2: 100-year Peak Discharge (Q100) Estimation Based on Watershed Size2

Table 3: Summary of Approximate Hydrologic Data3

Table 4: Summary of Hydraulic Analysis Results3

Table 5: Channel Prioritization Assessment Scoring Summary.....4

Appendices

- Appendix A: Storm Water Facilities Key Map and 4300 Mission Bay Drive Map
- Appendix B: City of San Diego Operations and Maintenance (O&M) Channel Maintenance Inspection Forms completed for the channel and Site photos taken by the City of San Diego
- Appendix C: Hydrologic Support Material
- Appendix D: Hydraulic Analysis Output
- Appendix E: Channel Prioritization Assessment Sheet
- Appendix F: Channel Maintenance Prioritization Summary Sheet
- Appendix G: Available As-built plans
- Appendix H: Compact Disc: PDF Version of Full Report

1.0 Executive Summary

This report and preliminary analyses concludes that the Channel Prioritization Score for the 4300 Mission Bay Drive is **54.1 out of 100**. This score is at average and indicates that the channel is recommended for maintenance. If the channel is maintained to reflect the as-built condition, the hydraulic capacity of the channel will increase from the current 5-year storm event capacity to a 100-year storm event capacity. In addition to the hydraulic capacity, the analyses considered other factors including water quality, community input and aesthetics. The analyses concluded that these other factors are generally in good condition and the benefits of maintaining the channel are mainly to reduce the flood risk.

2.0 Introduction

This report summarizes the findings for the Annual Drainage Channel Field Assessment and Maintenance Prioritization Project (Phase 1) for the City of San Diego for Master Storm Water System Maintenance Program (MMP), dated October 2011, 4300 Mission Bay Drive. Refer to Appendix A for the Storm Water Facilities Key Map and Channel Map.

Purpose

As part of the Master Storm Water System Maintenance Program (MMP), the City of San Diego performed site visits to drainage channels within the MMP and designated several drainage channels as maintenance priorities. The purpose of Phase 1 of this project is to perform a desktop analysis to evaluate the drainage channels identified by the City of San Diego and rank them in order of significance for the purposes of City of San Diego maintenance activities.

3.0 Desktop Channel Maintenance Prioritization Analysis

The desktop channel maintenance prioritization analysis is based on the following items which were reviewed and evaluated to determine the maintenance priority:

- City of San Diego Operations and Maintenance (O&M) Channel Maintenance Inspection Forms completed for the channel by the City of San Diego (Refer to Appendix B)
- Site photos taken by the City of San Diego (Refer to Appendix B)
- Available as-built plans (Refer to Appendix G)
- Hydraulic Analysis (Refer to Section 5.0 and Appendix D for detailed output)

Section 5.1 of the MMP discusses the Annual Maintenance Needs Determination Process. As part of the determination process, the MMP recommends that certain factors be evaluated including flood risk to life and property, water quality, community input and aesthetics. These four factors were utilized

for this channel maintenance prioritization analysis. For the purposes of prioritizing the channel for maintenance activities, each main factor is weighted as shown in Table 1 below:

Table 1

| Channel Prioritization Assessment Factors and Weighting | |
|--|-----------------------------|
| Factor | Percent Weighted (%) |
| Flood Risk | 75 |
| Water Quality | 10 |
| Community Input | 10 |
| Aesthetics | 5 |

As part of the channel prioritization analysis, each of the main factors has been divided into sub-factors. To determine the Flood Risk factor, a basic hydraulic analysis was performed for the channel. The hydraulic analysis is described in more detail in the Hydraulic Analysis section (Section 5.0) of this report. The remaining factors, Water Quality, Community Input and Aesthetics were assessed based on the site photos and the information provided on the (O&M) Channel Maintenance Inspection Form completed for the channel provided by the City of San Diego. These factors and sub-factors and how they relate to the Channel Prioritization Score are shown in more detail on the Channel Prioritization Assessment Sheet located in Appendix E.

4.0 Hydrologic Summary

Estimated Peak Discharges

A drainage study for the channel was not available at the authorship of this report. The drainage channel is not a Federal Emergency Management Agency (FEMA) defined channel and no detailed hydrologic analysis was available. Therefore, the 100-year storm event peak discharge (Q100) for the channel was estimated based on the size of the watershed tributary to the channel as shown in Table 2 below:

Table 2

| 100-year Peak Discharge (Q100) Estimation Based on Watershed Size | | | | |
|--|----|---|-----|----|
| Watershed Area (square miles) | <1 | 1 | 2 | >4 |
| cfs¹ per acre | 4 | 2 | 1.5 | 1 |

cfs = cubic feet per second

The 2-, 5-, 10-, 25-, and 50-year storm event flow rates were then approximated by taking the ratio of the unknown storm event 6-hour precipitation and the 100-year storm event 6-hour precipitation, and then multiplying Q100 by the ratio to estimate the flow rate for the unknown storm event. Hydrologic support material is located in Appendix C. A summary of the estimated peak discharges are provided in the table below:

Table 3

| Summary of Approximate Hydrologic Data | | | | | | |
|---|---------------|---------------|----------------|----------------|----------------|-----------------|
| Drainage Area: 117 acres | | | | | | |
| 6-hour Precipitation | 1 | 1.3 | 1.5 | 1.7 | 1.9 | 2.1 |
| Frequency | 2-Year | 5-Year | 10-Year | 25-Year | 50-Year | 100-Year |
| Discharge (cfs)¹ | 223 | 290 | 334 | 379 | 423 | 468 |

cfs = cubic feet per second

5.0 Hydraulic Analysis

A basic hydraulic analysis of the channel was performed to assess the Flood Risk factor. The channel assessment limits are shown on Map _ located in Appendix A. Manning's equation was utilized to calculate the capacity of the channel under two conditions:

1. As-built Conditions: based on the material and geometry as shown on the available as-built plans. (Refer to Appendix G)
2. Current Conditions: based on the vegetation and sediment levels estimated from the site photos taken by the City of San Diego and information provided on the (O&M) Channel Maintenance Inspection Form prepared by the City of San Diego.

Culvert crossings that may exist within the channel reach were not analyzed as part of this hydraulic analysis. Existing culverts may be inefficient or undersized, however the culvert hydraulics were not considered as part of this analysis.

The multiple storm event peak discharges previously calculated in Section 4.0 were evaluated under each condition to assess the capacity of the channel and evaluate the benefit of performing maintenance activities on the channel. See the table below for a summary of the hydraulic results and Appendix D for detailed hydraulic output.

Table 4

| Summary of Hydraulic Analysis Results | | | |
|--|--------------------------------------|----------------------------------|--------------------------------------|
| CURRENT CHANNEL CAPACITY | | AS-BUILT CHANNEL CAPACITY | |
| Current Condition (cfs) | Equivalent Storm Event (year) | As-built Condition (cfs) | Equivalent Storm Event (year) |
| 290 | 5 | 468 | 100 |

cfs = cubic feet per second

6.0 Other Channel Prioritization Factors

Sections 4.0 and 5.0 above discuss the determination process for the Flood Risk factor. For more information on the assessment of the Water Quality, Community Input, and Aesthetics factors please refer to the Channel Prioritization Assessment Sheet in Attachment E. The Channel Prioritization Assessment Sheet lists and describes the sub-factors that are considered in the determination of the four main channel assessment factors.

7.0 Summary of Findings and Recommendations

A summary of the Channel Assessment is shown in the table below:

Table 5

| Channel Prioritization Assessment Scoring Summary | | |
|--|-----------------------------|--------------------------------------|
| Factor | Percent Weighted (%) | Weighted Factor Score/Maximum |
| Flood Risk | 75 | 38.1/75 |
| Water Quality | 10 | 6/10 |
| Community Input | 10 | 5/10 |
| Aesthetics | 5 | 5/5 |
| Overall Channel Score: | | 54.1/100 |

Additionally, the following items should be noted:

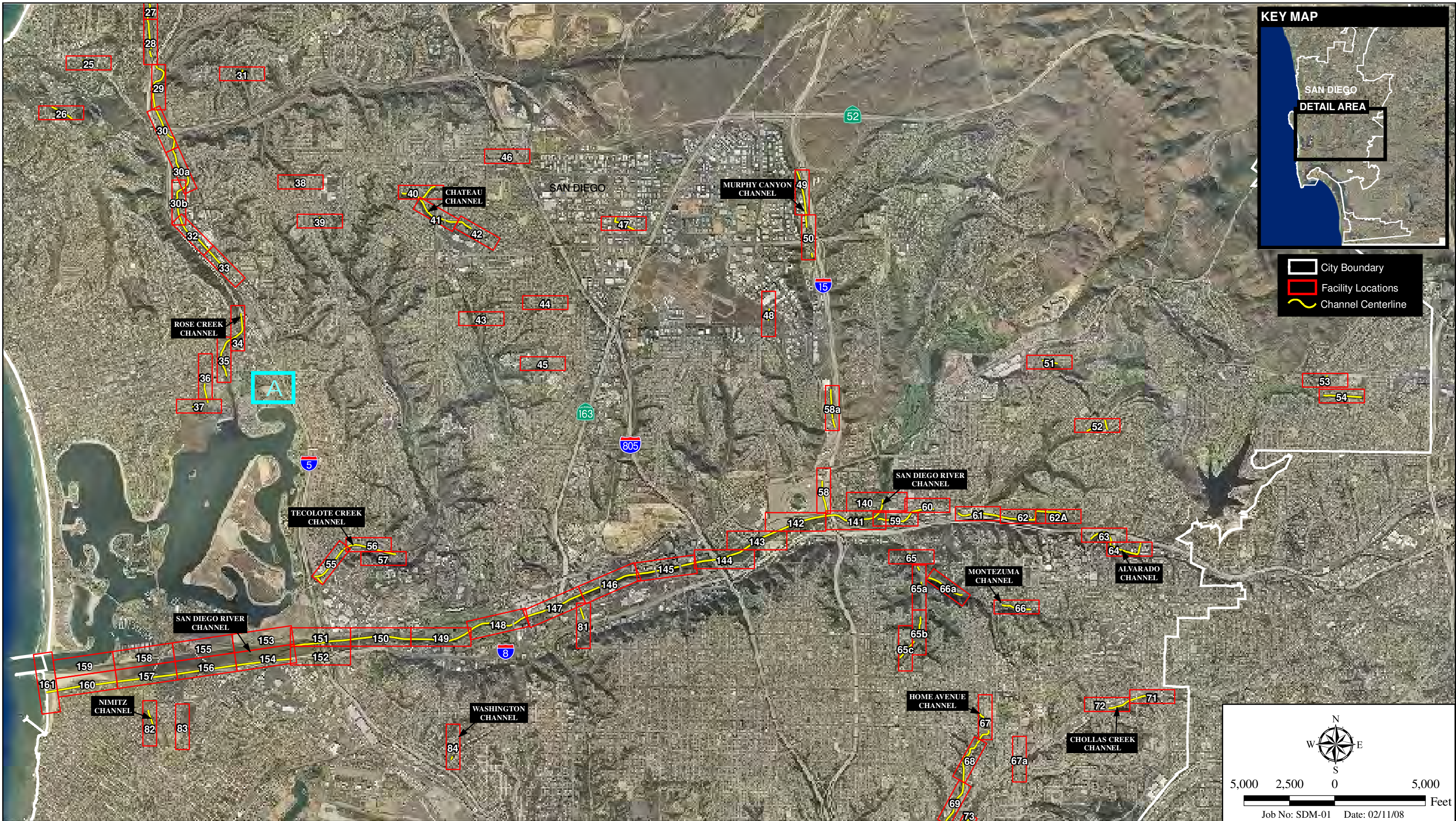
- Based on site photos taken by the City of San Diego, heavy vegetation exists in the channel. A high risk of vegetation flowing downstream and clogging the culvert exists.

Based on the evaluation of the four weighted channel prioritization factors described in Section 3.0 of this report, the Channel Prioritization Score for MMP 4300 Mission Bay Drive is **54.1**. Refer to the Channel Prioritization Assessment Sheet located in Appendix E for details on the evaluation of the weighted factors and resulting score for this channel.

It is recommended that this drainage channel be maintained to increase the current capacity of the channel from a 5-year storm event back to a 100-year storm event capacity.

A summary of the channel including an aerial map, channel prioritization score, and other pertinent information is shown on the exhibit titled “Channel Maintenance Prioritization Summary Sheet” located in Appendix F.

Appendix A
Master Storm Water System Maintenance Program (MMP),
dated October 2011, Storm Water Facilities
Key Map and 4300 Mission Bay Drive



I:\ArcGIS\SDM-01\Map\ENV\MSMP\Fig2c_18_Corridor.mxd -NM

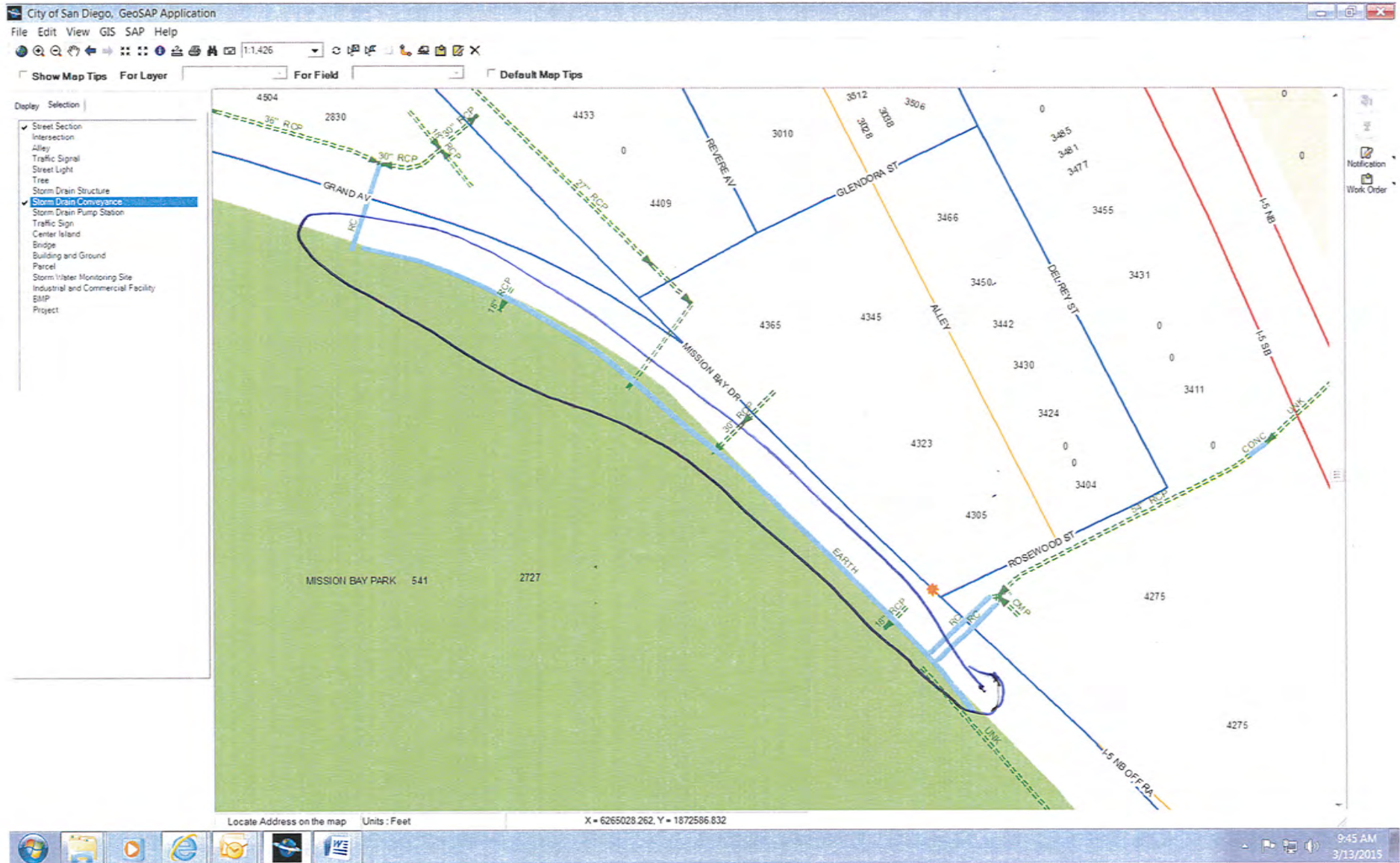
Stormwater Facilities - I-8 Corridor

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM

Figure 2c



'A' Shown on: Storm Water Facilities – I-8 Corridor (Figure 2c)



4300 MISSION BAY DRIVE
(ON GOLF COURSE PROPERTY)

Appendix B
City of San Diego Operations and Maintenance (O&M)
Channel Maintenance Inspection Forms completed
for the channel and Site photos taken by the City of San Diego

Operations and Maintenance

Channel Maintenance Inspection Form

Date: *7/18/15* Time: *10:00 AM*

Channel Map No.: *Mission Bay Golf Course*

Watershed: *Mission Bay Golf*

Inspector: *Jacques*

Weather: *Good*

Initial Inspection

Follow Up Inspection

| Item | Condition | Comments |
|---|---------------------------|--|
| A. Channel Condition | | |
| 1= Poor Condition/Needs Immediate Attention | | |
| 2= Moderate Condition | | |
| 3= Good Condition | | |
| 1. Structure Condition | 1 (2) 3 N/A | |
| 2. Erosion | 1 2 (3) N/A | |
| 3. Trash/Debris | (1) 2 3 N/A | Type of trash and source: <i>veg. & sediment & trees</i> |
| 4. Water Conveyance/ Volume | (1) 2 3 N/A <i>40%</i> | |
| 5. Standing Water | (Y) N | |
| A. Ponding | (Y) N | |
| B. Noticeable odors | Y (N) | |
| C. Algae | (Y) N | |
| 6. Vegetation | (1) 2 3 N/A | Approx. Coverage/Density of Vegetation: <i>100%</i> |
| A. Invasive (Arundo) | (1) 2 3 N/A | <i>Palms</i> |
| B. Native | 1 (2) 3 N/A | |
| 7. Sediment | 1 (2) 3 N/A | Approx. Depth/Coverage of Sediment: <i>65%</i> |
| 8. Transients/ encampments | Y (N) | |

B. Culverts and Outfalls

1= Poor Condition/Needs Immediate Attention

2= Moderate Condition

3= Good Condition

| Item | Condition | Comments |
|---|-------------|---|
| 1. Structure Condition | 1 (2) 3 N/A | |
| 2. Trash/ <u>Debris</u> / <u>Sediment</u> | (1) 2 3 N/A | |
| 3. Clogging | 1 (2) 3 N/A | Lots of Veg & Palms (may) clog at West End of channel |

C. See Map Attached

-Identify Key Issues on Map

-Inspect and take photographs from vantage points identified on Map

Other Comments:

D. To Be Completed by Management

Follow Up Actions

1.

2.

3.

E. Infrastructure Failure Issues

| Item | Condition | Comments |
|-----------------------------------|--|----------|
| 1. Broken Concrete/Gunite? | Y <input checked="" type="radio"/> N N/A | |
| 2. Broken/Missing Trash Fence? | Y <input checked="" type="radio"/> N N/A | |
| 3. Broken/Missing Poles/Supports? | Y <input checked="" type="radio"/> N N/A | |
| 4. Exposed Rebar? | Y <input checked="" type="radio"/> N N/A | |
| 5. Rock/Debris Accumulation? | <input checked="" type="radio"/> Y N N/A | |
| 6. Potential Flooding/Litigation? | <input checked="" type="radio"/> Y N N/A | |
| 7. Slope Failure? | Y <input checked="" type="radio"/> N N/A | |

Other Comments/Observations:

Mission Bay Golf Course Soil Channel



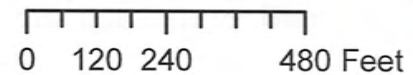
11 10 9 8 7 6 5 4 3 2 1

PHOTOS 1-10 TAKEN LOOKING

NORTHWEST



PHOTO 11 TAKEN
LOOKING
SOUTHEAST





Mission Bay Golf Course.1 (5-29-2015).JPG



Mission Bay Golf Course.2 (5-29-2015).JPG



Mission Bay Golf Course.3 (5-29-2015).JPG



Mission Bay Golf Course.4 (5-29-2015).JPG



Mission Bay Golf Course.5 (5-29-2015).JPG



Mission Bay Golf Course.6 (5-29-2015).JPG



Mission Bay Golf Course.7 (5-29-2015).JPG



Mission Bay Golf Course.8 (5-29-2015).JPG



Mission Bay Golf Course.9 (5-29-2015).JPG

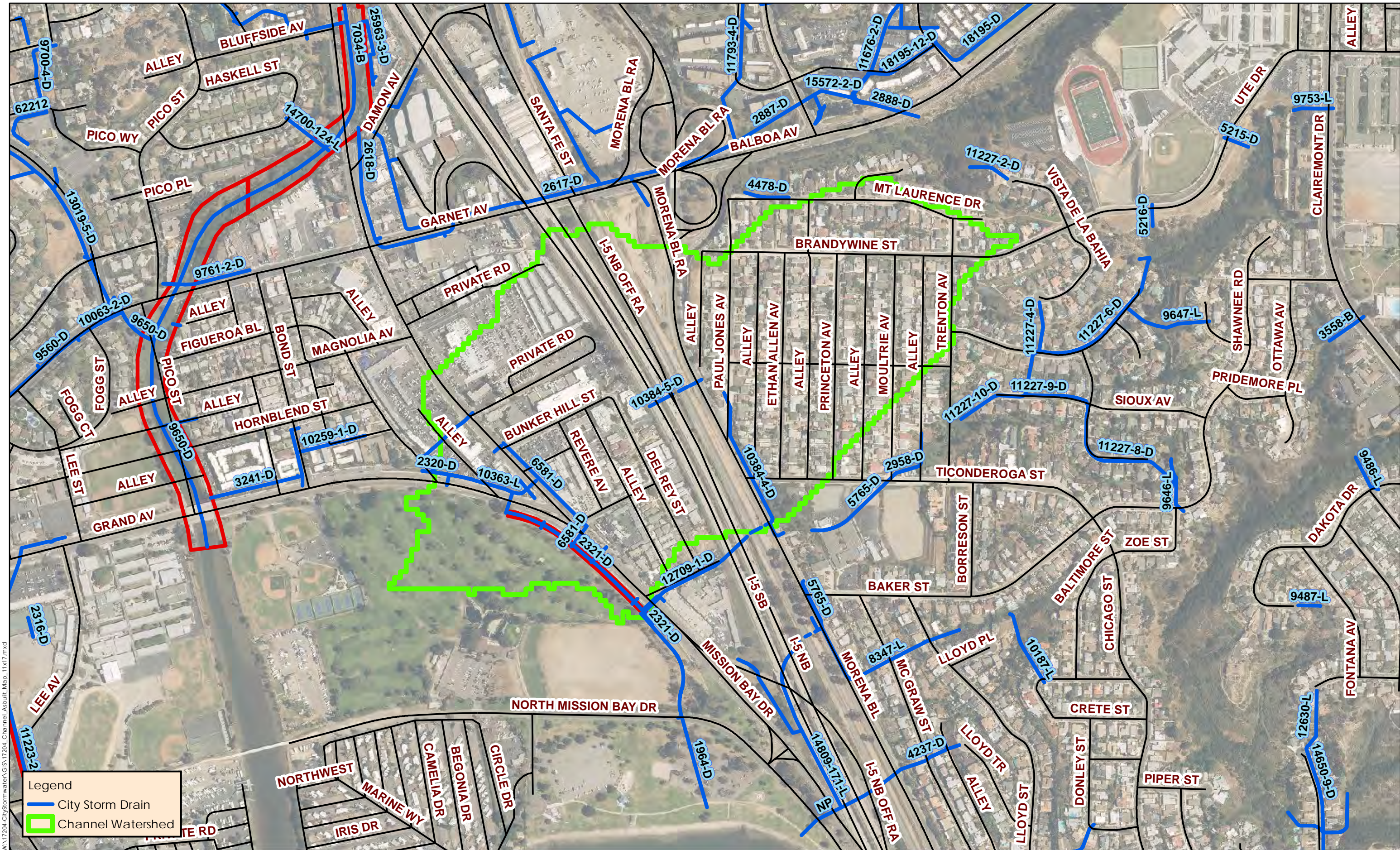


Mission Bay Golf Course.10 (5-29-2015).JPG



Mission Bay Golf Course.11 (5-29-2015).JPG

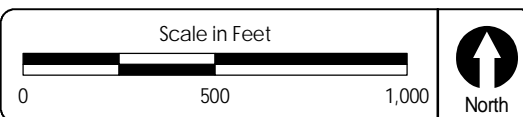
Appendix C
Hydrologic Support Material



Legend

- City Storm Drain
- Channel Watershed

W:\17204-CityStormwater\GIS\17204_Channel_Asbuilt_Map_11x17.mxd



Date of Exhibit: 7/16/2015
 DigitalGlobe Aerial Image: 04.2013

4300 Mission Bay Drive Channel - Watershed Map

Master Maintenance Program Proposed Map

San Diego County Hydrology Manual



Prepared by the County of San Diego
Department of Public Works
Flood Control Section
June 2003

LIST OF APPENDICES

| <u>LETTER</u> | <u>TITLE</u> | |
|---------------|--|-----|
| A | Hydrologic Soil Groups Map | A-1 |
| B | Isopluvial Maps | B-1 |
| C | Precipitation Zone Number (PZN) Map | C-1 |
| D | Worksheets for NRCS Hydrologic Method Calculations | D-1 |
| E | 85 th Percentile Precipitation Isopluvial Map | E-1 |

County of San Diego Hydrology Manual

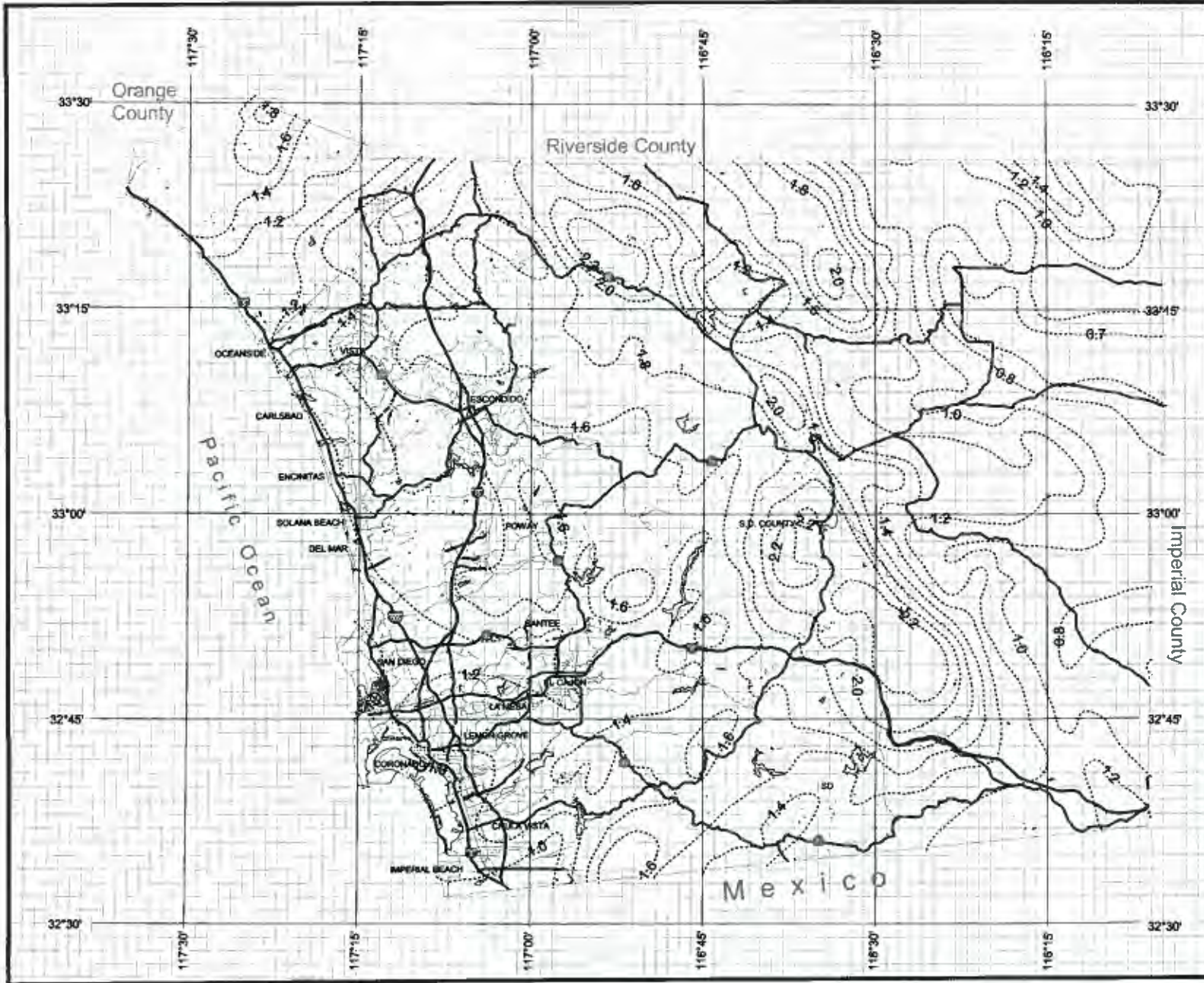


Rainfall Isophivials

2 Year Rainfall Event - 6 Hours



* $P_0 = 1.0$ in



DPW
GIS
Department of Public Works
Geographic Information Systems

SanGIS
We Have San Diego Covered!



3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright 2008, All Rights Reserved.

This product may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

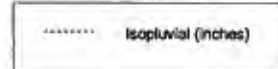
This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

County of San Diego Hydrology Manual

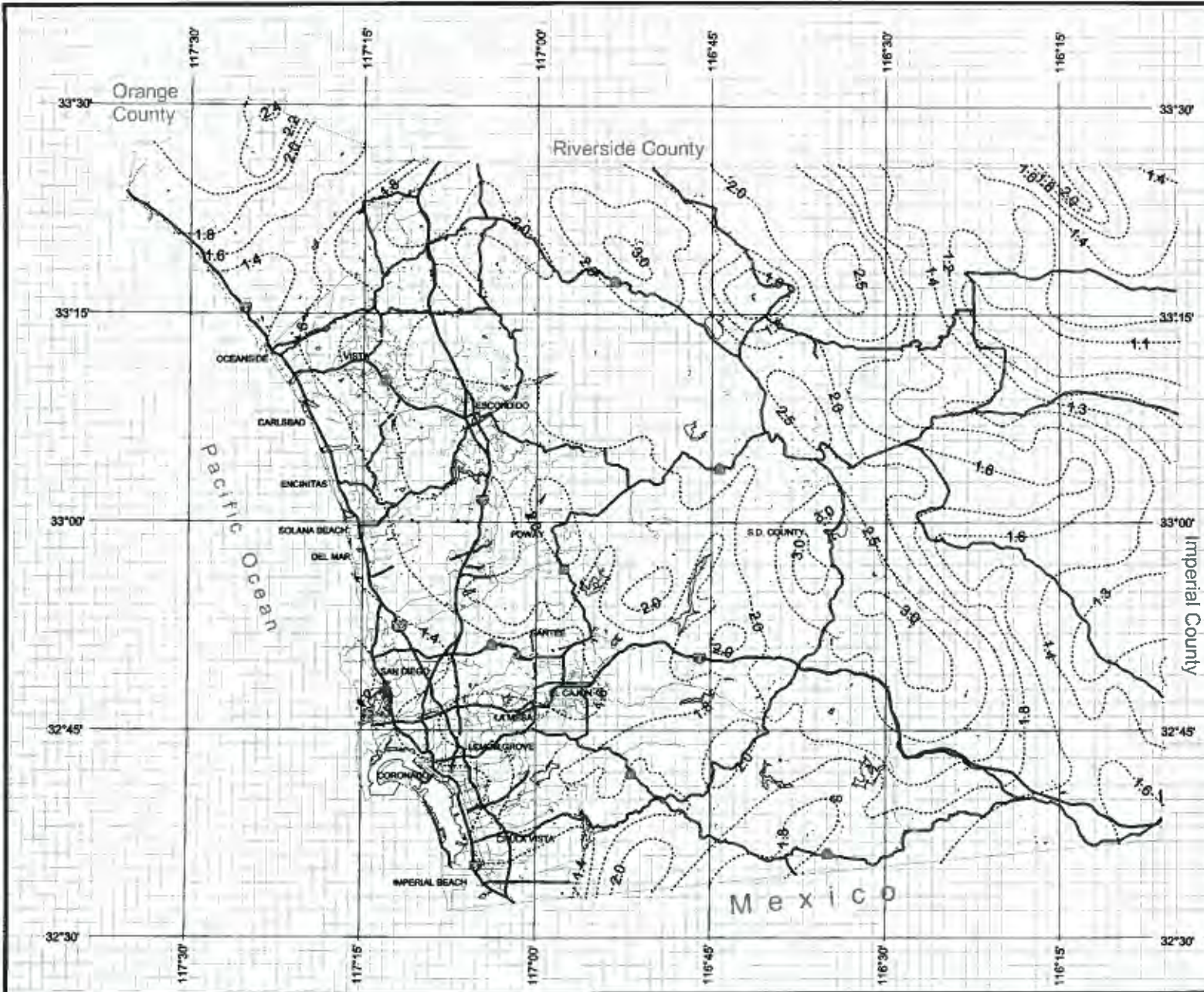


Rainfall Isopluvials

5 Year Rainfall Event - 6 Hours



* $P_6 = 1.3 \text{ in}$



3 0 3 Miles

This map is provided without warranty of any kind, either express or implied, including, but not limited to, the implied warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE. Copyright © 2005. All Rights Reserved.

This product may contain information which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

County of San Diego Hydrology Manual

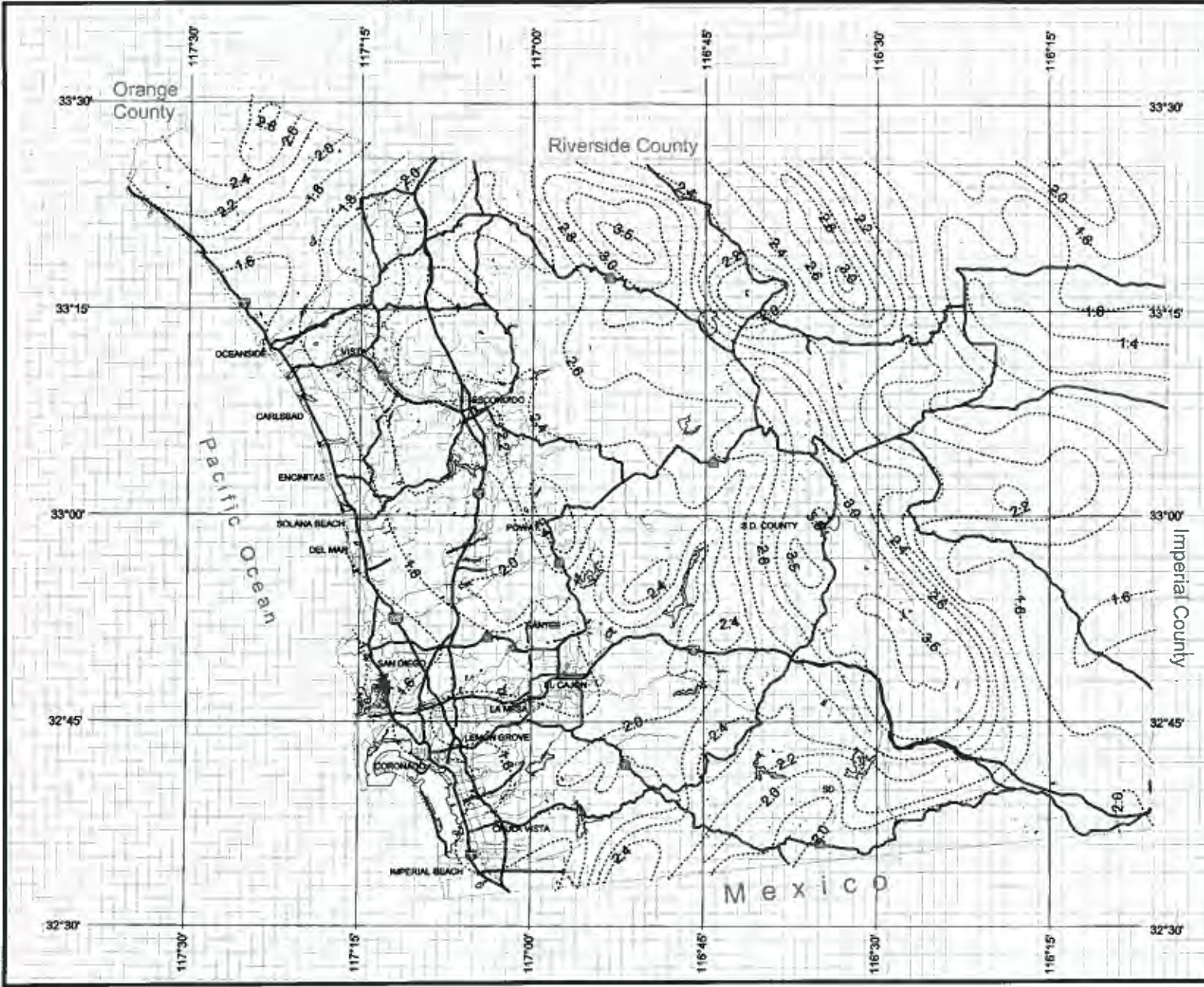


Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours



* $P_6 = 1.5$ in



3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright 2005. All Rights Reserved.

This product may contain information from the SDCAD Regional Information System which cannot be reproduced without the written permission of SDCAD.

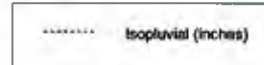
This product may contain information which has been prepared and will be published under the authority of the County of San Diego.

County of San Diego Hydrology Manual

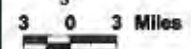
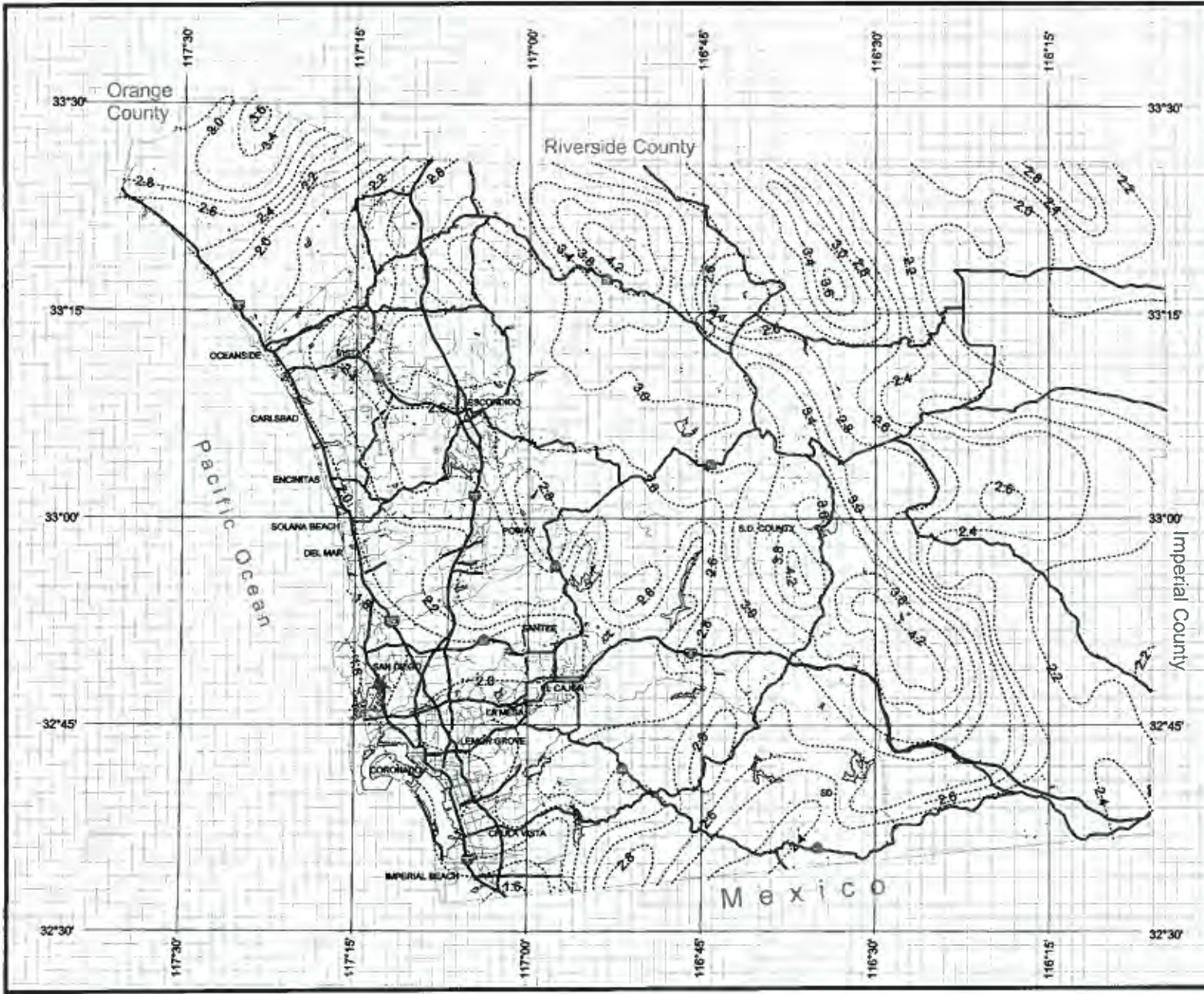


Rainfall Isopluvials

25 Year Rainfall Event - 6 Hours



* $P_6 = 1.7$ in



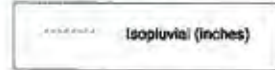
THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.
This product may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.
This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

County of San Diego Hydrology Manual

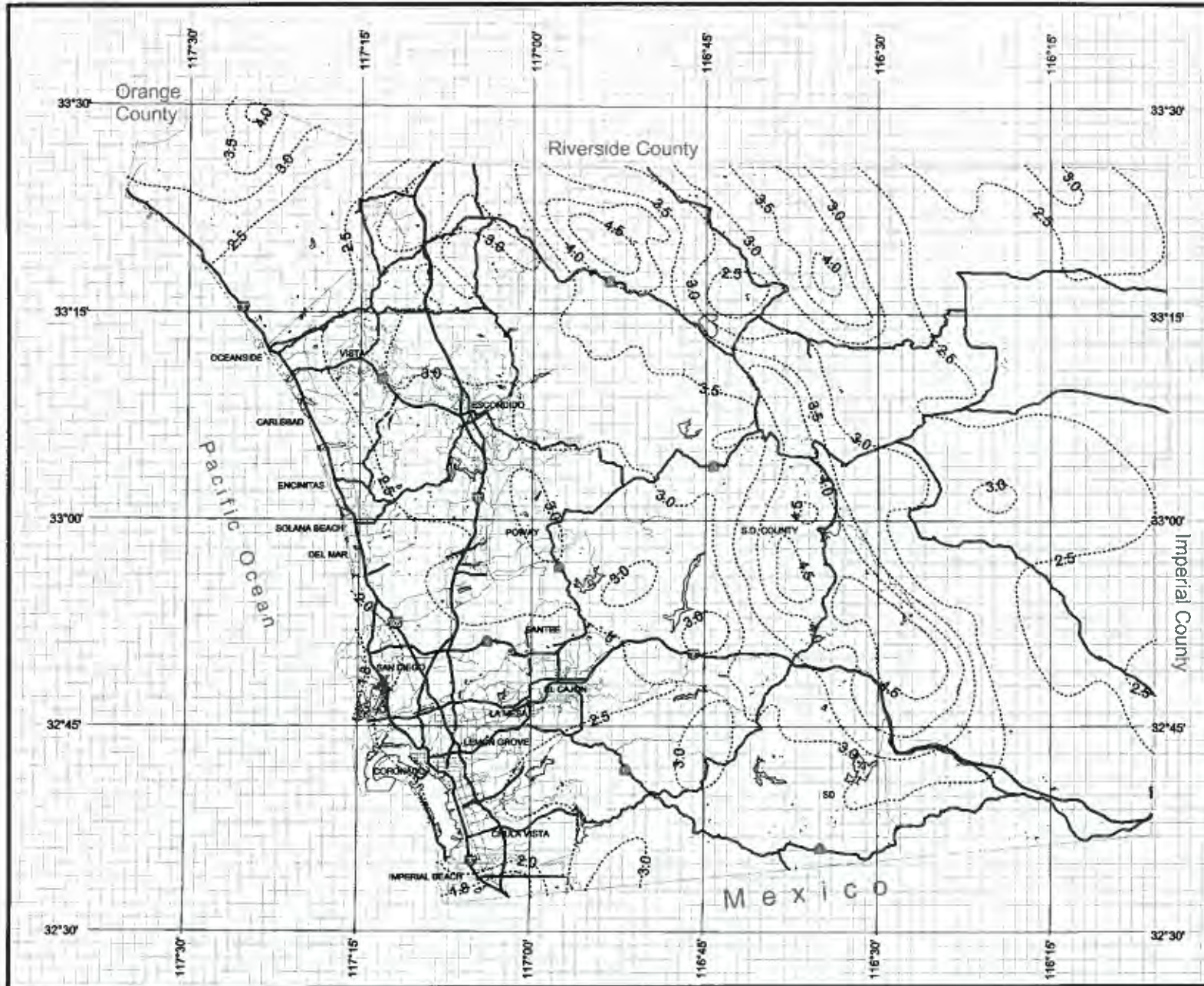


Rainfall Isophrials

50 Year Rainfall Event - 6 Hours



* $P_6 = 1.9$ in



DPW
GIS
Department of Public Works
Geographic Information Systems

SanGIS
We Have San Diego Covered!



3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright 2008. All Rights Reserved.

This product may contain information from the SANDAG Regional Information System which should be handled within the strict guidelines of SANDAG.

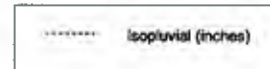
This product may contain information which has been reproduced with permission granted by The Ohio State University.

County of San Diego Hydrology Manual

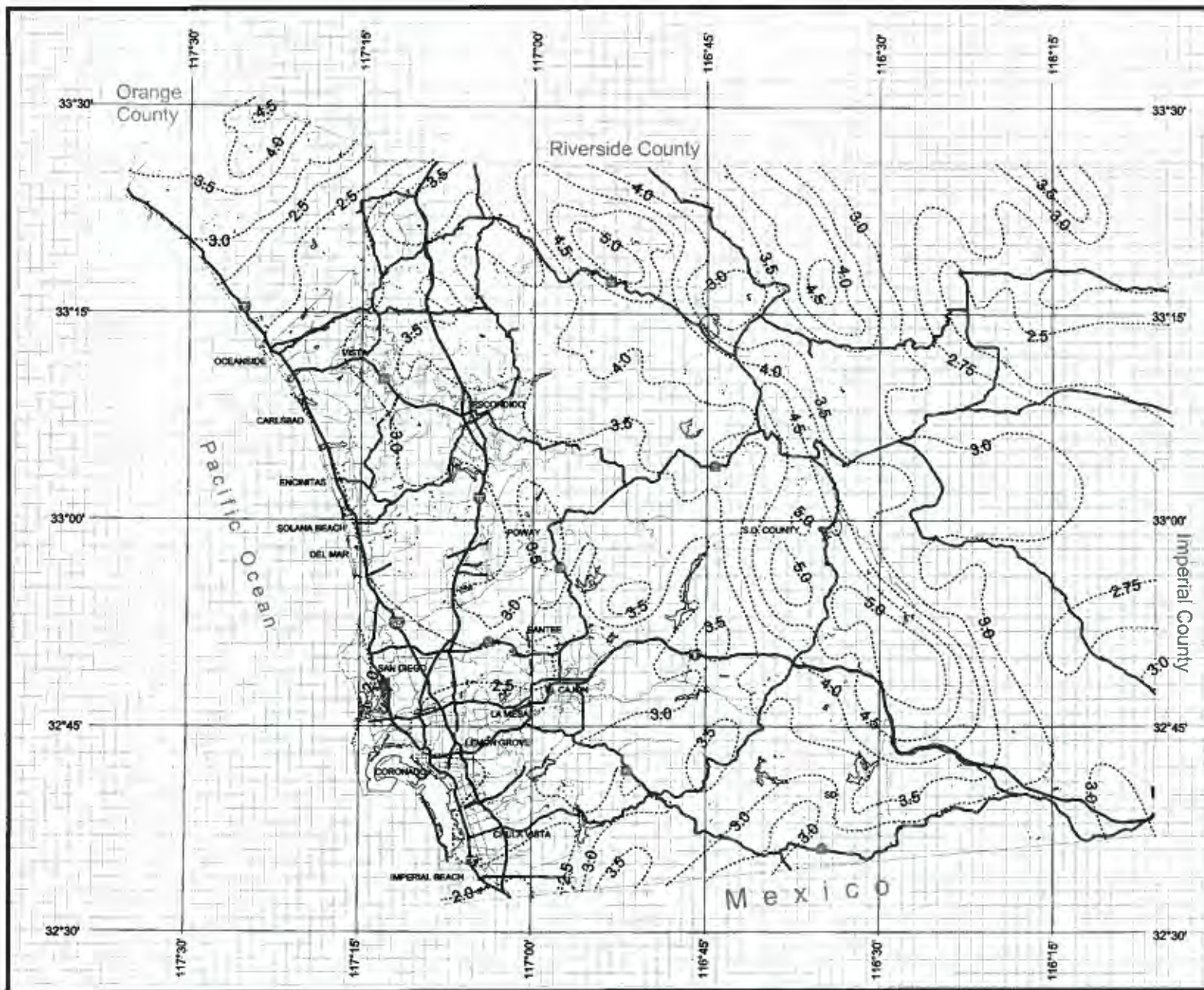


Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours



* $P_6 = 2.1$ in



3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright © 2005. All Rights Reserved.

The analysis may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Graham Maps.

Appendix D
Hydraulic Analysis Output

Hydraulic Analysis Report

Project Data

Project Title: Proposed_Map_4300MissionBayDr
Designer: Rick Engineering Company J-17204-D
Project Date: Wednesday, July 15, 2015
Project Units: U.S. Customary Units

Channel Analysis: asbuilt_100

Notes: The cross-section of the channel on the as-built plans show an earthen trapezoidal channel with a 20-foot wide bottom width and 1.5:1 side slopes. A channel depth is not specified on the channel cross section detail on the as-builts, therefore the depth was scaled off based on the dimensions provided on the cross section detail, and estimated to be 8.5 feet. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficients used for each of the channel side slopes and channel bottom are $n = 0.03$.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

| Station (ft) | Elevation (ft) | Manning's n |
|--------------|----------------|-------------|
| 0.00 | 8.50 | 0.0300 |
| 12.75 | 0.00 | 0.0300 |
| 32.75 | 0.00 | 0.0300 |
| 45.50 | 8.50 | ----- |

Longitudinal Slope: 0.0015 (ft/ft)

Flow: 468.0000 (cfs)

Result Parameters

Depth: 4.2686 (ft)

Area of Flow: 112.7034 (ft²)

Wetted Perimeter: 35.3907 (ft)

Hydraulic Radius: 3.1846 (ft)

Average Velocity: 4.1525 (ft/s)

Top Width: 32.8058 (ft)

Froude Number: 0.3948

Critical Depth: 2.4136 (ft)

Critical Velocity: 8.2091 (ft/s)

Critical Slope: 0.0110 (ft/ft)

Critical Top Width: 27.2407 (ft)

Calculated Max Shear Stress: 0.3995 (lb/ft²)

Calculated Avg Shear Stress: 0.2981 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.0300

Channel Analysis: current_5

Notes: The cross-section of the channel on the as-built plans show an earthen trapezoidal channel with a 20-foot wide bottom width and 1.5:1 side slopes. A channel depth is not specified on the channel cross section detail on the as-builts, therefore the depth was scaled off based on the dimensions provided on the cross section detail, and estimated to be 8.5 feet. Based on the site photos provided to us, the channel is very highly vegetated. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficients used for each of the channel side slopes and channel bottom are $n = 0.17$. The roughness coefficient used is based on dense willows.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

| Station (ft) | Elevation (ft) | Manning's n |
|--------------|----------------|-------------|
| 0.00 | 8.50 | 0.1700 |
| 12.75 | 0.00 | 0.1700 |
| 32.75 | 0.00 | 0.1700 |
| 45.50 | 8.50 | ----- |

Longitudinal Slope: 0.0015 (ft/ft)

Flow: 290.0000 (cfs)

Result Parameters

Depth: 8.4466 (ft)

Area of Flow: 275.9498 (ft²)

Wetted Perimeter: 50.4547 (ft)

Hydraulic Radius: 5.4693 (ft)

Average Velocity: 1.0509 (ft/s)

Top Width: 45.3398 (ft)

Froude Number: 0.0751

Critical Depth: 1.7836 (ft)

Critical Velocity: 7.1703 (ft/s)

Critical Slope: 0.3816 (ft/ft)

Critical Top Width: 25.3509 (ft)

Calculated Max Shear Stress: 0.7906 (lb/ft²)

Calculated Avg Shear Stress: 0.5119 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.1700

CITY OF SAN DIEGO



**DRAINAGE DESIGN
MANUAL**

APRIL • 1984

TABLE OF CONTENTS (Continued)

| | | |
|--------------------|---|-----------------|
| 1-104.12 | Chart/Gutter and Roadway Discharge - Velocity Chart . . | 70A |
| 1-104.13 | Channel Easements | 71 |
| 1-104.14 | Mannings Roughness coefficient | 73 |
| 1-104.14A | Table/Design Values for Mannings Roughness Coefficient (n) | 74 |
| 1-104.14B | Chart/Nomograph for Solution of Manning Equation . . . | 76 |
| 1-104.15 | Design Guides | 77 |
| 1-104-15A | Figure/Typical Channel Plan | 78 |
| 1-104.15B | Figure/Typical Channel Profile | 79 |
| APPENDIX I | | |
| | Rational Method | 80 thru 87 |
| APPENDIX II | | |
| | Modified Rational Method | 88 thru 92 |
| APPENDIX III | | |
| | SCS Method | 93 thru 119 |
| SEDIMENT DETENTION | | |
| | Basin Desilting | 120 thru 126 |
| APPENDIX IV | | |
| | What pH Values Mean | 131 |
| | Definitions (CALTRANS-Highway Design Manual). | 132 thru 138 |
| | Department Instructionf for C.I.P.C.P. | 139 thru 142 |
| INDEX | | |
| | Index | 143 thru 146 |

TABLE 1-104.14A

DESIGN VALUES FOR MANNINGS ROUGHNESS COEFFICIENT (n)

| <u>TYPE OF CHANNEL</u> | <u>N VALUE</u> |
|---|----------------|
| Unlined Channels: | |
| Clay Loam; | 0.023 |
| Sand | 0.020 |
| Gravel | 0.030 |
| Rock | 0.040 |
| Lined Channels: | |
| Portland Cement Concrete | 0.015 |
| Air Blown Mortar | 0.018 |
| Asphalt Concrete | 0.018 |
| Grass Lined Channels: (Shallow depths) | |
| 2 inch length | 0.050 |
| 4 - 6 inch length | 0.060 |
| 6 - 12 inch length | 0.120 |
| 12 - 24 inch + length | 0.200 |
| Pavement and Gutters: | |
| Concrete | 0.015 |
| Asphalt Concrete | 0.018 |
| Natural Streams: (Less than 100 feet wide at flood stage) | |
| 1. Regular section | |
| a. Some grass and weeds, little or no brush | 0.030 |
| b. Dense growth of weeds, depth of flow substantially greater than weed height | 0.040 |
| c. Some weeds, light brush on bank | 0.040 |
| d. Some weeds, heavy brush on banks | 0.060 |
| e. With trees in channel, branches submerged at flood stage, increase above values by | 0.015 |

TABLE 1-104.14A (Continued)

| | | |
|----|--|-------|
| 2. | Irregular section, with pools, slight channel meander increase all values listed in 1. Regular Section, by | 0.015 |
|----|--|-------|

Flood Plains: (adjacent to natural streams)

| | | |
|----|---|-------|
| 1. | Pasture, no brush | |
| | a. Short grass | 0.030 |
| | b. High grass | 0.040 |
| 2. | Cultivated areas | |
| | a. No crop | 0.040 |
| | b. Mature row crops | 0.040 |
| | c. Mature field crops | 0.050 |
| 3. | Heavy weeds, scattered brush | 0.050 |
| 4. | Light brush and trees | 0.060 |
| 5. | Medium to dense brush | 0.090 |
| 6. | Dense willows | 0.170 |
| 7. | Cleared land with tree stumps, 100-150 per acre | 0.060 |
| 8. | Heavy stand of timer, little undergrowth | |
| | a. Flood depth below branches | 0.110 |
| | b. Flood depth reaches branches | 0.140 |

Appendix E
Channel Prioritization Assessment Sheet

| Channel Prioritization Assessment Sheet for <u>Proposed Map: 4300 Mission Bay Drive</u> | | | | | | | Total Channel Score: | | 54.1 /100 | | | | | |
|---|--|--|--|--|--|--|--|---------------|-----------------|--|------|--|----|--|
| Flood Hazard 5% of total weight | | | | | | | Score | factor weight | Weighted Points | | | | | |
| <p>Δ capacity</p> <p>a. Ris of flooding Current Channel normal depth capacity ¹ <input type="text" value="290 cfs"/> <input type="text" value="5 -yr. storm event"/> 2-yr.=score of 5; 5-yr.=score of 4; 10-yr.=score of 3; 25-yr.=score of 2; 50-yr.=score of 1; 100-yr.=score of 0</p> <p>b. Increase in storm event capacity Channel As-uilt normal depth capacity ¹ <input type="text" value="40 cfs"/> <input type="text" value="100 -yr. storm event"/> add 1 to score for every level increase in -year storm event capacity, post-maintenance</p> <p>c. et percent increase in channel capacity post-maintenance <input type="text" value=""/> % Less than 100% = score of 0; 100%-199% = score of 1; 200%-299% = score of 2; 300%-399% = score of 3; 400%-500%= score of 4; Over 500% = score of 5</p> | | | | | | | Sum of sub-factor a-c scores: | | 8 | | 25% | | 10 | |
| <p>Consequence of flooding adjacent areas</p> <p>Surrounding area land use area within 100 feet of the channel or area in which more than 10,000 ft is impacted from flooding. Is there open space surrounding the channel</p> <p><input type="text" value="Roads"/> Residential = score of 4; Commercial = score of 4; Roads = score of 2; Agriculture = score of 1; Other = score of 1</p> <p><input type="text" value="es"/> If yes, subtract land use score by 1</p> | | | | | | | 0 1 2 3 4 | | 50% | | 9.35 | | | |
| <p>Clogging Potential</p> <p>Are there trees/large debris that have potential to flow D/S and clog culverts/the channel</p> <p><input type="text" value="es"/></p> | | | | | | | 0 1 2 3 4 | | 25% | | 1.5 | | | |
| | | | | | | | Total Weighted Flood Hazard Points | | 38.1 | | | | | |
| Water Quality/Channel Condition 10% of total weight | | | | | | | | | | | | | | |
| <p>Trash/Debris</p> <p>Type of trash and Source <input type="text" value="None"/></p> | | | | | | | 0 1 2 3 4 | | 20% | | 0 | | | |
| <p>Standing water</p> <p>Ponding <input type="text" value="es"/></p> <p>oticeable odors <input type="text" value="o"/></p> <p>Algae <input type="text" value="es"/></p> | | | | | | | 0 1 2 3 4 | | 15% | | 1 | | | |
| <p>Sediment</p> <p>Appro. sediment coverage ased on information provided on City of San Diego O Channel aintenance Inspection orm <input type="text" value="5%"/></p> <p>Roc/debris Accumulation <input type="text" value="es"/></p> | | | | | | | 0 1 2 3 4 | | 35% | | 4 | | | |
| <p>Transients/encampments</p> <p>Culverts and Outfalls</p> <p>Culvert structure condition <input type="text" value="O"/></p> | | | | | | | 0 1 2 3 4 | | 10% | | 0 | | | |
| <p>Infrastructure Issues</p> <p>roen concrete/gunite <input type="text" value="o"/></p> <p>roen or missing trash fence/fence poles/supports <input type="text" value="o"/></p> <p>Slope failure <input type="text" value="o"/></p> | | | | | | | 0 1 2 3 4 | | 10% | | 0 | | | |
| | | | | | | | Total Weighted Water Quality Points | | 6.0 | | | | | |
| Community Input 10% of total weight | | | | | | | | | | | | | | |
| <p>Community Complaints Received <input type="text" value="YES"/> <input type="text" value="O"/></p> | | | | | | | YES O | | 50% | | 5 | | | |
| <p>Community Outreach Input <input type="text" value=""/></p> | | | | | | | 0 1 2 3 4 | | 50% | | 0 | | | |
| | | | | | | | Total Weighted Community Input Points | | 5.0 | | | | | |
| Aesthetics 5% of total weight | | | | | | | | | | | | | | |
| <p>Aesthetics</p> <p>Are the aesthetics of the channel compromised <input type="text" value="es"/></p> | | | | | | | 0 1 2 3 4 | | 100% | | 5 | | | |
| | | | | | | | Total Weighted Aesthetics Points | | 5.0 | | | | | |

1. See appendi D for geometry parameters

| Scoring Legend | |
|----------------|--|
| 0 | actor is in good condition and does not need attention |
| 1 | actor is in good condition, but will eventually need attention |
| 2 | actor needs attention |
| 3 | actor is in bad condition and needs attention |
| 4 | actor is in severe condition and needs immediate attention |

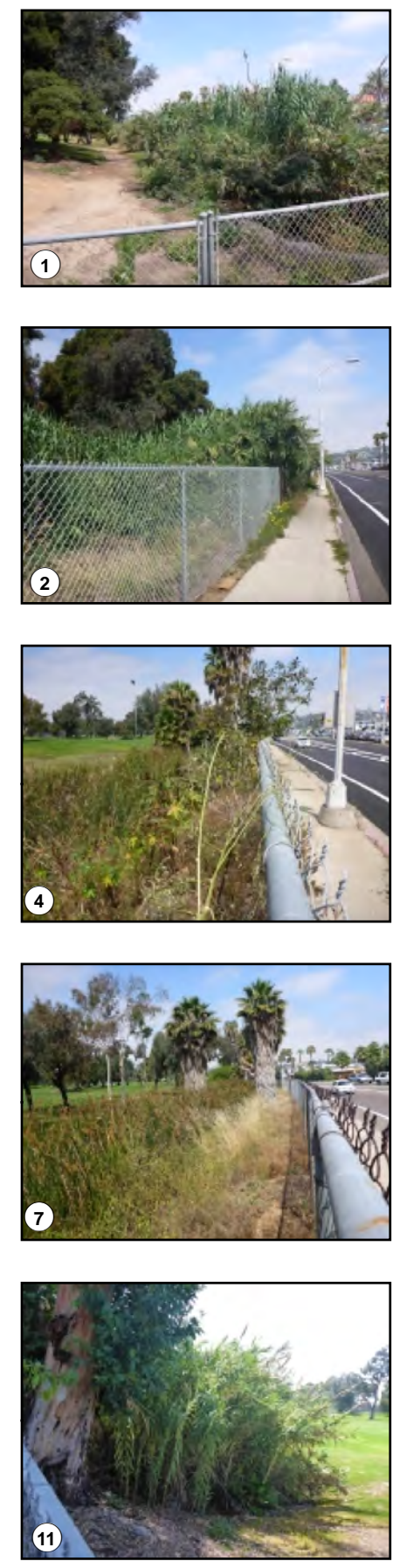
Appendix F
Channel Maintenance Prioritization Summary Sheet



Legend

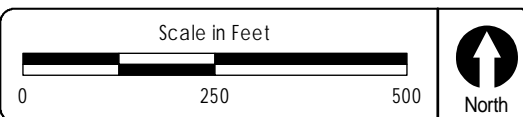
- Photo Location
- Channel Survey
- City Storm Drain Structure
- City Storm Drain

Photos:



Assessment Results

- **Channel Prioritization Score:**
54.1 out of 100
 - **Flood Hazard Score:**
38.1 out of 75
 - **Water Quality Score:**
6 out of 10
 - **Community Input Score:**
5 out of 10
 - **Aesthetics Score:**
5 out of 5
- **Capacity Prior to Maintenance:**
5-year storm event
- **Capacity After Maintenance (As-built Capacity):**
100-year storm event
- **Clogging Potential:** *HIGH*
- **Approximate Vegetation Coverage:** *HIGH*
- **Surrounding Area:** *Commercial*
- **Infrastructure Failures:**
NONE
- **Site Evaluation Date:**
May 29, 2015
- **Notes/Comments:**
Based on site photos taken by the City of San Diego, heavy vegetation exists in the channel. A high risk of vegetation flowing downstream and clogging the culvert exists.

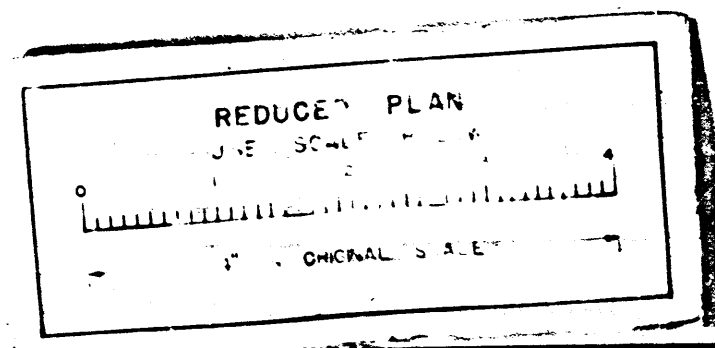
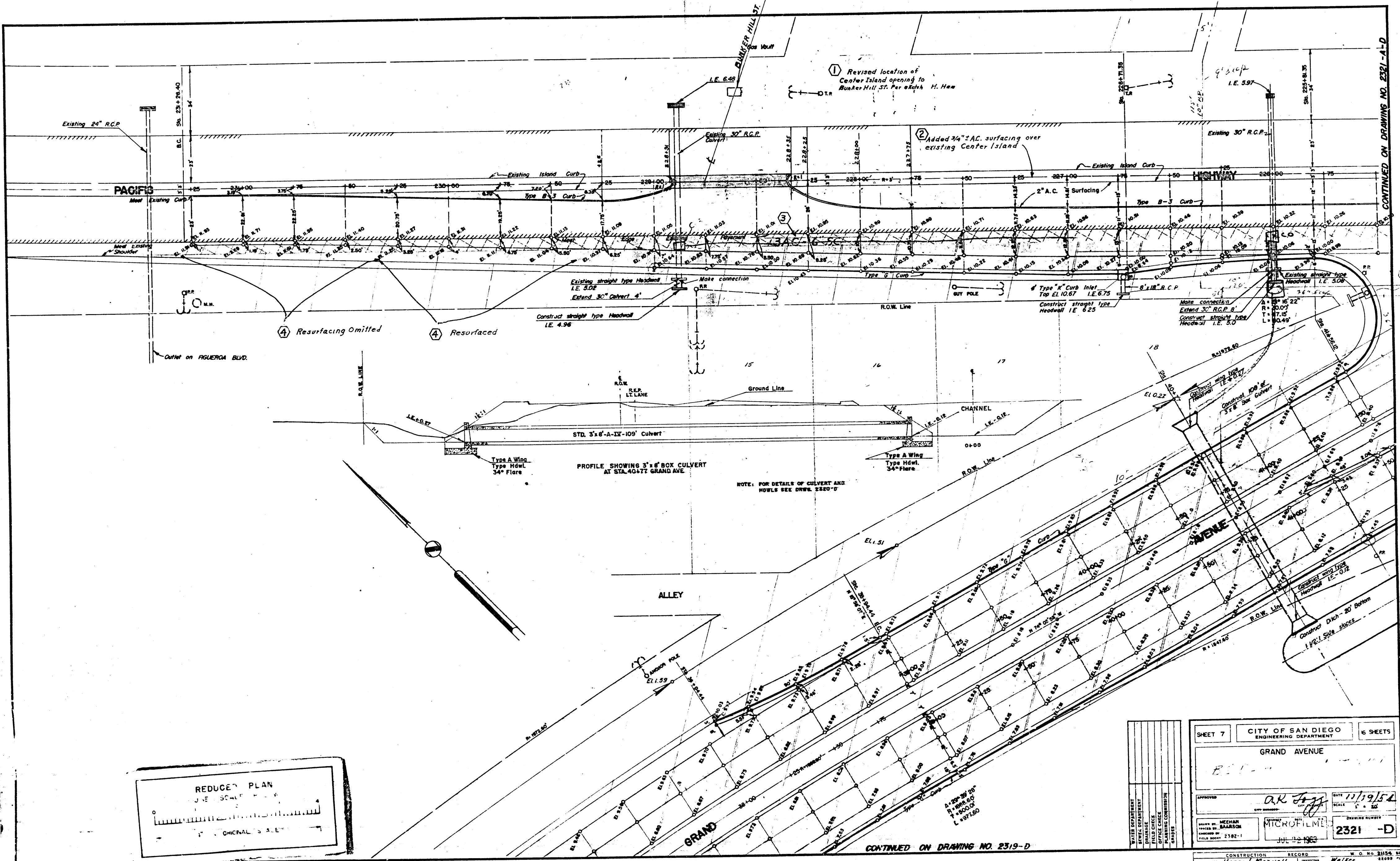


Channel: 4300 Mission Bay Drive

Channel Maintenance Prioritization Summary Sheet

Appendix G
Available As-built plans

CONTINUED ON DRAWING NO. 2321-A-D



PROFILE SHOWING 3' x 6' BOX CULVERT AT STA. 40+77 GRAND AVE.

NOTE: FOR DETAILS OF CULVERT AND HOWLS SEE DRAW. 2320-D

CONTINUED ON DRAWING NO. 2319-D

| | | | |
|---------------------|---------|------------------------|----------|
| WATER DEPARTMENT | SHEET 7 | CITY OF SAN DIEGO | 6 SHEETS |
| SEWER DEPARTMENT | | ENGINEERING DEPARTMENT | |
| DRAINAGE | | | |
| UTILITY | | | |
| OFFICE CHECK | | | |
| PLANNING COMMISSION | | | |
| GRADING | | | |

GRAND AVENUE

APPROVED: *AK Fogg* DATE: 11/19/52

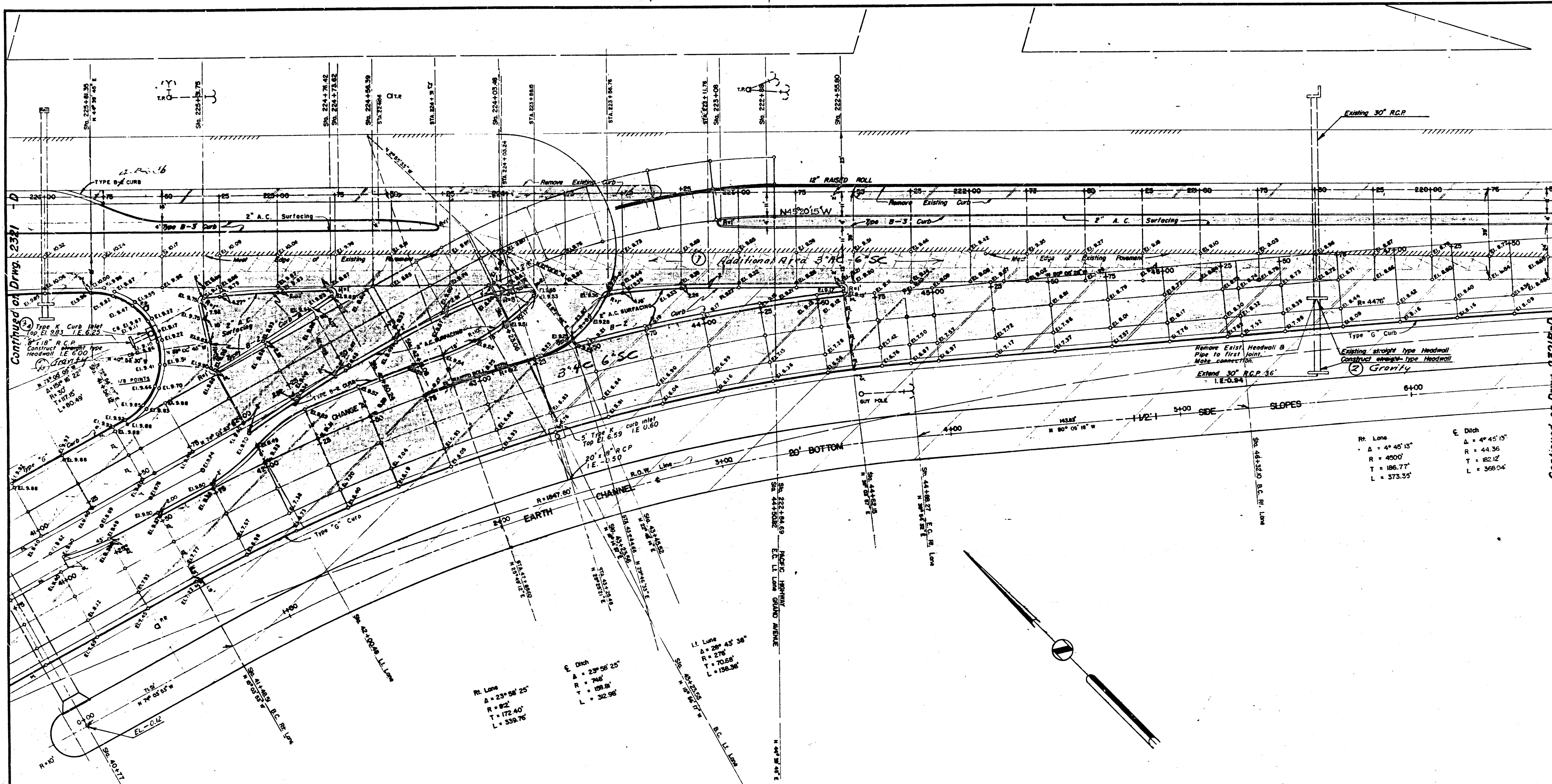
DRAWN BY: MEHRAN
CHECKED BY: SALASON
FIELD BOOK: 2782-1

MICROFILME

DRAWING NUMBER: 2321 -D

JUL 12 1963

| | | |
|--------------------------|-------------------|-----------------|
| CONSTRUCTION | RECORD | W. O. NO. 2156 |
| DESIGNED: HAROLD MAXWELL | REVISIONS: Walker | RECORD NO. 2321 |
| DATE: 2-21-55 | | |
| BY: 2-28-56 | | |



Continued on Drwg. 2321-D

Continued on Drwg. 2321B-D

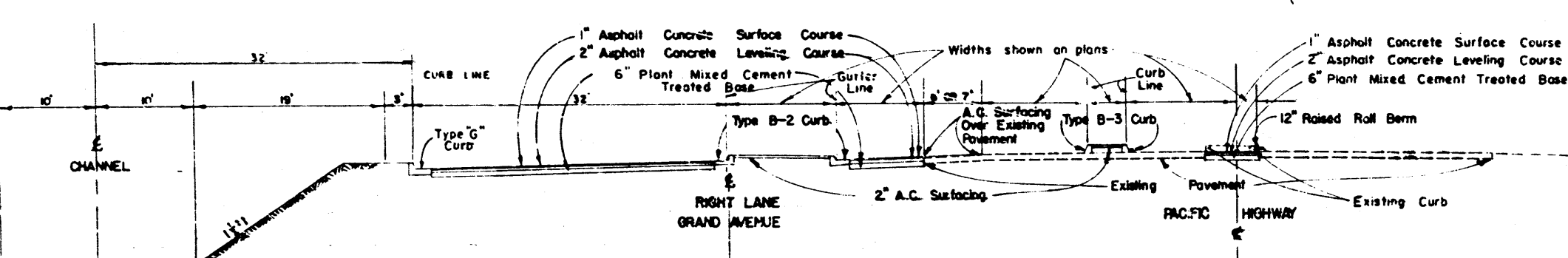
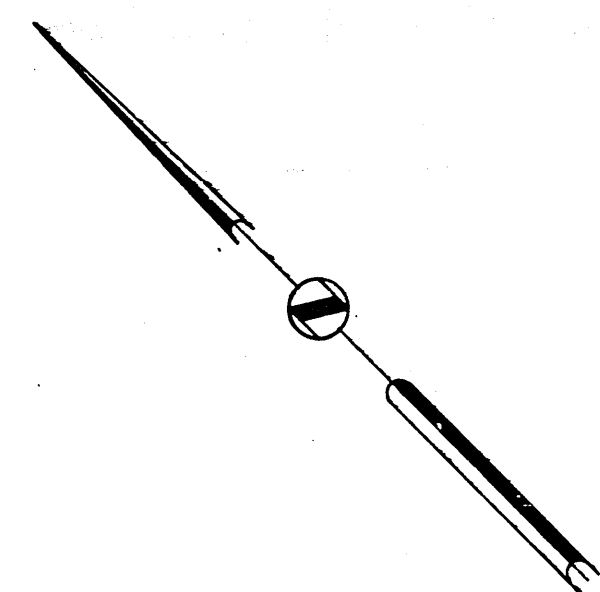
Rt. Lane
 $\Delta = 4^\circ 45' 15''$
 $R = 4500'$
 $T = 186.77'$
 $L = 373.35'$

E. Ditch
 $\Delta = 4^\circ 45' 15''$
 $R = 44.36'$
 $T = 182.12'$
 $L = 368.04'$

Rt. Lane
 $\Delta = 23^\circ 58' 25''$
 $R = 82'$
 $T = 172.40'$
 $L = 339.76'$

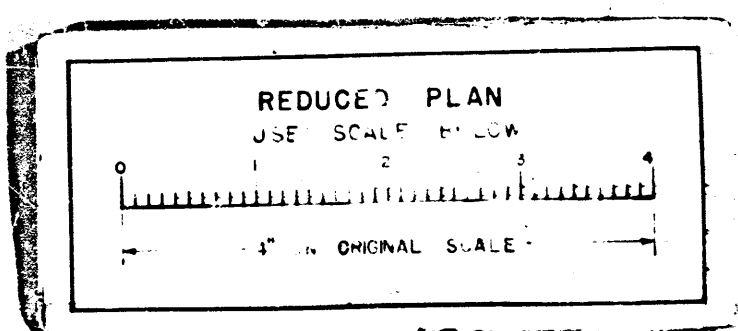
E. Ditch
 $\Delta = 23^\circ 58' 25''$
 $R = 746'$
 $T = 159.81'$
 $L = 32.96'$

Lt. Lane
 $\Delta = 29^\circ 43' 36''$
 $R = 276'$
 $T = 70.68'$
 $L = 158.36'$



TYPICAL SECTION OF GRAND AVENUE AND CHANNEL AT PACIFIC HIGHWAY

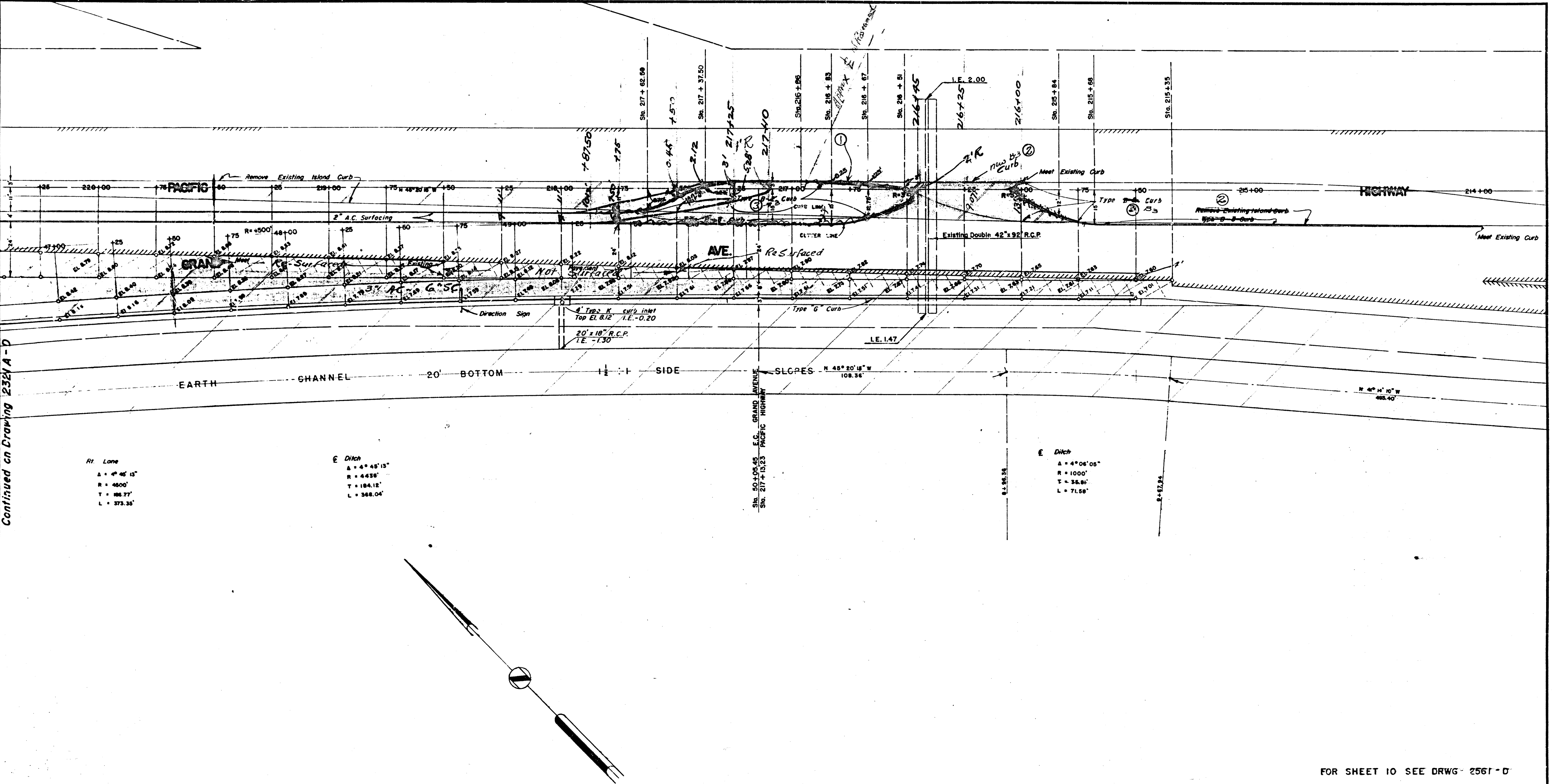
Scale 1" = 10'



| | | | | |
|--|---|---|--|--|
| WATER DEPARTMENT SEWER DEPARTMENT DRAINAGE FIELD CHECK PLANNING COMMISSION GRABER | SHEET 8 | CITY OF SAN DIEGO ENGINEERING DEPARTMENT | 16 SHEETS | |
| | GRAND AVENUE | | | |
| | APPROVED: <i>A.R. J...</i> CITY ENGINEER | DATE: 11/19/64 | SCALE: 1" = 20' | |
| | DRAWN BY: MEENAN CHECKED BY: PARSON DATE PLOTTED: 7-21-66 | COLLABORATED BY: MICROP... DRAWING NUMBER: 2321A-D | CONSTRUCTION RECORD CONTRACTOR: Hazard Maxwell DATE STARTED: 7-21-66 DATE COMPLETED: 8-5-66 | |

CHANGE A LEFT TURN LANE-GRAND AVE. TO PACIFIC HWY. 8/2/66 JKA

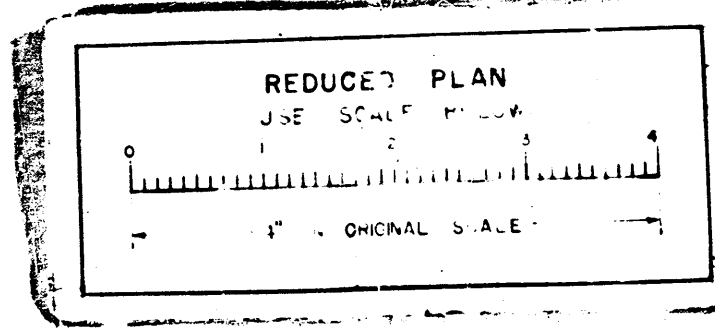
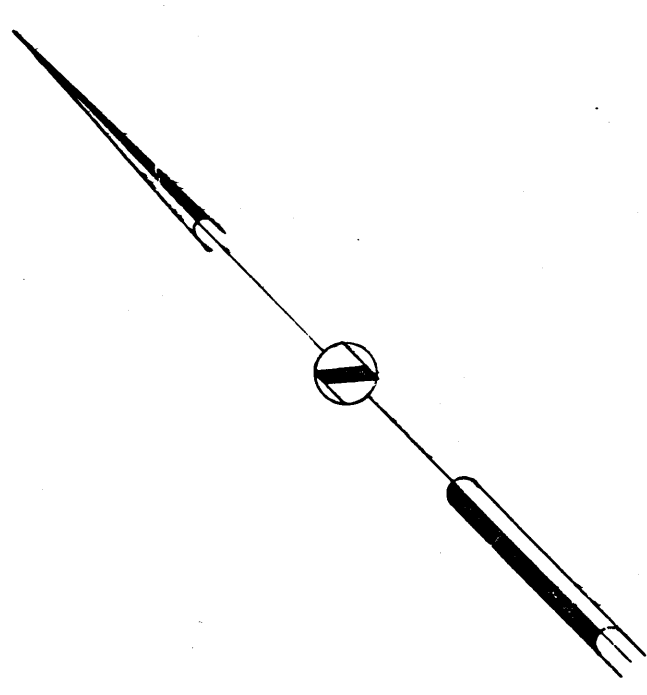
Continued on Drawing 2321 A - D



Rt. Lane
 A = 4° 45' 15"
 R = 4600'
 T = 186.77'
 L = 373.35'

E Ditch
 A = 4° 45' 15"
 R = 4436'
 T = 184.12'
 L = 368.04'

E Ditch
 A = 4° 06' 08"
 R = 1000'
 T = 36.84'
 L = 71.58'



FOR SHEET 10 SEE DRWG 2321 A - D

| | |
|---|---|
| WATER DEPARTMENT SEWER DEPARTMENT DRAINAGE FIELD CHECK OFFICE CHECK PLANNING COMMISSION SPECIAL | SHEET 9 CITY OF SAN DIEGO ENGINEERING DEPARTMENT GRAND AVENUE 16 SHEETS APPROVED: <i>OK Fogg</i> CITY MANAGER DRAWN BY: MEYMAN CHECKED BY: BAARSON FIELD BOOK: MICROFILM DATE: 11/19/64 SCALE: 1" = 40' DRAWING NUMBER: 2321B - D |
|---|---|

| | | | |
|----------------|--------|--------------|------|
| CONSTRUCTION | RECORD | W O No. 2104 | PL |
| DATE STAFFED | DATE | DATE | DATE |
| DATE COMPLETED | | | |

Appendix H
Compact Disc
PDF Version of Full Report