APPENDIX G
DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT CITY OF YUCAIPA, CA

DRAINAGE STUDY

For

Yucaipa Freeway Corridor Project
City of Yucaipa, CA

May 2007

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INTRODUCTION

The purpose of this study is to define the onsite and offsite drainage requirements to support development of the Freeway Corridor project in the City of Yucaipa. This document is intended to support the Specific Plan for the project being prepared and submitted to the City of Yucaipa under separate cover.

The Yucaipa Freeway Corridor project consists of approximately 1,234 acres located along the IH-10 corridor within the City of Yucaipa in San Bernardino County, California. It is bounded on the south by the San Bernardino/Riverside County line, on the west by IH-10 and an extension of 8th Street, on the east by city limits, and on the north by Colorado Street and Clenaga Drive (Exhibit 1). The IH-10 freeway bisects the site from west to east.

Current land use of the property is characteristic of a small rural town with some areas being relatively highly developed with residential, commercial and civic utility and other areas being open space. Impervious cover in the area is low to moderate.

The City of Yucaipa adopted a Master Plan for Drainage (MPD, November 1993) that identified the drainage improvements throughout the city necessary to confine the 100-year flood flows within the channel banks, including the area encompassing the project site. These improvements included channel enlargements and storm water detention areas necessary to mitigate flood prone areas and minimize erosion. The approach to this study is to determine whether the proposed land uses anticipated in the Yucaipa Freeway Corridor project are compliant with those anticipated in the MDP and, if not, identify the necessary modifications to the MDP to accommodate the development as proposed. It is noted that the MDP has been approved by the San Bernardino County Flood Control District for full conveyance only. It does not however include an approved detention basin alternative or bulking factor.

Existing Drainage Conditions

The Yucaipa watershed, located in San Bernardino County, California, encompasses approximately 40 square miles and drains into Live Oak Canyon. Six major drainageways service the watershed: Gateway Wash, Wilson Creek, Oak Glen Wash, Chicken Springs Wash, Yucaipa Creek and Wildwood Creek. Of the six drainage ways, three directly affect the project area: Yucaipa Creek, Wildwood Creek and Wilson Creek. The confluence with Live Oak Creek is immediately downstream of the site (Exhibit 2).

According to Flood Insurance Rate Map (FIRM) panel 06071C8740 F, dated March 18, 1996 (Exhibit 3), large portions of the project area are flood prone and influenced by the 100-year floodplain.

Topography of the watershed ranges from 1,900 feet in the lower elevation to above 8,700 feet in the mountains. The climate is typical of a desert with summer temperatures ranging above 100 degrees Fahrenheit. Annual rainfall ranges from 10 to 25 inches between the alluvial valley and the mountain ridges. Precipitation is seasonal, with the majority of rainfall occurring in the first quarter of the calendar year.

The San Bernardino County Hydrology Manual (1986) provides reference to rainfall isopluvials for storm frequencies ranging from 2- through 100-year probability events. Information on the 6- and 24-hour precipitation values for the Yucaipa area are summarized in the following table.

TABLE 1 – Precipitation in San Bernardino County

Rainfall Frequency	6 Hour Precipitation (inches)	24 Hour Precipitation (inches)
2 – Year	1.7	3.2
100 – Year	3.7	8.0

The existing drainage channels are subject to high velocities during flood flow events. Not only are the channels inadequate to convey the flow, as witnessed by the expansive floodplains in the area, they are also highly erodible as is evidenced by sections of the channels having steep, nearly vertical, channel banks. According to the MPD the 100-year storm flows in the vicinity of the project on the drainage channels affecting the site are calculated to be as follows:

TABLE 2 – Design Flows for Major Drainage Channels in MPD

Drainage Channel	100-year Flow in cubic feet per second (cfs)*	Velocity in feet per second (fps)*
Wilson Creek	12,164 – 12,626	11.3
Yucaipa Creek	2,510	5.9
Wildwood Creek	4,624 – 6,757	7.6 – 8.9

*Flow rates and velocities are based on clear water conditions.

Appendix A provides pertinent exhibits from the MDP (1993 Boyle Engineering Corporation) for the above channels. The exhibits contain information on the proposed channel size and location of flow changes.

Summary of 1993 Master Plan for Drainage

Since the MPD is the primary document that characterizes the flooding problems in the area, as well as making recommendations on the necessary improvements, it is appropriate to summarize the findings of that study as part of this report.

The study was performed by Boyle Engineering using the comprehensive Storm Drain Plan No.5 prepared by the San Bernardino Flood Control District in 1979, as referenced. The watershed boundary was approximated using USGS quadrangle map sheets to be approximately 40 square miles. Land uses were obtained from the City of Yucaipa General Plan and soils approximated using the NRCS soil survey information.

The analysis was performed in accordance with the County of San Bernardino hydrology criteria and included both the Rational and Unit Hydrograph Methods for determining design flow hydrographs. The 100-year storm event was used as the design criteria. A combination of soil types and land uses were used to determine rainfall losses and impervious covers. The land uses and impervious covers used in this modeling are summarized in the following table.

TABLE 3 – Impervious Factors for Land Use Types in City of Yucaipa (From 1993 MPD)

Land Use	Symbol	Impervious Factor (Rational Method)
Commercial Neighborhood	CN	90
General	CG	90
Service	CS	90
Community Industrial	IC	90
Institutional	IN	40
Planned Development	PD	20 – 50
Rural Living	RL	0 – 20
Single Residential	RS	30 – 50
Multiple Residential	RM	65 – 80
Natural		0

The report examined two major alternatives for flood conveyance. The first included concrete lining of all channels. The second included a combination of armoring channel sections and implementing four regional flood retarding (or storm water detention) basins. The second alternative was recommended. In addition to flood conveyance capacity, the 1993 report specifically highlighted certain channel reaches that are highly subject to erosion.

The report distinguishes between local, secondary and regional facilities based on the peak 100-year or peak 25-year runoff rate anticipated. Regional facilities are associated with Q_{100} > 750 cfs. Secondary systems are those designated to convey Q_{25} > 300 cfs. Local systems are designed for Q_{25} > 200 cfs or the street capacity is exceeded.

Proposed Drainage Improvements

The MPD identifies the conceptual solution for mitigating the flood risk areas associated with the major drainageways of Yucaipa Creek, Wilson Creek, Oak Glen Wash, Gateway Wash, Chicken Springs Wash and Wildwood Creek as they affect the entire City of Yucaipa, including the Freeway Corridor project area. These conceptual requirements depict the structural channel requirements and right of way requirements, without specifically depicting the alignment of the channel itself. The definition of these final alignments will be determined on the basis of more detailed investigations required during the engineering phases of the project. The channel configurations were in part determined by the eroded conditions of the channel segments and the erosive potential exhibited by the soils. Two options were considered in the report, one of which assumed concrete lining of all channel sections. The second option assumes a channel system of riprap side slopes and bottom sections combined with velocity retarding structures at 500 foot intervals. This second option also presumes the construction of regional storm water detention facilities on Wilson Creek and Wildwood Creek upstream of the Yucaipa Corridor project site.

Wilson Creek

Wilson Creek is one of the two major tributaries conveying water within the City of Yucaipa. Its lower reaches, from 13th Street to the westerly limits of the city, is anticipated to be modified to a trapezoidal earthen channel section with riprap channel banks ranging between 1.5:1 to 2.5:1 side slopes. The length of this improvement is approximately 5,315 feet. In an effort to minimize erosion, three drop structures are proposed to allow the channel to be constructed at a moderate slope of 1 percent. Grade control dams will be located at 500 foot intervals for velocity and erosion control. Required rights of way for this reach of the channel will be approximately 160 feet downstream of Dunlap Blvd., and 115 feet for a distance of 1900 feet upstream of Dunlap Blvd. as proposed in the MDP. Two storm water detention basins are also proposed in the Wilson Creek watershed upstream of the project site. One, with a storage capacity of 103 acre-feet, is proposed upstream near the east side of Second Street. The second, with a capacity of 231 acre-feet, is proposed on the Oak Glen Wash tributary on the east side of Second Street, as a means of controlling peak runoff rates downstream at the confluence Live Oak Creek.

Wildwood Creek

Wildwood Creek is the second major drainageway crossing the project site. Some 12,000 feet of Wildwood Creek are within the project area. It is also anticipated to be constructed as a riprap lined channel section with 2.5:1 side slopes and will require grade control structures at 500 foot intervals as a method of velocity control. A channel slope of 1 percent is anticipated, requiring construction of several drop structures along this reach. Right of way requirements ranging between 120 feet and 132 feet will be necessary as proposed in the MDP. One storm water detention basin is proposed east of Holmes Street with a capacity of 71 acre-feet of storage.

Yucaipa Creek

Only a small reach of Yucaipa Creek is within the project area. Approximately 1,000 feet of channel are proposed as a riprap lined section similar to Wildwood Creek. A right of way of 102 feet is proposed in the MDP for this reach.

Analysis Approach

Since the City of Yucaipa has adopted the MPD for sizing its primary drainage infrastructure, this report serves to determine if the development pattern proposed by the specific plan for the Yucaipa Freeway Corridor project is compliant with the anticipated peak runoff rates anticipated by the MPD. This was done by the following procedure:

- Determine percent of each land use within MPD defined sub-watersheds for both the MPD assumed developed condition and the Freeway Corridor proposed condition.

- Determine the composite percent impervious for each localized sub-watershed.

- Compare the composite percent impervious between the MPD report and the proposed land use in the Freeway Corridor project to determine if there is an adverse impact associated with the proposed land use.

- Recommend methods for mitigating the increase in runoff for those areas where runoff potential may be increased, including approximate sizing of storm water detention facilities.

Analysis Findings

The Project Site is located partially or wholly within 11 drainage sub-watersheds as defined by the MPD modeling effort. North of IH-10 the Project Site is located in drainage sub-watersheds numbered 45, 54, 63, 64 and 80. South of IH-10 the Project Site is located within drainage sub-watersheds 55, 82, 83, 84, 85 and 86. Exhibit 4 shows the boundaries of the drainage sub-watersheds masked against the City of Yucaipa land use types.

By comparison, Exhibit 5 compares the land uses of the proposed Yucaipa Freeway Corridor (as designated in exhibit 3.3.1 in the Master Plan) against these same drainage sub-watersheds.

Using the acreage of each land use type and the associated impervious cover ratio within each drainage boundary allows a comparison between the potential peak runoff for both the MPD and the Yucaipa Freeway Corridor master plan. This comparison is valid as potential runoff is related directly to the percent of impervious cover for various land uses, time of concentration and soil type. Soil types are identical for both the MPD and Freeway Corridor project and the effect development has on the time of concentrations between the two plans at a planning level will be nearly identical. This leaves only the percent impervious cover as the key component in comparing the estimated peak runoff rate of the MPD and Corridor project.

Table 4 (Attachment A) compares the impervious cover ratio for each of the drainage sub-watersheds. It can be seen that the impervious cover ratio for the proposed Yucaipa Freeway Corridor project is equal to, and in many case much less than, that proposed in the Yucaipa MPD for all sub-watersheds with the exception of sub-watershed 80. The increase in impervious cover for sub-watershed 80 is approximately 0.1-percent and can be considered negligible. The reduction in impervious cover proposed by the Freeway Corridor project for the majority of sub-watersheds is due to a larger percent of the sub-watershed remaining as open space in comparison to the MPD. The MPD assumed the majority of the sub-watershed is to be fully developed. With the percent impervious cover being equal to or less than those assumed in the MPD analysis it can be assumed the peak runoff rate generated by the proposed Freeway Corridor project will be equal to or less than that of the MPD.

It can also be assumed, therefore, that the improvements proposed by the Yucaipa MPD are adequate for development of the project. At the same time, it must be assumed that the improvements proposed are in fact constructed. Since the Freeway Corridor project is at the downstream end of the channel reaches on Yucaipa, Wilson and Wildwood Creeks, it is not mandatory that the upstream improvements also be constructed. However, since both Wilson Creek and Wildwood Creek improvements are dependent on the flood attenuation created by the three upstream storm water detention basins it will necessitate that these improvements also be in place.

The MPD identifies the improvements necessary on the major drainageways. As part of the Freeway Corridor project, a number of minor drainageways will also be constructed. To the extent that road sections follow the natural topography, many of these will result in storm drains in street rights of way. When street patterns diverge from the natural topographic contours, the minor drainage paths are expected to be constructed as open channel sections with riprap side slope in a manner similar to those of Wildwood and Wilson Creeks. Nominal right of way widths associated with these channels should be approximately 70 to 80 feet to accommodate the depth of the storm drains entering the channel.

The Master Plan for Drainage includes discussion about a computer model to evaluate the effect of land development on sediment transport. Three channels were studied, including Gateway Creek, Oak Glen Creek, and Wilson Creek. The goal of the study was to compare the total

sediment transport in present state with a future developed state. The study also considered a selection of new channel parameters, specifically variation in slope and/or friction in the channel, to indicate how to improve the channel to control changes in sedimentation due to development.

The study found that the effect of development would approximately double the total sediment transport at all return frequencies. Changes made to the slope and/or friction in the channels was shown to mitigate the effects of development. Changes in the slope and/or friction, as well as the channel geometry allowed mitigation for not only the mean sediment transported, but also the probability distribution of the total sediment discharge. The two channel options presented, concrete lining, and armored riprap with velocity control structures, were anticipated to address the erosion problems.

Conclusions and Recommendations

Based on the comparison of the overall impervious characteristics proposed by the Yucaipa Freeway Corridor project versus those anticipated in the planning of the Master Plan for Drainage, the corridor project can be constructed without adversely impacting the recommendations made in the 1993 plan.

The recommended improvements to the major drainageways can be summarized by the following characteristics presented in Table 5:

Table 5 – Recommended Improvements

Waterway	From	To	Bottom Width (ft)	Depth (ft)	Capacity [2] (cfs)	ROW Width (ft)
Yucaipa Creek [1]	9th Street	IH-10	24	11.5	2,510	102
Wildwood Creek [1]	Yucaipa Creek	Wilson Creek	32	16	6,757	132
Wildwood Creek [1]	IH-10	Yucaipa Creek	30	14-15	4,793-5,585	120-125
Wilson Creek [1]	13th Street	Dunlap Blvd.	38	19	12164-12,576	115
Wilson Creek [1]	Dunlap Blvd.	Wildwood Creek	40	20	12,582-12,626	160

[1] Assumes a slope of 1%.

[2] Channel capacity based on depth equal to normal flow depth times 1.5 plus freeboard. Freeboard is 2.5 feet for mean channel velocities less than 35 ft./sec and 3.5 feet for mean channel velocities greater than 35 ft./sec

Under existing conditions the project area is flood prone and the recommendations made in the 1993 plan will need to be constructed in order for the project area to be developed. Because the project site is at the downstream end of the channel improvements proposed, it is not necessary to construct the improvements upstream. However, it will be necessary to construct the three storm water detention basins on Wilson Creek and Wildwood Creek as discussed above. These basins serve to attenuate peak runoff rates which result in the channel sections proposed in the study. Consultation and approval with San Bernardino County Flood Control is required prior to any improvements to Wilson and Wildwood Creeks.

Attachment A

TABLE 4 - Comparison of Impervious Cover for 1993 Yucaipa MPD and Freeway Corridor Project

MASTER PLAN WATERSHED 45

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
CS	26.78	90	24.10
FW	8.34	40	3.33
FWY	5.38	40	2.15
IC	0.03	90	0.02
PD	45.75	40	18.30
RL1	10.49	20	2.10
RL-25	44.18	10	4.42
RL-25-AP	17.68	10	1.77
RS-10m	1.96	40	0.78
RS-20m	23.90	70	16.73
	184.49		73.71
Composite Impervious %		39.96%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
OS	30.09	0	0.00
CS	26.78	90	24.10
FW	8.34	40	3.33
FWY	5.38	40	2.15
IC	0.03	90	0.02
PD	0.00	40	0.00
RC	16	90	14.10
RL1	10.49	20	2.10
RL-25	44.18	10	4.42
RL-25-AP	17.68	10	1.77
RS-10m	1.96	40	0.78
RS-20m	23.90	70	16.73
	184.49		69.51
Composite Impervious %		37.68%	

MASTER PLAN WATERSHED 54

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
CS	34.69	90	31.22
FW	2.34	40	0.94
FWY	5.82	40	2.33
IC	20.30	90	18.27
IN	2.02	60	1.21
RS-20M	4.92	70	3.45
	70.08		57.41
Composite Impervious %		81.91%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
CS	32.66	90	29.39
CC	2.03	90	1.83
FW	2	40	0.94
FWY	5.82	40	2.33
IC	20.30	90	18.27
IN	2.02	60	1.21
RS-20M	4.92	70	3.45
	70.08		57.41
Composite Impervious %		81.91%	

MASTER PLAN WATERSHED 55

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
CS	11.01	90	9.91
FWY	22.85	40	9.14
PD	164.96	40	65.98
RS-10m	4.20	40	1.68
UNCLASSIFIED	93.74	0	0.00
	296.76		86.72
Composite Impervious %		29.22%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
CS	11.01	90	9.91
FWY	22.85	40	9.14
PD	18.16	40	7.26
Revised LP	146.80	24.91	36.57
RS-10m	4.20	40	1.68
UNCLASSIFIED	93.74	0	0.00
	296.76		64.56
Composite Impervious %		21.76%	

MASTER PLAN WATERSHED 64

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
CG	1.63	90	1.47
FWY	17.53	40	7.01
IC	1.97	90	1.78
PD	134.24	40	53.69
RS-10M	0.54	40	0.22
RS-20M	54.07	70	37.85
RS-72c	14.92	80	11.93
	224.90		113.95
Composite Impervious %		50.67%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
BP	6.04	70	4.23
CC	7.08	90	6.37
FWY	17.53	40	7.01
IC	2.32	90	2.09
OS	53.64	0	0.00
R-2	22.63	10	2.26
RC	39.81	90	35.83
ROW	6.37	40	2.55
RS-20M	54.07	70	37.85
RS-72C	14.92	80	11.94
	224.41		110.1281
Composite Impervious %		49.07%	

MASTER PLAN WATERSHED 82

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
FWY	28.87	40	11.55
IC	0.77	90	0.70
PD	203.01	40	81.21
RM-10M	13.15	65	8.55
UNCLASSIFIED	23.15	0	0.00
	268.95		101.99
Composite Impervious %		37.92%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
BP	8.04	70	5.63
FWY	28.87	40	11.55
OS	88.49	0	0.00
R-2	5.70	10	0.57
R-4	87.63	20	17.53
RC	20.88	90	18.79
RC_OS	8.16	60	4.89
UNCLASSIFIED	21.19	0	0.00
	268.96		58.96
Composite Impervious %		21.92%	

MASTER PLAN WATERSHED 83

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
FWY	12.40	40	4.96
PD	272.71	40	109.08
UNCLASSIFIED	65.55	0	0.00
	350.66		114.04
Composite Impervious %		32.52%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
BP	3.68	70	2.58
FWY	12.40	40	4.96
OS	165.94	0	0.00
PF	15.70	15	2.36
R-4	67.31	20	13.46
R-8	15.61	40	6.24
ROW	3.48	90	3.13
UNCLASSIFIED	65.55	0	0.00
	349.68		32.73
Composite Impervious %		9.36%	

TABLE 4 - Comparison of Impervious Cover for 1993 Yucaipa MPD and Freeway Corridor Project

MASTER PLAN WATERSHED 84

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
CS	0.01	90	0.01
FWY	18.20	40	7.28
PD	197.32	51.7	102.01
	215.53		109.30
Composite Impervious %		50.71%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
CC	10.04	60	6.02
FWY	18.20	40	7.28
OS	86.93	0	0.00
R-4	25.85	20	5.17
R-8	24.27	40	9.71
RC	50.01	90	45.01
	215.29		73.19
Composite Impervious %		34.00%	

MASTER PLAN WATERSHED 85

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
PD	147.77	40	59.11
UNCLASSIFIED	382	0	0.00
	529.58		59.11
Composite Impervious %		11.16%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
OS	86.94	0	0.00
PF	44.22	15	6.63
R-2	11.91	20	2.38
R-8	1.07	40	0.43
UNCLASSIFIED	382	0	0.00
	526.14		9.44
Composite Impervious %		1.79%	

MASTER PLAN WATERSHED 63

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
PD	5.25	40	2.10
RM-72c	68.42	80	54.74
RS-10m	2.57	40	1.03
RS-20m	97.56	70	68.29
RS-72c	44.34	80	35.47
	218.13		161.63
Composite Impervious %		74.09%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
PD	5.25	40	2.10
BP	8.10	70	5.67
OS	1.12	0	0.00
RM-72c	68.42	80	54.74
RS-10m	2.57	40	1.03
RS-20m	88.33	70	61.83
RS-72c	44.34	80	35.47
	218.13		160.84
Composite Impervious %		73.74%	

MASTER PLAN WATERSHED 80

EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
FW	3.64	40	1.45
IC	28.42	90	25.57
IN	4.04	60	2.43
PD	1.06	40	0.42
RL-25	35.48	10	3.55
RS-10m	60.26	40	24.10
RS-20m	16.85	70	11.80
RS-72c	3.12	80	2.49
	152.86		71.82
Composite Impervious %		46.98%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
BP	0.55	70	0.40
FW	3.64	40	1.45
IC	28.42	90	25.57
IN	4.04	60	2.43
OS	0.03	0	0.00
PD	0.48	40	0.19
RL-25	35.48	10	3.55
RS-10m	60.26	40	24.10
RS-20m	16.85	70	11.80
RS-72c	3.12	80	2.49
	152.86		71.99
Composite Impervious %		47.10%	

MASTER PLAN WATERSHED 86

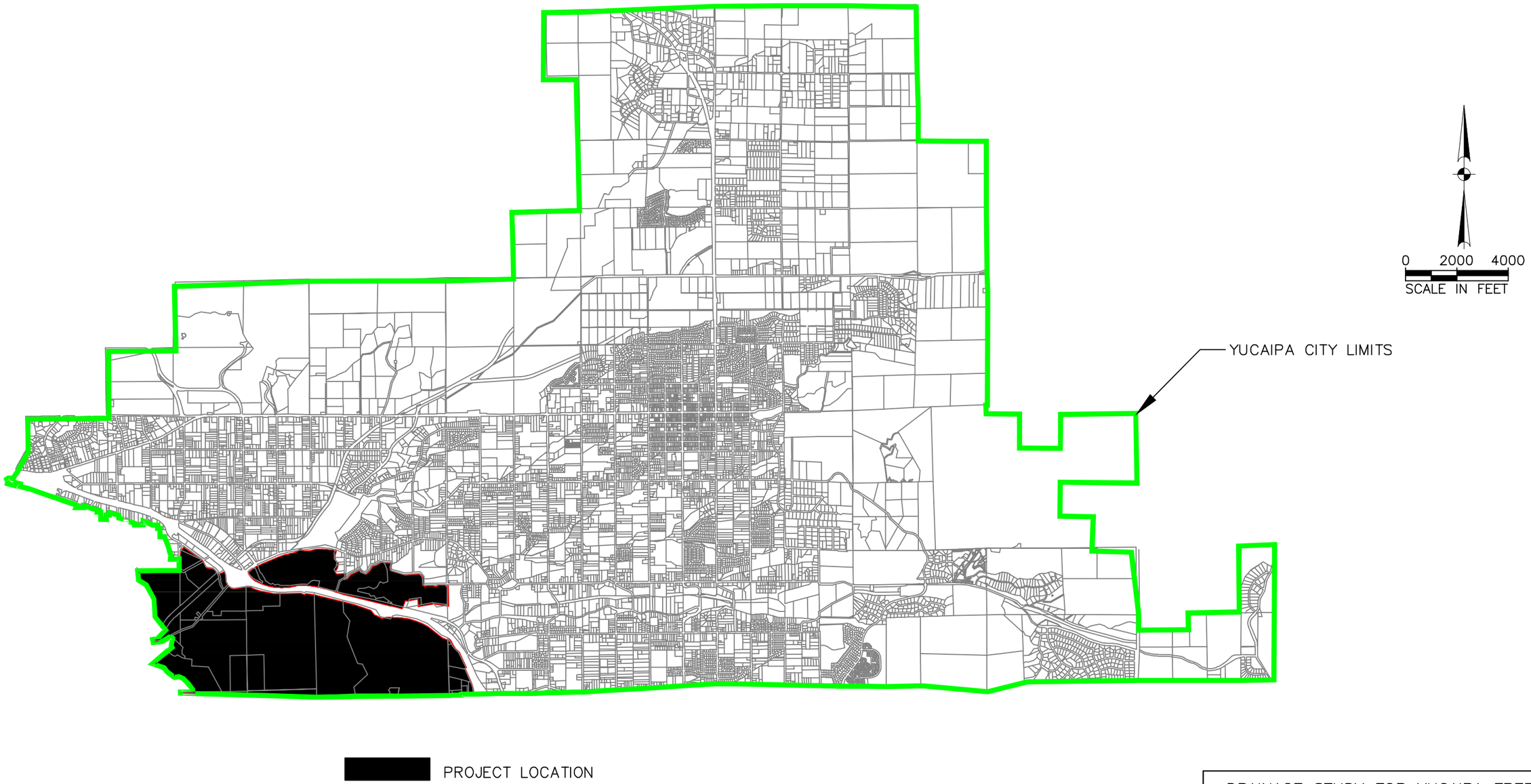
EXISTING MASTER PLAN FOR DRAINAGE LAND USE

	AC	%IMP	IMP AC
PD	48.51	40	19.41
UNCLASSIFIED	12.96	0	0.00
	61.48		19.41
Composite Impervious %		31.57%	

REVISED LAND PLAN

	AC	%IMP	IMP AC
OS	26.00	0	0.00
R-1	15.04	10	1.50
R-2	10.00	20	2.00
R-4	10.45	40	4.18
	61.49		7.68
Composite Impervious %		12.50%	

Exhibits



DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT

CITY OF YUCAIPA REFERENCE MAP

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5757 WOODWAY, SUITE 101 WEST
HOUSTON, TEXAS 77057–1599
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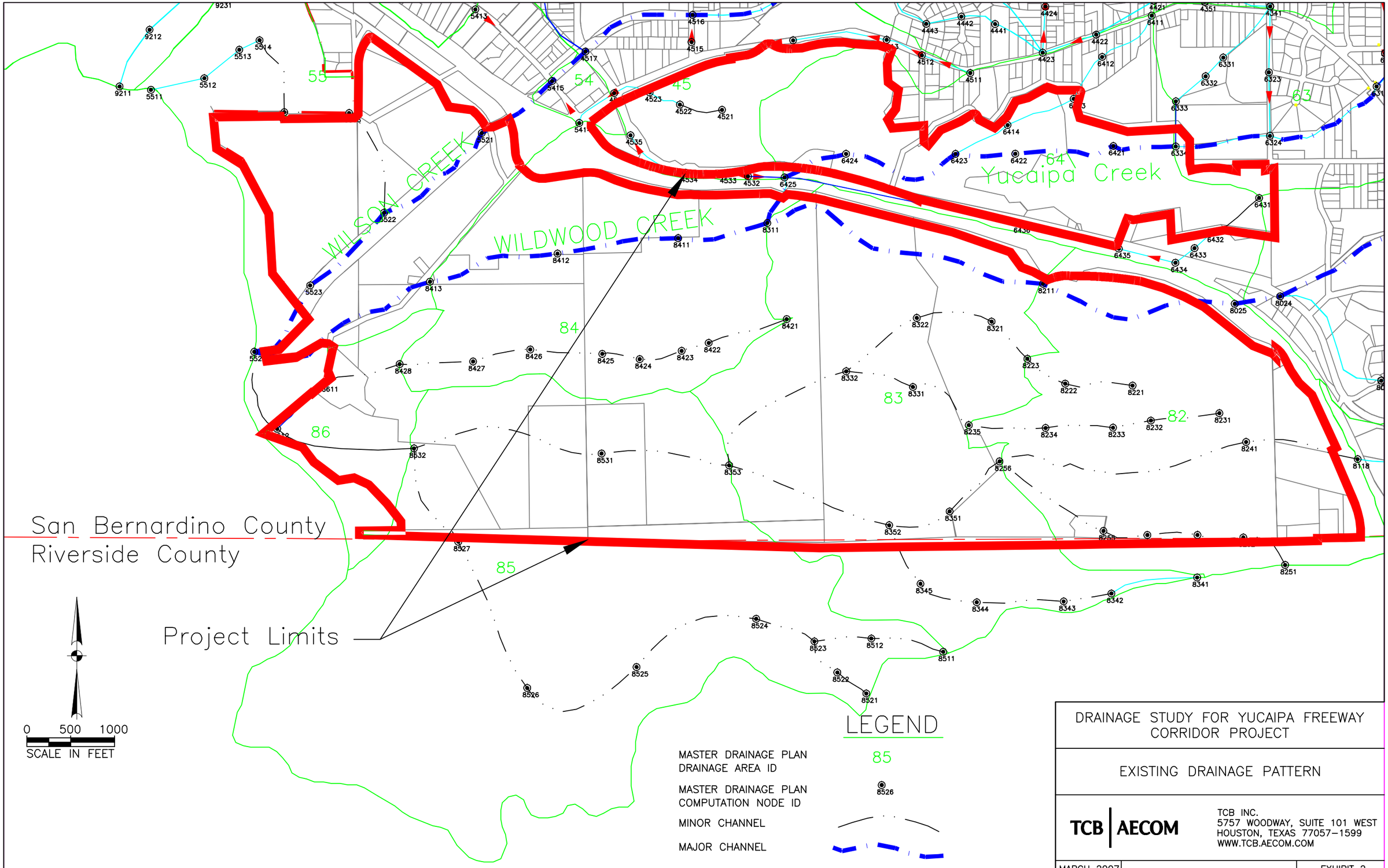
MARCH 2007 | EXHIBIT 1



DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT

EXISTING DRAINAGE PATTERN

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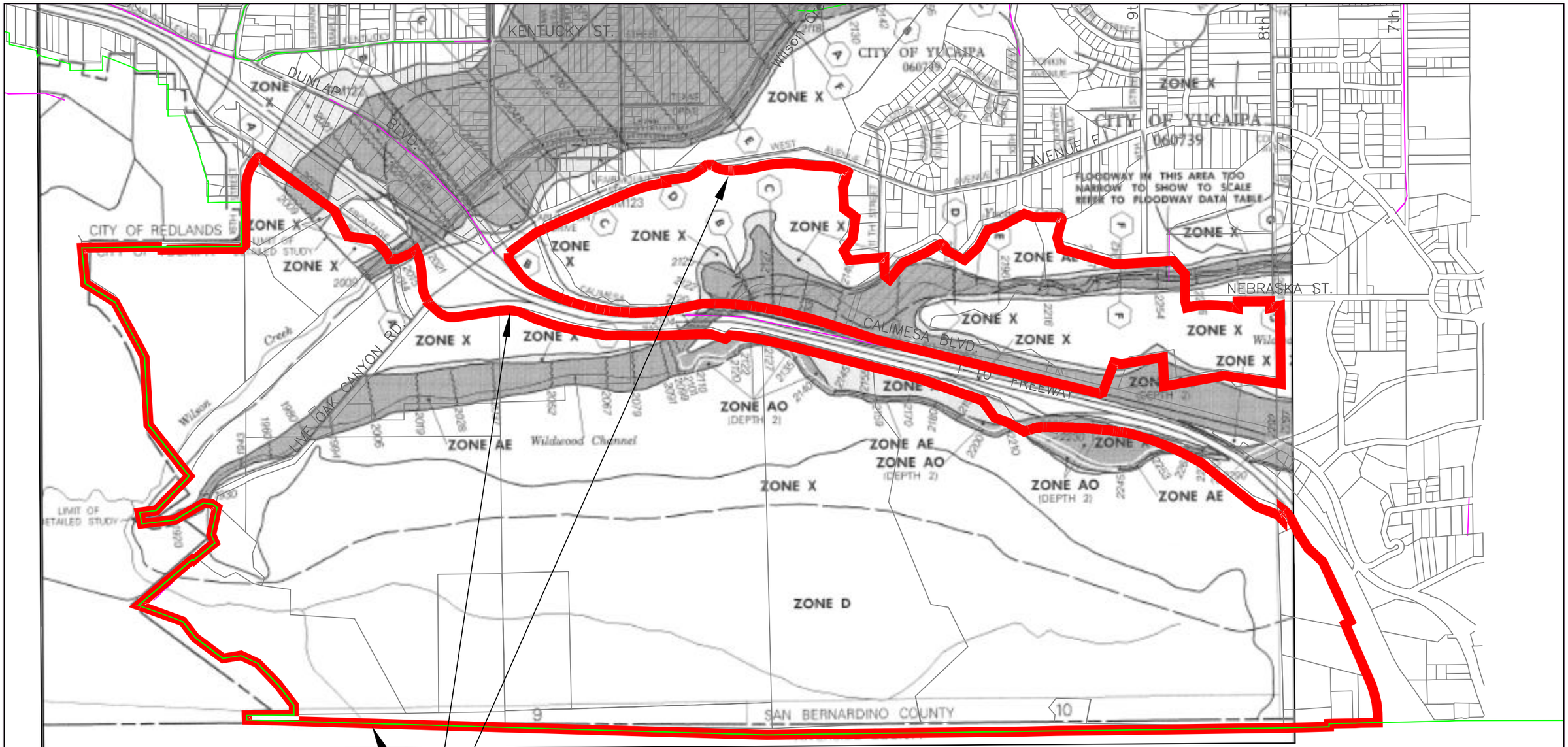
WWW.TCB.AECOM.COM

MARCH 2007 | EXHIBIT 2



PROJECT LOCATION

0 500 1000
SCALE IN FEET

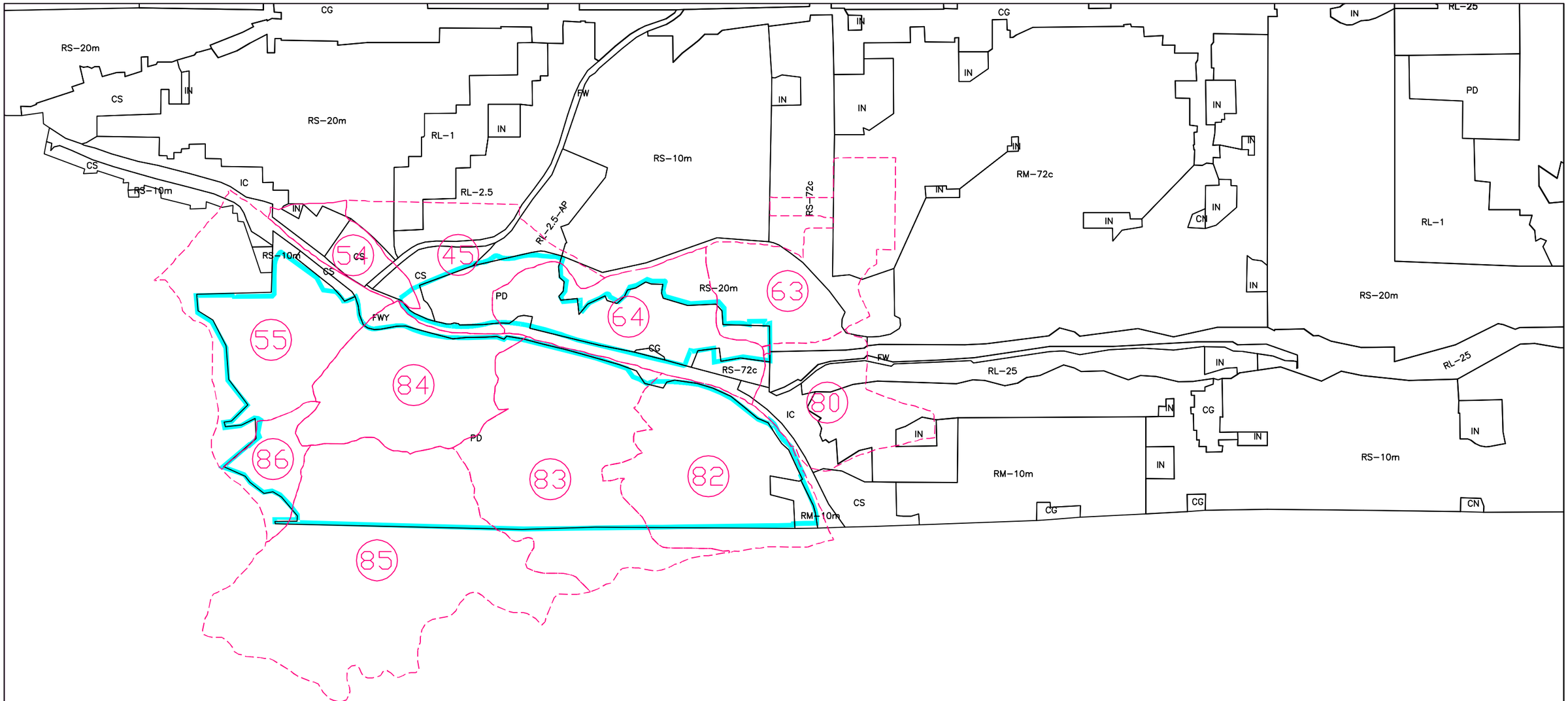
DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT

EXCERPT FROM FLOOD INSTURANCE RATE PANEL 06071C8740F

TCB | AECOM

TCB INC.
5757 WOODWAY, SUITE 101 WEST
HOUSTON, TEXAS 77057-1599
WWW.TCB.AECOM.COM

MARCH 2007 | EXHIBIT 3



LEGEND

85 — CITY OF YUCAIPA MASTER PLAN DRAINAGE SUBSHED

IN — CITY OF YUCAIPA MASTER PLAN DRAINAGE LAND USE DESIGNATION

PROJECT LIMITS

N

0 1000 2000

SCALE IN FEET

DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT

DRAINAGE SUBSHED AND CITY OF YUCAIPA MASTER PLAN DRAINAGE LAND USE

TCB | AECOM

TCB INC.
5757 WOODWAY, SUITE 101 WEST
HOUSTON, TEXAS 77057-1599
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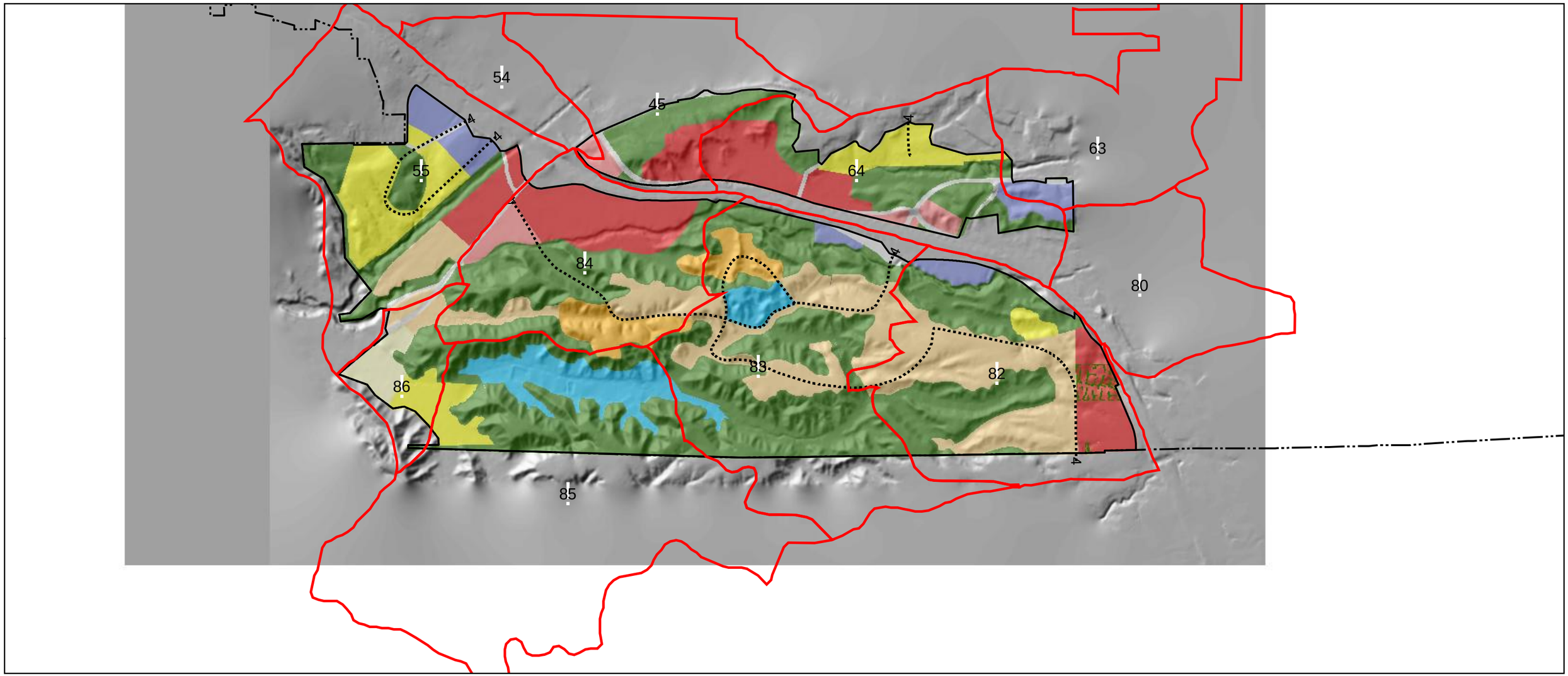
MARCH 2007 | EXHIBIT 4



Legend

- Specific Plan Area
- City Boundary
- County Boundary

Land Use Designations

- R-1 Residential (1 du/ac)
- R-2 Residential (2 du/ac)
- R-4 Residential (4 du/ac)
- R-8 Residential (8 du/ac)
- R-16 Residential (16 du/ac)
- BP Business Park
- RC Regional Commercial
- Hatched Areas with Open Space Deficit
- CC Community Commerical
- PF Public Facilities
- OS Open Space
- 4 Collector Street
- 85 City of Yucaipa Master Plan Drainage Subshed

LAST UPDATED: May 26, 2006.
SOURCE: City of Yucaipa, GIS 2005.

NORTH 0 1,100 2,200 3,300 4,400 Feet

DRAINAGE STUDY FOR YUCAIPA FREEWAY CORRIDOR PROJECT

DRAINAGE SUBSHED AND CITY OF YUCAIPA FREEWAY CORRIDOR LAND USE

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TCB INC.
5757 WOODWAY, SUITE 101 WEST
HOUSTON, TEXAS 77057-1599
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MARCH 2007 | EXHIBIT 5

Appendix

City of Yucaipa

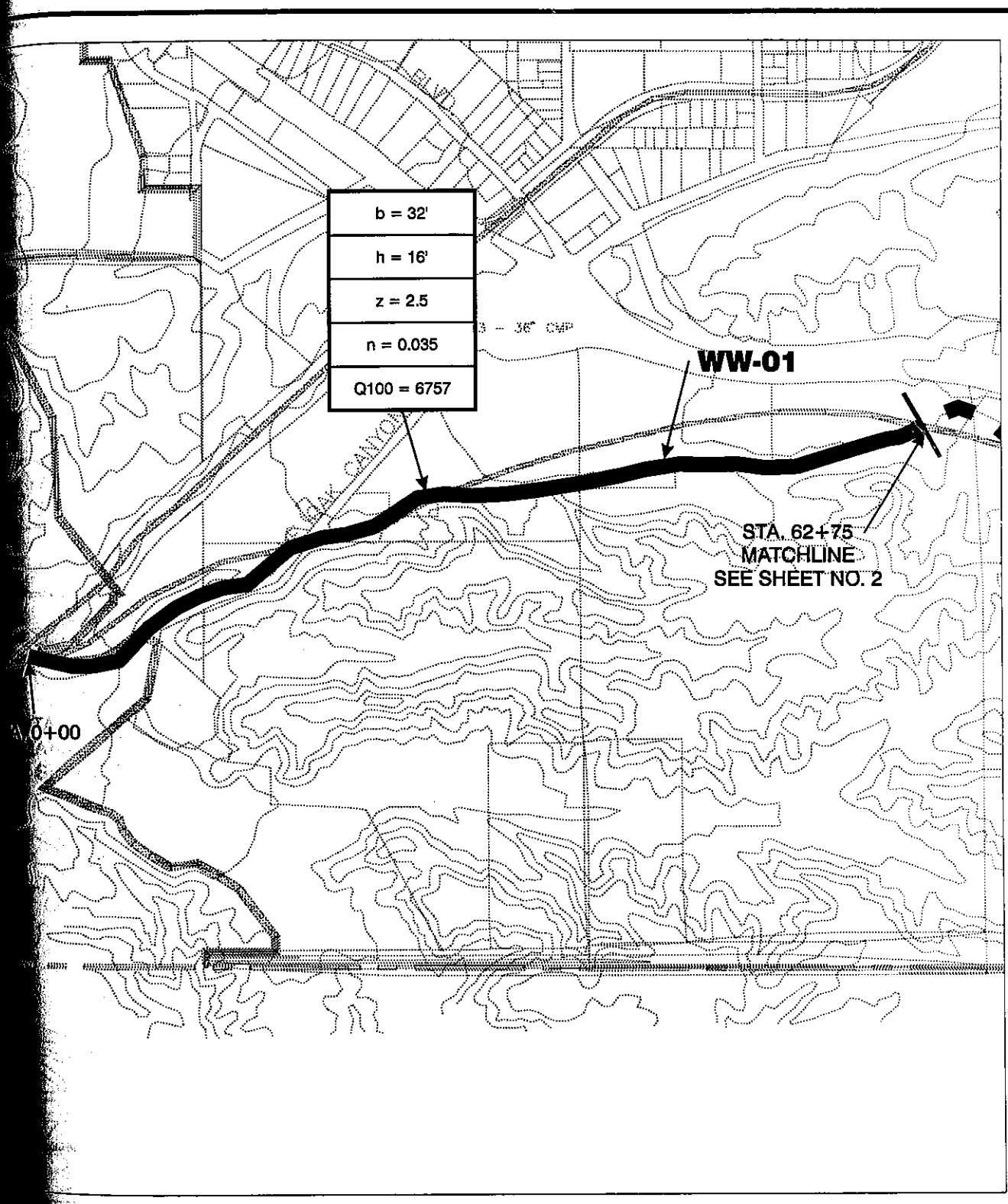
Master Plan of Drainage

November 1993

FINAL REPORT

PREPARED BY

BOYLE ENGINEERING CORPORATION
consulting engineers | architects



PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

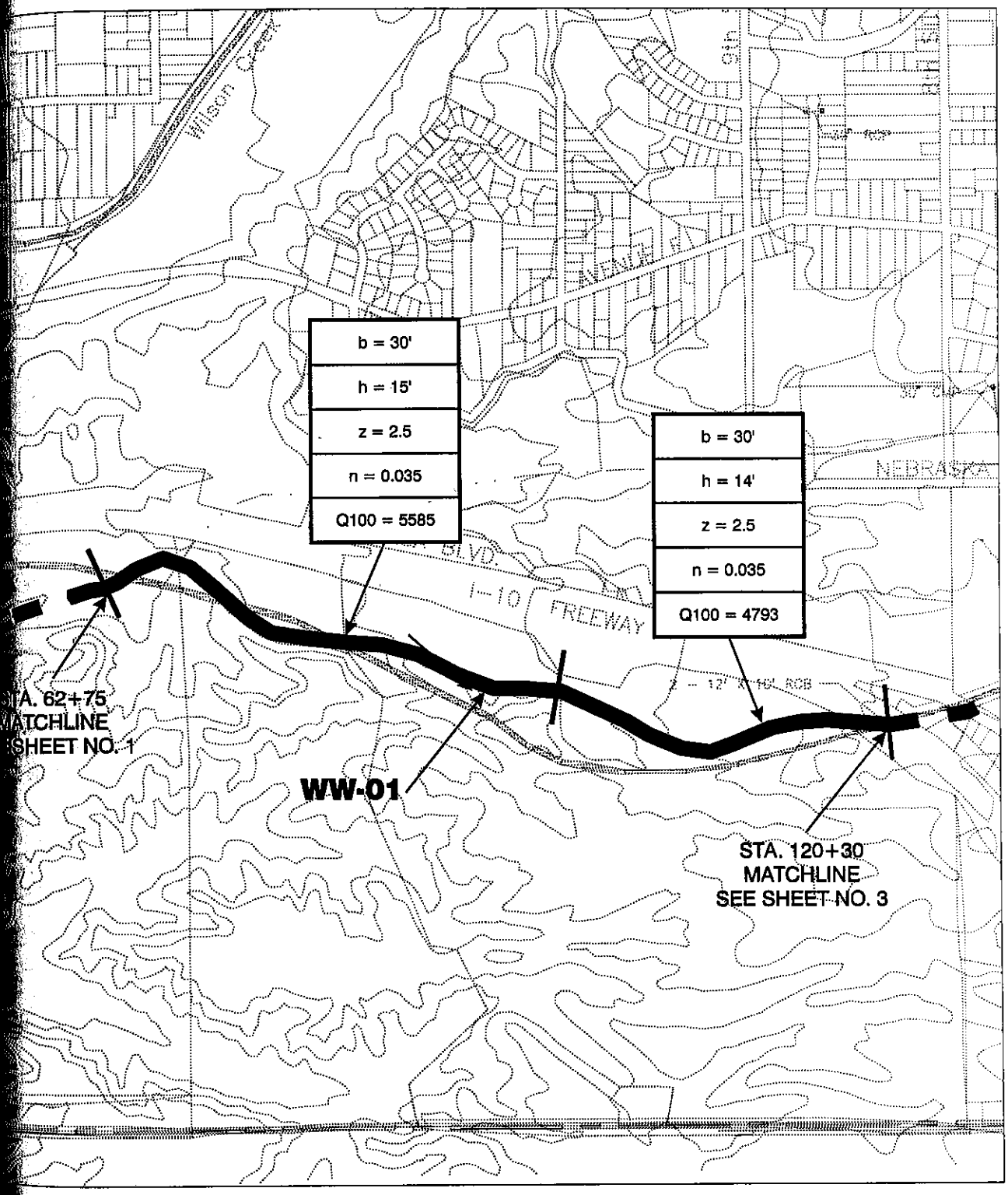
RPLAN
NAGE

CITY OF YUCAIPA
WILDWOOD CREEK (WW-01)
SHEET 1 OF 3

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION



PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

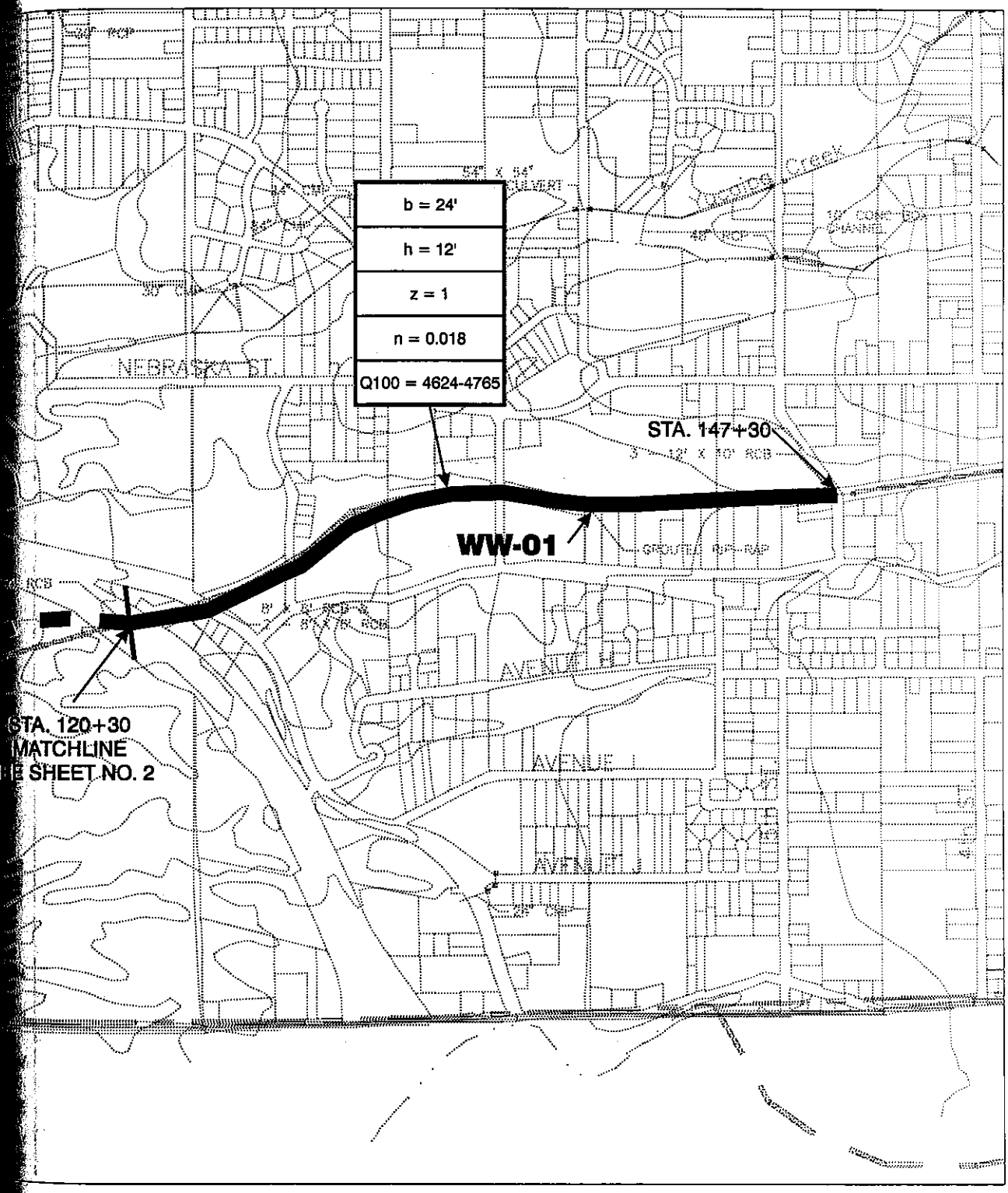
R PLAN
OF
INAGE

CITY OF YUCAIPA
WILDWOOD CREEK (WW-01)
SHEET 2 OF 3

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION

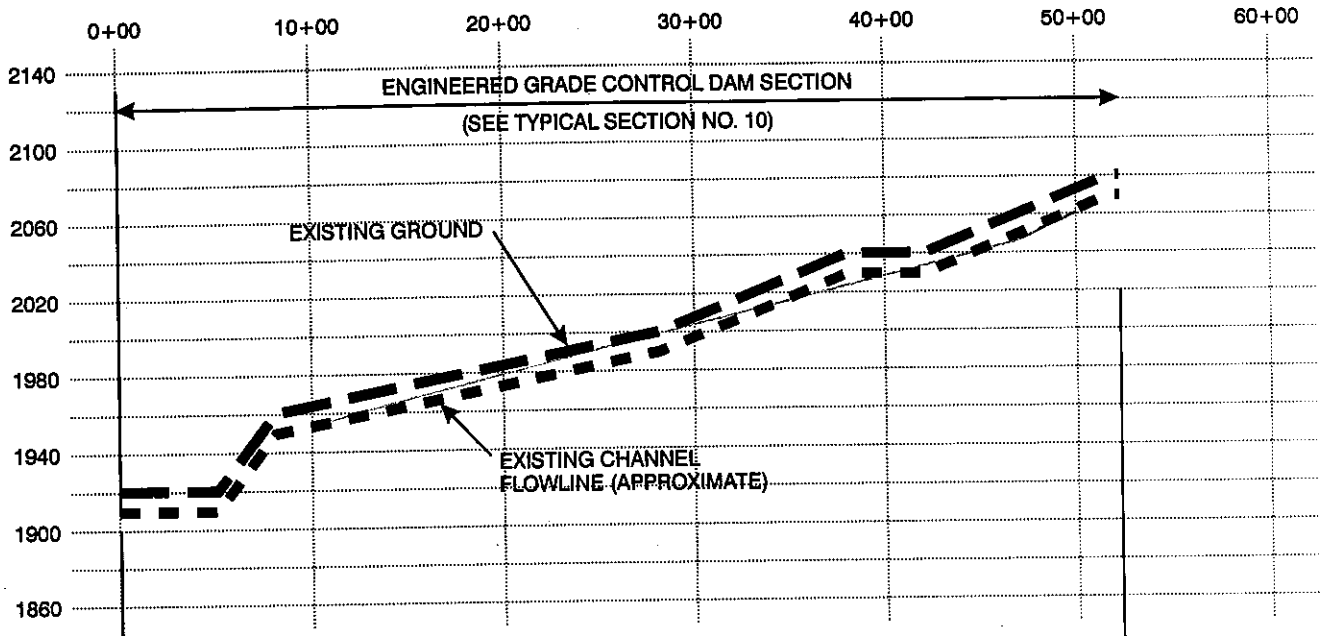


PROPOSED FACILITY

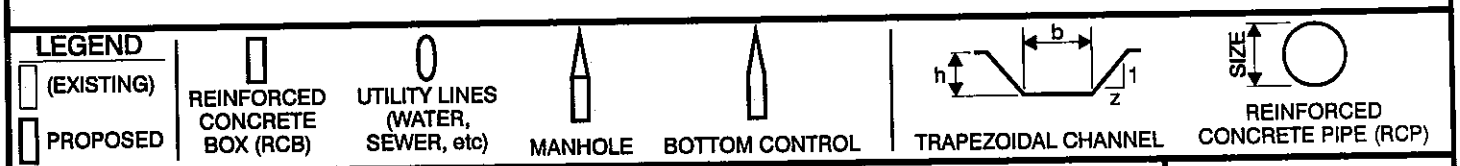
FACILITY SHOWN ELSEWHERE

R PLAN OF NAGE	**CITY OF YUCAIPA** **WILDWOOD CREEK (WW-01)** **SHEET 3 OF 3**	N SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION



LENGTH	5225'
SLOPE	.01 .001
FLOW	Q100 = 6757
SIZE	b=32', h=16', z=2.5
FACILITY TYPE	TYP. SEC. NO. 10

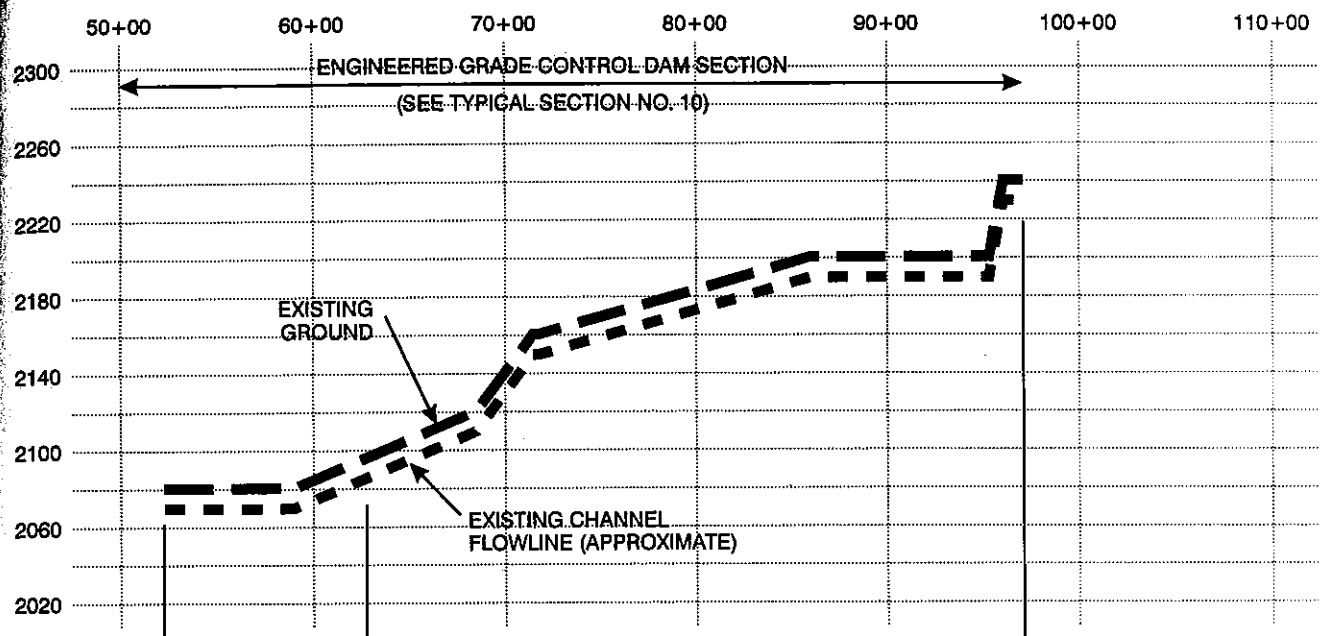


MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
WILDWOOD CREEK (WW-01)
SHEET 1 OF 3

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION



MATCHLINE - SEE SHEET 1

MATCHLINE - SEE SHEET 3

	52+25	62+75	97+10
LENGTH	1050'		3435'
SLOPE	.010		.010
FLOW	Q100 = 6757		Q100 = 5585
SIZE	b=32, h=16', z=2.5		b=30', h=15', z=2.5
FACILITY TYPE	TYP. SEC. NO. 10		TYP. SEC. NO. 10

LEGEND

(EXISTING)

PROPOSED

REINFORCED CONCRETE BOX (RCB)

UTILITY LINES (WATER, SEWER, etc)

MANHOLE

BOTTOM CONTROL

TRAPEZOIDAL CHANNEL

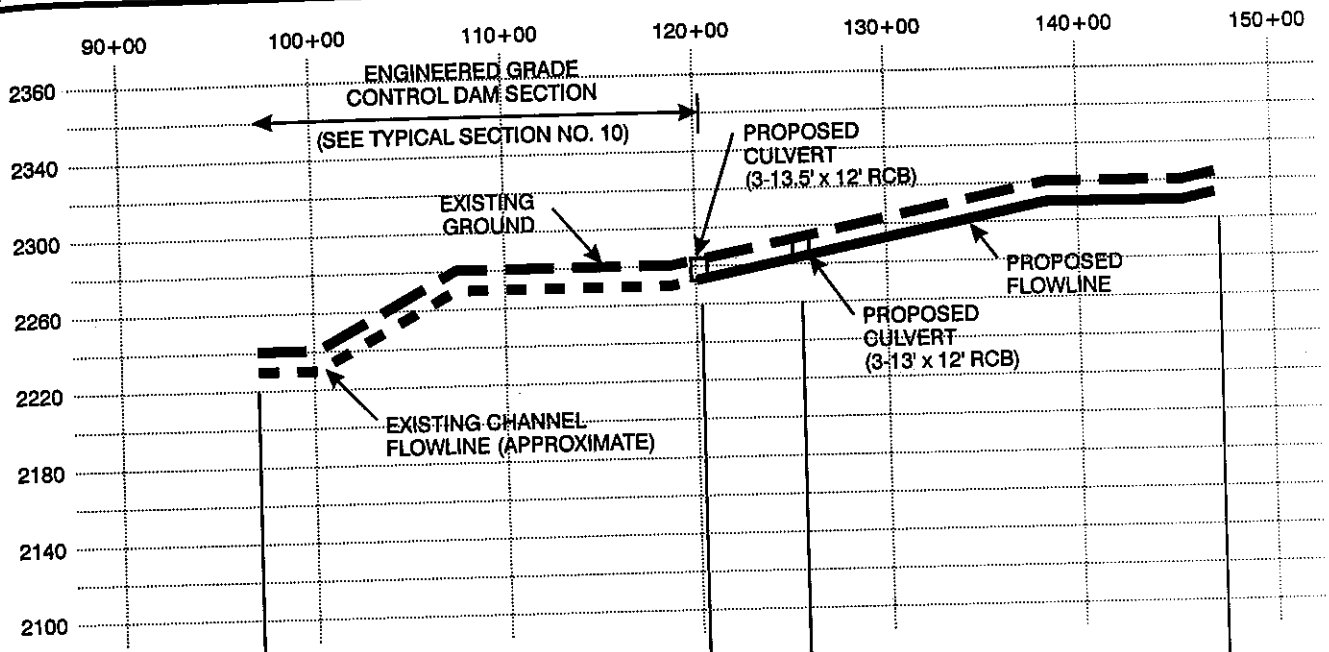
REINFORCED CONCRETE PIPE (RCP)

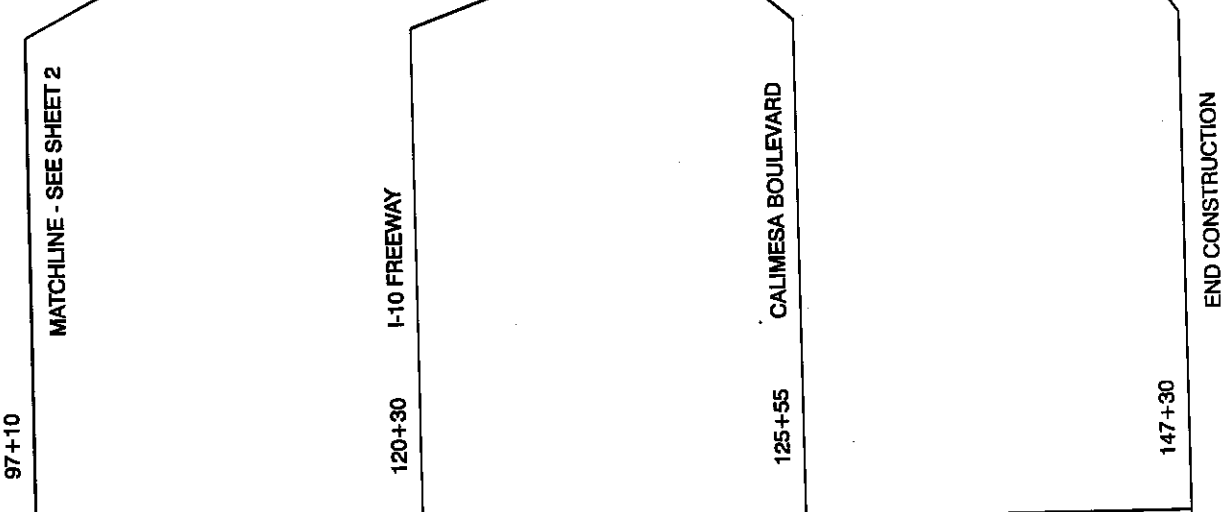
MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
WILDWOOD CREEK (WW-01)
SHEET 2 OF 3

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION





LENGTH	2320'	525'	2175'
SLOPE	.010	.012	.012
FLOW	Q100 = 4793	Q100 = 4765	Q100 = 4624
SIZE	b=30', h=14', z=2.5	b=24', h=12', z=1	b=24', h=12', z=1
FACILITY TYPE	TYPICAL SECTION NO. 10	TYPICAL SECTION NO. 13	TYPICAL SECTION NO. 13

LEGEND

(EXISTING)

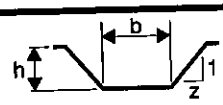
PROPOSED

REINFORCED CONCRETE BOX (RCB)

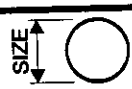
UTILITY LINES (WATER, SEWER, etc)

MANHOLE

BOTTOM CONTROL



TRAPEZOIDAL CHANNEL



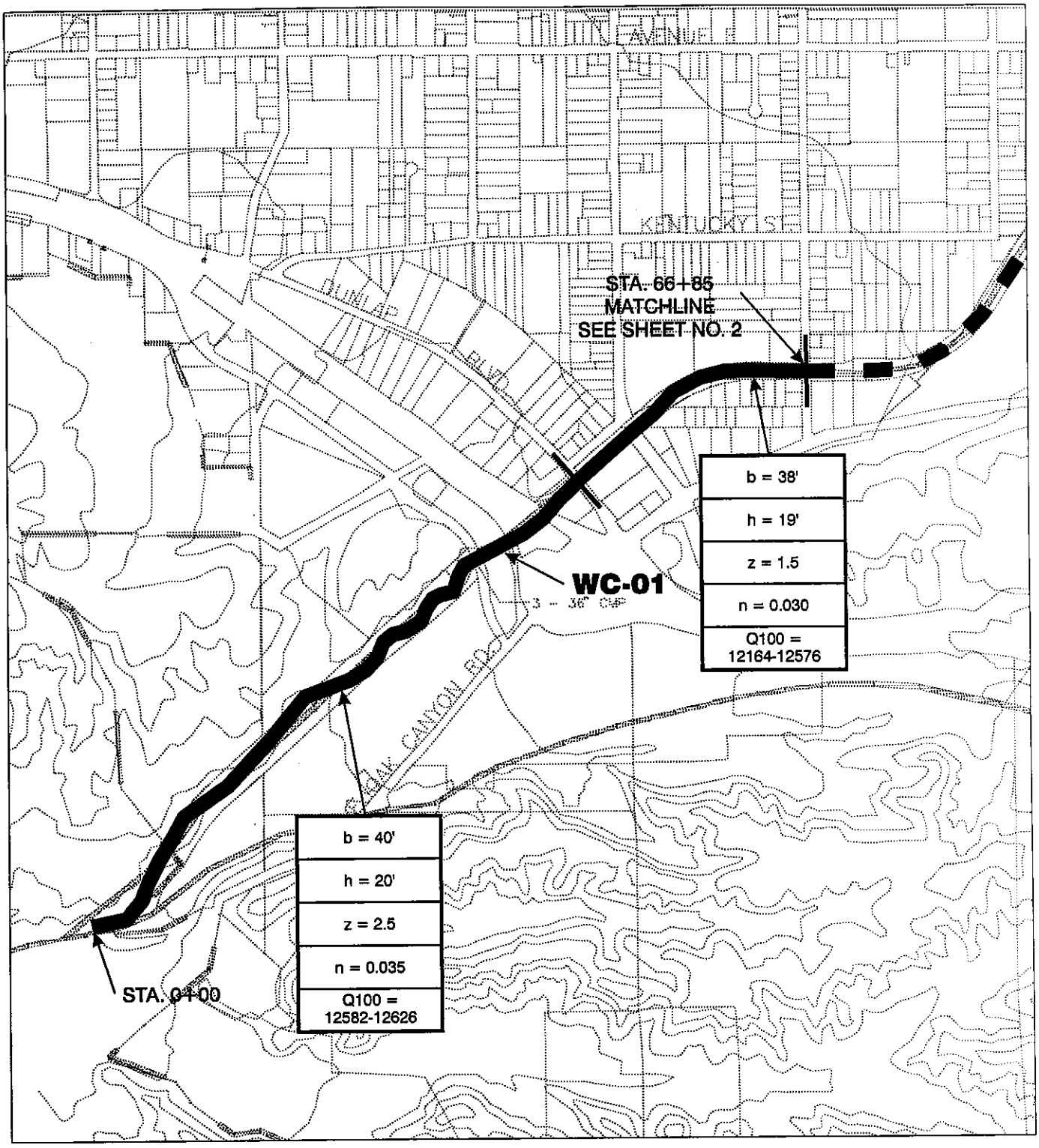
REINFORCED CONCRETE PIPE (RCP)

MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
WILDWOOD CREEK (WW-01)
SHEET 3 OF 3

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION



LEGEND

PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

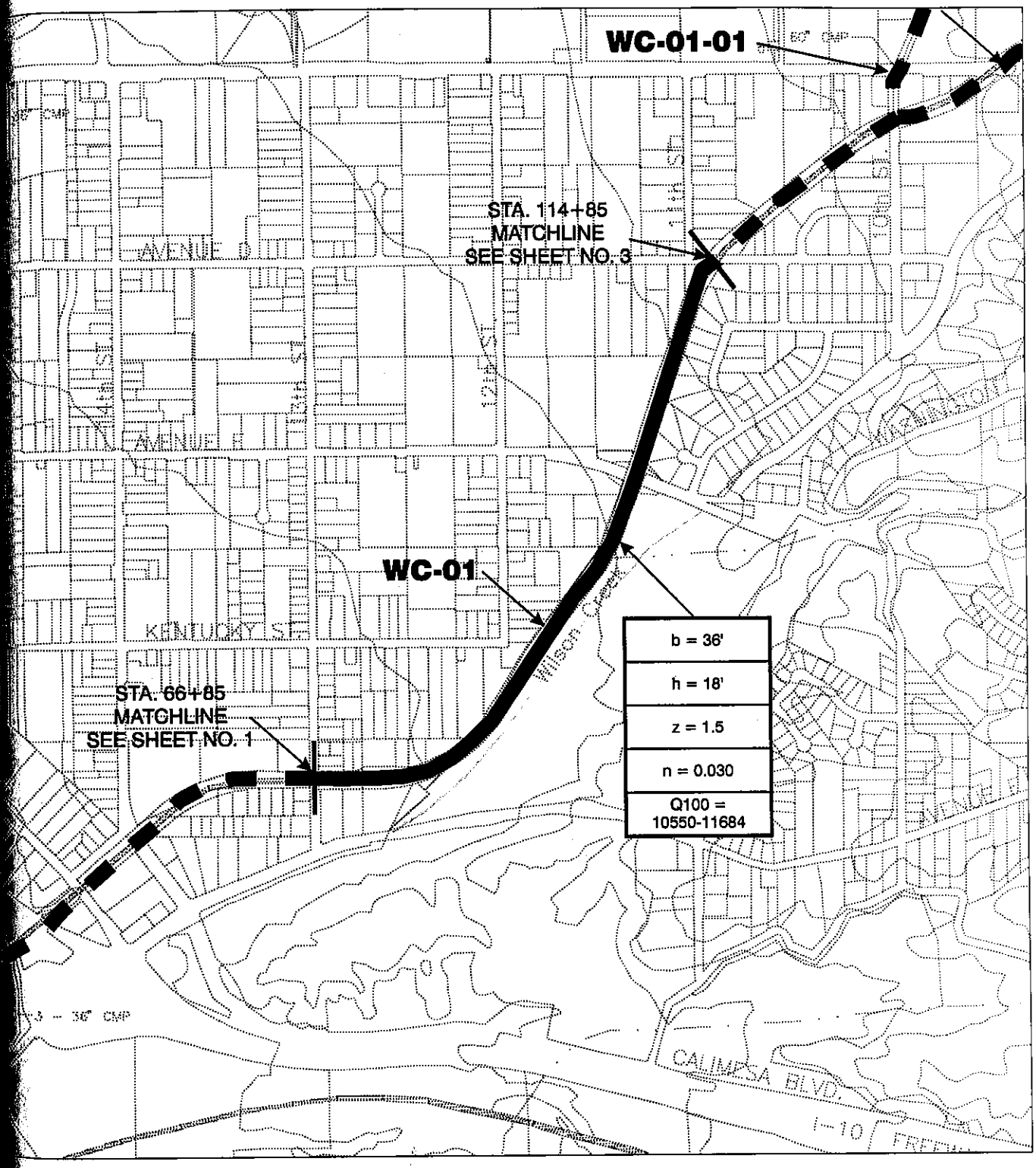
MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
WILSON CREEK (WC-01)
SHEET 1 OF 5

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION



LEGEND

PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

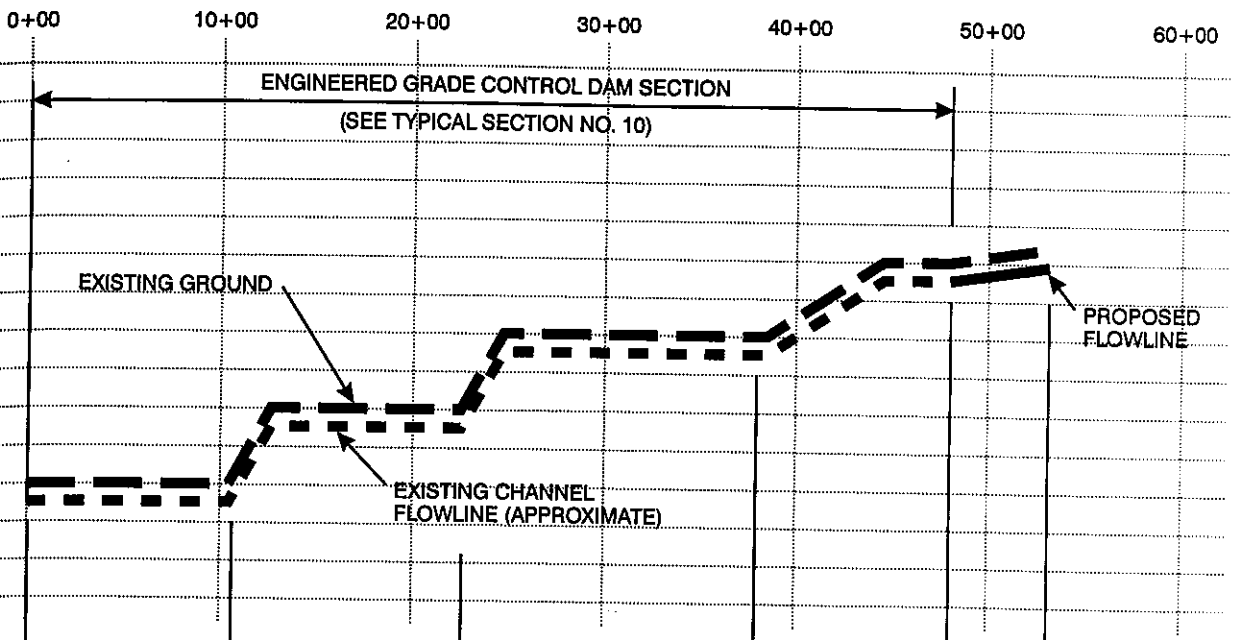
MASTER PLAN OF DRAINAGE

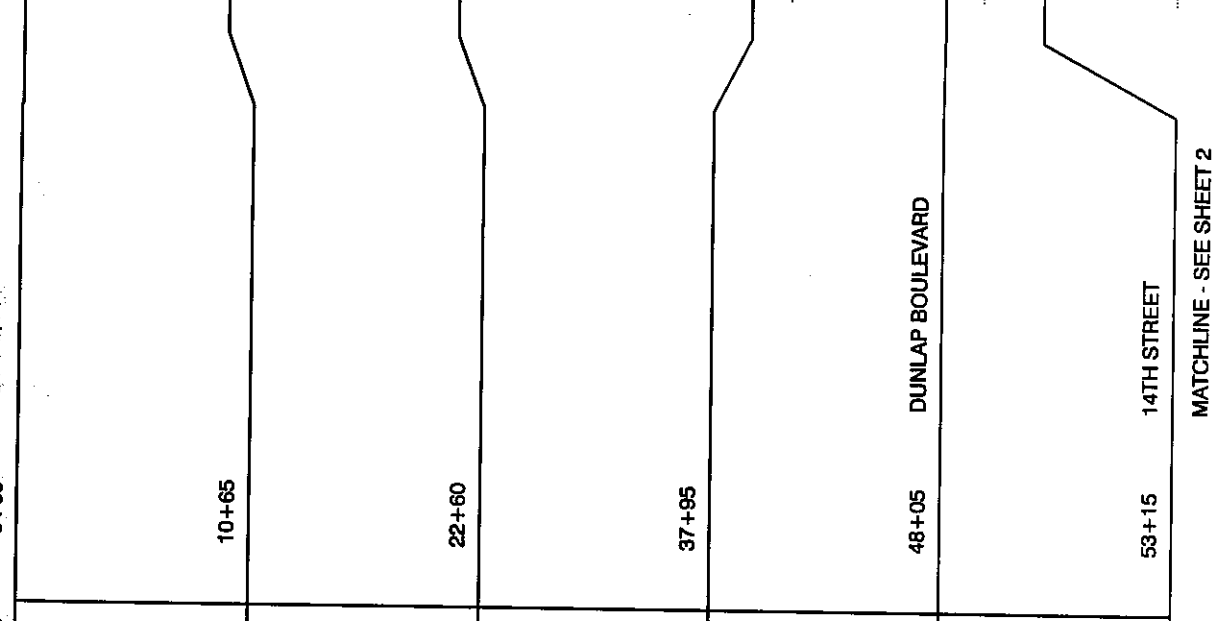
CITY OF YUCAIPA
WILSON CREEK (WC-01)
SHEET 2 OF 5

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION





TH	1065'	1195'	1535'	1010'	510'
PE	.010	.010	.010	.010	.016
OW	Q100 = 12626	Q100 = 12612	Q100 = 12594	Q100 = 12582	Q100 = 12576
IZE	b=40',h=20',z=2.5	b=40',h=20',z=2.5	b=40',h=20',z=2.5	b=40',h=20',z=2.5	b=38',h=19',z=1.5
TY PE	TYP. SEC. NO. 10	TYP. SEC. NO. 10	TYP. SEC. NO. 10	TYP. SEC. NO. 10	TYP. SEC. NO. 8

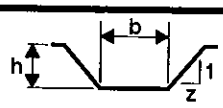
ND
ING)
SED

REINFORCED CONCRETE BOX (RCB)

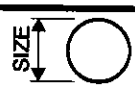
UTILITY LINES (WATER, SEWER, etc)

MANHOLE

BOTTOM CONTROL



TRAPEZOIDAL CHANNEL



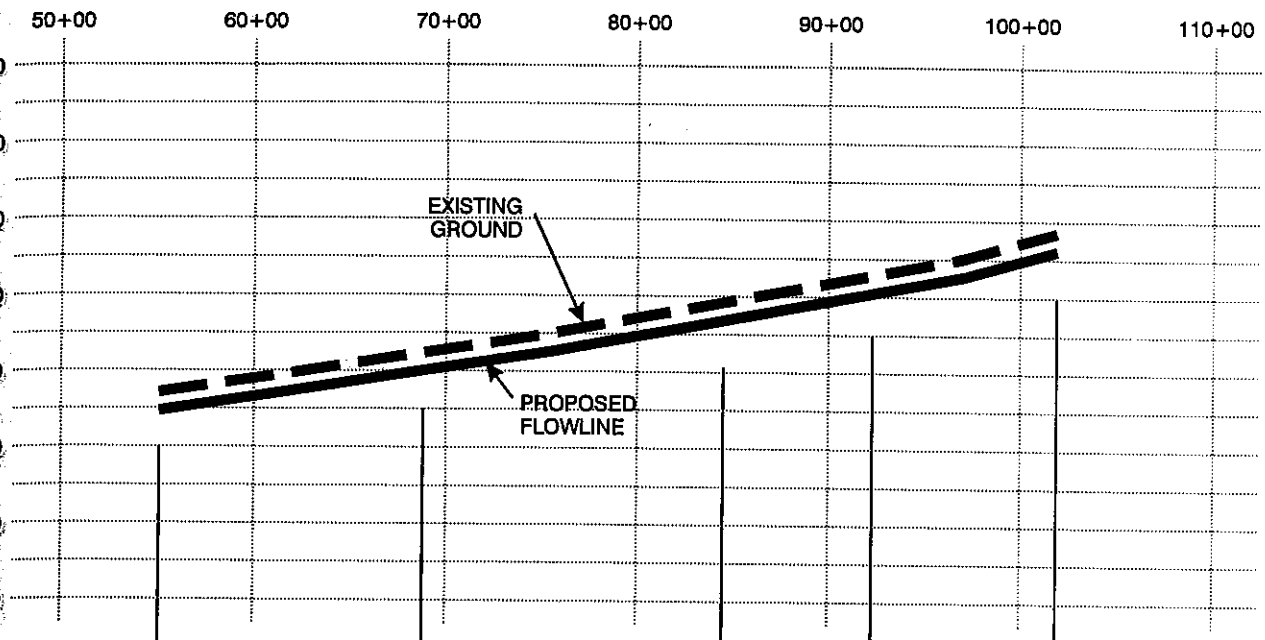
REINFORCED CONCRETE PIPE (RCP)

ER PLAN
OF
INAGE

CITY OF YUCAIPA
WILSON CREEK (WC-01)
SHEET 1 OF 7

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION



	14TH STREET 53+15 MATCHLINE - SEE SHEET 1	13TH STREET 66+85	12TH STREET 82+55	AVENUE E 90+35	99+95 MATCHLINE - SEE SHEET 3
NGTH	1370'	1570'	780'	960'	
OPE	.016	.018	.018	.018	
LOW	Q100 = 12164	Q100 = 11684	Q100 = 11451	Q100 = 11097	
SIZE	b=38', h=19', z=1.5	b=36', h=18', z=1.5	b=36', h=18', z=1.5	b=36', h=18', z=1.5	
ILITY YPE	TYP. SEC. NO. 8	TYP. SEC. NO. 8	TYP. SEC. NO. 8	TYP. SEC. NO. 8	

IND
STING)
ROSED

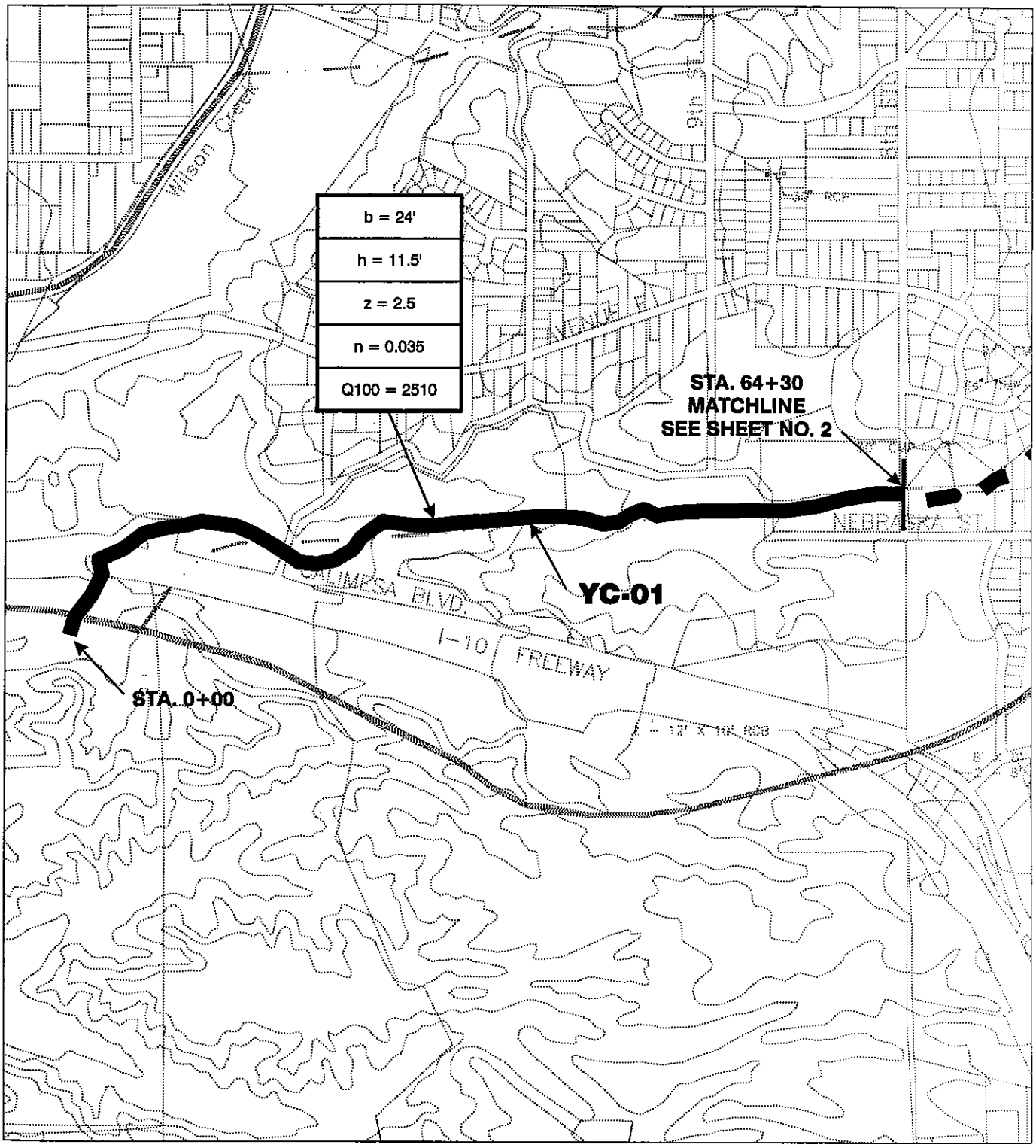
REINFORCED CONCRETE BOX (RCB) | UTILITY LINES (WATER, SEWER, etc) | MANHOLE | BOTTOM CONTROL | TRAPEZOIDAL CHANNEL (b, h, z, 1) | REINFORCED CONCRETE PIPE (RCP) (SIZE)

STER PLAN OF RAINAGE

CITY OF YUCAIPA
WILSON CREEK (WC-01)
SHEET 2 OF 7

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION



LEGEND

PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

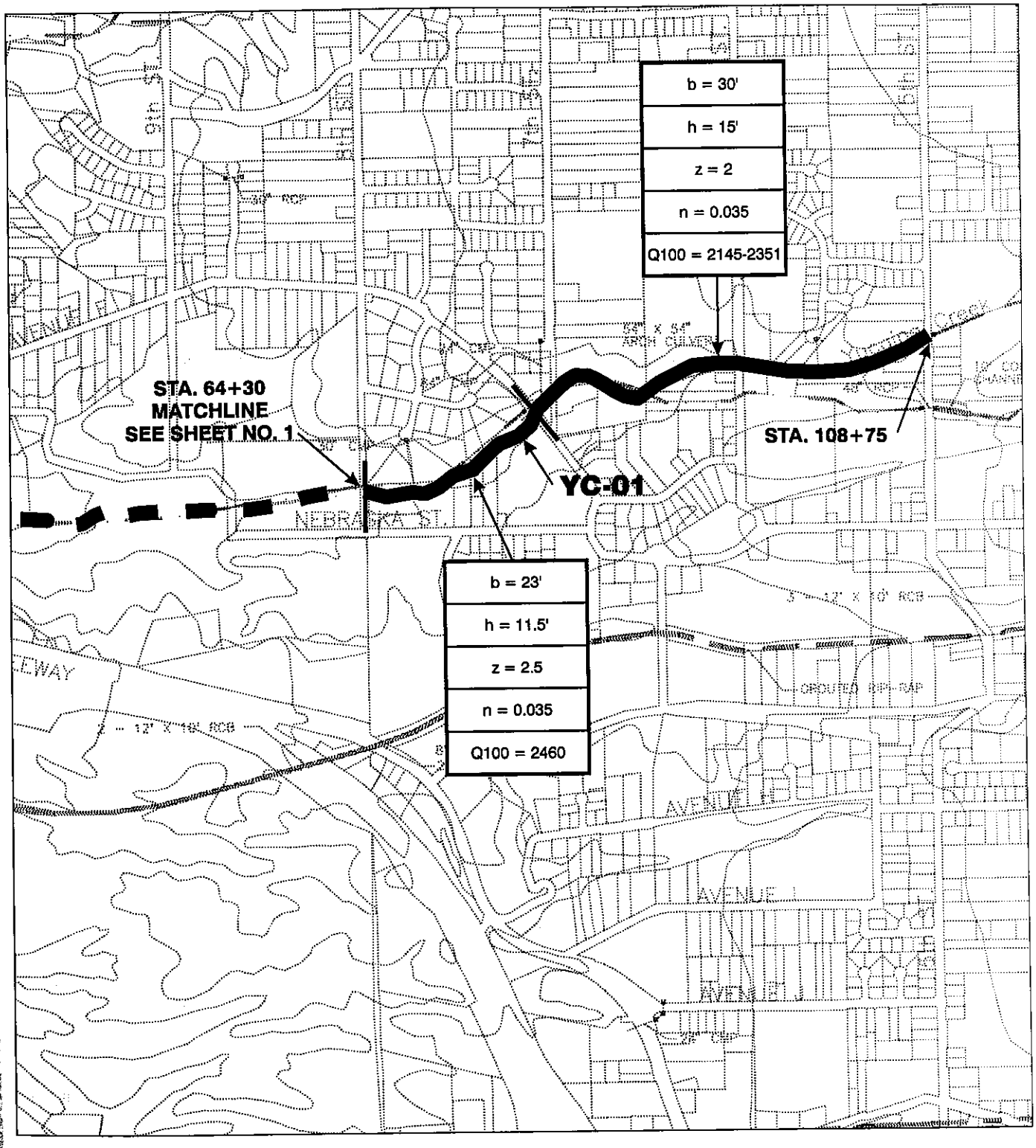
MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
YUCAIPA CREEK (YC-01)
SHEET 1 OF 2

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION



LEGEND

PROPOSED FACILITY

FACILITY SHOWN ELSEWHERE

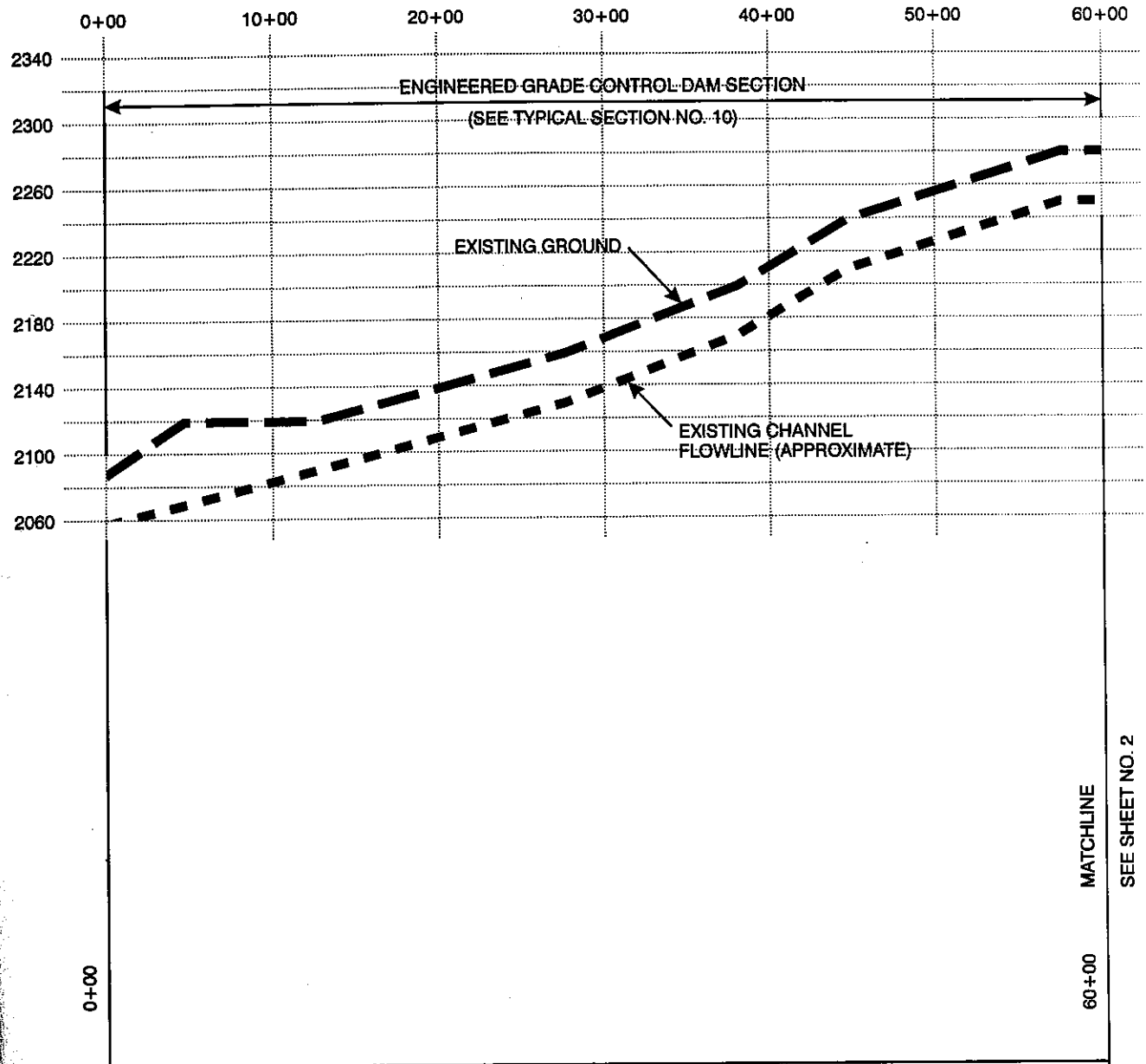
MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
YUCAIPA CREEK (YC-01)
SHEET 2 OF 2

N

SCALE: 1" = 1000'

BOYLE ENGINEERING CORPORATION



LENGTH	6000'
SLOPE	.010
FLOW	Q100 = 2510
SIZE	b=24', h=11.5', z=2.5
FACILITY TYPE	TYP. SEC. NO. 10

LEGEND

(EXISTING)

PROPOSED

REINFORCED CONCRETE BOX (RCB

UTILITY LINES (WATER, SEWER, etc)

MANHOLE

BOTTOM CONTROL

TRAPEZOIDAL CHANNEL

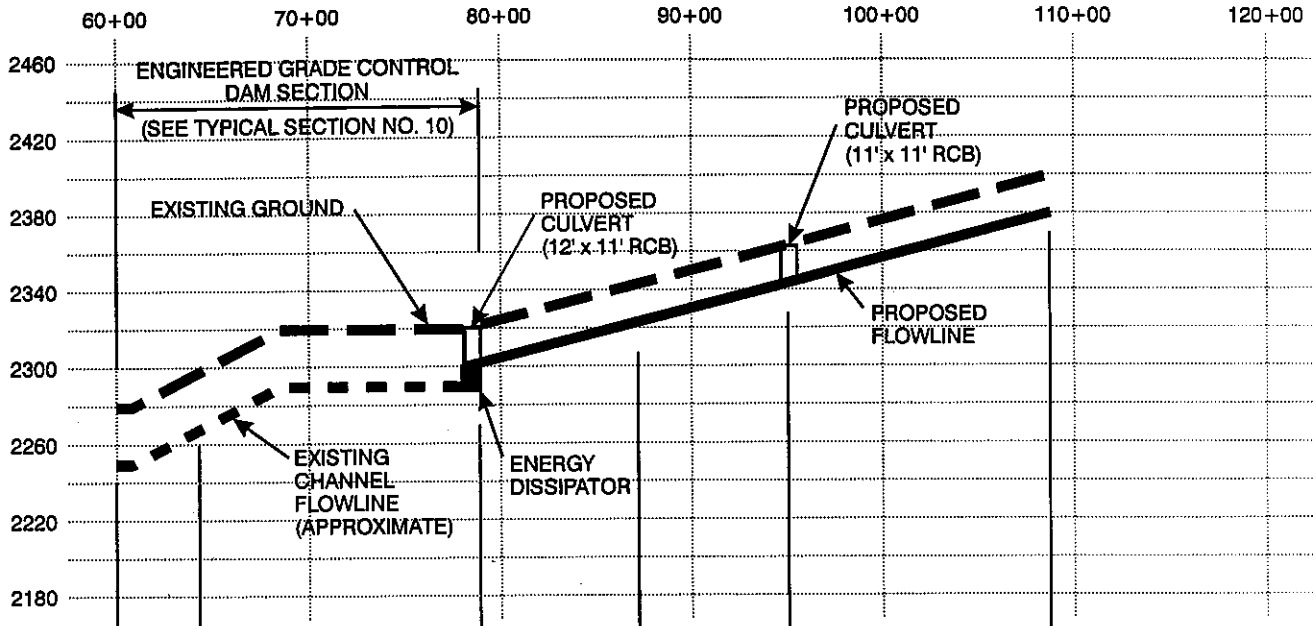
REINFORCED CONCRETE PIPE (RCP)

MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
YUCAIPA CREEK (YC-01)
SHEET 1 OF 2

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION



MATCHLINE	60+00	64+30	78+90	87+20	95+05	108+75
	SEE SHEET NO. 1	8TH STREET	AVENUE F		6TH STREET	5TH STREET

LENGTH	430'	1460'	830'	785'	1370'
SLOPE	.010	.010	.030	.021	.034
FLOW	Q100 = 2510	Q100 = 2460	Q100 = 2351	Q100 = 2188	Q100 = 2145
SIZE	b=24',h=11.5',z=2.5	b=23',h=11.5',z=2.5	b=30',h=15',z=2	b=30',h=15',z=2	b=30',h=15',z=2
FACILITY TYPE	TYP. SEC. NO. 10	TYP. SEC. NO. 10	TYP. SEC. NO. 2	TYP. SEC. NO. 2	TYP. SEC. NO. 2

LEGEND

(EXISTING)

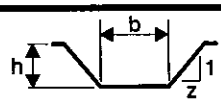
PROPOSED

REINFORCED CONCRETE BOX (RCB

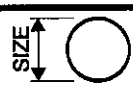
UTILITY LINES (WATER, SEWER, etc)

MANHOLE

BOTTOM CONTROL



TRAPEZOIDAL CHANNEL



REINFORCED CONCRETE PIPE (RCP)

MASTER PLAN OF DRAINAGE

CITY OF YUCAIPA
YUCAIPA CREEK (YC-01)
SHEET 2 OF 2

SCALE:
H: 1" = 1000'
V: 1" = 100'

BOYLE ENGINEERING CORPORATION