• DRAINAGE STUDY •
FOR

TM 5346
Environmental Log No. 02-03-067

DABBS MAJOR SUBDIVISION

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WO. 3004

Property-Existing Conditions

The property, as shown on the attached drainage map, consists of 38.37 acres of undeveloped land between Aqueduct Road on the west and Old Highway 395 on the east and north of Via Urner Way in the community of Bonsall. The property which was covered with grove in the past is currently ~~without vegetation~~ covered in plant container stock except for some on-site drives. The hydrologic soil group's map indicates the soil groups for the site consists of Soil Groups B, C and D (see attached map). On-site, natural drainage flows south in two existing drainage swales from a ridge at an existing reservoir 100'-150' north of the property. The reservoir is currently dry and contains plant container stock. The reservoir has a pipe that when full would drain it to the north away from the property. The two on-site drainage swales converge on the property and exit at one point on the southerly boundary. Also a small portion of the property drains east toward Old Highway 395 from a ridge line along the easterly boundary of the property.

Proposed Development-Low Impact Development:

The development consists of the creation of nine residential lots of an average of four acres from the 38.37 acre parcel. ~~which is currently without vegetation but was a citrus grove~~

Only minimal grading is proposed for the site. No mass grading is planned. Grading for the on-site 28' wide easement road is proposed. Drainage crossing the on-site road will be deposited into the natural drainage channels flowing south which carried it before. Our analysis includes grading for building pads and driveways serving these pads, which will be done by future purchasers of the lots. Lot grading will be done according to San Diego County Design Standard DS-8. The remainder of the site will remain undisturbed. The grass lined swales on the building pads will help treat any pollutants of concern.

No grading of the two natural channels flowing south is planned except for the placement of storm drains where the road and proposed driveways cross them. Road slopes will be hydro-seeded with native vegetation. The flow lines of the channels will be planted in ditichlis spacata native grass so they act as a vetetated swales in the treatment of any pollutants generated on the developed site. Similar planting will be done at the toes of fill slopes along the road. Drainage deposited in these swales from the road before entering storm drains will disconnect portions of impervious surfaces.

The proposed road is designed on existing grade except for the first 300' where the road must cut through existing terrain. Hence over most of the road alignment minimal slopes will be created. Earthen brow ditches are proposed to protect the graded slopes. These slopes will become vegetated over time as well as those portions of the property where no pads, road and driveways are proposed.

This large lot residential development is planned to truly be a Low Impact development. The project will minimally disturb the majority portion of the site and will continue to allow the natural swales to carry drainage through the site. Also a large portion of the site will flow through an infiltration/detention basin near the southerly boundary of the site.

Comparison-Existing Conditions versus Existing Conditions plus project Conditions

The following calculations compare the existing conditions versus existing conditions plus project conditions for the 100-year storm event at the points of exit (POE) from the property boundary.

According to the County Hydrology Manual the rational method of analysis should be used to determine basin drainage flows because the overall drainage basin is less than 0.5 square miles. With this method flow is dependent upon runoff coefficient 'C', the time of concentration as well as the acreage of the basin. 'C' is used to express the percentage of rainfall, which becomes surface runoff. ~~The Cn runoff curve numbers are used in the U.S. Soil Conservation Service Method for watersheds over 0.5 square miles and hence are not applicable here.~~

Use the "San Diego County Hydrology Manual dated June 2003
Note: See Drainage Plan for Drainage Areas
Location: 117°09'15"
33°17'45"
USE: Rational Method with 100 year storm frequency

Cofficient of Runoff (C)

From the Soil Group Map (attached), the drainage basin is about an average of soils type C and D with a small area of B.
From Table 3-1, "Runoff Coefficients for Urban Areas" for "Undisturbed Natural Terrain" are as follows:
B: C=0.25
C: C=0.30
D: C=0.35

For the Developed condition, Low Density Residential (LDR), For 1.0 DU/A or less the coefficients are:

B: C=0.32
C: C=0.36
D: C=0.41

ON-SITE BASIN:

POE-1-Exit at southerly property line.
A=A1+A2 =15.2+24.8=40.0 Acres

Existing Conditions:

Prorate Soil runoff coefficients by area for the existing condition:

A1=15.2 Acres
Type B: C=0.25 x 1.20=0.30
Type C: C=0.30x 9.89= 2.97
Type D: C=0.35 x 4.11=1.44

4.71

C=4.71/15.2=0.31

A2=24.8 Acres
Type B: C=0.25 x 4.53=1.13
Type C: C=0.30x 14.97=4.49
Type D: C=0.35 x 5.29=1.85
7.47

C=7.47/24.8=0.30

Prorated for overall area C=0.304
Use C=0.30 to be conservative for the Existing Condition

~~Use undisturbed Natural Terrain runoff coefficients for the existing coverate in container stock.~~
~~Prorated Natural C=0.31~~

~~DU/A or less, C=0.39 (average of C & B) (average of C & D)~~
~~The pre-development condition of the property is grove. Considering the Cn values as a relative relationship of runoff factors, C=0.41. Use C=0.39 to be conservative.~~

~~Drainage Calculations for Point of Exit (POE) at southerly boundary of property:~~
~~A=A1+A2+A3=0.9+11.3+27.7=39.9 Acres~~

Time of Concentration:
The basin begins at the reservoir site which will remain in a natural condition.
From Table 3-2, the Initial Time of Concentration Ti=6.9 min. (10%, Lm=100')
Tt: L=1775-100=1675', H=910-779=131'
From Figure 3-4, Tt=6.3 min.
Tc=6.9+6.3=13.2 min.

From Figure 3-1

I100=4.93"/hr.

~~Q100=CIA=(0.39)(4.9)(39.9)=76.2 cfs~~
Q100=CIA=(0.30)(4.93)(40.0)=59.16 cfs

~~Since the runoff coefficient and Time of Concentration as well as the area is the same in the pre and post development condition, Q100=76.2 cfs remains unchanged.~~
~~Hence the velocity of flow at the Point of Exit will remain unchanged and any downstream drainage facilities in the area will not be impacted by the proposed development.~~

~~85th Percentile Precipitation is 0.82" (see attached chart)~~

For flow based BMP's , use Iwq=0.2"/hr.
Qwq=(0.30)(0.2)(40)=2.4 cfs

Existing Plus Project Conditions:

A=40.0 Acres

For coefficient of runoff C, prorate runoff coefficients for developed condition as follows to better account for proposed impervious area.

For Impervious areas use C=0.90
For landscaped or undisturbed natural areas use C=0.30

Impervious Areas:

Proposed pads as shown on the plan average 0.5 acres. To be conservative, assume 50 % of the proposed pads are impervious
100% of the driveways (16' wide)
100% of the road (24'wide)
The remainder of the basin to be landscaped or natural.

Impervious areas
Pads with in on-site basin
Apads=2.19 acres (50%)
Aroads=0.81 acres
Adriveways=1.05 acres

Total Impervious area=4.05 acres

Prorate:
4.05 x .90=3.645
35.95 x 0.30=10.785
14.43

Prorated Post Development C=14.43/40=0.36

Time of Concentration:

Tc=Ti+Tt
Analyze Lot 1 for Tc
For Ti: Begins on building pad
From Table 3-2, for LDR 1DU/Acre and a grade of approximately 1.0% across building pad
Ti=11.5 min.
Ti: Travel time from pad to southerly boundary:
Using Figure 3.4 since grading is not planned in the existing drainage swales:
H=879-779=100', L=1350'
Tt=5.5 min.
Tc=11.5+5.5=17.0 Min.
I100=4.19"/hr.
Q100=(0.36)(4.19)(40.0)= 60.33 cfs

Qwq=(0.36)(0.2)(40.0)=2.9 cfs

Change in Q100 from Existing to Existing plus Project Conditions:

Delta Q100=60.33-59.16=1.17 cfs

Check Flow at on-site road crossing:
A1=15.2 acres
C=0.36

Tc:
From Table 3-2, for LDR 1DU/Acre and a grade of approximately 1.0% across building pad
Ti=11.5 min.
Ti: Travel time from pad to road crossing.
Using Figure 3.4
H=879-804=75', L=875'
Tt=3.7 min.
Tc=11.5+5.5=15.2 Min.
I100=4.50"/hr.
Q100=(0.36)(4.50)(15.2)= 24.6 cfs

USE 24" STORM DRAIN WITH RIP RAP ENERGY DISSIPATOR

CHECK USE OF DETENTION BASIN AT SOUTHERLY POE-1 OF PROPERTY:
To limit Q100 to pre-developed value.
6 hour rainfall is 3.5"
Basin area is 40.0 acres

Existing Conditions
C=0.30
Q100=59.16 cfs
Tc=13.2 min.

Existing plus Project Conditions
C=0.36
Q100=60.33 cfs
Tc=17 min.

Attached are inflow hydrographs for the Existing Conditions and the Existing Plus Project Conditions for the 100 year storm event. The area under the hydrographs is the inflow volume of water. From the attached Exhibit A the area between these hydrographs indicate a storage of 34,320 cf necessary in the detention facility in order that the outflow does not exceed predevelopment flow in the 100 year storm event.
Also the outflow pipe can carry no more than 59.16 cfs when the basin is at the stage where the storage is a minimum 30,240 cf.

Construct Grass Lined Detention Basin at location of existing siltation basin near southerly boundary of property. Use 3:1 side slopes for basin .

Check Depth:
Assume 2-24" outlet pipes each taking half of the existing flow in the 100 year storm.
Qeach=59.16/2=29.58 cfs.
Hw/d =2.0 for groove end projecting.
Hw=2 X 2=4'. Hence at a depth of 4' the basin will release no more than Q=59.16 cfs and must have a storage of at least 34,320 cf at this depth to store the excess from the existing plus project condition 100 year storm event-Q=60.3 cfs.
To be conservative, design the basin, so that at a depth of 3', the basin has at least 30,240 cf of storage.
Set the base of the emergency spillways 4' up from bottom of basin and top of basin at minimum of 5' up from base of basin.

Install 2-24" R.C.P. Pipes at downstream end of spillway with groove end projecting and Rip Rap Energy Dissipator at end of pipes.

OFF-SITE BASIN:

POE-2-Exit at easterly property line
Extend POE-2 to Old Highway 395 at southeast corner of the property in order to analyze off site impacted area.

Drainage for this Basin flows from a ridge along the easterly boundary of the property east to Old Highway 395 where several existing curb inlets with grates intercept drainage and carry it across via storm drains to a natural swale which carries drainage east toward toward Freeway-Route 15.

Only a small portion of the pads along the easterly boundary of the project will drain into this basin. Hence for simplicity, analyze entire area as a whole.

Existing Condition:

A3=11.6 Acres

Type C: C=0.30
C=0.90 for impervious area -portion of existing paving of Old Highway 395 within the basin.
Apave=0.83 acres

Prorate:
0.83 x .90= 0.747
10.77 x 0.30=3.23
3.978

Prorated Existing Conditions C=3.978/11.6=0=0.34

Time of Concentration:
Use as the flow point the midpoint along the north-south ridge to come up with average Tc
From Table 3-2, the Initial Time of Concentration Ti=6.9 min. (10%, Lm=100')
Tt: L=875-800=75', H=850-100=750'
From Figure 3-4, Tt=3.1 min.

Tc=6.9+3.1=10.0 min.

I100=5.9"/hr.

Q100=(0.34)(5.9)(11.6)=23.27 cfs

Existing Plus Project Condition

Runoff Coefficient C:
Only a small portion of the proposed pads and the proposed road will drain into this area.

Again assume 50% of the pads to be impervious and the remainder of the area to have a runoff coefficient for the natural condition.

Impervious Areas
0.83 acres -Old 395 paving
0.31 acres-Access Road
0.44 acres-50% of pads draining east
Total impervious area=1.58 acres

Prorate:
1.58 x 0 .90=1.422
10.02 x 0.30=3.006
4.428

Prorated Post Development C=4.428/11.6=0=0.38

Tc=Ti+Tt
For Ti: Begins on building pad
From Table 3-2, for LDR 1DU/Acre and a grade of approximately 1.0% across building pad
Ti=11.5 min.
Tt: Travel time from pad ; Use 3.1 min. calculated in the existing condition:
Tc=11.5+3.1=14.6 Min.
I100=4.62"/hr.
Q100=(0.38)(4.62)(11.6)=20.4 cfs
Qwq=(0.38)(0.2)(11.6)=0.9 cfs
Hence the drainage flow is actually reduced in the developed condition due to the increase in the time of concentration on the pads even with the coefficient of runoff is slightly higher.

~~Impervious AreaType B: C=0.25 x 1.20=0.30~~
~~Type C: C=0.30x 8.99= 2.70~~
~~Type D: C=0.35 x 4.13=1.45~~
~~4.45~~
~~C=4.45/14.3=0.31~~

Table of existing conditions versus existing plus project conditions

BEFORE						AFTER			
Drain Basin	A	C	Tc	I	Q100	C	Tc	I	Q100
POE-1	40.0	0.30	13.2	4.93	59.2	0.36	17.0	4.19	60.3
POE-2	11.6	0.34	10.0	5.90	23.3	0.38	14.6	4.62	20.4

~~**BEFORE**~~

~~Drain Basin~~	~~C~~	~~Tc~~	~~I~~	~~A~~	~~Q100~~	~~V~~	~~Qwq~~
					~~cfs~~	~~fps~~	~~cfs~~
~~POE-1~~	~~0.39~~	~~16.5~~	~~4.3~~	~~39.9~~	~~76.2~~	~~1.72~~	~~18.7~~

~~**AFTER**~~

~~Drain Basin~~	~~C~~	~~Tc~~	~~I~~	~~A~~	~~Q100~~	~~V~~	~~Qwq~~
					~~cfs~~	~~fps~~	~~cfs~~
~~POE~~	~~0.39~~	~~16.5~~	~~4.3~~	~~39.9~~	~~76.2~~	~~1.72~~	~~18.7~~

~~Drainage for each lot pad along the easterly ridge splits along this ridge so that there will not be any diversion. In accord with our analysis above, drainage flowing east from the easterly ridge will likewise remain unchanged since the runoff coefficient and Time of Concentration Drainage will be unchanged for the pre and post development condition.~~

~~Again we will use C=0.39~~
~~From Table 3-2 for the 1% pad, Ti=11.5 minutes, I100=5.4"/hr.~~
~~Since the pads are as close to the easterly property line as 50', Tt will be disregarded.~~

~~Q100 by pad for both the pre and post development condition:~~
~~Lot 1: A=1.2 acres~~
~~Q100=(0.39)(5.4)(1.2)=2.5 cfs~~
~~Lot 2: A=0.8 acres~~
~~Q100=(0.39)(5.4)(0.8)=1.7 cfs~~
~~Lot 1: A=0.7 acres~~
~~Q100=(0.39)(5.4)(0.7)=1.5 cfs~~
~~Lot 1: A=1.2 acres~~
~~Q100=(0.39)(5.4)(1.2)=2.5 cfs~~

PLACE RIP RAP ENERGY DISSIPATORS AT THE OUTLET OF ALL STORM DRAINS TO REDUCE STORM WATER VELOCITY TO A NON-EROSIVE LEVEL.

100-year Flood Line inundation lines:

Use the flow and section location at the point of exit at the southerly boundary to be conservative Q100=60.3 cfs

Section (at southerly boundary)

MANNINGS: Q=1.486/n(A)R(2/3)S(1/2)
WHERE: n=0.04
Q=37.15(A)R(2/3)S(1/2)

Section A (see attached)
S=3.0%
Q=6.43(A)R(2/3)
Assume 1' deep; check flow:
A=38' sf, P=44', R=0.90, R2/3=0.91
Q=6.43(38)(0.91)=222 CFS OK
This is most restrictive section. Assume depth of water to confluence is one foot deep to be conservative.

Mitigating Measures

Drainage in the developed condition will remain the same as in the undeveloped condition because of the rural character of the proposed development.

Existing siltation basins situated in the existing on site drainage courses will remain. The existing channel beyond these basins will continue to function as a BMP filtering out pollutants before drainage leaves the property as native vegetation returns to them.

If the graded portion of the site is greater than 1 acre, a "Notice of Intent" to comply with terms of the General Permit to Discharge storm water will be filed with the State Water Resources Control Board. Associated therewith the following will be done:

1. A Storm water Pollution Prevention Plan (SWPPP) will be developed and implemented which will specify Best Management Practices (BMP's) that will prevent all construction pollutants from contacting storm water and with the intent of preventing erosion and keeping sediment from moving off site into receiving waters or adjacent properties.
2. Eliminate or reduce non-storm water discharges to storm sewer systems and other waters of the United States.
3. Conduct inspections and maintenance of all BMPs.

This SWPPP will also comply with the county's requirements for construction BMPs to prevent pollutants from entering storm water conveyances and receiving waters. These will include:

- Placement of Gravel Bags at selected locations including across the streets at county required intervals based upon street slope and across utility trenches, drainage courses and at the inlets and outlets of drainage systems.
- Application of Bonded Fibber Matrix on planted slopes at application rates required by the county or erosion control mats

- Installation of silt fences at toes of constructed slopes.
- Application of soil stabilizers, mulch or wood chips to graded areas of less than 5%.

These measures should limit the siltation and erosion associated with runoff from the proposed on-site development at the time of construction.

A grading permit will be obtained for each future building site by the property owner, prior to any grading, where required by the county grading ordinance. At that time the owner will be required to comply with all the provisions and policies of the county regarding planting, irrigation, drainage and erosion control.

San Diego County Soils Groups, Data Obtained from SanGIS

Scale:1"=2000'

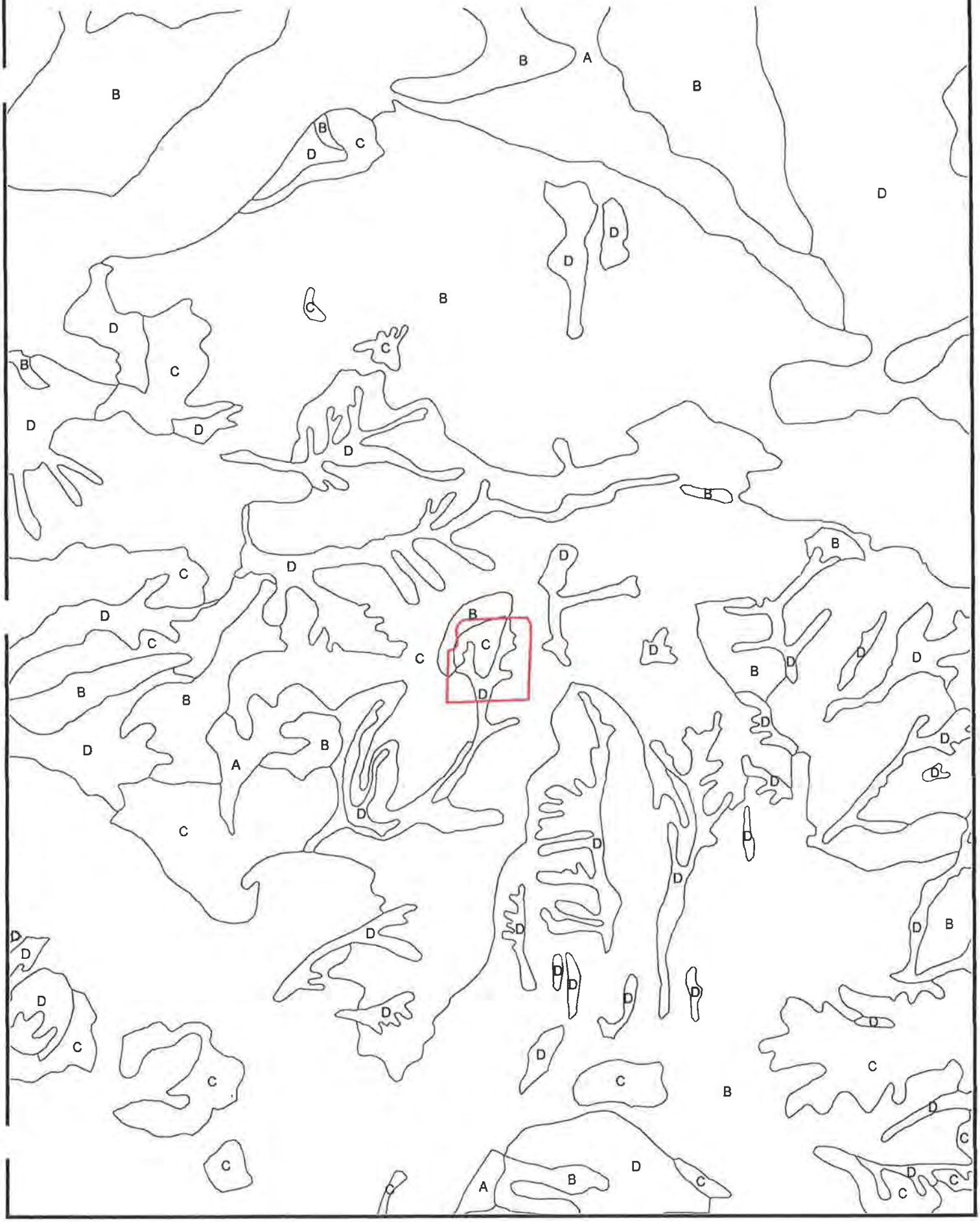


Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

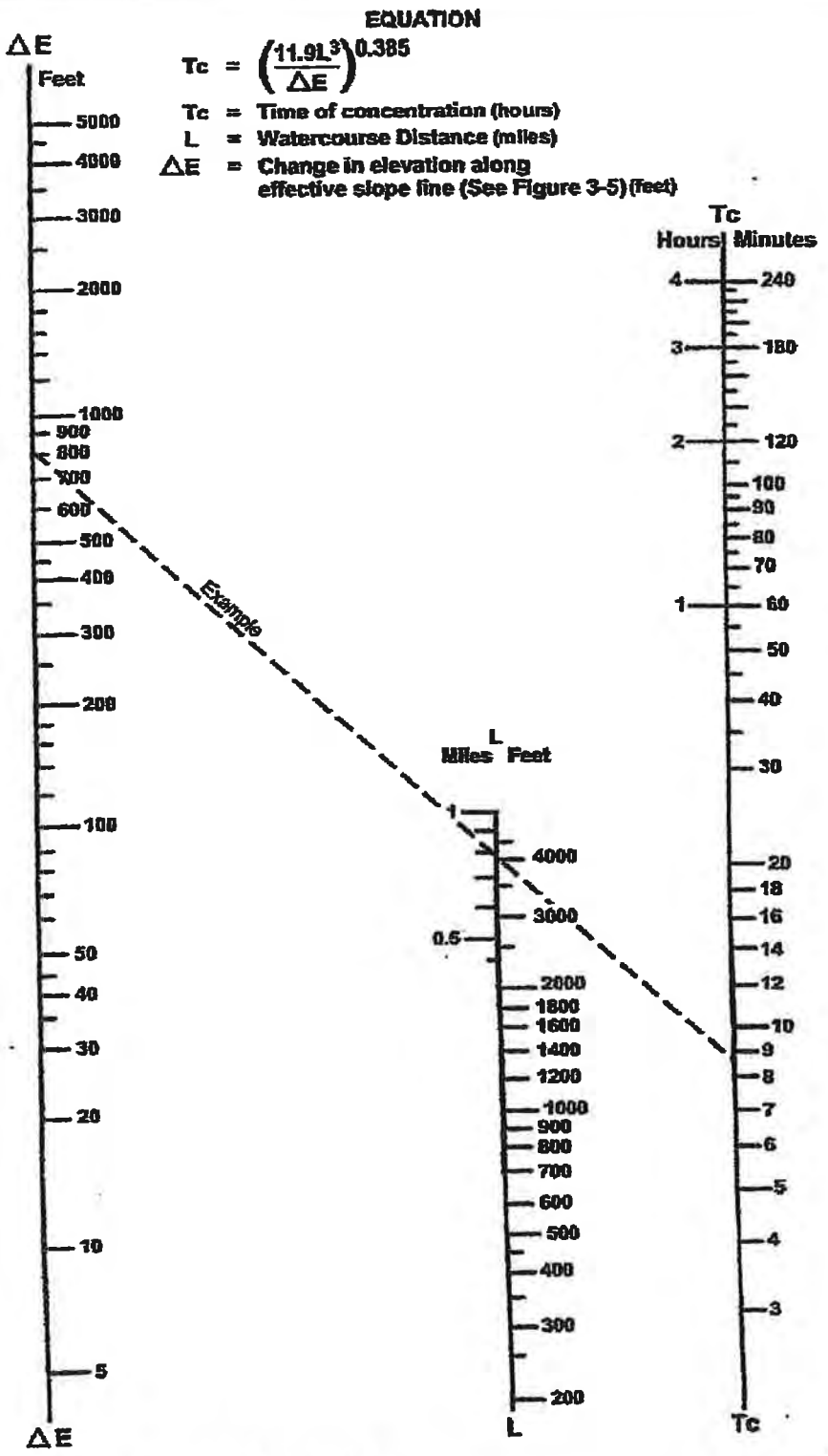
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

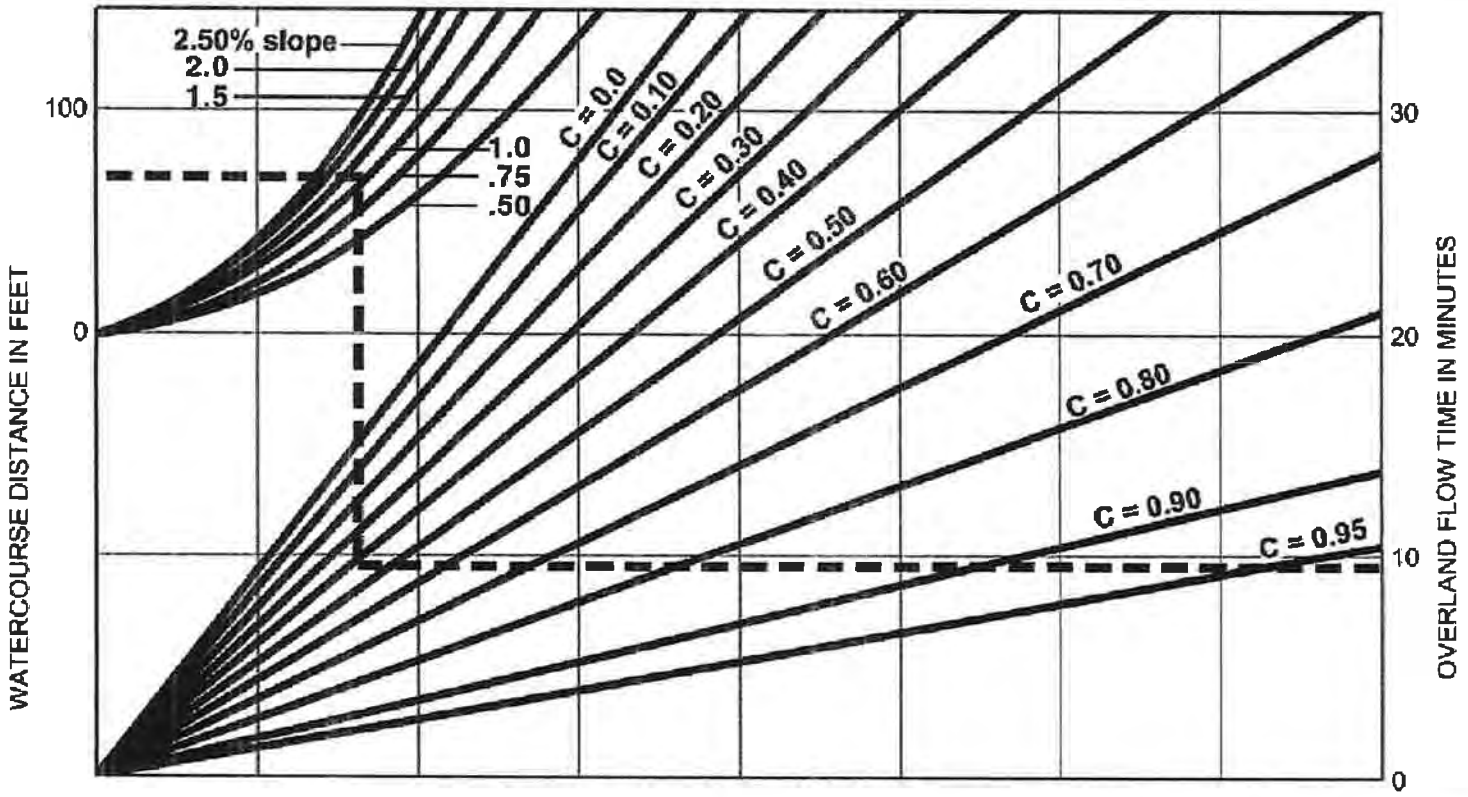
*See Table 3-1 for more detailed description



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

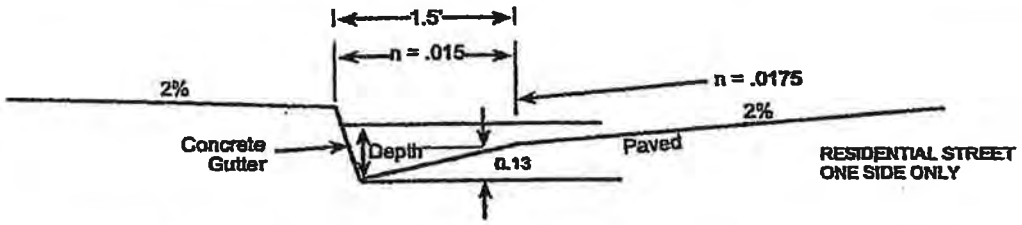
180 ± 1/2 AC. PADS (USE 70' per Table 3-2
S = 1.0%
C = 0.36 LDR 1 DU/A OR LESS
SOIL TYPE C
T = 11.14 min.

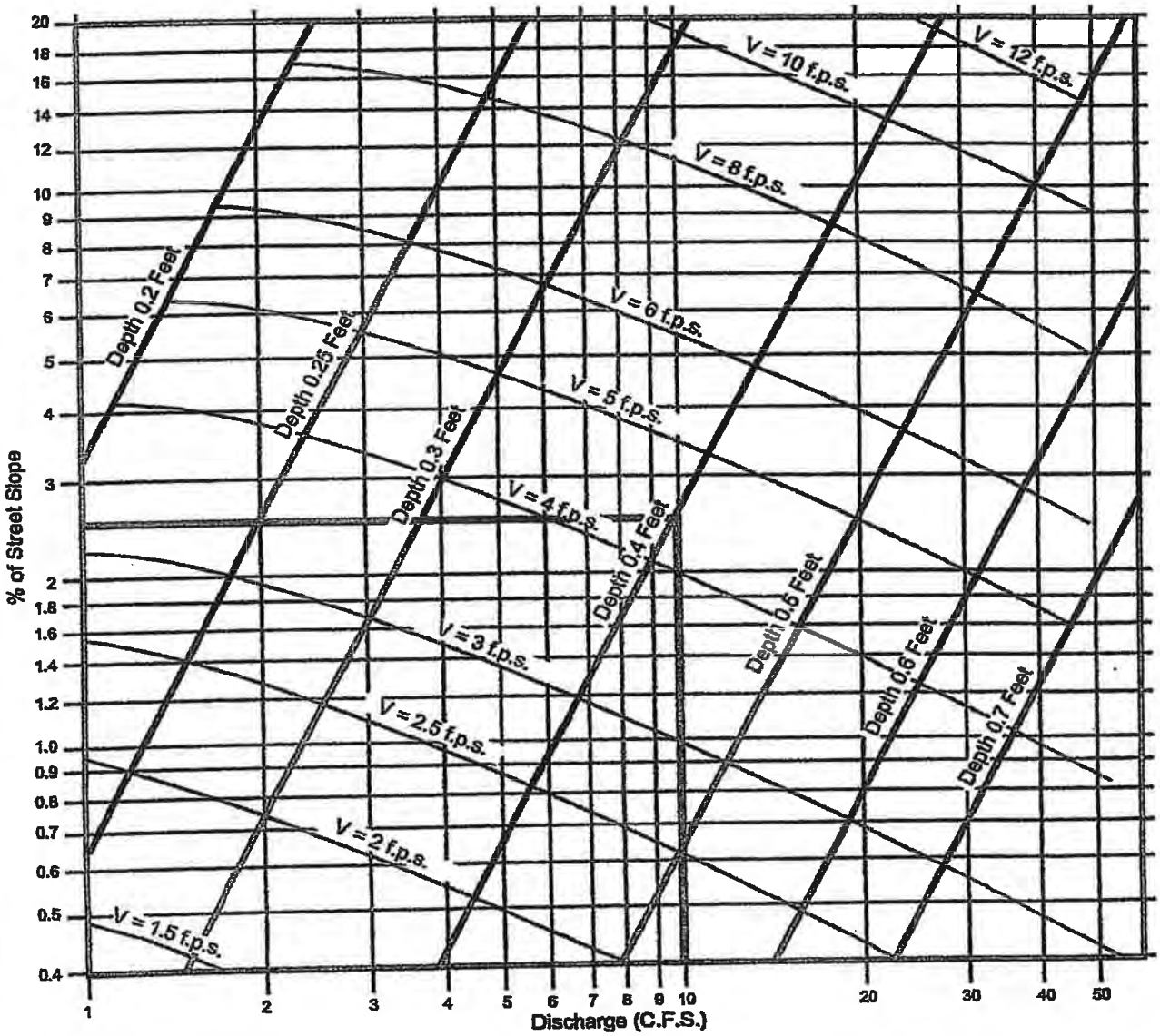
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph





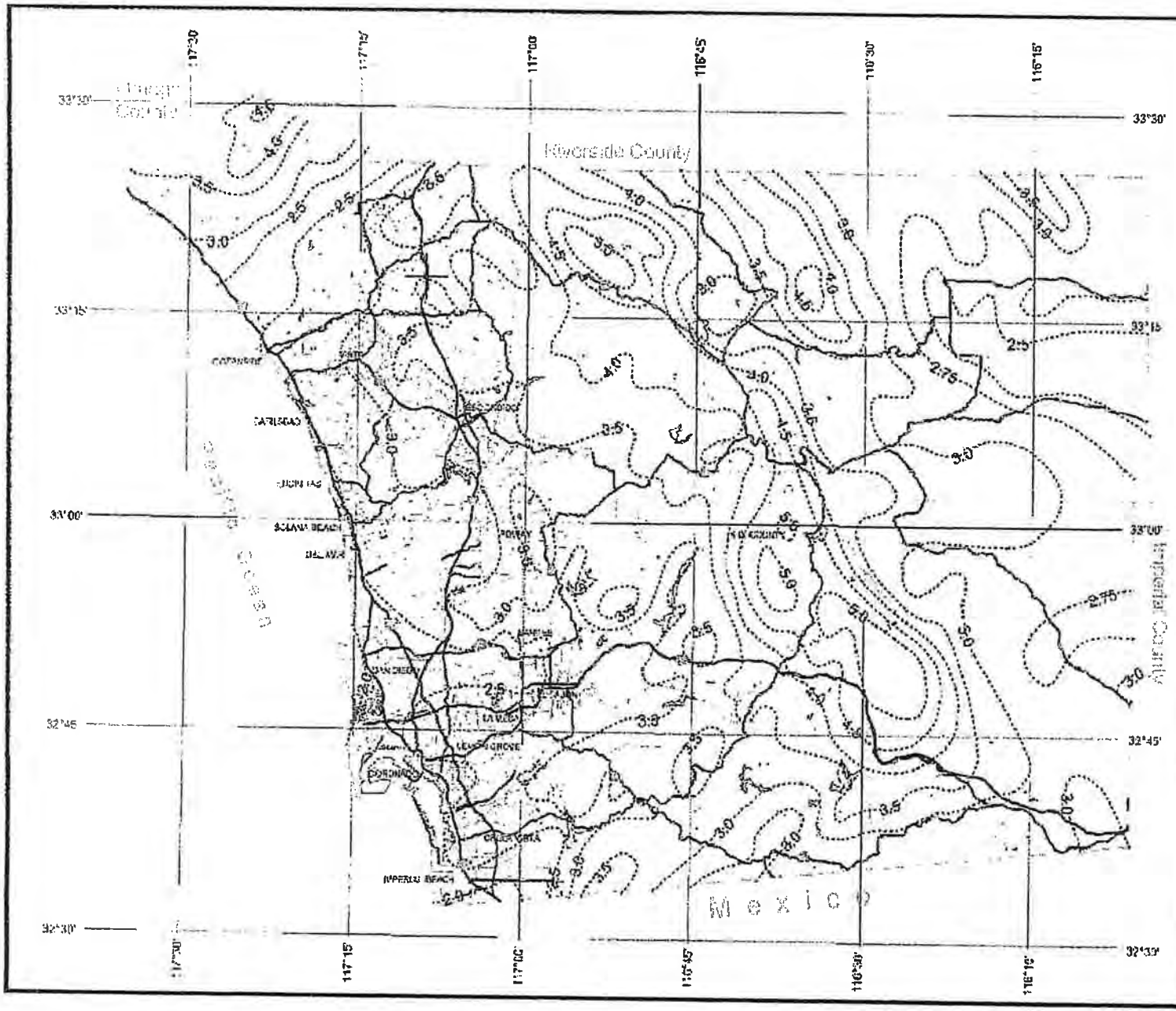
EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

LOCATION

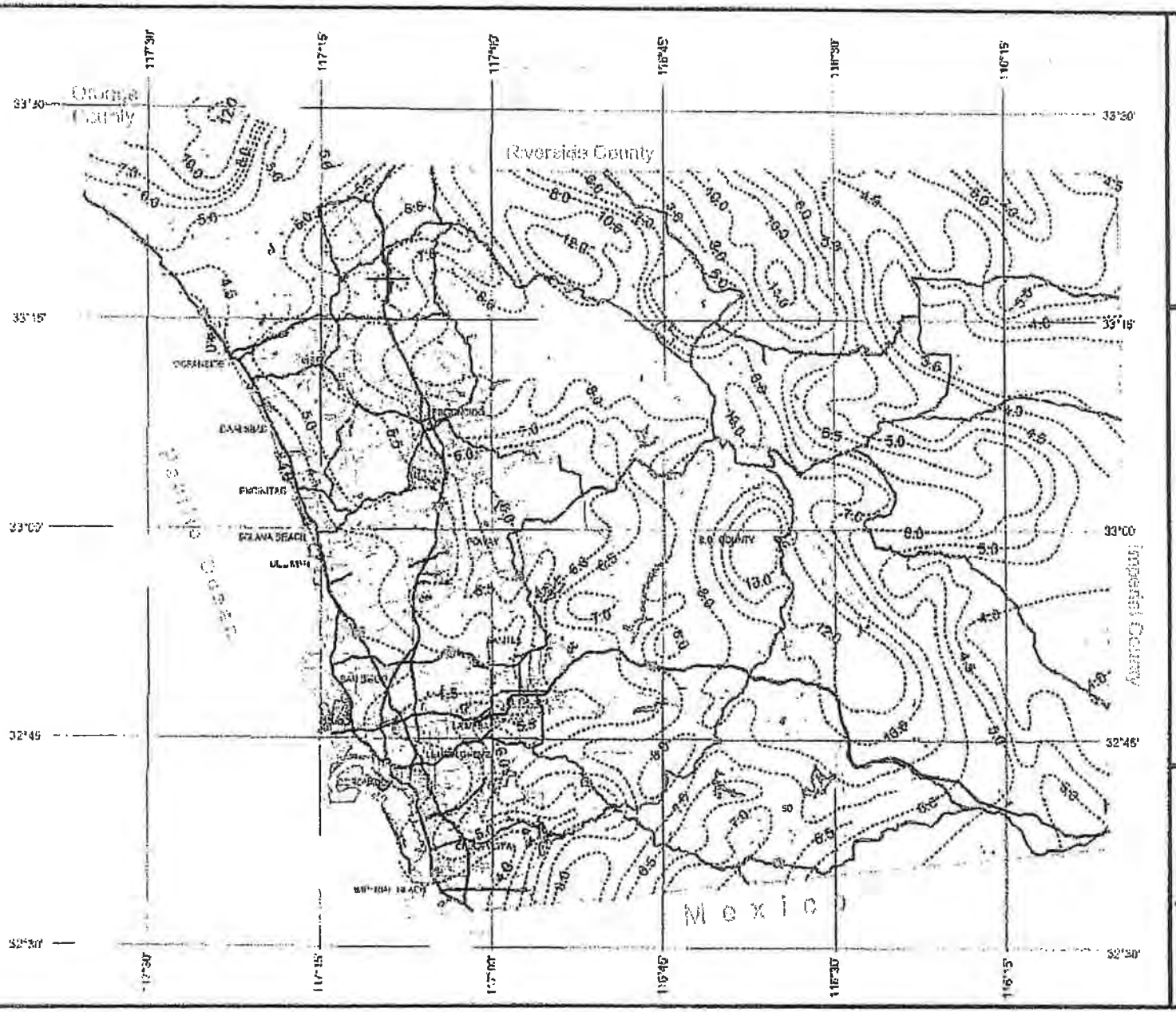
117°09'15"
33°17'45"

DPW GIS

SanGIS

N
W
E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

LOCATION

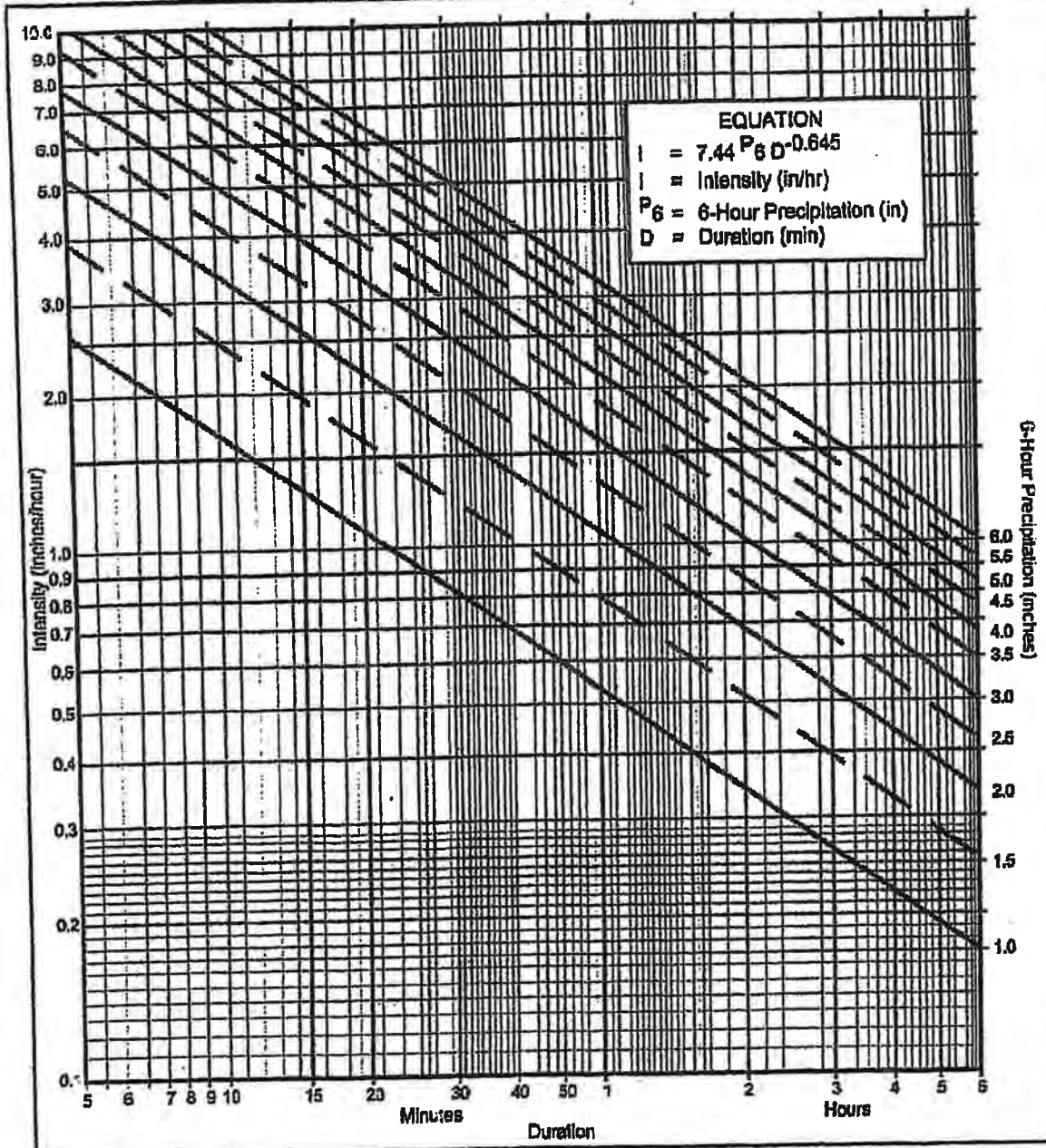
117°09'15"
33°17'45"

DPW GIS

SanGIS

N W E S

3 0 3 Miles



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = 3.5 in., P_{24} = 6.0, $\frac{P_6}{P_{24}}$ = 58 %(2)

(c) Adjusted P_6(2) = 3.5 in.

(d) t_x = _____ min.

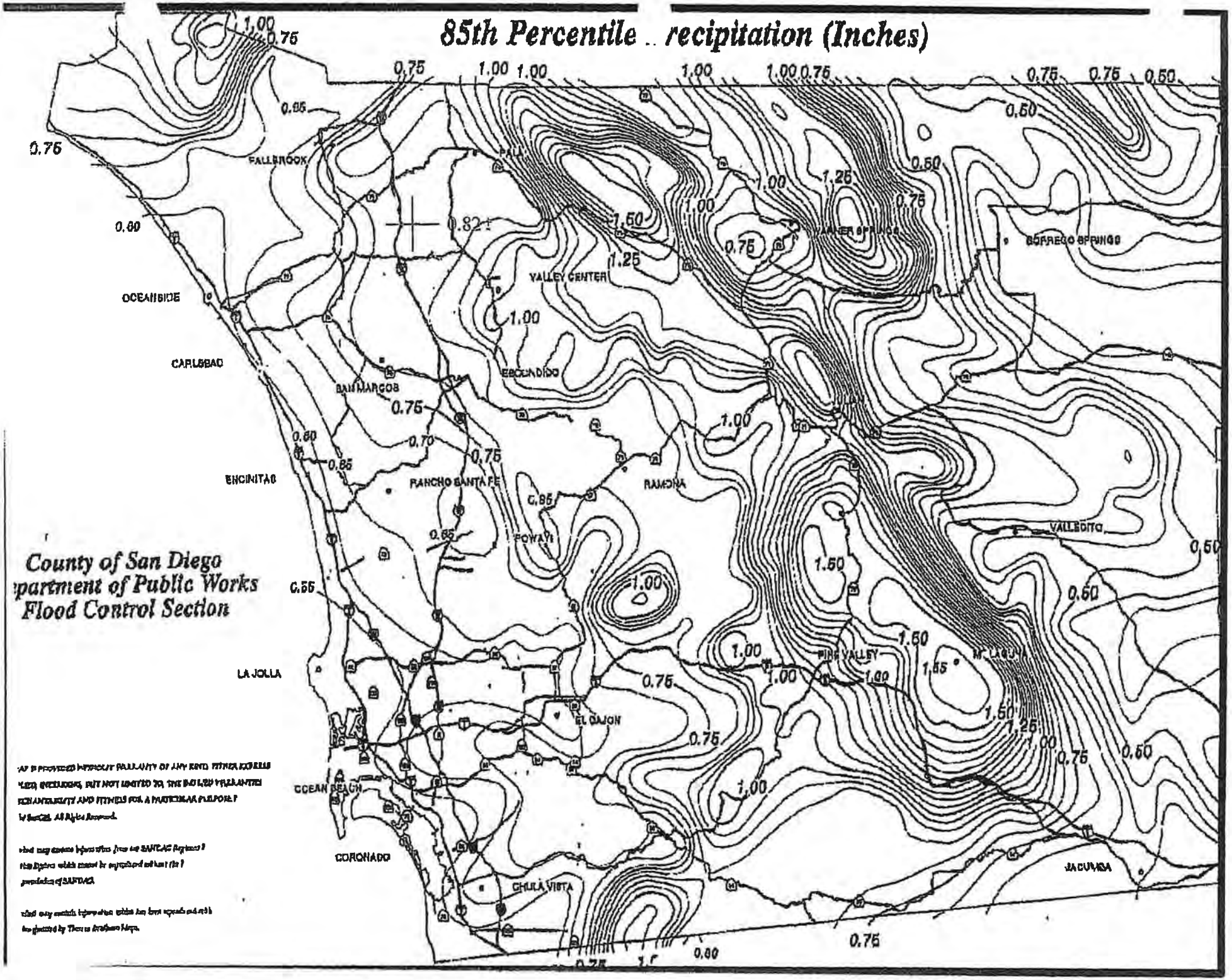
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.35	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.65	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1


85th Percentile .. recipitation (Inches)
FALLBROOK
PALA
OCEANSIDE
VALLEY CENTER
CARLSBAD
ESCONDIDO
SAN MARCOS
ENCINITAS
RANCHO SANTA FE
RAMONA
POWAY
VALLECITO
LA JOLLA
EL CAJON
PINE VALLEY
OCEAN BEACH
CORONADO
CHULA VISTA
JACUMBA
County of San Diego
Department of Public Works
Flood Control Section

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 1/31/2008
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 13 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 40 ACRES
RUNOFF COEFFICIENT 0.3
PEAK DISCHARGE 59.16 CFS

EXISTING CONDITIONS

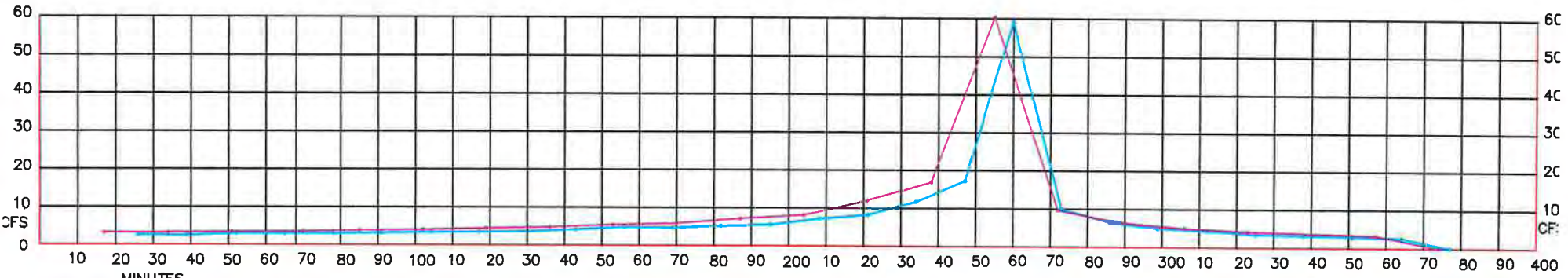
TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 13	DISCHARGE (CFS) = 0
TIME (MIN) = 26	DISCHARGE (CFS) = 2.6
TIME (MIN) = 39	DISCHARGE (CFS) = 2.6
TIME (MIN) = 52	DISCHARGE (CFS) = 2.8
TIME (MIN) = 65	DISCHARGE (CFS) = 2.8
TIME (MIN) = 78	DISCHARGE (CFS) = 3
TIME (MIN) = 91	DISCHARGE (CFS) = 3.1
TIME (MIN) = 104	DISCHARGE (CFS) = 3.3
TIME (MIN) = 117	DISCHARGE (CFS) = 3.5
TIME (MIN) = 130	DISCHARGE (CFS) = 3.8
TIME (MIN) = 143	DISCHARGE (CFS) = 4
TIME (MIN) = 156	DISCHARGE (CFS) = 4.4
TIME (MIN) = 169	DISCHARGE (CFS) = 4.7
TIME (MIN) = 182	DISCHARGE (CFS) = 5.3
TIME (MIN) = 195	DISCHARGE (CFS) = 5.8
TIME (MIN) = 208	DISCHARGE (CFS) = 7.1
TIME (MIN) = 221	DISCHARGE (CFS) = 8.1
TIME (MIN) = 234	DISCHARGE (CFS) = 11.8
TIME (MIN) = 247	DISCHARGE (CFS) = 17.3
TIME (MIN) = 260	DISCHARGE (CFS) = 59.16
TIME (MIN) = 273	DISCHARGE (CFS) = 9.5
TIME (MIN) = 286	DISCHARGE (CFS) = 6.3
TIME (MIN) = 299	DISCHARGE (CFS) = 5
TIME (MIN) = 312	DISCHARGE (CFS) = 4.2
TIME (MIN) = 325	DISCHARGE (CFS) = 3.6
TIME (MIN) = 338	DISCHARGE (CFS) = 3.2
TIME (MIN) = 351	DISCHARGE (CFS) = 2.9
TIME (MIN) = 364	DISCHARGE (CFS) = 2.7
TIME (MIN) = 377	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 1/31/2008
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 17 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 40 ACRES
NOFF COEFFICIENT 0.36
K DISCHARGE 60.33 CFS

EXISTING PLUS PROJECT CONDITIONS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 17	DISCHARGE (CFS) = 3.1
TIME (MIN) = 34	DISCHARGE (CFS) = 3.2
TIME (MIN) = 51	DISCHARGE (CFS) = 3.4
TIME (MIN) = 68	DISCHARGE (CFS) = 3.5
TIME (MIN) = 85	DISCHARGE (CFS) = 3.8
TIME (MIN) = 102	DISCHARGE (CFS) = 4
TIME (MIN) = 119	DISCHARGE (CFS) = 4.4
TIME (MIN) = 136	DISCHARGE (CFS) = 4.7
TIME (MIN) = 153	DISCHARGE (CFS) = 5.4
TIME (MIN) = 170	DISCHARGE (CFS) = 5.8
TIME (MIN) = 187	DISCHARGE (CFS) = 7.1
TIME (MIN) = 204	DISCHARGE (CFS) = 8.1
TIME (MIN) = 221	DISCHARGE (CFS) = 11.9
TIME (MIN) = 238	DISCHARGE (CFS) = 16.8
TIME (MIN) = 255	DISCHARGE (CFS) = 60.33
TIME (MIN) = 272	DISCHARGE (CFS) = 9.6
TIME (MIN) = 289	DISCHARGE (CFS) = 6.4
TIME (MIN) = 306	DISCHARGE (CFS) = 5
TIME (MIN) = 323	DISCHARGE (CFS) = 4.2
TIME (MIN) = 340	DISCHARGE (CFS) = 3.7
TIME (MIN) = 357	DISCHARGE (CFS) = 3.3
TIME (MIN) = 374	DISCHARGE (CFS) = 0



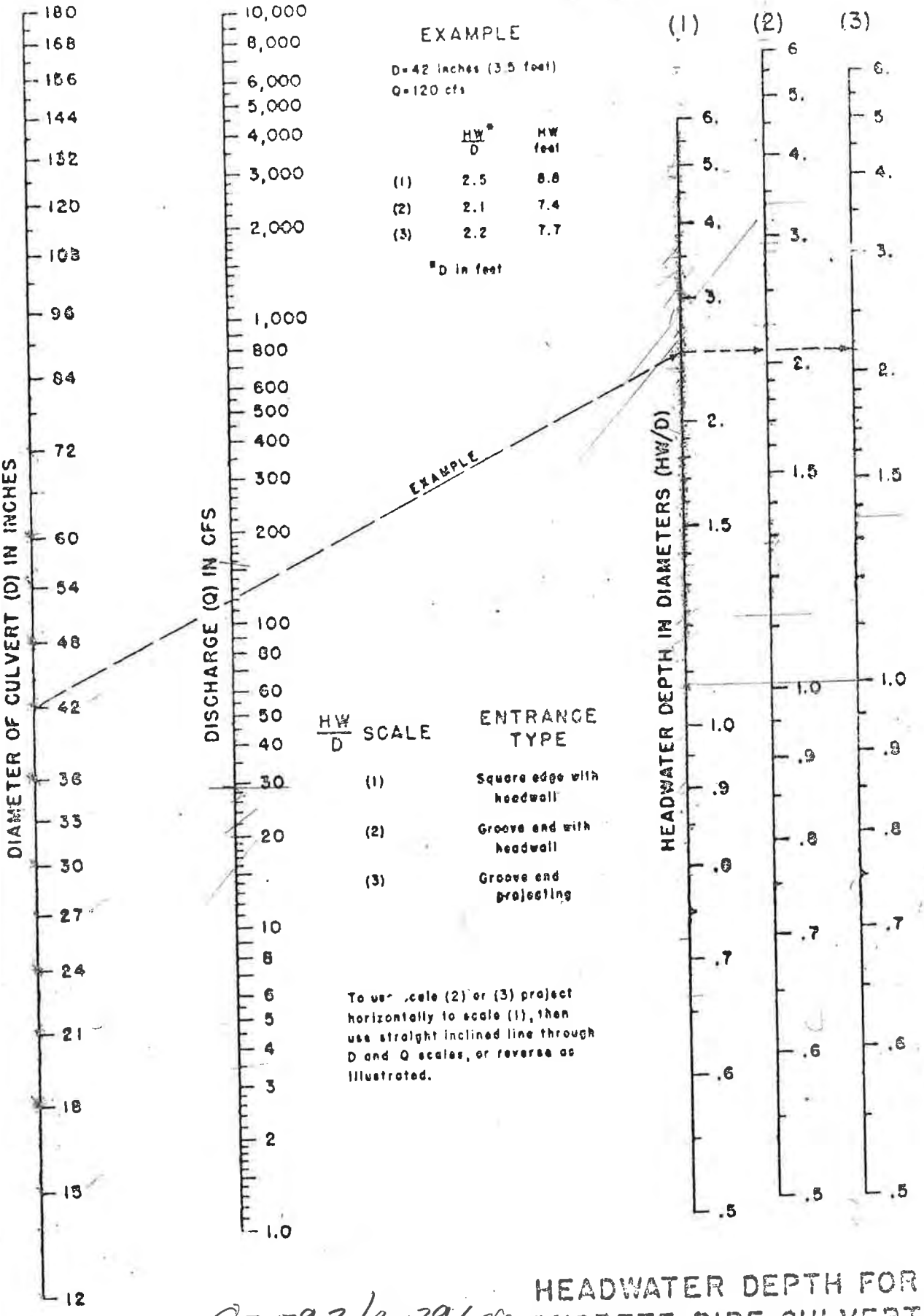
DETENTION GRAPH
EXHIBIT A SCALE 1"=40'

EXISTING CONDITIONS: Q100=59.16 CFS
EXISTING PLUS PROJECT CONDITIONS: Q100=60.33 CFS

RESERVOIR VOLUME=572 X 60=34,320 CF

EXHIBIT A

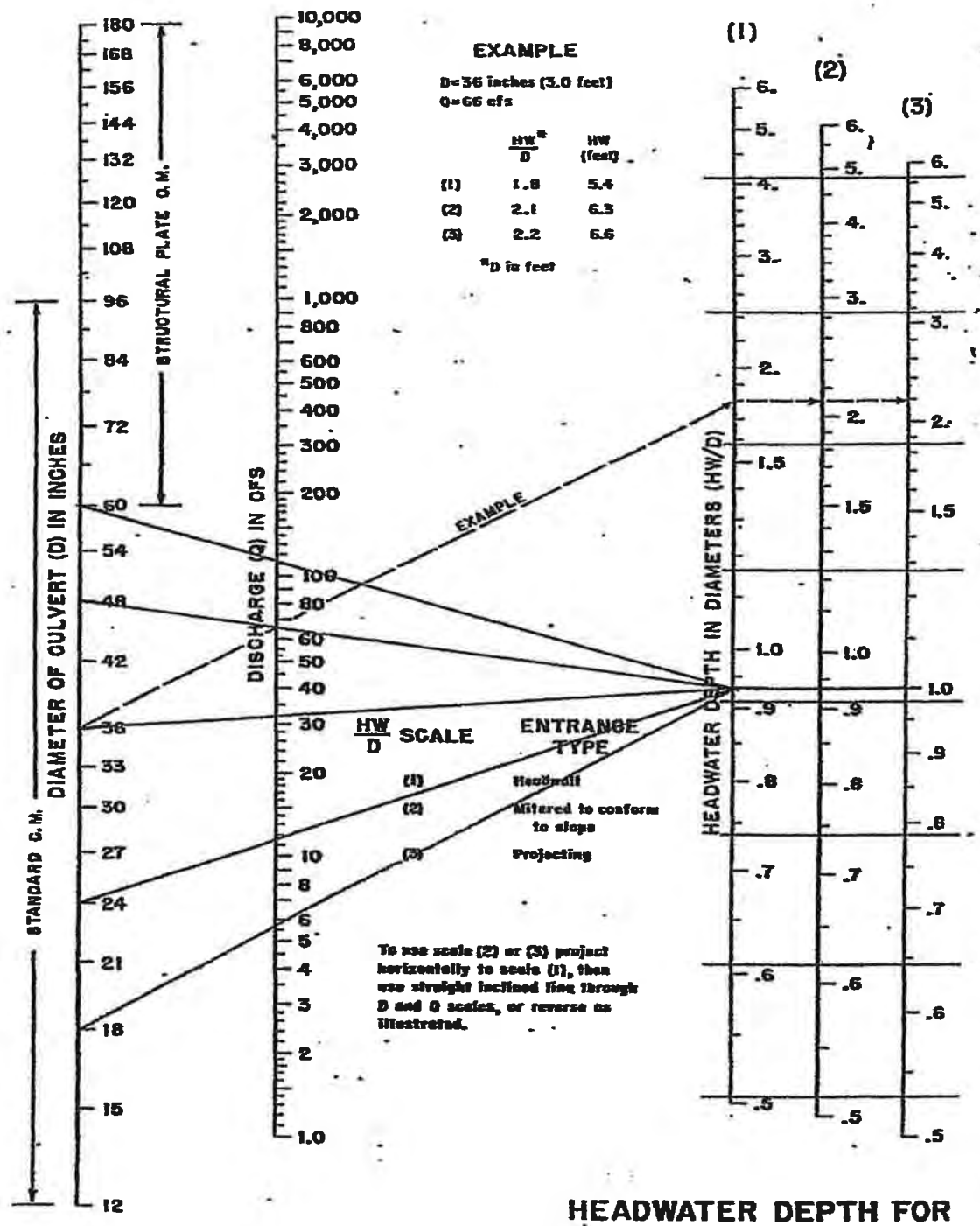
1" = 40'



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH ENTRANCE CONTROL

MAY 1956

CHART D-1



BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

*200-1.6.1 Selection of Riprap and Filter Blanket Material

Vel. Ft/Sec (1)	Rock Class (2)	Riprap Thickness "T"	Filter Blanket (3)			
			Upper Layer(s)			Lower Layer (6)
			Opt. 1 Sec. 200 (4)	Opt. 2 Sec. 400 (4)	Opt. 3 (5)	
6-7	No. 3 Backing	.6'	3/16"	C2	D.G.	—
7-8	No. 2 Backing	1.0	1/4"	B3	D.G.	—
8-9.5	Facing	1.4	3/8"	—	D.G.	—
9.5-11	Light	2.0	1/2"	—	3/4", 1 1/2" P.B.	—
11-13	1/4 Ton	2.7	3/4"	—	3/4", 1 1/2" P.B.	Sand
13-15	1/2 Ton	3.4	1"	—	3/4", 1 1/2" P.B.	Sand
15-17	1 Ton	4.3	1 1/2"	—	Type B	Sand
17-20	2 Ton	5.4	2"	—	Type B	Sand

Practical use of this table is limited to situations where "T" is less than D.

(1) Average velocity in pipe or bottom velocity in energy dissipator, whichever is greater.

MIRAFI 700X or equivalent

(2) If desired riprap and filter blanket class is not available, use next larger class.

(3) Filter blanket thickness = 1 foot or "T", whichever is less.

(4) Standard Specifications for Public Works Construction.

(5) D.G. = Disintegrated Granite, 1 MM to 10 MM

P.B. = Processed Miscellaneous Base

Type B = Type B bedding material, (minimum 75% crushed particles, 100% passing 2 1/2" sieve, 10% passing 1" sieve)

(6) Sand 75% retained on #200 sieve.

SECTION 201 - CONCRETE, MORTAR AND RELATED MATERIALS

201-1 PORTLAND CEMENT CONCRETE

201-1.1.2 Concrete Specified By Class (Pg. 88)

In "Concrete Class Use Table" modify as follows:

(1) Revise:
Concrete Pavement (not integral with curb) 520-A-2500

To Read:
Concrete Pavement (not integral with curb), Cross Gutter and Alley Aprons 560-C-3250

(2) Revise:
Curb, Integral Curb and Pavement, Gutter, Walk, Alley Aprons 520-C-2500

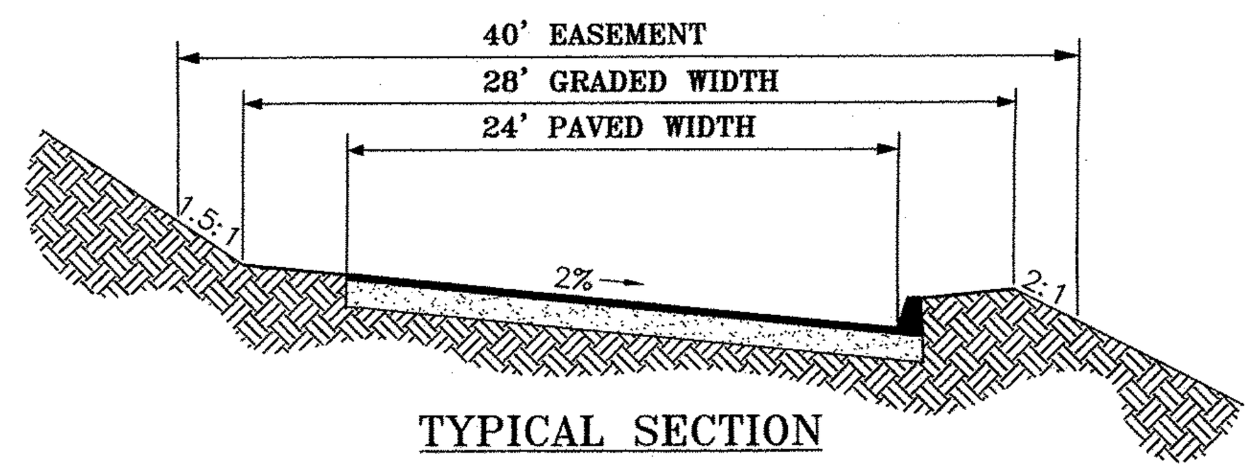
To Read:
Curb and Gutter (separate or combined) and Walks 520-C-2500

(3) Change concrete class for "Sidehill Surface Drainage Facilities" from "500-C-2500" to "520-C-2500".

1991?

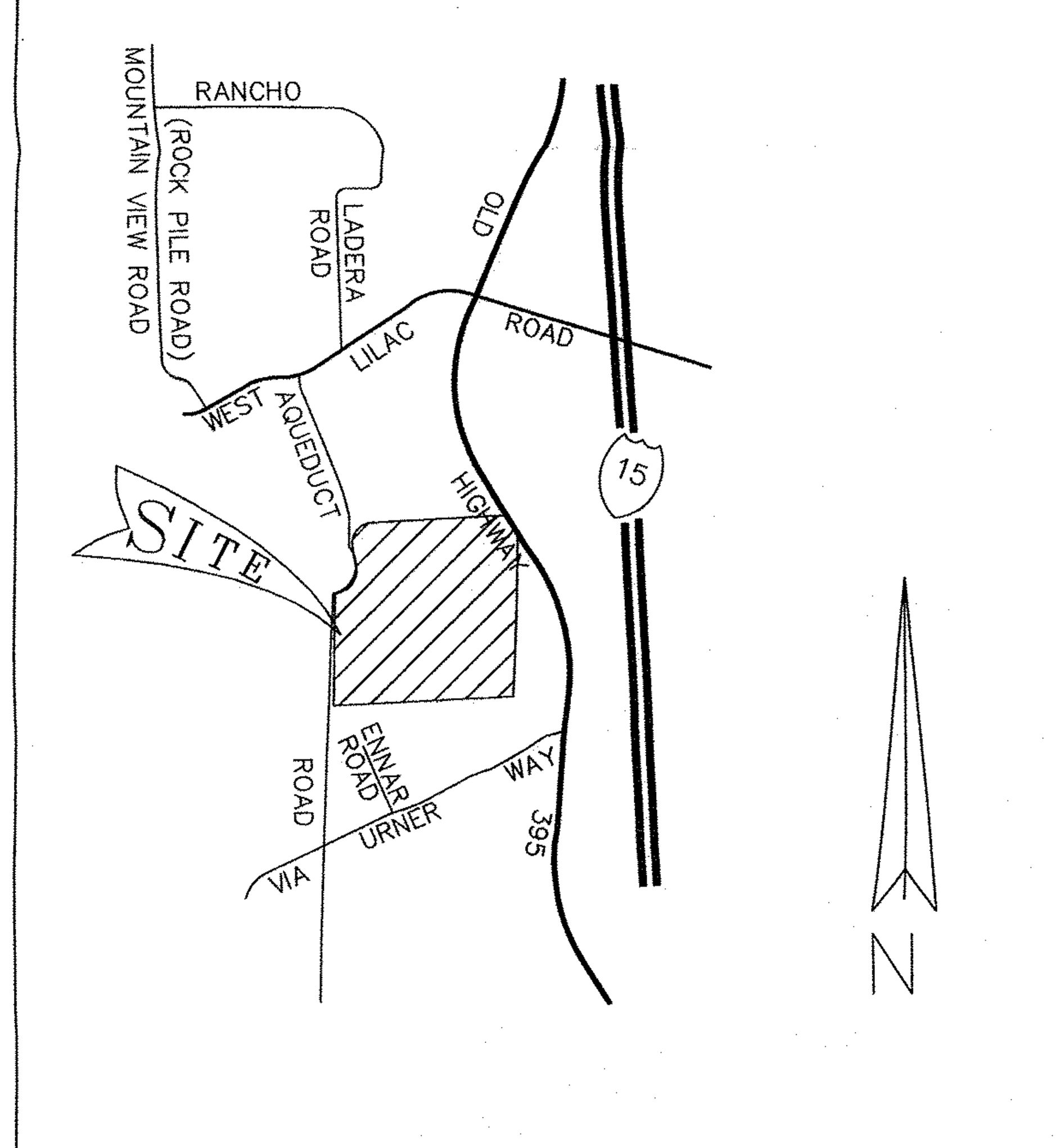
LEGEND

- PROPOSED STORM DRAIN WITH RIP RAP ENERGY DISSIPATOR
- UNPAVED BROW DITCH (PER SDRSD D-75), DIMENSIONS ONLY
- DIRECTION OF FLOW
- PROPOSED CUT SLOPES (1.5:1 MINOR SLOPES; 2:1 MAJOR SLOPES UNLESS SHOWN OTHERWISE)
- FILL SLOPES (2:1)
- EXISTING NATURAL DRAINAGE SWALE TO BE RE-VEGETATED WITH DITICHLIS SPACATA 20' WIDE (MIN)
- EXISTING RIDGE
- SOIL GROUP BOUNDARIES
- PROPOSED DRAINAGE SWALE TO BE VEGETATED WITH DITICHLIS SPACATA 15' WIDE (MIN)
- GRASS LINED PAD SWALE



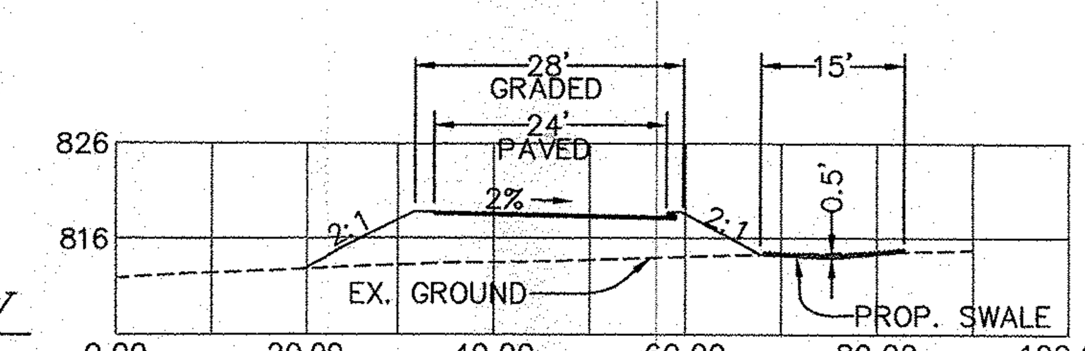
TYPICAL SECTION

NOTE:
THIS PLAN IS PROVIDED TO ALLOW FOR A FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN VALID GRADING PERMISSIONS BEFORE COMMENCING SUCH ACTIVITY.

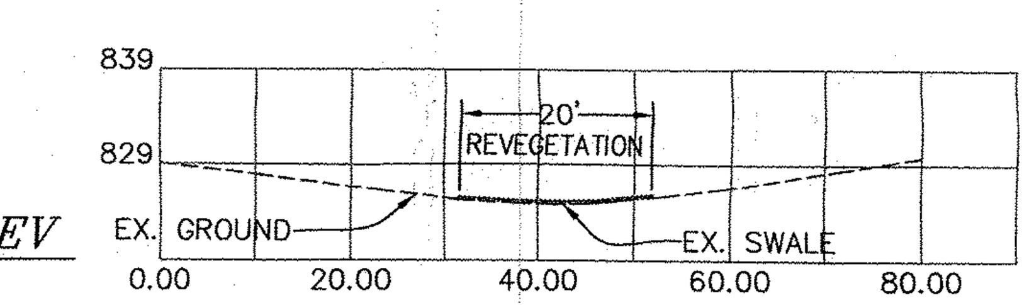


VICINITY MAP

NO SCALE T.B. 1048, J-7



DATUM ELEV
806.00
GROUP BIO
SECTION AA



DATUM ELEV
819.00
GROUP BIO
SECTION BB

SECTION AA
PROPOSED VEGETATED SWALE
SCALE:1"=20'

SECTION BB
EXISTING RE-VEGETATED SWALE
SCALE:1"=20'

SCALE: 1"=100'

0 100 200 300 400

PROPERTY OWNER INFORMATION
NAME: DON DABBS
ADDRESS: P.O. BOX 966
BONSALL, CA 92003
TELEPHONE NUMBER: (760) 727-7371 (24 HOUR CONTACT NUMBER)
SITE A.P.N. NUMBER: 127-071-38
SITE ADDRESS: Old Highway 395 ±
BONSALL, CA 92003

REGISTERED PROFESSIONAL ENGINEER
GARY K. PIRO
NO. 24000
EXP. 12-31-01
CIVIL
STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY	ENGINEER OF WORK
TOPO FROM COUNTY 200 SCALE 410-1719	PREPARED BY: PIRO ENGINEERING 930 BOARDWALK, SUITE "D" SAN MARCOS, CA. 92069 (760) 744-3700 GARY K. PIRO RCE NO: 24000 EXPIRES: 12-31-05

COUNTY OF SAN DIEGO
DEPARTMENT OF PLANNING AND LAND USE

DRAINAGE MAP AND LID AND TREATMENT BMP LOCATION MAP FOR TM 5346

SHEET: 1 OF SHEETS: 1

MINOR GRADING PLAN

drain-4-8-08.lsh Z:\Sdsk\proj\3004\dwg\3004-DrainageMap.dwg 8/19/2009 4:06:06 PM PDT