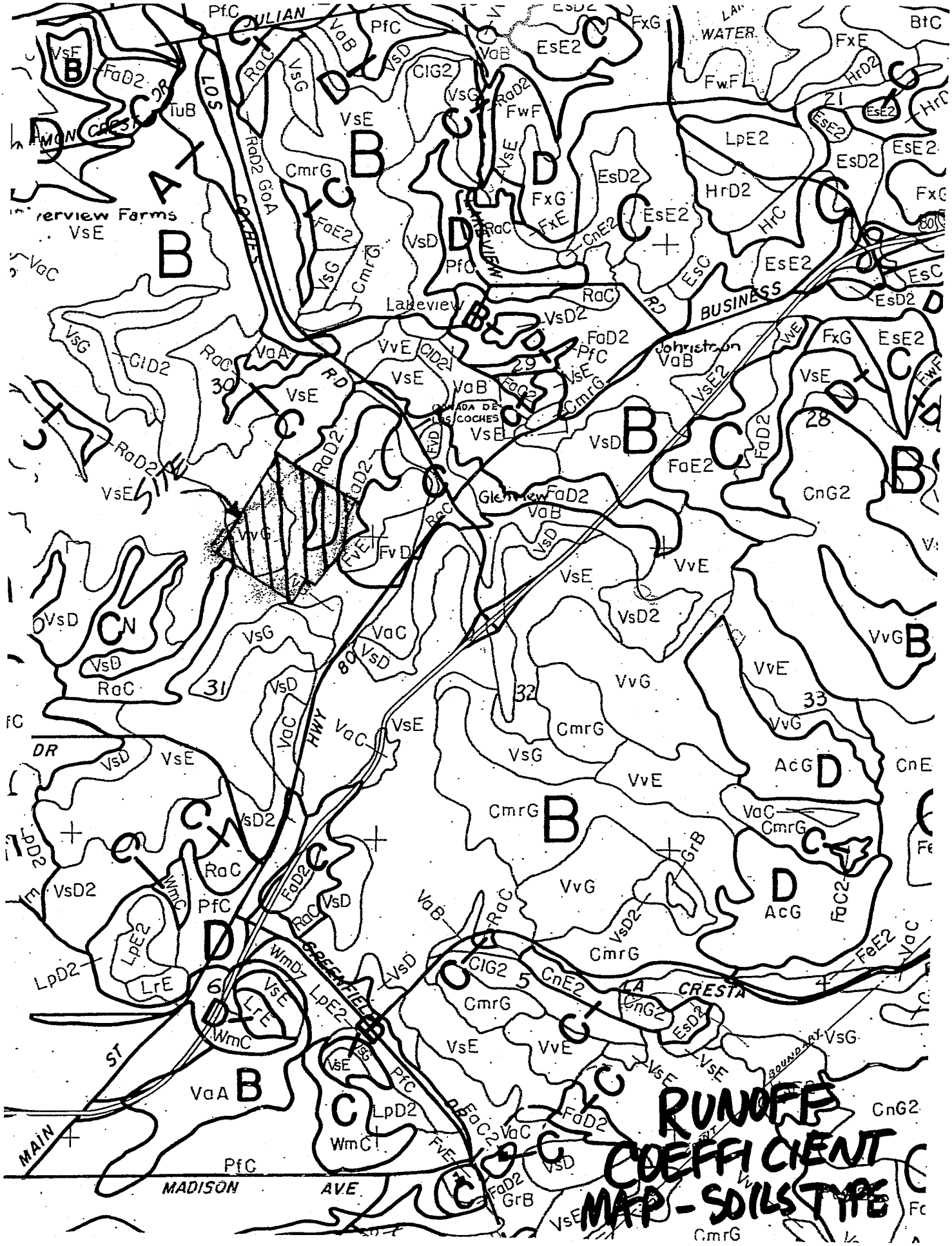
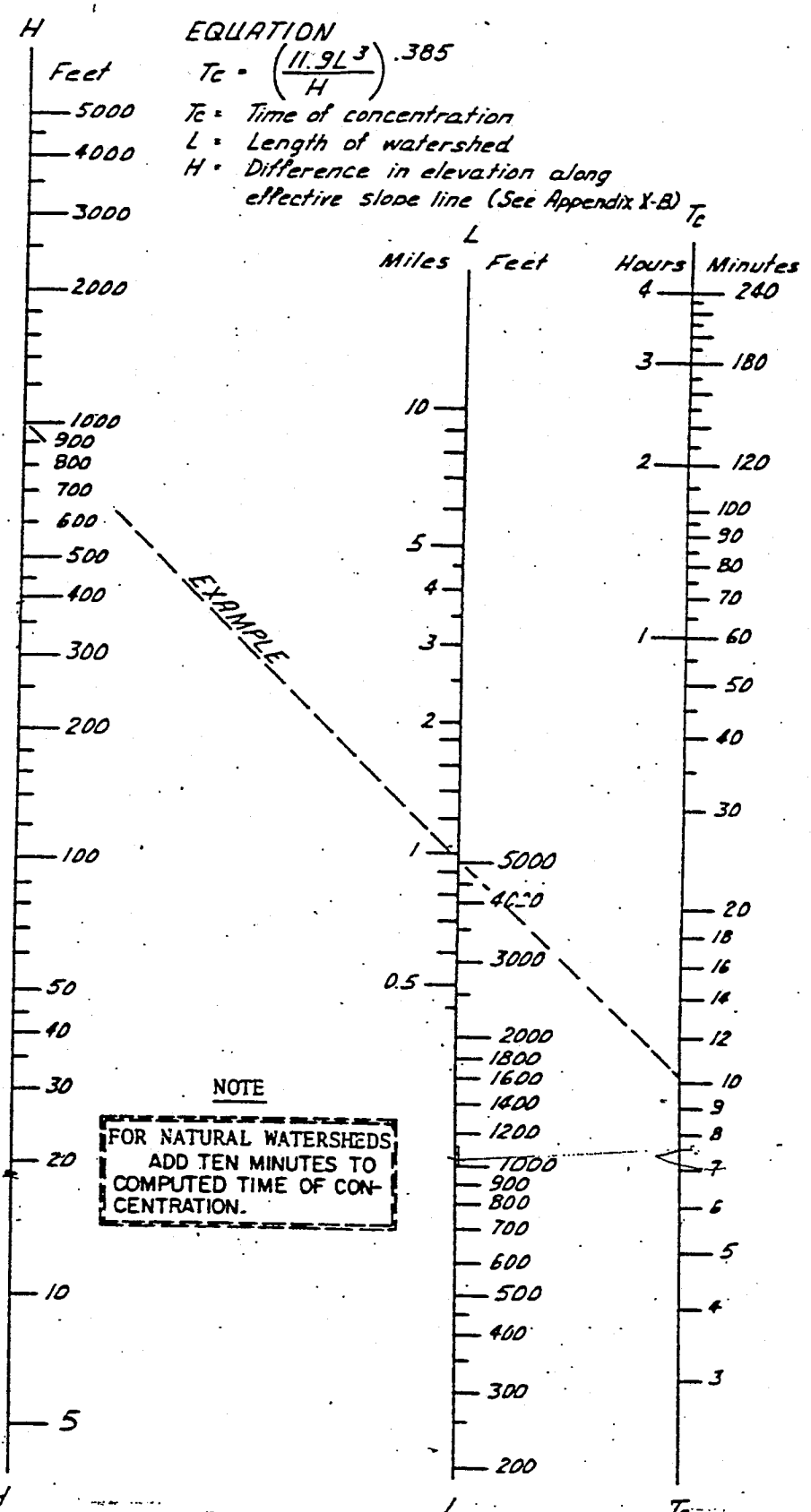

RUNOFF
COEFFICIENT
MAP - SOILS TYPE
LOS COCHES
LA CRESTA
GREENFIELD
MAIN ST
MADISON AVE
HWY 80
Lakeview
Johnston
BUSINESS RD
Glenview
WATER
PfC
VaB
VsD
VsE
VsG
RaC
RaD2
FaD2
FaE2
CmrG
VvE
VvG
VsD2
CnG2
EsE2
EsD2
FxG
FxE
HrD2
LpE2
LpD2
WmC
WmD7
LrE
CnE2
CIG2
AcG
GrB
FeE2
FaC2
VaA
VaC
RoC
TuB
FvE
FvD
CnE
BtC
HrC
EsC



SAN DIEGO COUNTY
DEPARTMENT OF SPECIAL DISTRICT SERVICES
DESIGN MANUAL

NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (T_c) FOR NATURAL WATERSHEDS

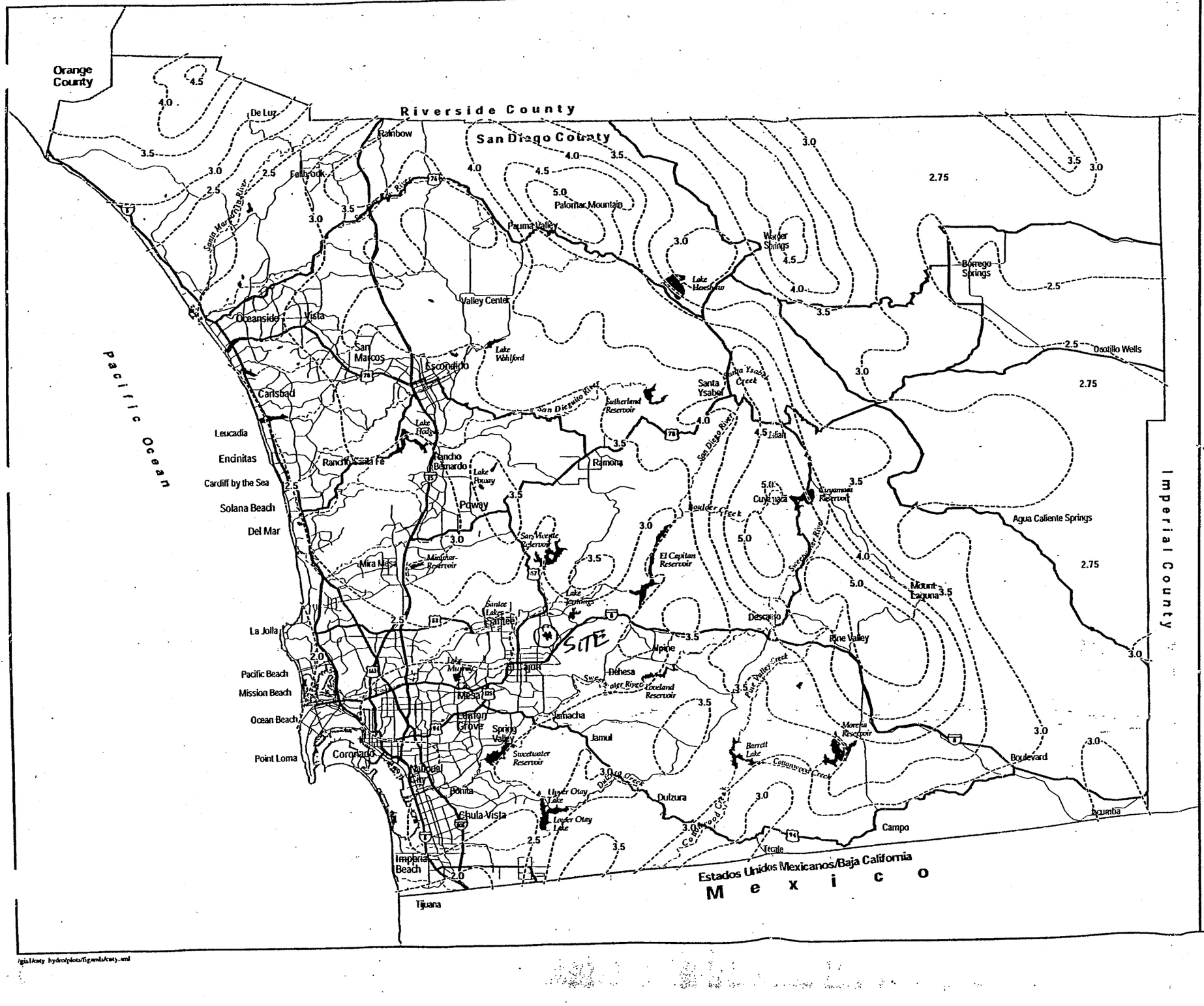
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$P_6 = 2.7$



Map Notes

Stateplane Projection, Zone6, NAD83
Creation Date: June 22, 2001
NOT TO BE USED FOR DESIGN CALCULATIONS

N

0 7.5
MILES

amec

/gis/data hydro/plots/figures/isoty.aml

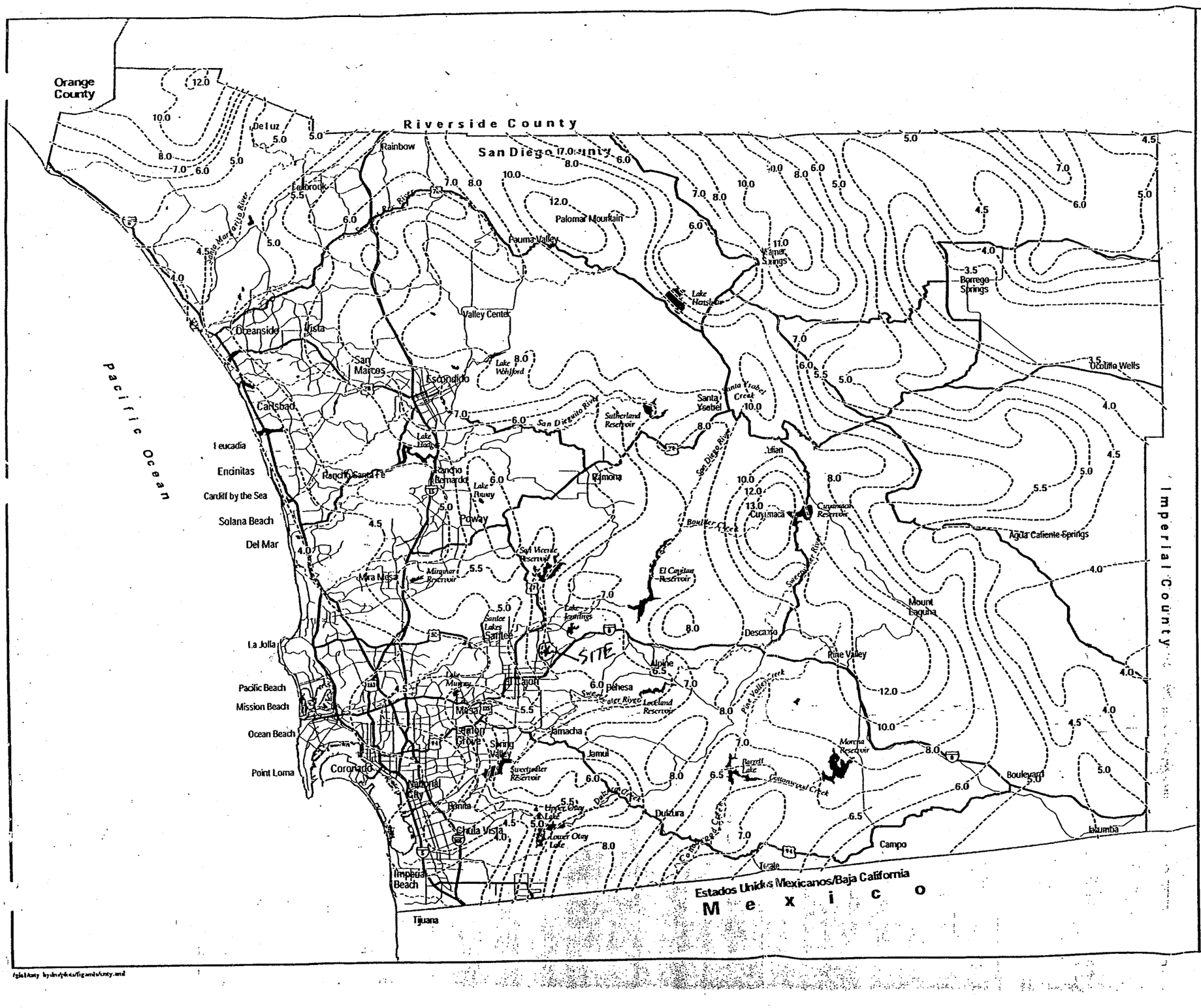
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$P_{24} = 6.0$



Map Notes

Stateplane Projection, Zone6, NAD83
Creation Date: June 22, 2001
NOT TO BE USED FOR DESIGN CALCULATIONS

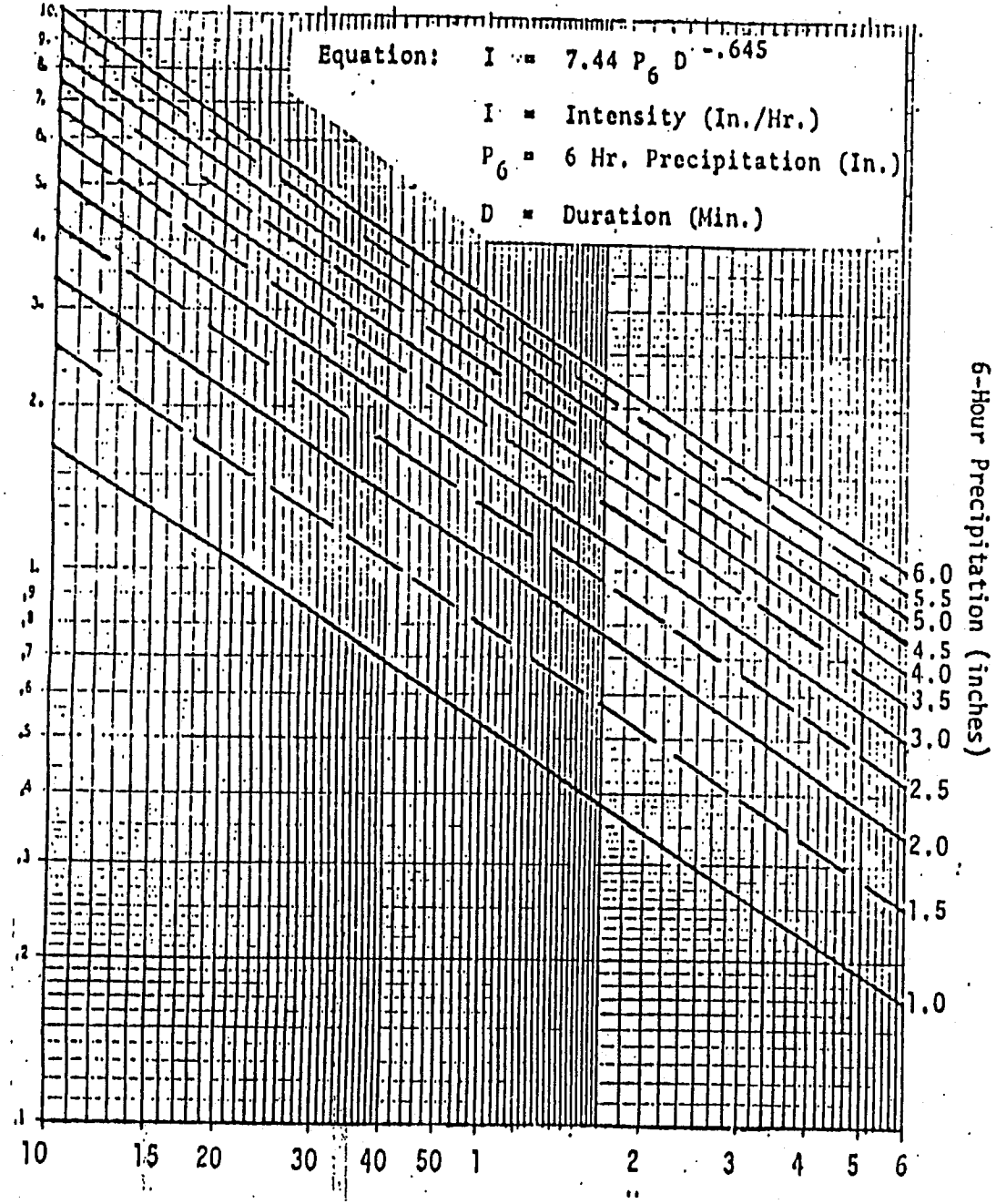
N

0 7.5
MILES

amec

/gis/data by dm/dyk/cs/figures/cnty.mxd

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

0) Selected Frequency 100 yr.

1) P_6 = 2.7 in., P_{24} = 60, $\frac{{}^*P_6}{P_{24}}$ = 45 %*

2) Adjusted $^*P_6$ = 2.7 in.

3) t_c = _____ min.

4) I = _____ in/hr.

*Not Applicable to Desert Region

R·E·C onsultants, Inc.
Civil Engineering · Environmental

Engineering Division
7445 Mission Valley Rd.
Suite 109
San Diego, CA 92108
619.688.0305
Fax.294.9394

Environmental Division
9517 Grossmont Summit Dr.
La Mesa, CA 91941
619.466.0107
Fax.466.0597

LOS COCHES

EXISTING HYDROLOGY

BASIN X $Q = CIA$

$A = 21.2$ Ac.

$C = 0.35$ per chart — 100% Group B (See Soils Map)

$H = 955 - 600 = 355$

$L = 1300'$

T_c = 3 minutes + 10 minutes for natural
= 13 minutes

$I_{100} = 3.8$ in/hr

$Q_{100} = (0.35)(3.8)(21.2) =$ **28.2 cfs**

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LOS COCHES

EXISTING HYDROLOGY

BASIN Y $Q = CIA$

$A = 45.2$ Ac.

$C =$ 30% Group C Soil (See Soils Map)
70% Group B "

$C = (0.30)(0.4) + (0.7)(0.35) = 0.37$

$H = 995 - 615 = 380$

$L = 1600'$

$T_c = 4 \text{ min} + 10 \text{ min (natural)}$

$= 14 \text{ minutes}$

$I_{100} = 3.6 \text{ in/hr}$

$Q_{100} = (0.37)(3.6)(45.2) = \underline{60.2 \text{ cfs}}$

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619.466.0107
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LOS COCHES

BASIN A — $Q = CIA$

Break in to two subasins

BASIN A1 – Natural $C = 0.35$ 100% Soil Group B (see chart)

BASIN A2 – Developed $C = 0.45$

BASIN A1 $A = 10.4$ Ac.

$C = 0.35$

$H = 955 - 640 = 315'$

$L = 1200'$

$T_c = 3\text{min} + 10\text{min natural} = 13\text{mins}$

$I_{100} = 3.8$ in/hr

$Q_{100} = (0.35)(3.8)(10.4) = 13.8$ cfs

BASIN A2 $A = 6.7$

$C = 0.45$

$T_c \rightarrow$ use 10 minutes (min)

$I_{100} = 4.5$

$Q_{100} = (0.45)(4.5)(6.7) = 13.6$ cfs

BASIN A $= 13.8\text{cfs} + 13.6\text{cfs} = 27.4$ cfs

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LOS COCHES

BASIN B $Q = CIA$

Break into two Sub Basins

BASIN B1 – Natural C = 10% Soil C, 90% Soil B

$C = (0.9)(0.35) + (0.1)(0.4) = 0.36$

BASIN B2 – Developed C = 50% Soil B, 50% Soil C

$C = (0.5)(0.45) + (0.5)(0.5) = 0.48$

BASIN B1

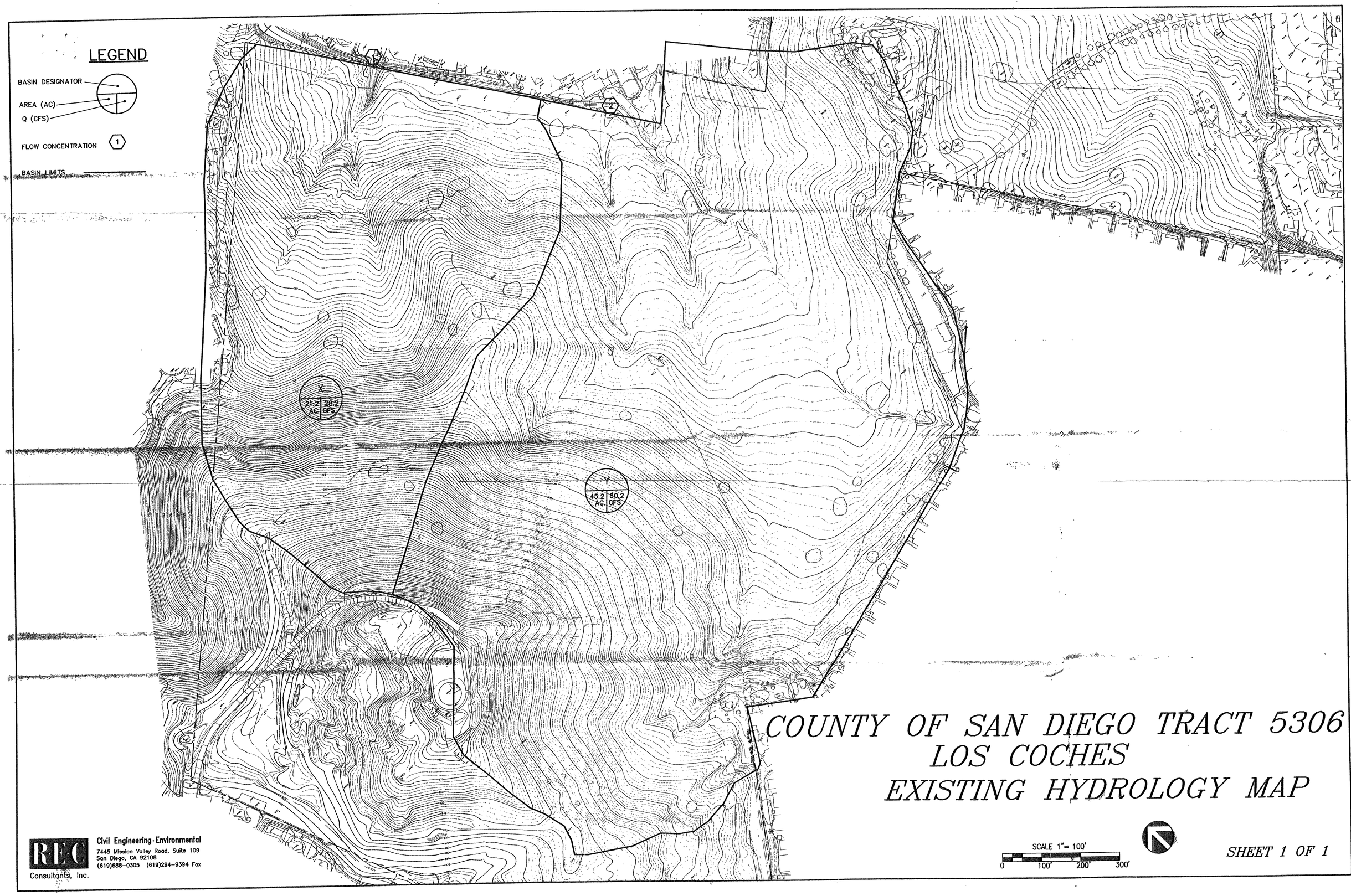
$A = 24.7$ Ac
$C = 0.36$
$H = 995 - 629 = 366$
$L = 1400$
$T_c = 4$ mins + 10 natural = 14 mins
$I_{100} = 3.6$ in/hr
$Q_{100} = (0.36)(3.6)(24.7) = \underline{32.0 \text{ cfs}}$

BASIN B2

$A = 24.6$ Ac
$C = 0.48$
$T_c \rightarrow$ use 10 minutes min
$I_{100} = 4.5$ in/hr
$Q_{100} = (0.48)(4.5)(24.6) = \underline{53.1 \text{ cfs}}$

BASIN B $Q_{100} = 32.0 \text{ cfs} + 53.1 \text{ cfs} = \underline{\underline{85.1 \text{ cfs}}}$

HYDROLOGY MAPS



COUNTY OF SAN DIEGO TRACT 5306
LOS COCHES
EXISTING HYDROLOGY MAP

SCALE 1"= 100'
0 100' 200' 300'

SHEET 1 OF 1

REC Consultants, Inc.
Civil Engineering · Environmental
7445 Mission Valley Road, Suite 109
San Diego, CA 92108
(619)688-0305 (619)294-9394 Fax

COUNTY TRACT 5306, HYDROLOGY MAP

LEGEND

BASIN DESIGNATOR

AREA (AC)

Q (CFS)

FLOW CONCENTRATION (1)

BASIN LIMITS

SUB-BASIN LIMITS

PROPOSED STORM DRAIN

BROW DITCH

A2 — 6.7 AC. | 13.6 CFS

A — 17.1 AC. | 27.4 CFS

A1 — 10.4 AC. | 13.8 CFS

B — 49.3 AC. | 85.1 CFS

B1 — 24.7 AC. | 32.0 CFS

B2 — 24.6 AC. | 50.7 CFS

MAP NO. 9524

WELLINGTON HILL DR.

OPEN SPACE LOT A

ZONE BOUNDARY

BLOCK 17 S TRACT
RANCHO EL CAJON
DB 170 P 71

COUNTY OF SAN DIEGO TR 5306RPL2
LOS COCHES
HYDROLOGY MAP

SCALE 1"= 100'

0 100' 200' 300'

SHEET 1 OF 1

COUNTY TRACT 5306, HYDROLOGY MAP

REC Consultants, Inc.

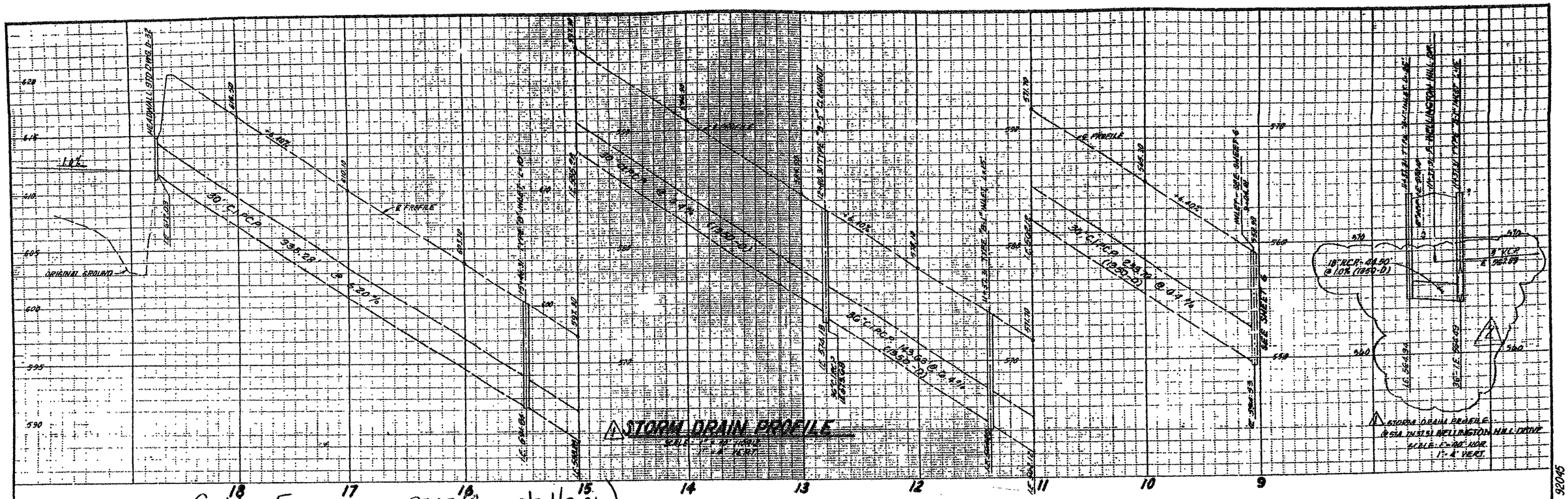
Civil Engineering · Environmental

7445 Mission Valley Road, Suite 109
San Diego, CA 92108
(619)688-0305 (619)294-9394 Fax

HYDRAULIC CALCULATIONS

(EXISTING PIPES THAT TM 5306 CONNECTS TO)

RODNEY STOKES CO.



Q_{100} = 74.8 per Grabhorn Engineering TM3747 (Report Herein)

Q_{100} = 80.9 Proposed per Tentative map 5306 (Calcs herein)

* See Calcs following page Showing 30" CIRCP IS sufficient to handle 80.9 cfs

Confluence point

BASIN A1 + BASIN A2

Q_{100} = 74.8 + 40.3 = 115.1 cfs (per TM 3747 report)

Q_{100} = 80.9 + 28.2 = 109.1 cfs proposed

SEE CALC'S IN REPORT ENCLOSED

PRECISION
DEC 26 1984
MICROFILMED

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

ENGINEER OF REVISION
grabhorn engineering corp.
CIVIL ENGINEERING LAND PLANNING SURVEYING
9819 chesapeake drive, suite 101
san diego, california 92123
telephone (619) 569-7227
RICHARD G. GRABHORN RCE 19375

ENGINEER OF WORK
SNIPES-DYE ASSOCIATES
CIVIL ENGINEERING LAND SURVEYING
3562 GROVE STREET, LEMON GROVE, CA. 92045
TELEPHONE (714) 697-9234

COUNTY APPROVED CHANGES			
No.	Description	Approved by	Date
1	NEW ENGINEER OF WORK, REVISED STORM DRAIN & STREET NAMES	N.Sims	5-30-84
2	REVISED STORM DRAIN PROFILE PER LDA PLAN	Nilson	12/14/84
3	Total Number of Shts. changed	Nilson	12/19/84

BENCH MARK
DESCRIPTION: SEE SHEET 1
LOCATION:
RECORD FROM:
ELEVATION: DATUM:

PRIVATE CONTRACT
SHEET 7 COUNTY OF SAN DIEGO DEPARTMENT OF TRANSPORTATION 25 SHEETS
PLANS FOR THE GRADING OF:
TRACT 3747
STORM DRAIN SYSTEM
CALIF. COORDINATE INDEX: 246-1797
APPROVED R.J. HASSMAN DIRECTOR OF TRANSPORTATION
BY R.J. Hassman 12/14/1984 DATE
ENGINEER OF WORK Roger L. Snipes RCE 19795
GRADING PERMIT NO. L-8961

4-9-84 FILE NO. 235-003

ENGINEER'S NAME: ROGER L. SNIPES, SNIPES-DYE ASSOCIATES, 3562 GROVE STREET, LEMON GROVE, CA. 92045
PHONE NO. (714) 697-9234

BASIN A - Proposed Hydraulics

tmp#1.txt

Manning Pipe Calculator

Given Input Data:

Shape	Circular	
Solving for	Depth of Flow	
Diameter	30.0000 in	← Existing pipe size
Flowrate	85.1000 cfs	← Q100 proposed
Slope	0.0620 ft/ft	← slope per plans (LTM 3747-1) See previous sheet for As-Built profile.
Manning's n	0.0150	

Computed Results:

Depth	23.6091 in *
Area	4.9087 ft2
Wetted Area	4.1439 ft2
Wetted Perimeter	65.4631 in
Perimeter	94.2478 in
Velocity	20.5362 fps
Hydraulic Radius	9.1154 in
Percent Full	78.6969 %
Full flow Flowrate	88.5143 cfs
Full flow velocity	18.0320 fps

* Depth = 24"

∴ pipe sufficient

This shows BASIN A proposed for TM5306 with Q_{100} = 85.1, will be able to be handled by the existing 30" pipe. Further Downstream, proposed flows are less than designed flows, so the entire Storm Drain System is sufficient.

APPENDEX: TM 3747-1 DRAINAGE STUDY

SNIPES-DYE ASSOCIATES
Civil Engineers and Land Surveyors
3562 Grove St. (714) 697-9234
LEMON GROVE, CA 92045

FOR REF. ONLY

See Drainage Map/Area Revisions

HYDROLOGY AND HYDRAULIC CALCULATIONS FOR WELLINGTON HILLS SUBDIVISION COUNTY OF SAN DIEGO TRACT NO. 3747

PREPARED BY ROGER L. SNIPES, RCE 18134
DEC. 5, 1978

THE UPSTREAM WATERSHED CONTAINS TWO DRAINAGE BASINS (SEE ATTACHED 200 SCALE COUNTY ORTHOPHOTO):

BASIN A1 IS 26.1 ACRES, $Q_{100} = 37.9$ cfs ✓ (SEE FIGURE 1)

THE COLLECTION POINT IS A SUMP CONDITION WITH NO POSSIBILITY OF OVERFLOW SO THAT THE ENTIRE Q_{100} MUST ENTER THE PIPE.

THE AVAILABLE HEADWATER IS 609.2 − 597.0 = 12.2 ✓

ASSUME 24" RCP w/ INLET CONTROL
SEE p.4 HW = 5.8' < 12.2 O.K. ✓

ASSUME 24" CMP w/ INLET CONTROL
SEE p.5 HW = 7.2 ≤ 12.2 O.K. ✓

USE EITHER 24" RCP OR 24" CMP ✓

ALL Calcs O.K.
M. Uhi 2-2-79

TM 3747-1

DRAINAGE AREA A_{11}

$A = 26.1$ ACRES

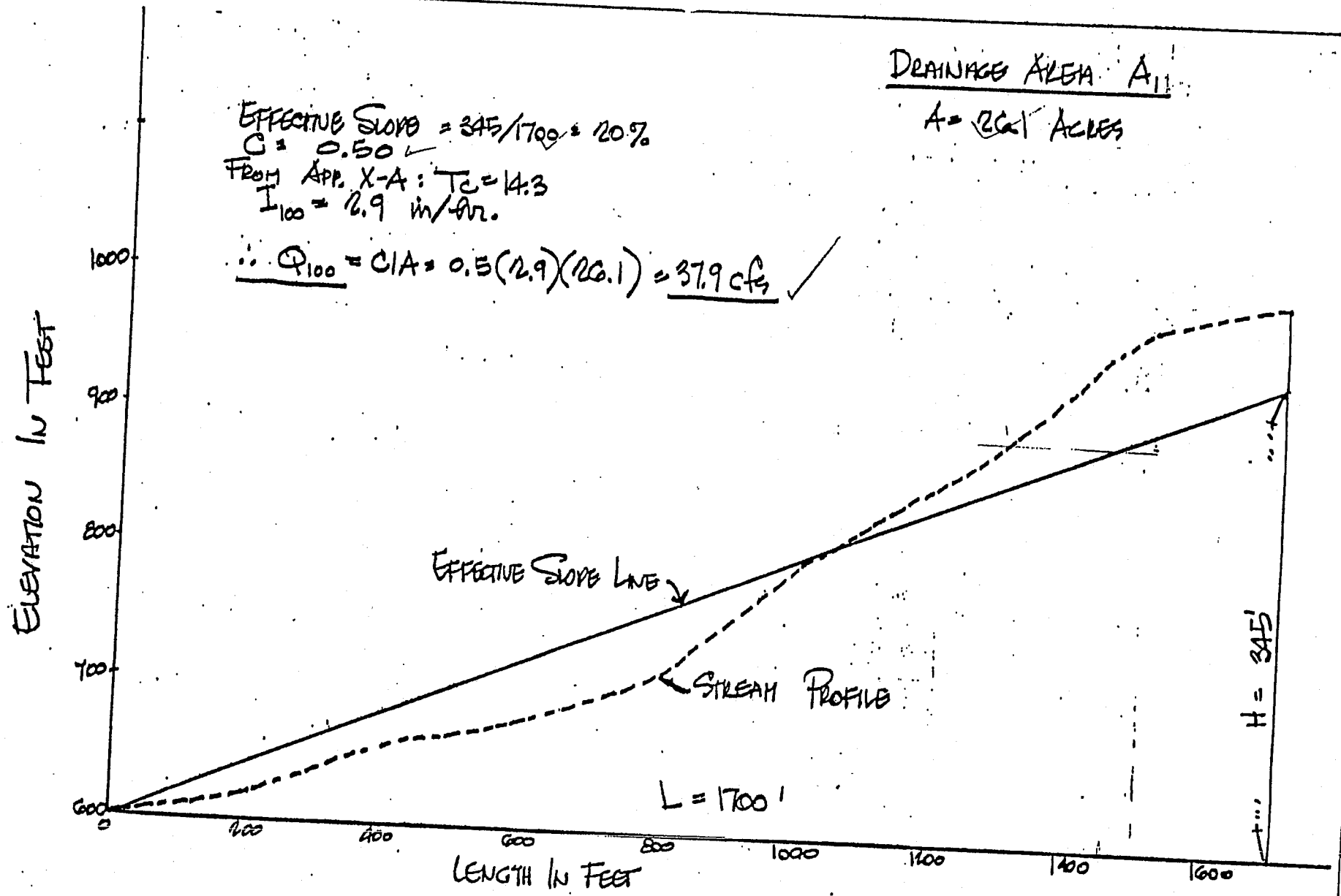
EFFECTIVE SLOPE = 345/1700 = 20%

$C = 0.50$

FROM APP. X-A: $T_c = 14.3$

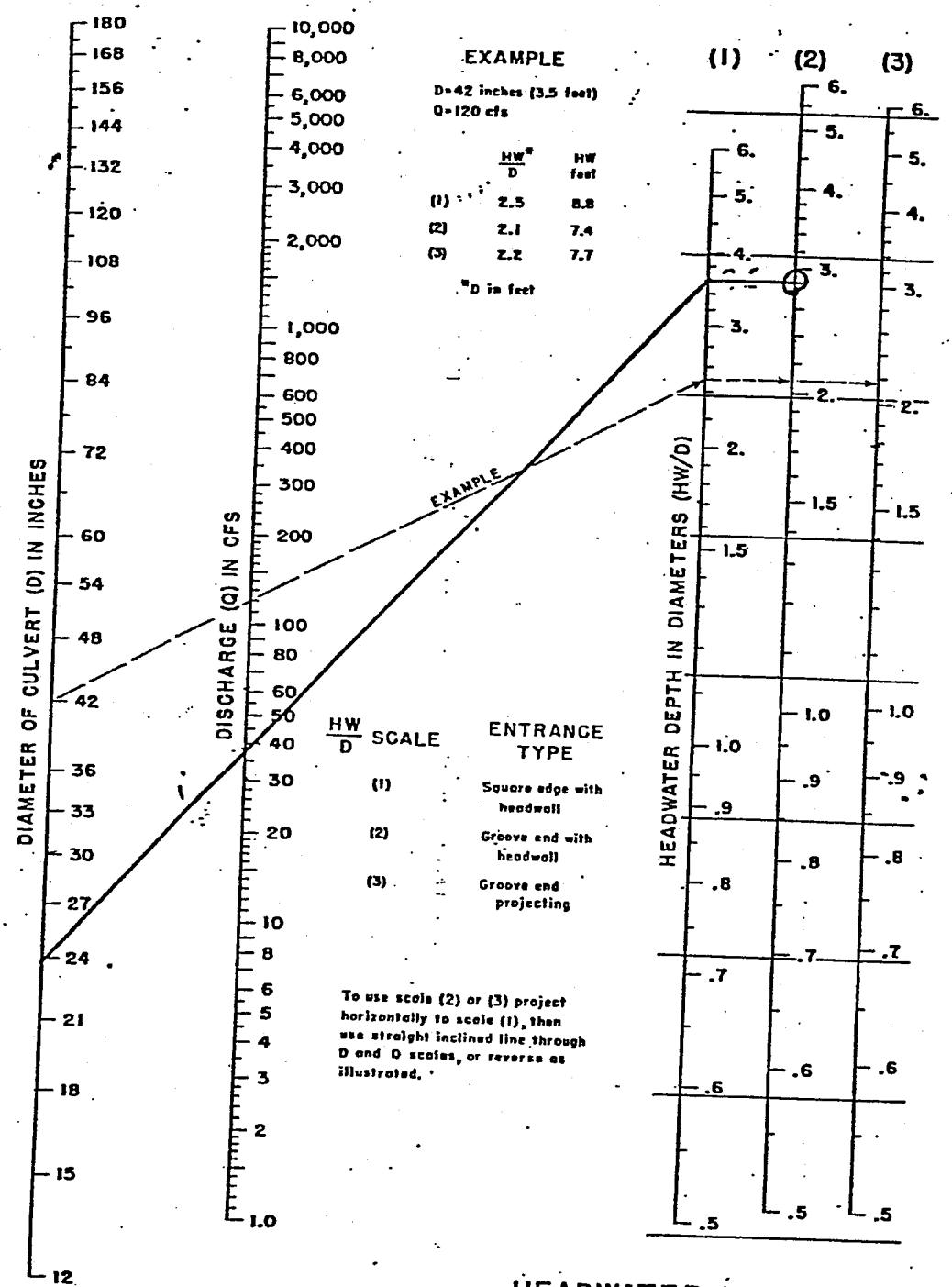
$I_{100} = 2.9$ in/hr.

$\therefore Q_{100} = CIA = 0.5(2.9)(26.1) = 37.9$ cfs



4

CHART 2

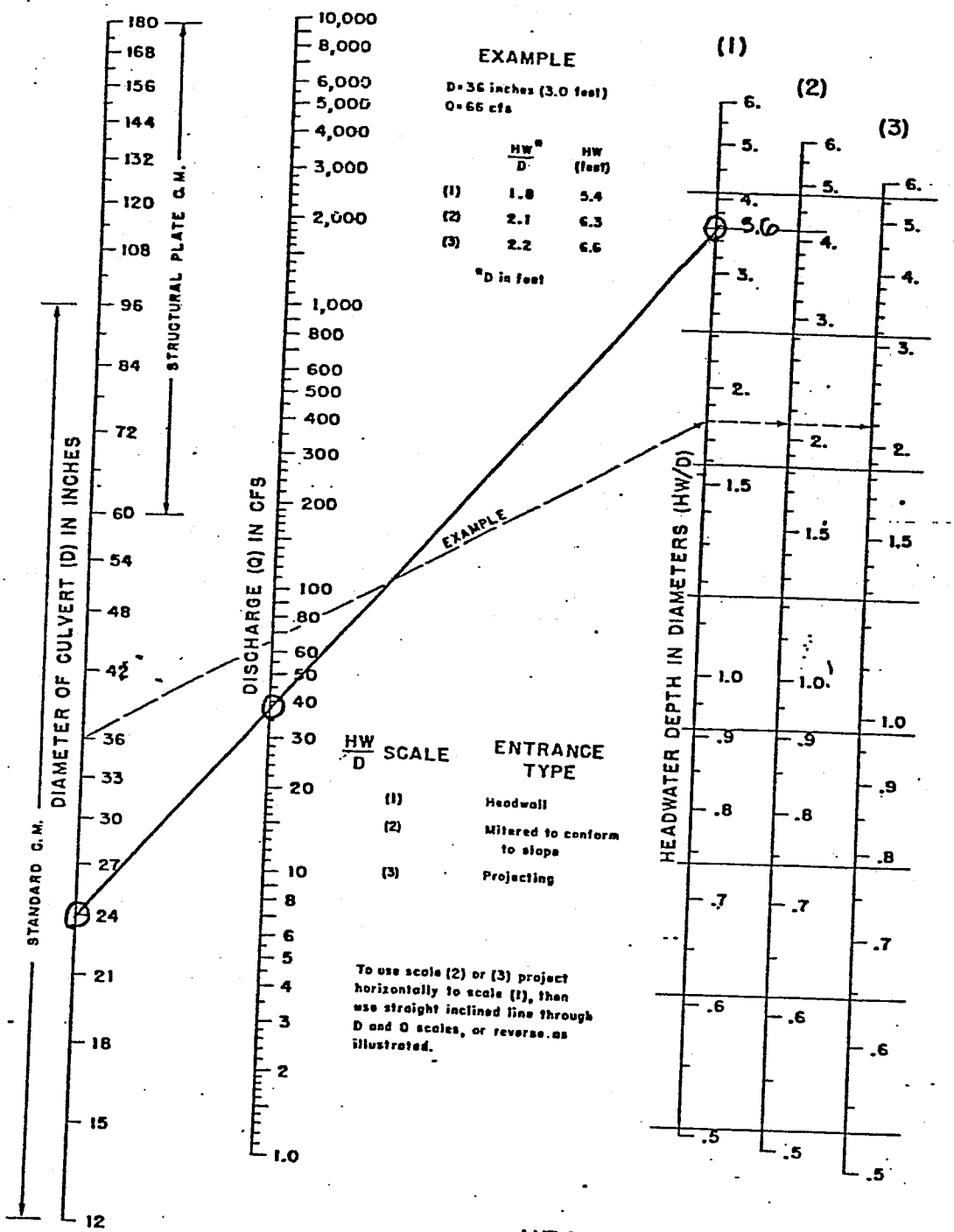


HW = 2.9(2) = 5.8'

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

CHART 5



HW = 3.6(2) = 7.2

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

BUREAU OF PUBLIC ROADS JAN. 1963

BASIN A2

$Q_{100} = 103.5$ cfs

$Q_{50} = 96.4$ cfs

$Q_{10} = 75$ cfs

UNDER EXISTING COUNTY POUCH STORM DRAIN AT TERMINUS OF JACKSON HILL RD. MUST TAKE AT LEAST Q_{10} WITH OVERFLOW TO Q_{100} BEING CARRIED WITHIN THE STREET R.O.W.

AVAILABLE HEADWATER = 11'

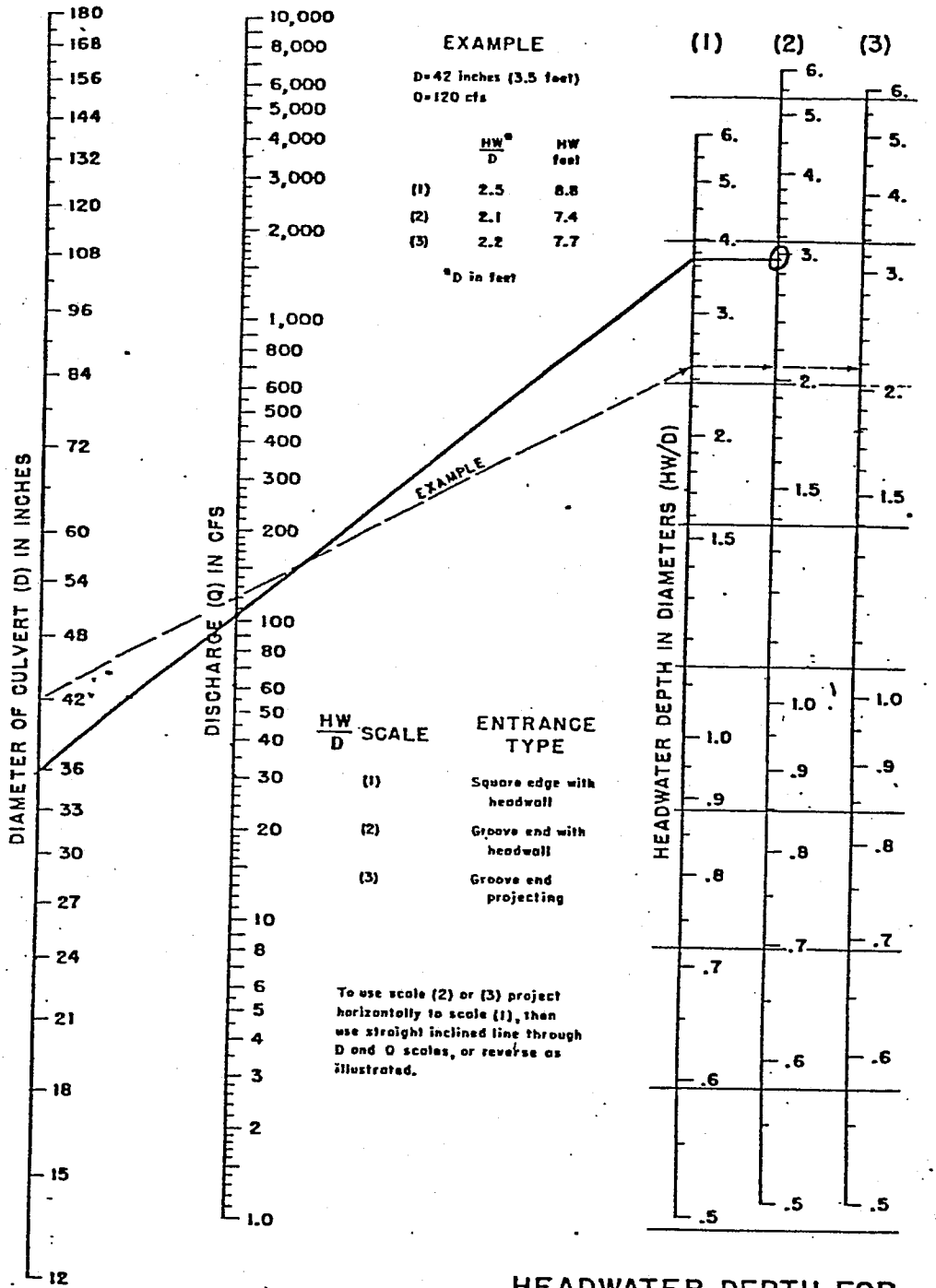
ASSUME 36" RCP W/ INLET CONTROL
SEE p. 7 HW = 8.7' < 11' O.K.

ASSUME 36" CMP W/ INLET CONTROL
SEE p. 8 HW = 10.8 < 11' O.K.

USE EITHER 36" RCP OR 36" CMP ✓

ENTIRE FLOW WILL BE IN PIPE

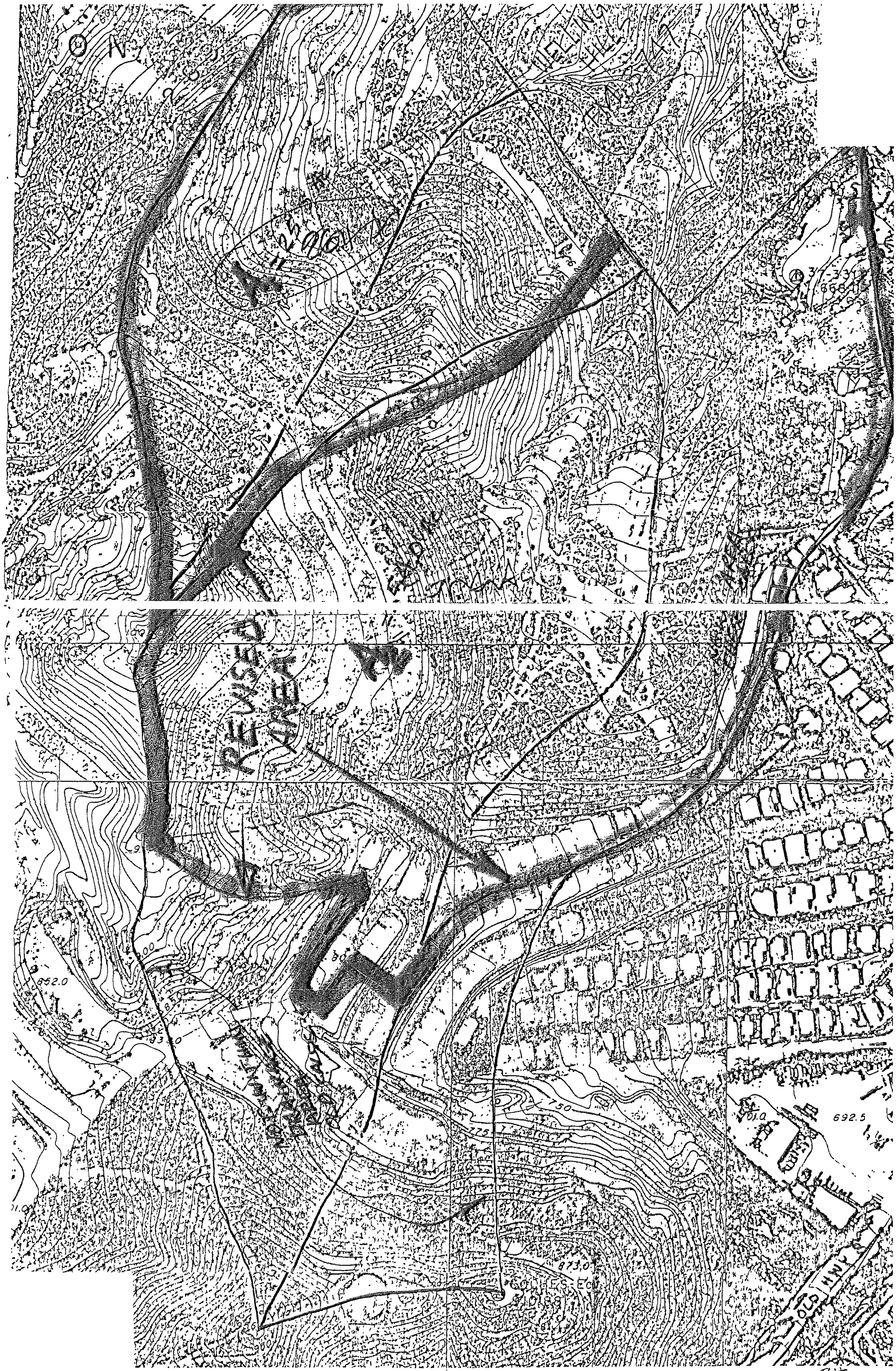
CHART 2



HW = 2.9(3) = 8.7'

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

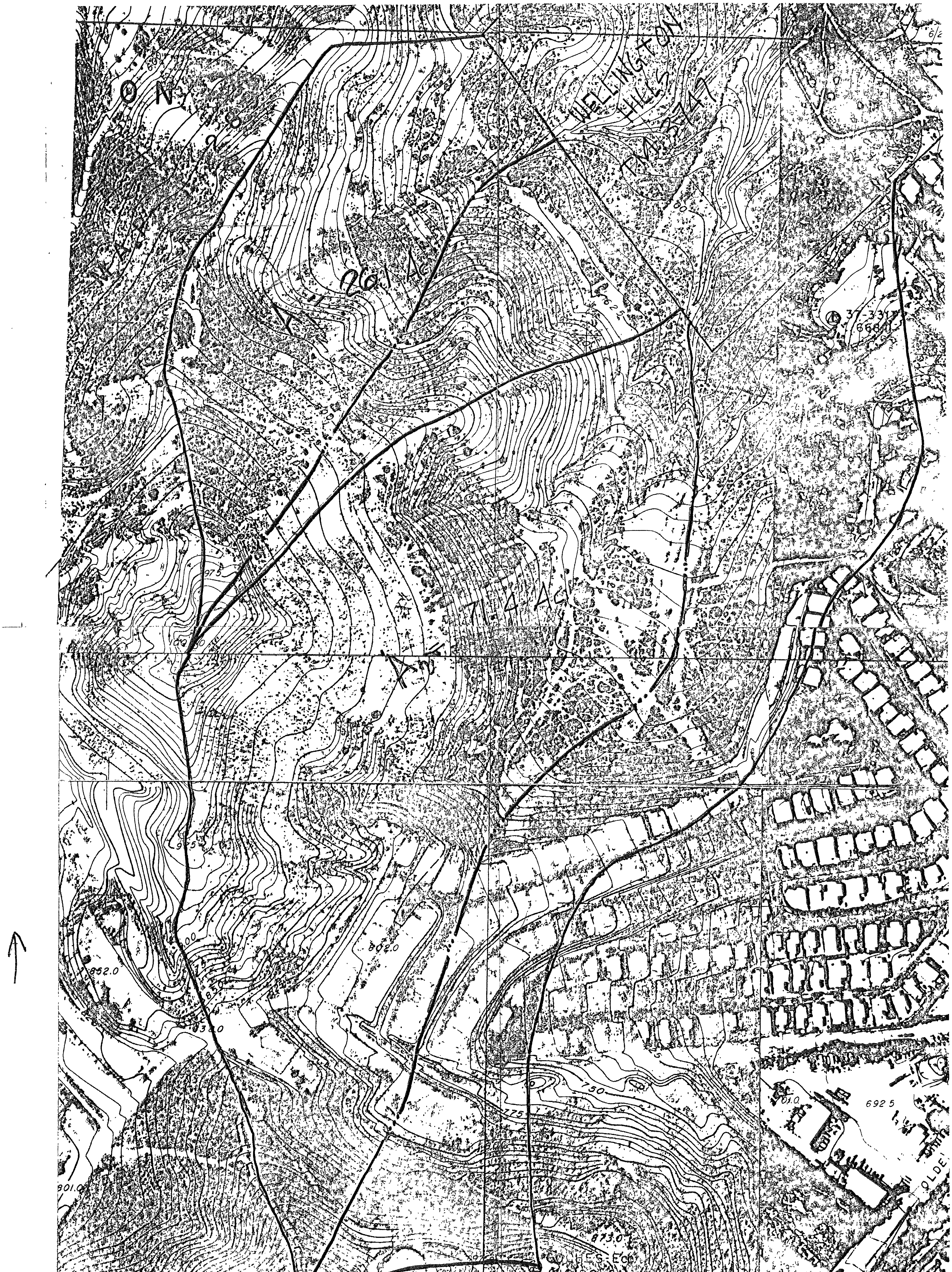
BUREAU OF PUBLIC ROADS JAN. 1963

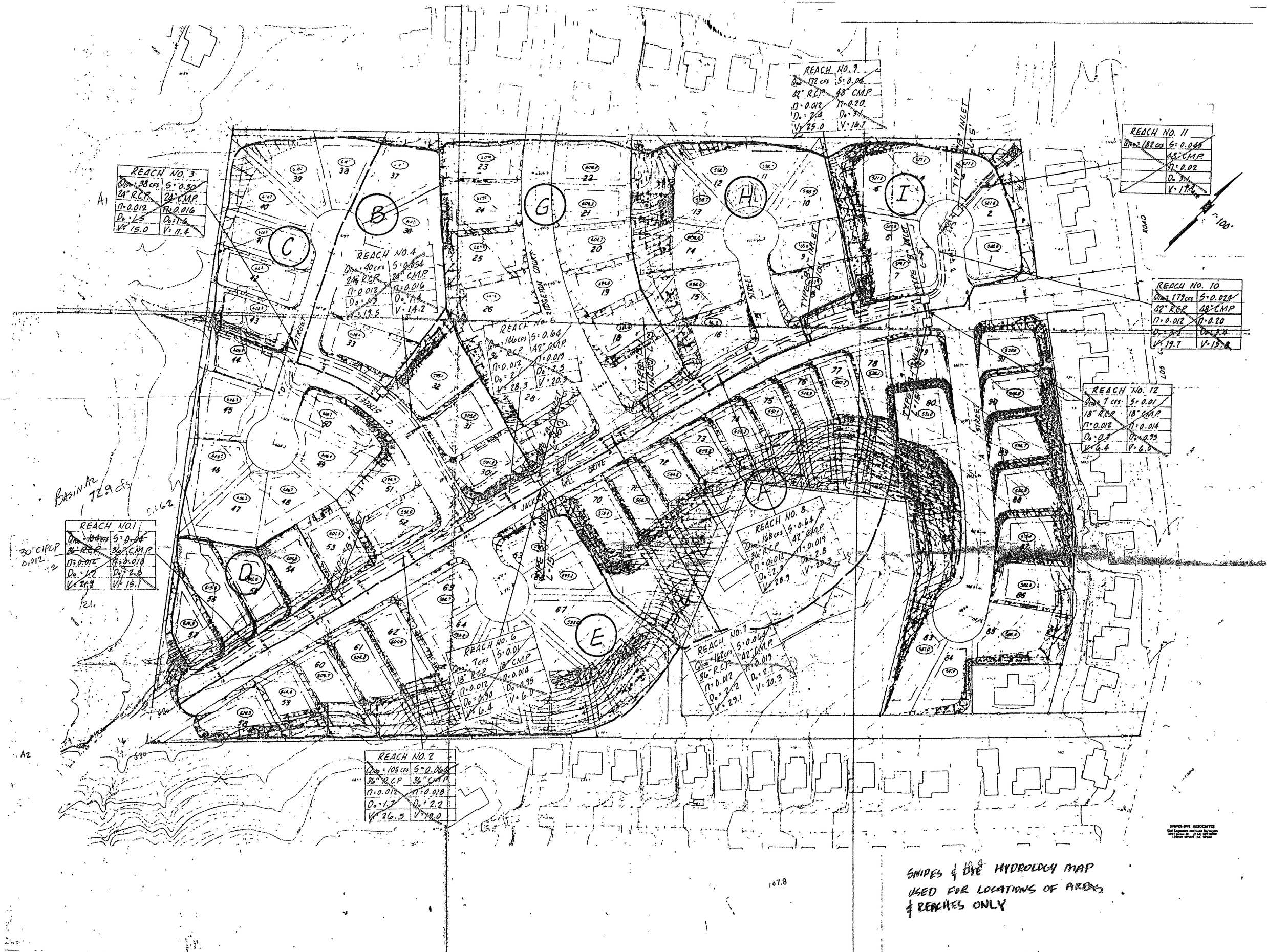


Scale — ADJUST FOR STRETCH

$A_1 = 0.97$ ← $(2)(14.2)(200)^2 \div 43560 =$

$0.97 \,/\, 2 \,/\, 302 \,/\, 200)^2 \div 43560 =$


WELLINGTON
HILLS
261AC
714AC
625
37-331
668
975
852.0
802.0
750
775
873.0
692 5
OLDE



SNIDES & DYE HYDROLOGY MAP
USED FOR LOCATIONS OF AREAS
& REACHES ONLY

DRAINAGE AREA MAP
CO. OF SAN DIEGO TRACT NO. 3747

351,500
440
283
116
1,159,500
43,560

REACH NO. 9
Q_{100} = 172 cfs | S = 0.04
42" R.C.P. | 48" C.M.P.
n = 0.012 | n = 0.020
D_o = 2.4 | D_o = 3.1
V = 25.0 | V = 16.7

REACH NO. 11
Q_{100} = 182 cfs | S = 0.045
48" C.M.P.
n = 0.02
D_o = 3.1
V = 17.7

REACH NO. 3
Q_{100} = 38 cfs | S = 0.30
24" R.C.P. | 24" C.M.P.
n = 0.012 | n = 0.016
D_o = 1.5 | D_o = 1.6
V = 15.0 | V = 11.4

REACH NO. 4
Q_{100} = 40 cfs | S = 0.054
24" R.C.P. | 24" C.M.P.
n = 0.012 | n = 0.016
D_o = 1.3 | D_o = 1.4
V = 19.5 | V = 14.2

REACH NO. 5
Q_{100} = 140 cfs | S = 0.64
36" R.C.P. | 48" C.M.P.
n = 0.012 | n = 0.019
D_o = 2.1 | D_o = 2.5
V = 28.3 | V = 20.3

REACH NO. 10
Q_{100} = 179 cfs | S = 0.024
42" R.C.P. | 48" C.M.P.
n = 0.012 | n = 0.020
D_o = 3.2 | D_o = 3.4
V = 19.7 | V = 15.8

REACH NO. 12
Q_{100} = 7 cfs | S = 0.01
18" R.C.P. | 18" C.M.P.
n = 0.012 | n = 0.014
D_o = 0.9 | D_o = 0.95
V = 6.4 | V = 6.0

REACH NO. 1
Q_{100} = 104 cfs | S = 0.04
36" R.C.P. | 36" C.M.P.
n = 0.012 | n = 0.018
D_o = 1.9 | D_o = 2.8
V = 21.9 | V = 15.1

REACH NO. 6
Q_{100} = 7 cfs | S = 0.01
18" R.C.P. | 18" C.M.P.
n = 0.012 | n = 0.014
D_o = 0.90 | D_o = 0.95
V = 6.4 | V = 6.0

REACH NO. 8
Q_{100} = 168 cfs | S = 0.64
36" R.C.P. | 42" C.M.P.
n = 0.012 | n = 0.019
D_o = 2.3 | D_o = 2.8
V = 28.9 | V = 20.3

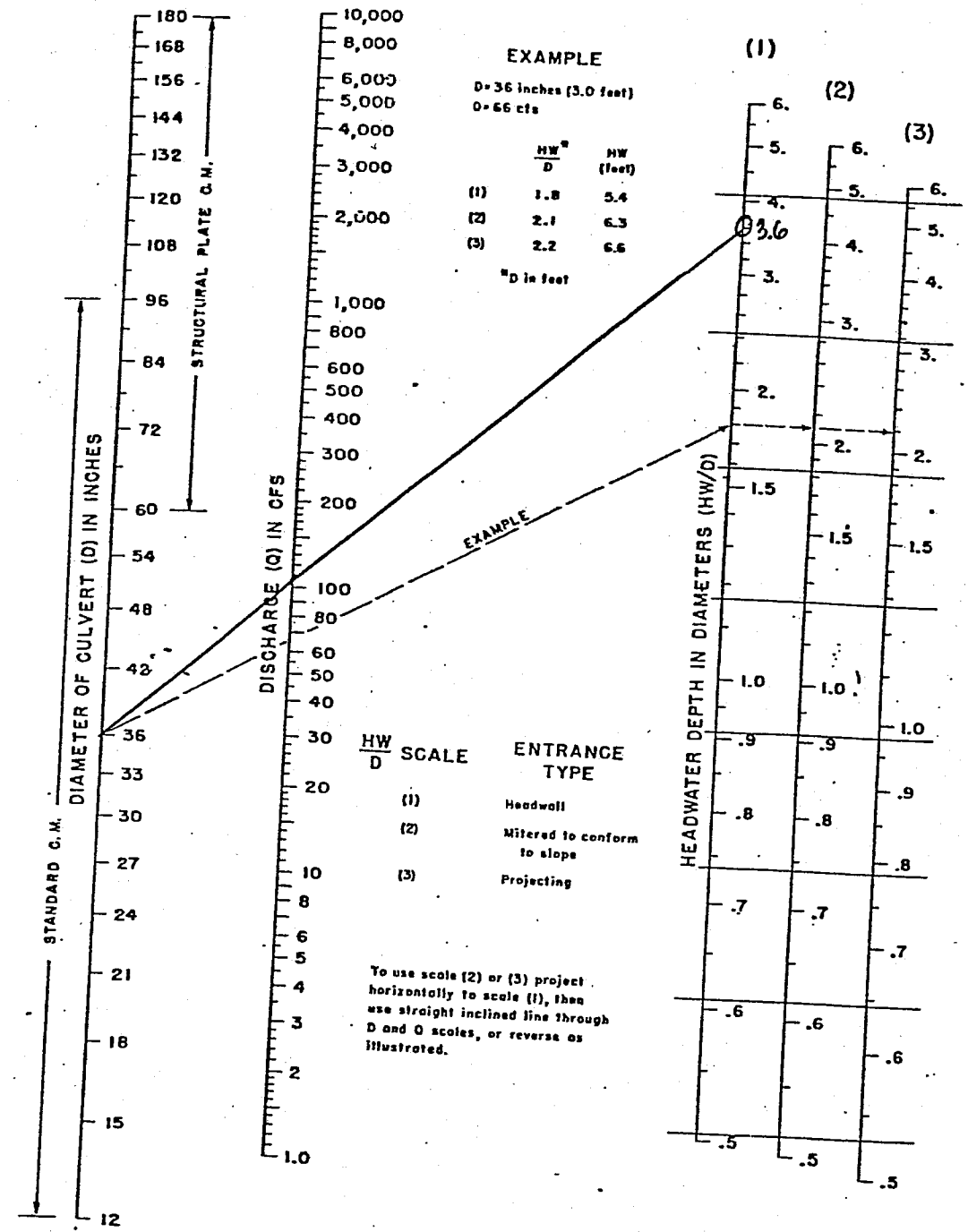
REACH NO. 7
Q_{100} = 162 cfs | S = 0.064
36" R.C.P. | 42" C.M.P.
n = 0.012 | n = 0.019
D_o = 2.2 | D_o = 2.7
V = 29.1 | V = 20.3

REACH NO. 2
Q_{100} = 105 cfs | S = 0.064
36" R.C.P. | 36" C.M.P.
n = 0.012 | n = 0.018
D_o = 1.7 | D_o = 2.2
V = 26.5 | V = 19.0

Job Number _____ Job Name _____ Sheet ___ of ___ Scale 1" = 40'
Contour Interval 2' Photogrammetry by SAN-LO AERIAL SURVEYS, INC., San Diego, California Date of Photography Dec. 1, 1972

SNIDER-DYE ASSOCIATES
Civil Engineers and Land Surveyors
3960 Grove St. (714) 462-4524
LEMON GROVE, CA. 92045

CHART 5



HW = 3.6(3) = 10.8

BUREAU OF PUBLIC ROADS JAN. 1963

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

BASIN B

AREA = 1.7 AC.
C = 0.5
$T_C = T_i + T_f = 14.3 + 0.3 = 14.6$
$I_{100} = 2.9$
$I_{50} = 2.8$
$I_{10} = 2.2$

$Q_{100} = 0.5(2.9)(1.7) = 2.5$ cfs
USE TYPE B INLET ✓

BASIN D

$Q_{100} = 0.5(2.9)(1.3) = 1.9$ cfs
USE TYPE B INLET

BASIN C

$Q_{100} = 0.5(2.9)(6.2) = 9.0$ cfs
USE TYPE B-1 INLET, L = 15'

BASIN E

$Q_{100} = 0.5(2.9)(4.9) = 7.1$ cfs
USE TYPE B-1 INLET, L = 15'

BASIN G

$Q_{100} = 0.5(2.8)(4.3) = 6.0$ cfs
USE TYPE B-1, L = 15'

BASIN F

$Q_{100} = 0.5(2.7)(5.2) = 7.0$ cfs

BASIN H

$Q_{100} = 0.5(2.8)(3.0) = 4.2$
USE TYPE B-1 INLET, L = 10'

BASIN I

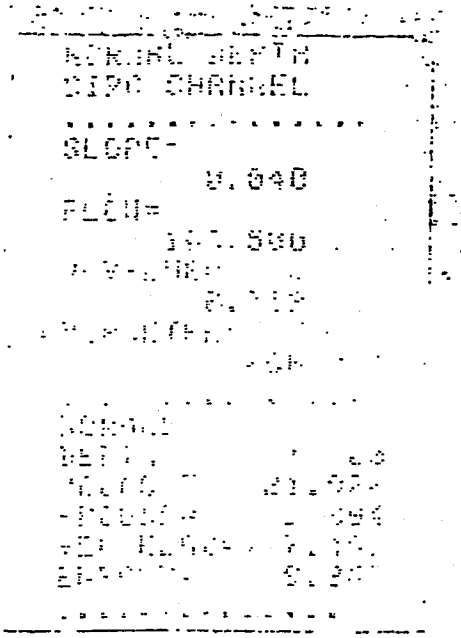
$Q_{100} = 0.5(2.7)(1.9) = 2.6$
USE TYPE B INLET.

THE ABOVE INLET CAPACITIES HAVE BEEN DESIGNED SO THAT Q_{100} WILL ENTER THE PIPE WITH NO OVERFLOW ON THE STREET.

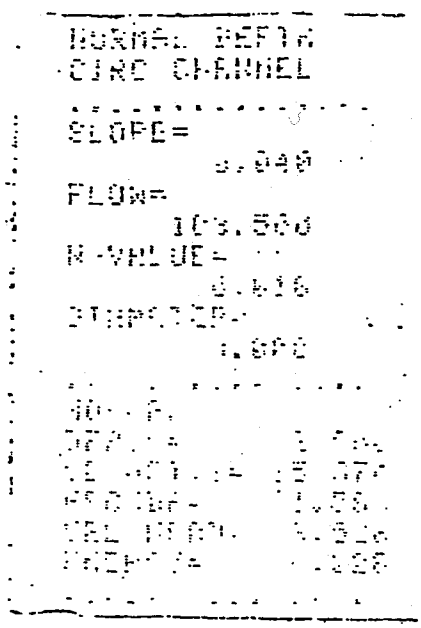
THE NORMAL DEPTHS FOR THE VARIOUS REACHES OF THE STORM DRAIN SYSTEM ARE CALCULATED AS FOLLOWS, SHOWING THE THE SYSTEM WILL TEND TO FLOW WITH A FREE WATER SURFACE, I.E., NOT FLOW UNDER PRESSURE.

REACH 1

36" RCP

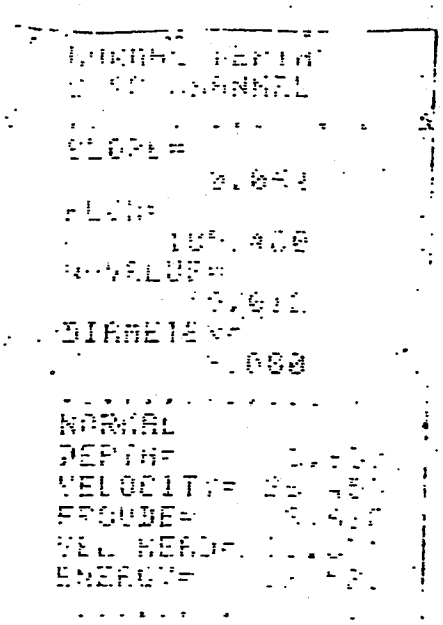


36" CMP

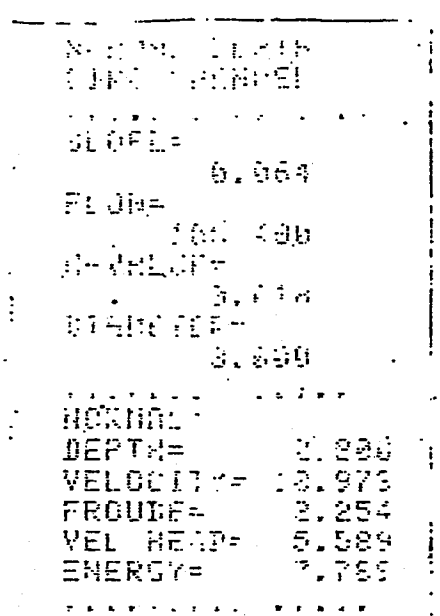


Reach 2

36" RCP



36" CMP



REACH 3

24" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.............
SLOPE
        0.030
FLOW=
       27.800
N-VALUE=
        0.012
DIAMETER=
        2.000
.... .........
NORMAL
DEPTH=      1.000
VELOCITY=  14.456
FROUDE=     2.152
VEL HEAD=   3.473
ENERGY=     4.973
```

24" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.............
SLOPE=
        0.030
FLOW=
       27.000
N-VALUE=
        0.010
DIAMETER=
        2.000
.... .........
NORMAL
DEPTH=      1.000
VELOCITY=  14.309
FROUDE=     2.152
VEL HEAD=   3.473
ENERGY=     4.973
```

REACH 4

24" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.............
SLOPE=
        0.054
FLOW=
       42.300
N-VALUE=
        0.012
DIAMETER=
        2.000
.... .........
NORMAL
DEPTH=      1.250
VELOCITY=  19.511
FROUDE=     3.075
VEL HEAD=   5.911
ENERGY=     7.161
```

24" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.............
SLOPE=
        0.054
FLOW=
       42.300
N-VALUE=
        0.010
DIAMETER=
        2.000
.... .........
NORMAL
DEPTH=      1.250
VELOCITY=  19.511
FROUDE=     3.075
VEL HEAD=   5.911
ENERGY=     7.161
```

REACH 5

36" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.................
SLOPE=
        0.064
FLOW=
      145.700
N-VALUE=
        0.012
DIAMETER=
        3.000
.................
NORMAL
DEPTH=       1.050
VELOCITY=   20.316
FROUDE=      2.464
VEL HEAD=    6.413
ENERGY=      7.463
.................
```

42" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.................
SLOPE=
        0.064
FLOW=
      145.700
N-VALUE=
        0.012
DIAMETER=
        3.500
.................
NORMAL
DEPTH=       1.450
VELOCITY=   20.254
FROUDE=      2.360
VEL HEAD=    6.379
ENERGY=      7.829
.................
```

REACH 6

18" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.................
SLOPE=
        0.019
FLOW=
        7.100
N-VALUE=
        0.012
DIAMETER=
        1.500
.................
NORMAL
DEPTH=       0.950
VELOCITY=    6.013
FROUDE=      1.151
VEL HEAD=    0.562
ENERGY=      1.512
.................
```

18" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.................
SLOPE=
        0.019
FLOW=
        7.100
N-VALUE=
        0.014
DIAMETER=
        1.500
.................
NORMAL
DEPTH=       0.750
VELOCITY=    5.917
FROUDE=      1.088
VEL HEAD=    0.552
ENERGY=      1.302
.................
```

REACH 7

30" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.....
SLOPE=
        0.054
FLOW=
      161.000
N-VALUE=
        0.012
DIAMETER=
        3.000
.....
NORMAL
DEPTH=      2.260
VELOCITY=  39.125
FROUDE=     3.469
VEL HEAD=  23.172
ENERGY=    25.432
.....
```

42" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.....
SLOPE=
        0.064
FLOW=
      161.820
N-VALUE=
        0.013
DIAMETER=
        3.500
.....
NORMAL
DEPTH=      2.700
VELOCITY=  29.316
FROUDE=     2.179
VEL HEAD=   6.429
ENERGY=     9.129
.....
```

REACH 8

30" RCP

```
NORMAL DEPTH
CIRC CHANNEL
.....
SLOPE=
        0.064
FLOW=
      161.800
N-VALUE=
        0.012
DIAMETER=
        3.000
.....
NORMAL
DEPTH=      2.303
VELOCITY=  38.856
FROUDE=     3.353
VEL HEAD=  23.930
ENERGY=    26.230
.....
```

42" CMP

```
NORMAL DEPTH
CIRC CHANNEL
.....
SLOPE=
        0.064
FLOW=
      161.800
N-VALUE=
        0.013
DIAMETER=
        3.500
.....
NORMAL
DEPTH=      2.806
VELOCITY=  29.336
FROUDE=     2.142
VEL HEAD=   6.422
ENERGY=     9.222
.....
```

REACH 9

42" RCP

NORMAL DEPTH
CIRC CHANNEL

SLOPE=
0.040
FLOW=
172.000
N-VALUE=
0.012
DIAMETER=
3.500

NORMAL
DEPTH= 1.250
VELOCITY= 20.041
FROUDE= 2.879
VEL HEAD= 6.737
ENERGY= 12.087

48"CMP

NORMAL DEPTH
CIRC CHANNEL

SLOPE=
0.040
FLOW=
172.000
N-VALUE=
0.020
DIAMETER=
4.000

NORMAL
DEPTH= 3.050
VELOCITY= 16.729
FROUDE= 1.038
VEL HEAD= 4.346
ENERGY= 7.396

REACH 10

42" RCP

NORMAL DEPTH
CIRC CHANNEL

SLOPE=
0.024
FLOW=
172.000
N-VALUE=
0.012
DIAMETER=
3.500

NORMAL
DEPTH= 3.150
VELOCITY= 19.559
FROUDE= 1.952
VEL HEAD= 5.941
ENERGY= 9.151

48" CMP

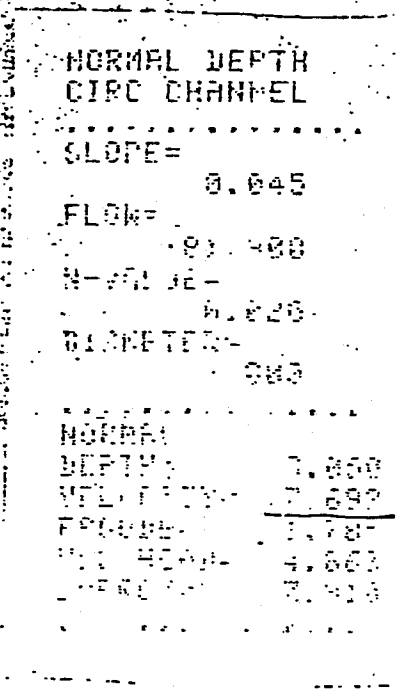
NORMAL DEPTH
CIRC CHANNEL

SLOPE=
0.035
FLOW=
172.000
N-VALUE=
0.020
DIAMETER=
4.000

NORMAL
DEPTH= 3.400
VELOCITY= 15.750
FROUDE= 1.505
VEL HEAD= 3.851
ENERGY= 7.252

Reach 11

48" CMP



The Exit Velocity is 17.7 fps, within the range that can be handled by a Rip Rap Energy Dissipator.

Roger L. Snipes
PCE 18134

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4-9-84 corrections 4-3-84 SHT 1 OF 9

PREPARED BY DANIEL W. SULLIVAN, R.C.E. 32238

HYDROLOGY AND HYDRAULIC CALCULATIONS FOR WELLINGTON HILL SUBDIVISION

COUNTY OF SAN DIEGO TRACT NO. 3747

(REVISION TO SNIPES-DYE ASSOCIATES ORIGINAL HYDROLOGY)

THE UPSTREAM WATERSHED CONTAINS TWO BASINS. (SEE ATTACHED TOPO.

BASIN A1 = ~~25.3~~ 27.3 Ac. C = 0.5

$\frac{1}{40000} = \frac{29.78}{x}$ $x = \frac{43560}{40000} = 27.3$ Ac

Tc = 14.3

400/1400'

I_{100} = 2.95"/Hr.

$Q_{100} = 0.5 (2.95)(27.3) = 40.3$ CFS.

Try 30" CIPCP @ 4.2% n = 0.015

USING PIPE FLOW CHART AS PER STREET AND HIGHWAY DRAINAGE VOLUME 2:

D_N = 1.3' < 2.5' ∴ ok.

BASIN A2 = ~~54.0~~ 55.4 Ac. C = 0.5

$\frac{1}{40000} = \frac{60.3}{x}$ $x = \frac{43560}{40000} = 55.4$ Ac

60.3

Tc = 17.6

I_{100} = 2.7"/hr.

$Q_{100} = (0.5)(2.7)(55.4) = 74.8$

985
605
380/3200

Try 30" @ 6.2% n = 0.015

D_N = 1.9' < 2.5' ∴ ok

TA 2711.1

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BASIN D:

$A = 1.3$ Ac. $C = 0.5$

$I_{50} = 2.7$

$Q_{50} = (0.5)(2.7)(1.3)$

$Q_{50} = 1.8$ CFS.

$I_{100} = 2.9$

$Q_{100} = (0.5)(2.9)(1.3)$

$Q_{100} = 1.9$ CFS ✓

BASIN B:

$A = 1.7$ Ac. $C = 0.5$

$T_c = 14.9$

$I_{50} = 2.7$

$Q_{50} = (0.5)(2.7)(1.7)$

$= 2.3$ CFS.

USE TYPE B INLET $L = 9$

$I_{100} = 2.9$

$Q_{100} = (0.5)(2.9)(1.7)$

$= 2.5$ CFS. ← USE ✓

BASIN C:

$A = 6.2$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(6.2)$

$= 8.4$ CFS.

USE TYPE B-1 INLET, $L = 15$

$Q_{100} = 0.5(2.9)(6.2)$

$= 9.0$ CFS. ← USE

BASIN E:

$A = 4.9$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(4.9)$

$= 6.6$ CFS.

USE TYPE B-1 INLET, $L = 15'$

$Q_{100} = 0.5(2.9)(4.9)$

$= 7.1$ CFS, ← USE

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BASIN G:

$A = 4.3$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(4.3)$
$= 5.8$ CFS.

$Q_{100} = (0.5)(2.9)(4.3)$
$= 6.2$ CFS. ← USE

USE TYPE B-1 INLET, L=15'

BASIN F:

$A = 5.2$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(5.2)$
$= 6.5$ CFS

$Q_{100} = (0.5)(2.9)(5.2)$
$= 7.0$ CFS. ← USE

USE TYPE B-1, INLET, L=15'

BASIN H:

$A = 3.0$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(3.0)$
$= 3.9$ CFS

$Q_{100} = (0.5)(2.9)(3.0)$
$= 4.2$ CFS ← USE

USE TYPE B-1 INLET, L=10'

BASIN I:

$A = 1.9$ Ac. $C = 0.5$

$Q_{50} = (0.5)(2.7)(1.9)$
$= 2.4$ CFS

$Q_{100} = (0.5)(2.9)(1.9)$
$= 2.6$ CFS. ← USE

USE TYPE B INLET, L=5'

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REACH NO. 1 :

Q_{100} = ~~72.9~~ 74.3 CFS. 30" C.I.P.C.P. n = 0.015 S = 0.062

D_o = 1.75' V = 20 FPS. T_f = 0.3 min. ∴ ok.

REACH NO. 2 :

Q_{100} = BASIN D + REACH NO. 1 = 1.9 + ~~72.9~~ 74.3 = ~~74.8~~ 76.7 CFS (NEGLE ADDITI T_f

Using 30" C.I.P.C.P. @ S = 0.064 n = 0.015

D_o = 1.74' V = 20 FPS T_f = 0.2 min. ∴ okay

REACH NO. 3 :

Q_{100} = ~~36.1~~ 40.3 CFS.

Using 30" C.I.P.C.P. @ S = 0.065 n = 0.015

∴ ok by inspection.

REACH NO. 4 :

Q_{100} = ~~36.1~~ 40.3 + Basin B 2.5 = ~~39.6~~ 42.8 CFS.

Using 30" CIPCP @ S = 0.036 n = 0.015

D_o = 1.25' V = 14 FPS. ∴ okay

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REACH NO. 5 :

RECALC. ALL BASINS UPSTREAM FOR NEW Tc :

$T_c = 17.6 + 0.3 + 0.2 = 18.1$ min.

$I_{10.0} = 2.65$ "/Hr.

$A = A_1 + A_2 + D + B$

$= 27.3 + 54.0 + 1.3 + 1.7$

$= 85.7$ Ac. $C = 0.5$

$Q_{100} = (0.5)(2.65)(85.7)$

$= 114.0$ CFS.

Using 36" CIPCP @ S= 0.064 n=0.015

$D_o = 1.95'$ V = 22.4 FPS ∴ ok.

Tc = 0.1 min. Cap. 160 cfs full

REACH NO. 6 :

$Q_{100} =$ Basin E $= 7.1$ CFS.

Using 18" RCP @ 0.01 n = 0.012

$D_o = 0.9'$ V = 7 FPS. ∴ ok.

REACH NO. 7 :

$T_c = 18.1 + 0.1 = 18.2$ min.

$I_{100} = 2.6$ "/Hr.

$A = 85.7 + \text{Basin C } 2.2 + \text{Basin E } 4.9 = 96.8$ Ac. $C = 0.5$

$Q = (0.5)(2.6)(96.8)$

$= 125.8$ CFS.

Using 36" C.I.P.CP. @ 0.064 n=0.015

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$D_o = 2.08'$ $V = 23.1$ FPS. ∴ ok.

$T_c = 0.2$ min.

REACH NO. 8:

$T_c = 18.2 + 0.2 = 18.4$ min.

$I_{100} = 2.6$ "/hr.

$A = \cancel{93.4} + 4.3 = \cancel{97.7}$ (101.1) Ac. $C = 0.5$

$Q_{100} = (0.5)(2.6)(\cancel{97.7}\ 101.1)$

$= \cancel{127.0}$ (131.4) CFS.

Using 3 C" C.I.P.C.P. @ $S = 0.064$ $n = 0.015$

$D_o = 2.2'$ $V = 23.3$ fps. ∴ ok.

$T_c = 0.2$ min.

REACH NO. 9:

$T_c = 18.4 + 0.2 = 18.6$ min.

$I_{100} = 2.6$ "/hr.

$A = \cancel{97.7}$ (101.1) + 3.0 (Basin H) = (104.1) Ac. $C = 0.5$

$Q_{100} = 0.5(2.6)(\cancel{\text{illegible}}\ 104.1)$

$= \cancel{\text{illegible}}$ (135.3) CFS. Cap. 112 CFS

Using 36" CIPCP @ $S = 0.036$ $n = 0.015$

PIPE UNDER PRESSURE $S_f = 0.051$ $\Delta H = (S_f - S)L$

OK AVAILABLE → IN UPSTREAM INLET $\Delta H = 0.015(217.9) = 3.3'$

.051
.036
.015

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REACH NO. 10:

$T_c = 18.6 + 0.2 = 18.8$ min.

$I_{100} = 2.55$"/Hr.

$A = \cancel{104.1}\ 109.3 + 5.2 = \cancel{105.9}$ Ac. $C = 0.5$

$Q_{100} = 0.5(2.55)(109.3)$
$= \cancel{139.4}\ 139.2$ CFS. Adj. 120 cfs

Using 36" RCP @ 0.042 $n = 0.012$

$D_o = 2.2'$ $V = 24.5$ FPS. ∴ ok.

REACH NO. 11:

$Q_{100} = 2.6 + \cancel{135} = \cancel{137.6}\ 142.0$ CFS Adj. 140 cfs

Using 42" CMP @ 0.045

$n = 0.02$ $D_o = 2.54'$ $V = 16.5$ fps