DELTA CONSULTING & ENGINEERING
OF ST. HELENA

HYDROLOGY REPORT

FOR THE

CARVER SUTRO WINERY

LOCATED AT

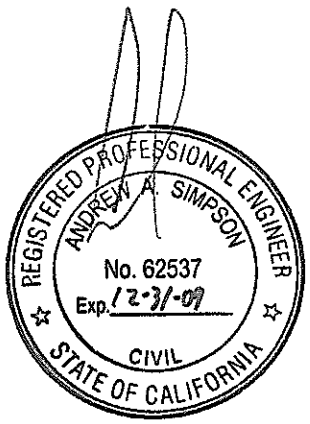
3106 PALISADES ROAD
CALISTOGA, CA 94515

County: NAPA
APN: 017-230-034

JANUARY 27, 2009

PREPARED FOR:

DENIS SUTRO, OWNER



1104 ADAMS STREET, SUITE 203 – ST. HELENA, CALIFORNIA 94574
707-963-8456 TELE + 707-963-8528 FAX

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1. Report Description & Background

This report shall address the site hydrology associated with the proposed development of a winery and associated caves with an annual production of 20,000 gallons to be located at 3106 Palisades Road, Calistoga, CA also known as Napa County Assessor's parcel 01-230-034, a parcel of ~86 acres.

2. General Location & Description

a. The winery shall be located at the base of a 125 foot high hill adjacent to the owner's residence and accessory farm structures. The caves shall be constructed into said hill.

b. The parcel topography consists of a combination of valley floor, gradual hillside, and steep hillside. Horns Creek (blue line stream on USGS 7.5' Calistoga quadrangle map) bisects the parcel and the proposed development is located outside of any County defined setbacks from the creek.

c. The parcel current support native hillside vegetation typically found on the eastern side of the Napa Valley hills. In addition, the parcel has vineyards (less than 20 acres), a residence, and buildings typical of an agricultural farm operation.

3. Drainage Basins and Sub-Basins

a. As shown on the Hydrology Exhibit which follows, the major area of runoff to the site is from the small hill. The watershed area is approximately 0.61 acres. A cutoff ditch is located at the base of the hill and appears to have been constructed years ago to route hill runoff from the vineyard. Consequently, the runoff from the hill to the winery site is diverted from the project site.

The hydrology calculations assume 100% of the runoff shall reach the winery site even though the cutoff ditch will intercept 80-90% of the runoff.

4. Drainage Facility Design

For this preliminary design, several drop inlets and trench drains were designed at the winery site. In addition, the parking area is estimated to sheet flow to the swale along with driveway runoff. All storm water shall be conveyed via storm drain piping and released to a subsurface infiltration, clarification, and detention system. The subsurface system, if it becomes inundated, shall release to the existing road side swale located along Palisades Road or Horn Creek. The final design will be subject to change.

The Rational Method was utilized for determining the peak runoff from the project site for a 10-year and 100-year storm event. Following is a table of variables used in the calculations:

Runoff Coefficient =	0.60
Runoff Area =	0.61 acres
Time of Concentration =	1 hour
Intensity (10 year) =	1.1"/hour
Intensity (100 year) =	1.6"/hour
Q (10 year) =	0.40 ft^3/s
Q (100 year) =	0.59 ft^3/s

For a 100 year storm, the flow rate is assumed to be 0.59 ft3/s or 264 gpm. Using Manning's equation 2642for a circular pipe and assuming a 200 foot, 6" diameter storm drain running at slope of 0.01 from the drop inlets to the infiltration system, following is a summary of the storm drain pipe:

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Flowrate
Diameter	6.0000 in
Depth	4.0000 in
Slope	0.0100 ft/ft
Manning's n	0.0100

Computed Results:

Flowrate	0.5718 cfs
Area	0.1963 ft2
Wetted Area	0.1391 ft2
Wetted Perimeter	11.4638 in
Perimeter	18.8496 in
Velocity	4.1120 fps
Hydraulic Radius	1.7467 in
Percent Full	66.6667 %
Full flow Flowrate	0.7294 cfs
Full flow velocity	3.7150 fps

Critical Information

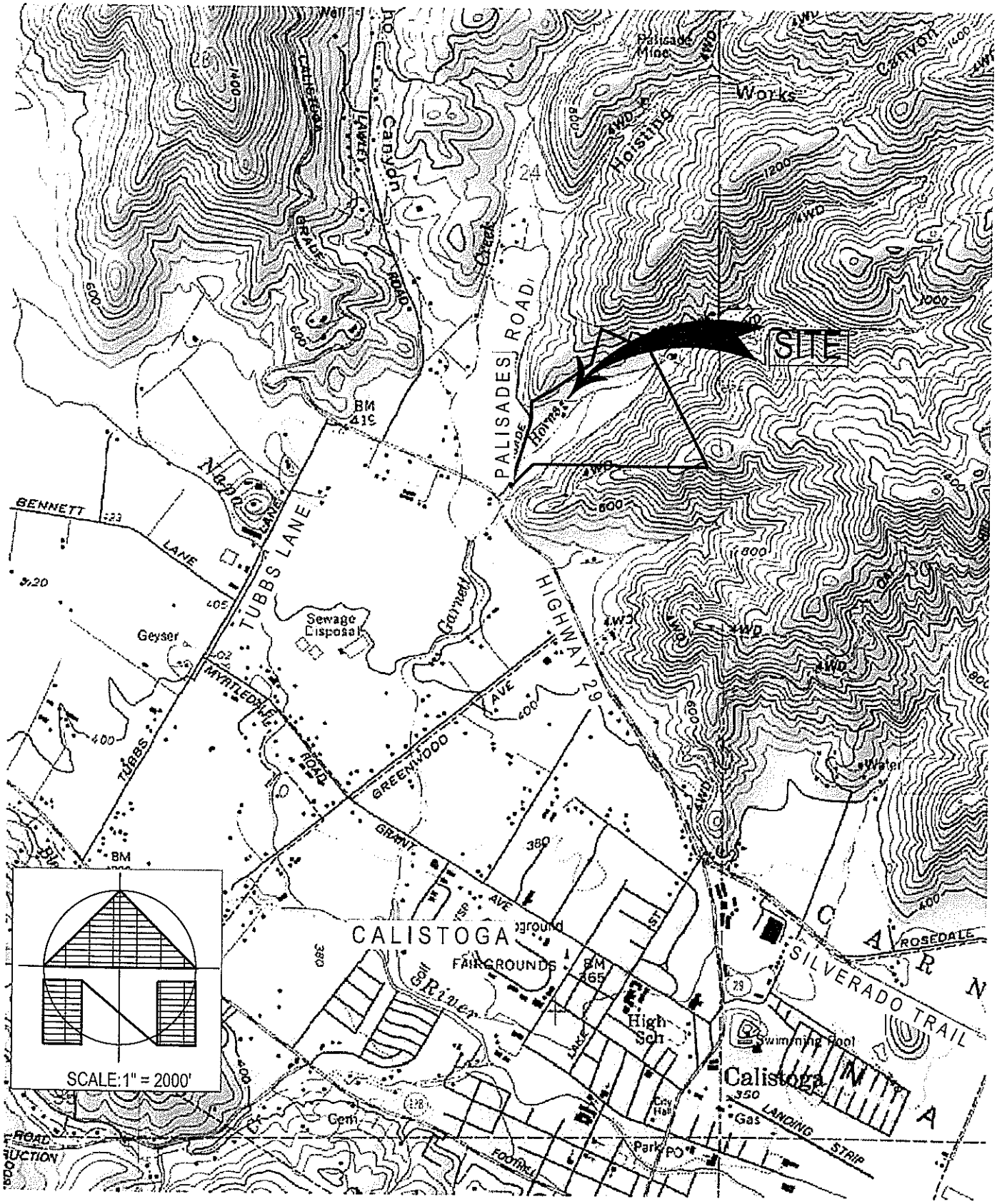
Critical depth	4.8020 in
Critical slope	0.0058 ft/ft
Critical velocity	3.3390 fps
Critical area	0.1733 ft2
Critical perimeter	13.0287 in
Critical hydraulic radius	1.9149 in
Critical top width	6.0000 in
Specific energy	0.5993 ft
Minimum energy	0.6002 ft
Froude number	1.3790
Flow condition	Supercritical Water Quality

After leaving the storm drain system, the storm water will enter a subsurface infiltration and detention system to be constructed in the center of the vine rows. The infiltration trench will consist of either ¾" gravel or chambers to allow the maximum volume per foot of trench. In addition, depending on the percolation rate of the soil, this system will allow regeneration of the groundwater and clarification of the storm water runoff. If the system is inundated, an over flow shall be directed to either Horn Creek or the existing swale located on Palisades Road.

The total length of the infiltration system and trench section shall be part of the final design.

5. Conclusion

In conclusion, this preliminary hydrology report concludes that even if all of the runoff to the proposed winery site were to enter the storm drain system, the system will be sufficient to handle the storm water flows.



SITE LOCATION

USGS QUAD MAP: YOUNTVILLE SCALE: 1"=2000'

CARVER-SUTRO WINERY

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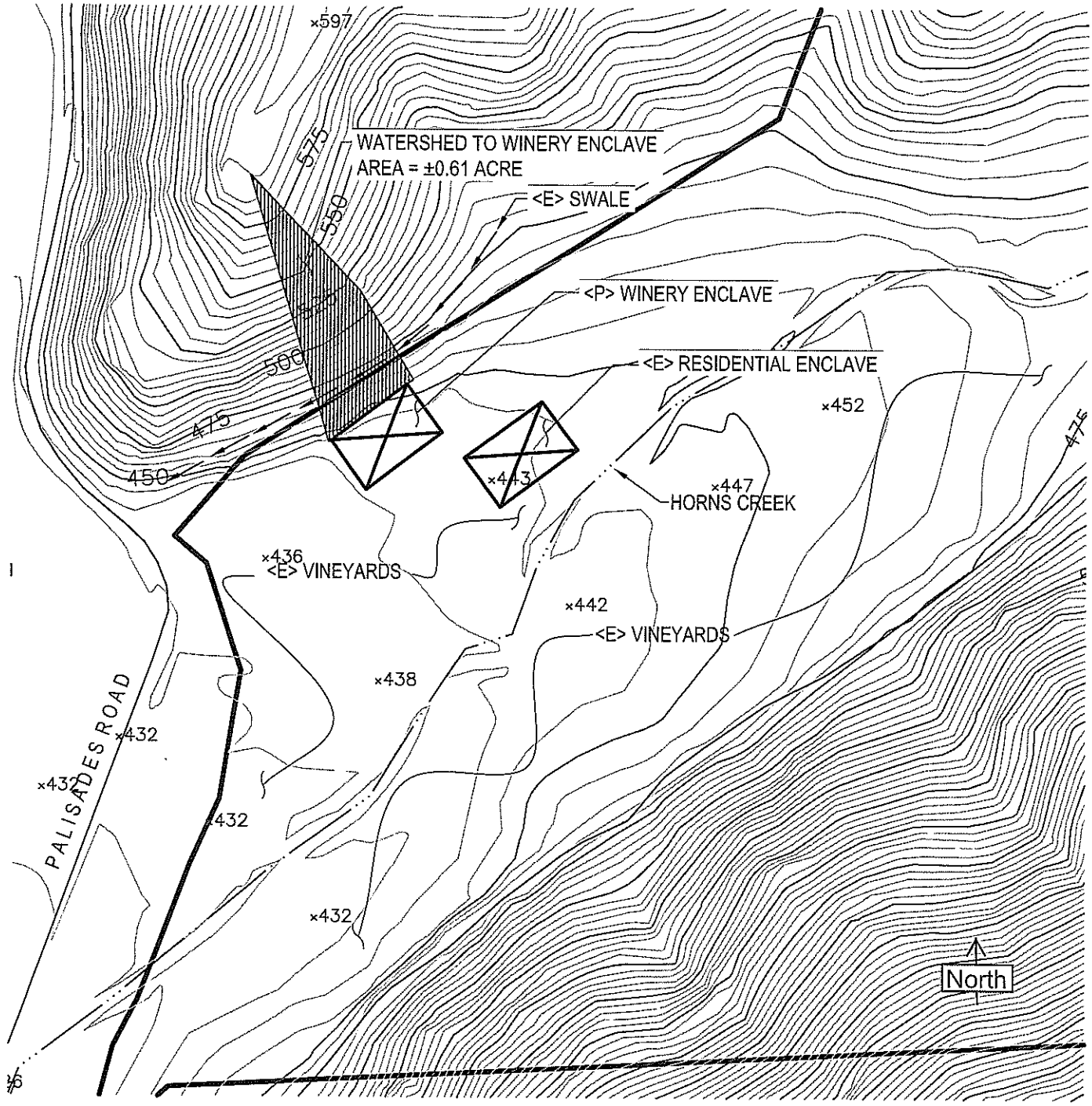
DATE: 1/10/2009	JOB # H-122	SHEET 1 OF 1
SCALE: AS NOTED	APN: 017-230-034	



HYDROLOGY-RATIONAL METHOD

Q = CiA
C = 0.60
A = ±0.61 acre
Time of Concentration = 1 hour
Intensity (10 year) = 1.1"/hr
Intensity (100 year) = 1.6"/hr
Q10 = 0.40 cfs
Q100 = 0.59 cfs

Note: Existing swale intercepts a majority of the hill runoff prior to reaching the winery site.

CARVER SUTRO WINERY
HYDROLOGY EXHIBIT

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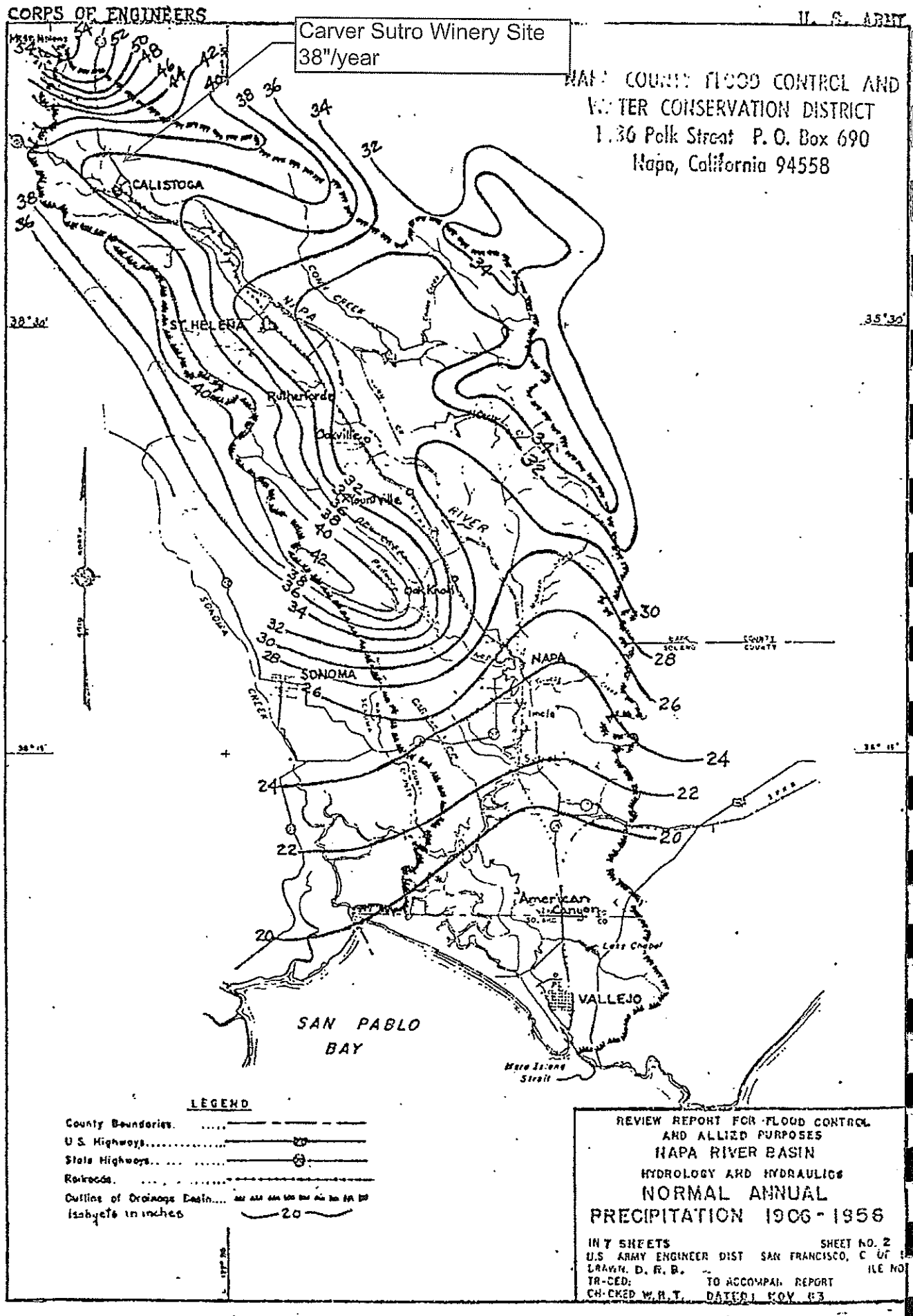
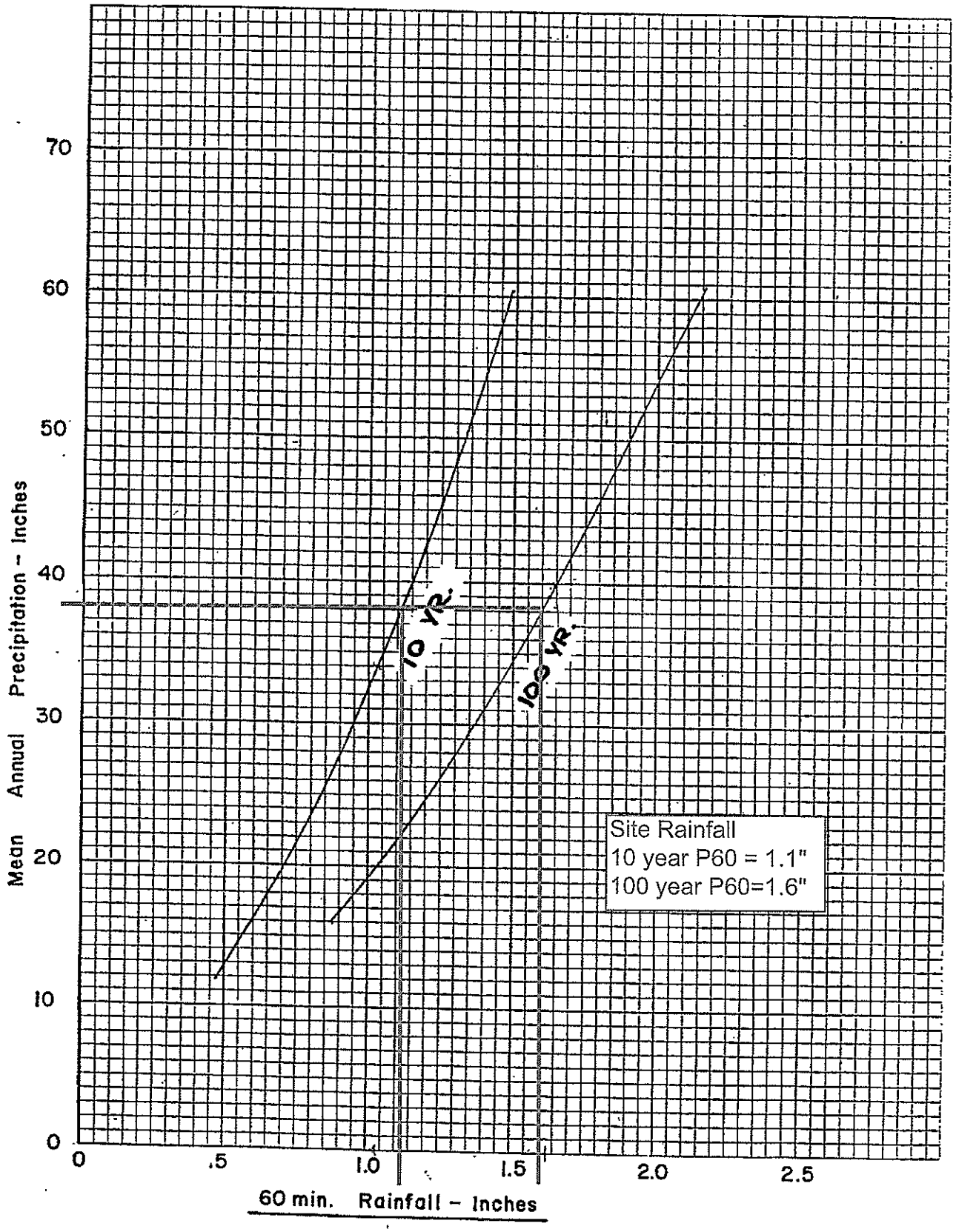
DATE: 01-27-09	JOB # H-122
SCALE: AS NOTED	APN: 017-230-034

SHEET 2 OF 2

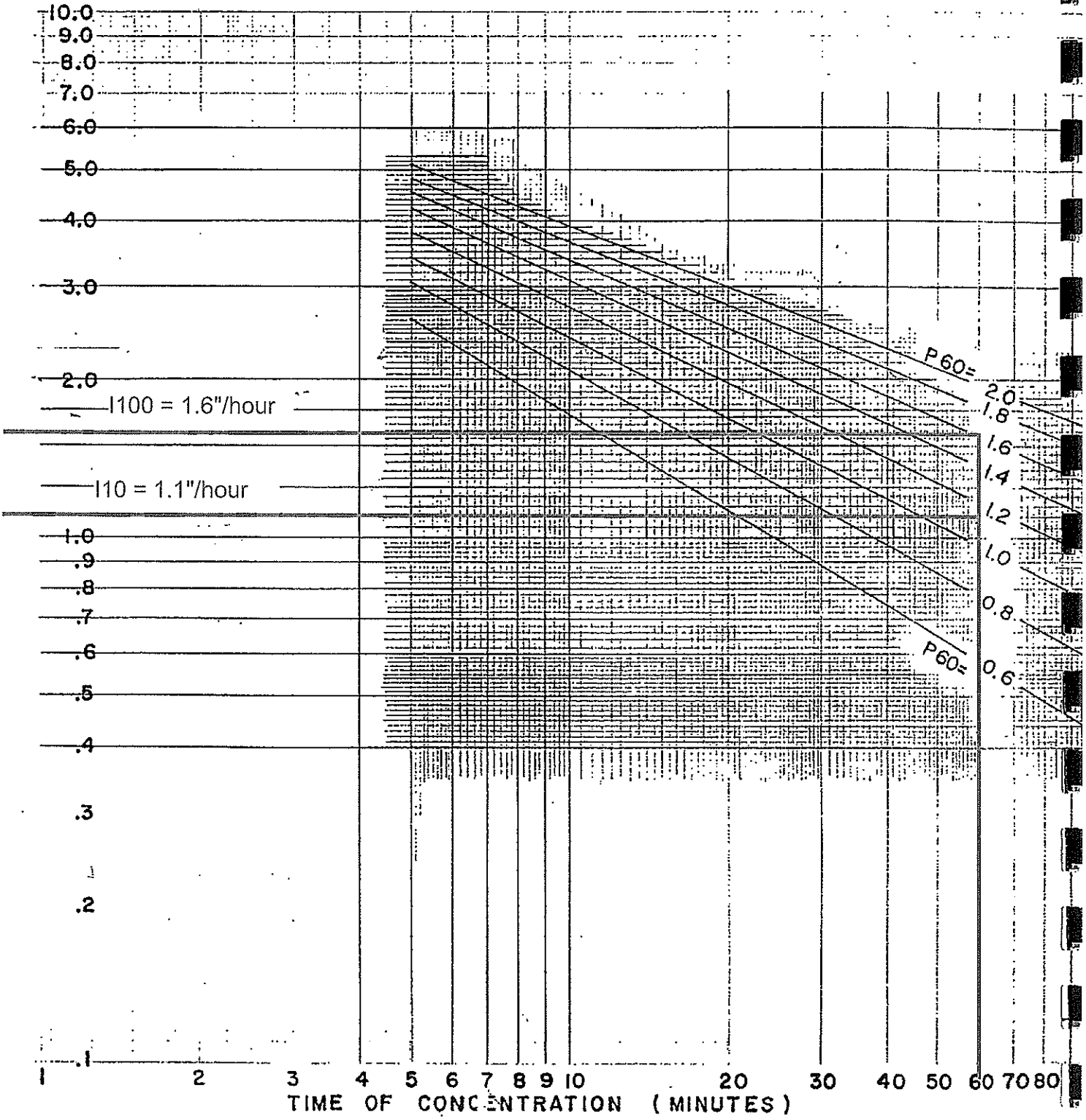

CORPS OF ENGINEERS
U. S. ARMY
Carver Sutro Winery Site
38"/year
NAPA COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
1136 Polk Street P. O. Box 690
Napa, California 94558
CALISTOGA
ST. HELENA
Rutherford
Oakville
Yountville
NAPA
SONOMA
Napa
Imola
American Canyon
VALLEJO
SAN PABLO
BAY
Mare Island Strait
RIVER
38°30'
35°30'
LEGEND
County Boundaries
U.S. Highways
State Highways
Railroads
Outline of Drainage Basin
Isohyets in inches
REVIEW REPORT FOR FLOOD CONTROL
AND ALLIED PURPOSES
NAPA RIVER BASIN
HYDROLOGY AND HYDRAULICS
NORMAL ANNUAL
PRECIPITATION 1906-1956
IN 7 SHEETS
SHEET NO. 2
U.S. ARMY ENGINEER DIST SAN FRANCISCO, C
DRAWN D. R. B.
FILE NO
TR-CED:
TO ACCOMPAN REPORT
CH-CKED W.R.T.
DATED NOV 63

MEAN ANNUAL PRECIPITATION vs 60 MINUTE RAINFALL



1.75

INTENSITY – DURATION CHART



Based on figure 7-8II.6 (-8-64)
State of California
Division of Highways
Planning Manual

Logarithmic, 2 x 2 Cycles

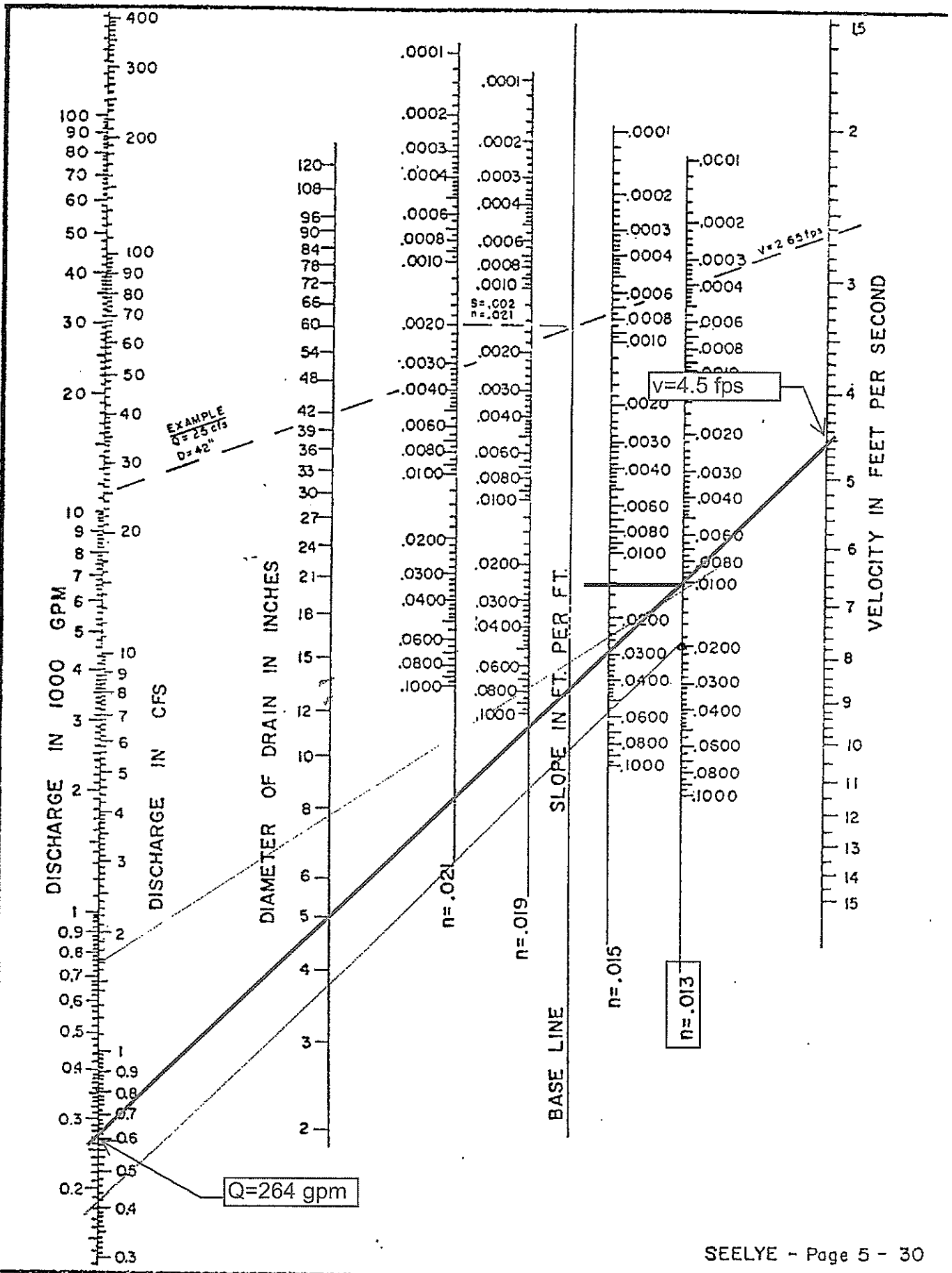
RUN-OFF PRODUCING CHARCTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES

WATERSHED TYPES AND FACTORS				
Run-off Producing Features	Extreme	High	Normal	Low
Relief	0.28-0.36 Steep, rugged terain, with average slopes above 30%.	0.20 - 0.28 Rolling, with average slopes of 10 to 30%.	0.14 - 0.20 Rolling, with average slopes of 5 to 10%.	0.08 - 0.14 Relatively flat land, with average slopes of 0 to 5%.
Soil Infiltration	0.12 - 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.08 - 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 - 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 - 0.06 High; deep sand or other soil that takes up water readily; very light, well drained soils.
Vegtal Cover	0.12-0.16 No effective plant cover; bare or very sparse cover.	0.08-0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10-0.12 Negligible; surface depressions, few and shallow; drainageways steep and small; no marshes.	0.08 - 0.10 Low; well-defined system of small drainageways; no ponds or marsh.	0.06 - 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes	0.04 - 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

Averaging each category & summing:
C = 0.32 + 0.10 + 0.07 + 0.11
C = 0.60



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REV.	DATE	BY
1	7-31-64	PCC

NOMOGRAPH FOR COMPUTING REQUIRED SIZE OF CIRCULAR DRAIN, FLOWING FULL

n=0.013 0.015 0.019 0.021

DRWG. NO.

FILED