Drainage Review for 52 Fremont Road, San Rafael

The existing property is currently an undeveloped lot. The development proposal is to construct a single-family residence, attached garage, driveway and associated improvements. The property slopes towards Marquard Avenue with an average slope of approximately 40%.

This report has been prepared to compare the runoff from the existing site and the runoff that would occur based on the development proposal. The methods described with in the County of Marin Hydrology Manual have been used to determine the runoff.

The Rational Method (Q=CiA) was used to determine the existing and proposed runoff. The runoff for the Existing Condition is 0.41 cfs and the runoff for the Proposed Condition is 0.39 cfs. This demonstrates that the runoff would not be increased.

Refer to the attached calculations.
PER THE MARIN HYDROLOGY MANUAL

DETERMINE THE TIME OF CONCENTRATION FOR THE EXISTING CONDITION

\[ T_c = \frac{1.8 (1.1-C) \sqrt{L}}{3 \sqrt{S(100)}} + 5 \text{min} \]

WHERE
- \( C \) = Runoff Coefficient
- \( L \) = Longest Run
- \( S \) = Average Slope

FROM THE DRAINAGE EXHIBIT - EXISTING (ATTACHED)

\[ C = 0.7, \quad L = 142 \text{ ft}, \quad S = 0.36 \text{ %} \]

\[ T_c = \frac{1.8 (1.1-0.7) \sqrt{142}}{3 \sqrt{36(100)}} + 5 \text{min} \]

\[ = 2.6 \text{min} + 5 \text{min} = 7.6 \text{min} \text{ or } 8 \text{min} \]

DETERMINE ZONE FROM MAP V: ZONE B

DETERMINE \( I_{60} \) FROM MAP I: 1.2 in/h

USE CHART K ZONE B TO FIND THE CORRECT CURVE USING THE \( I_{60} \) AND 1 HOUR INTERSECT (ATTACHED)

FOLLOW THIS CURVE TO FIND \( T_c \) FOR 8 min = 3.35 in/h

CALCULATE THE RUNOFF FOR THE EXISTING CONDITION

\[ Q = C \cdot i \cdot A \]

WHERE
- \( Q \) = Runoff Quantity
- \( C \) = Runoff Coefficient
- \( i \) = Rainfall Intensity
- \( A \) = Area in Acre

USE \( C = 0.7, \quad i = 3.35, \quad A = 0.1765 \)

\[ Q = 0.7 \cdot 3.35 \cdot 0.1765 \]

\[ = 0.41 \text{ cfs} \]

TO DETERMINE THE TIME OF CONCENTRATION FOR THE PROPOSED CONDITION THE SITE HAS BEEN DIVIDED INTO THREE DRAINAGE BASINS, SEE THE DRAINAGE EXHIBIT - PROPOSED (ATTACHED)

TO DETERMINE THE \( T_c \) FOR BASIN & BEGIN WITH THE POOF AREA TO FIND THE RUNOFF QUANTITY

USE \( Q = C \cdot i \cdot A \)
Roof C = 0.9
8min i = 3.35 in/hr  \therefore Q = 0.9 (3.35)(0.0160)
= 0.048 ft^3

The roof runoff is directed to the flow through planter. See detail (attached). The detail shows .5' deep reservoir - due to the roof a void space of 30% is used to determine how much water can be stored prior to runoff exiting the perforated pipe. The flow through planter is 28 ft^2.

Use time = \frac{volume}{rate}
\quad volume = 28(.5)(3)
\quad = 4.2 ft^3

\therefore \text{time} = \frac{4.2}{0.048} = 1.5 \text{ min}

Due to the steep slope and short distances, and to be conservative the travel time from the roof to the flow through planter and the time from the flow through planter to the curb is assumed to be zero.

To determine the time of concentration for basin B use the Kirpich formula

T_c = \frac{0.0078 \cdot L^{0.77}}{S^{0.385}}
\quad \text{where } T_c = \text{Time of Concentration (min)}
\quad L = \text{Length (ft)}
\quad S = \text{Slope (ft/ft)}

From the drainage exhibit - proposed
\quad L = 57 ft
\quad S = 0.088 ft/ft

\therefore T_c = \frac{0.0078 \cdot (57^{0.77})}{0.088^{0.385}} = 0.4 \text{ min}

To determine the time of concentration for basin C use \( Q = C_i \cdot A \) to find quantity of runoff.

To find i sum up the time of concentration from the initial \( T_c + T_c \) of basin A + \( T_c \) of basin B

\therefore 8 \text{ min} + 1.5 \text{ min} + 0.4 \text{ min} = 9.9 \text{ min}

Find i for 9.9 min from Chart K ZONE B = 3.00 in/hr
CALCULATE THE RUNOFF FROM THE ROOF IN BASIN C

USE \( Q = C_i A \)

ROOF \( C = 0.9 \)

9.9 min \( i = 3.00 \) in/hr

\( \therefore \) \( Q = 0.9(3.00)(0.0234) = 0.06 \) cfs

CALCULATE THE VOLUME IN THE FLOW THROUGH PLANTER IN BASIN C - THE AREA OF THE PLANTER IS 41 ft²

\( \therefore \) Volume = 41(1.5)(1.3) = 6.15 ft³

USE \( time = \frac{volume}{rate} \)

WHERE volume = 6.15 ft³

rate = 0.06 cfs

\( time = \frac{6.15}{0.06} = 1.7 \) min

THE TOTAL \( T_c \) IS THE SUM OF THE INITIAL \( T_c \) AND THE THREE BASIN AREAS

\( T_c = 8 \) min + 1.5 min + 0.4 min + 1.7 min = 11.6 min

USE CHART K ZONE B TO FIND \( i \) FOR 11.6 min = 2.80 in/hr

USE \( Q = C_i A \) TO FIND THE RUNOFF OF THE PROPOSED CONDITION

FIND WEIGHTED \( C \) :

\( C = \frac{0.7(4083) + 0.9(3046)}{7129} = 0.79 \)

TOTAL SITE AREA IS 0.1765 ac

\( \therefore Q = 0.79(2.80)(0.1765) = 0.39 \) cfs

EXISTING CONDITION RUNOFF IS 0.41 cfs THE PROPOSED CONDITION RUNOFF IS 0.39 cfs - RUNOFF IS NOT INCREASED
Point 1
El: 142.5'

Point 2
El: 92.0'

Longest Run = 142'
Slope = 50.5'/142' = .36

Study Area is 0.1765 Acre

DRAINAGE EXHIBIT - EXISTING

52 FREMONT ROAD - SAN RAFAEL
APN: 012-043-12

MARQUARD AVENUE
PROPOSED RESIDENCE
MARQUARD
BASMAA EXHIBIT
SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION
DRAINAGE EXHIBIT - PROPOSED

AREA A BASIN
AREA B BASIN
AREA C BASIN
FLOW-THROUGH PLANTER
MARQUARD AVENUE
52 FREMONT ROAD - SAN RAFAEL
APN: 012-043-12
Study Area is 0.1765 Acre

FREMONT ROAD - SAN RAFAEL

ADDITIONAL INFORMATION
SEE CIVIL DRAWINGS FOR
FLOW-THROUGH PLANTER DETAIL

NOTE:
SURFACE AREA OF THE BIO-TREATMENT SOIL SHALL EQUAL 4% OF THE AREA
OF THE SITE THAT DRAINS TO TREATMENT MEASURE, UNLESS SIZING
CALCULATIONS ARE SUBMITTED DEMONSTRATING THAT PROVISION C.3
REQUIREMENTS ARE MET USING A SMALLER SURFACE AREA

DI FILLED WITH DRAIN ROCK TO ACT AS
ENERGY DISSIPATER, SEE UTILITY
PLAN FOR ADDITIONAL INFORMATION

DRAIN LINE, SEE UTILITY PLAN
FOR ADDITIONAL INFORMATION

BIO-TREATMENT SOIL (BSM)
MIX PER SPECS.

PERFORATED OR SLOTTED SLOPED
UNDERDRAIN (SLOPE AT 0.50% MIN)
WITH PERFORATIONS DOWN, SEE
PLAN FOR CONNECTION TO C.B. &
FOR INVERT ELEVATION

12" MIN OF CLASS II PERMEABLE
ROCK PER CALTRANS SPECIFICATIONS

6" RESERVOIR (VOID SPACE
IS .3 OF THE TOTAL VOLUME)

CLEANOUT WITH CAP AT FIN. GRADE
(SEE MUNICIPAL STANDARD DRAWING)
BEGINNING OF LINE

UNDERDRAIN CLEANOUT WITH
RIM TO FIN. GRADE, SEE UTILITY
PLAN FOR LOCATION AND INVERT
NATIVE SOIL DO NOT COMPACT

6" MIN.
PONDING
18" MIN.
6"
2"
4" MIN

6" RESERVOIR
The 1-to-72-hour portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 75* Recorder Stations and 305* Non-Recorder Stations. (n = 6-zone totals)

The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4
1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,
and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE B
from: "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"