Redwood City Office
255 Shoreline Drive, Suite 200
Redwood City, CA 94065
Tel 650.482.6300
Fax 650.482.6399

DRAINAGE CALCULATIONS

12400 Skyline Blvd
Woodside, CA 94062
BKF Job No: 20211523-10

March 2022

Revised December 2022

Redwood City Office
255 Shoreline Drive, Suite 200
Redwood City, CA 94065
Tel 650.482.6300
Fax 650.482.6399

Discharge Calculations for 10-year Event
Existing Conditions

Project Address: 12400 Skyline Blvd
BKF Job No: 20211523-10
Date: 12/19/2022
Calcs By: CW

Intensity (I):

I [in/hr] = 2.86

NOAA Rainfall Intensity
10-yr 10 min-duration

Existing Area (A):

Impervious Area [ft^2] =	11,447	C = 0.9
Semi-pervious Area [ft^2] =	0	C = 0.6
Pervious Area [ft^2] =	125,151	C = 0.3
	136,598	

Total Area [ac] = 3.14

Composite Runoff Coefficient (C):

C = 0.35

Existing Discharge (Q_E):

$Q_E = CIA$

Q_E [cfs]= 3.15

Redwood City Office
255 Shoreline Drive, Suite 200
Redwood City, CA 94065
Tel 650.482.6300
Fax 650.482.6399

Discharge Calculations for 10-year Event
Proposed Conditions

Project Address: 12400 Skyline Blvd
BKF Job No: 20211523-10
Date: 12/19/2022
Calcs By: CW

Intensity (I):

I [in/hr] = 2.86

NOAA Rainfall Intensity
10-yr 10 min-duration

Proposed Area (A):

Impervious Area [ft^2] =	19,206	C = 0.9
Semi-pervious Area [ft^2] =	1,062	C = 0.6
Pervious Area [ft^2] =	116,330	C = 0.3
	136,598	

Total Area [ac] = 3.14

Composite Runoff Coefficient (C):

C = 0.39

Proposed Discharge (Q_P):

$Q_P = CIA$

Q_P [cfs]= 3.46

Redwood City Office
255 Shoreline Drive, Suite 200
Redwood City, CA 94065
Tel 650.482.6300
Fax 650.482.6399

Detention System Volume Calculations

Design Discharge (Q_D):

$Q_D = Q_P - Q_E$

Q_E [cfs] =	3.15
Q_P [cfs] =	3.46
Q_D [cfs] =	0.310

Design Volume (V_D):

$V_D = Q_D$ *x duration [sec] x FS*

Per San Mateo County Drainage Manual

duration [min] =	60
FS =	1.2
V_D [ft^3] =	1339

Pipe diameter ID (in)	Pipe diameter ID (ft)	Pipe diameter OD (in)	Pipe diameter OD (ft)	Effective pipe length (ft)	Effective pipe storage volume (cu.ft)	Total Storage Volume (cu.ft)	Meets Required Volume (>V_D)
60	5	66	5.5	70	1374	1374	TRUE

Detention provided by a 70 foot long 60" diameter ADS N-12 HDPE pipes. Pipe is watertight, flowrate out to be restricted by orifice plate.

Total detention required =	1339
Total detention provided =	1374

Detention meets requirement: TRUE

Redwood City
255 Shoreline Drive, Suite 200
Redwood City, CA 94065
Tel 650.482.6300
Fax 650.482.6399

Orifice Calculations

Tributary Flow Rate (Q):

Q_{TRIB} [cfs] =	3.15	From (E) 10-year Discharge Calculations

Bypass Flow Rate (Q_{BYPASS}):

Flow Bypassing Detention

$Q_{BYPASS} = CIA$

Intensity (I):

I [in/hr] =	2.86	NOAA Rainfall Intensity 10-yr 10 min-duration

Bypass Area (A):

Impervious Area [ft^2] =	10,006	C = 0.9
Semi-pervious Area [ft^2] =	0	C = 0.6
Pervious Area [ft^2] =	115,751	C = 0.3
	125,757	

Total Area [ac] =	2.89

Composite Runoff Coefficient (C):

C =	0.35

Q_{BYPASS} [cfs] =	2.87

Orifice Flow Rate ($Q_{ORIFICE}$):

Flow out of Detention

$Q_{ORIFICE} = A \times V$

$Q = K \times D^2 \times SQRT(h)$

K [] =	3.780	k is the orifice constant
h [ft] =	4.500	h is the hydraulic head
D [ft] =	0.17	D is diameter of the orifice (2")

$Q_{ORIFICE}$ [cfs] =	0.23	$Q_{ORIFICE}$ is the maximum flow through the orifice

Total Flow Rate (Q_{TOTAL}):

$Q_{TOTAL} = Q_{BYPASS} + Q_{ORIFICE}$

Q_{TOTAL} [cfs] =	3.10

Check $Q_{TRIB} > Q_{TOTAL}$:

Check that the flow exiting the orifice is less than the existing flow rate

TRUE

NOAA Atlas 14, Volume 6, Version 2
Location name: Redwood City, California, USA*
Latitude: 37.4642°, Longitude: -122.347°
Elevation: 1705.11 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.27** (1.94-2.66)	**2.76** (2.36-3.26)	**3.43** (2.93-4.07)	**4.00** (3.37-4.78)	**4.78** (3.86-5.95)	**5.40** (4.26-6.91)	**6.06** (4.64-7.99)	**6.77** (5.00-9.23)	**7.79** (5.48-11.2)	**8.63** (5.83-12.9)
10-min	**1.62** (1.39-1.91)	**1.98** (1.69-2.34)	**2.46** (2.09-2.91)	**2.86** (2.42-3.43)	**3.42** (2.77-4.27)	**3.87** (3.05-4.96)	**4.34** (3.32-5.72)	**4.85** (3.59-6.62)	**5.58** (3.93-8.00)	**6.19** (4.18-9.25)
15-min	**1.31** (1.12-1.54)	**1.60** (1.37-1.88)	**1.98** (1.69-2.35)	**2.31** (1.95-2.76)	**2.76** (2.24-3.44)	**3.12** (2.46-4.00)	**3.50** (2.68-4.62)	**3.91** (2.90-5.34)	**4.50** (3.17-6.45)	**4.99** (3.37-7.46)
30-min	**0.912** (0.782-1.08)	**1.11** (0.954-1.32)	**1.38** (1.18-1.64)	**1.61** (1.36-1.93)	**1.93** (1.56-2.40)	**2.18** (1.72-2.79)	**2.44** (1.87-3.22)	**2.73** (2.02-3.72)	**3.14** (2.21-4.51)	**3.48** (2.35-5.21)
60-min	**0.648** (0.555-0.764)	**0.792** (0.677-0.935)	**0.983** (0.838-1.16)	**1.14** (0.966-1.37)	**1.37** (1.11-1.71)	**1.55** (1.22-1.98)	**1.74** (1.33-2.29)	**1.94** (1.44-2.65)	**2.23** (1.57-3.20)	**2.47** (1.67-3.70)
2-hr	**0.478** (0.410-0.564)	**0.578** (0.495-0.683)	**0.712** (0.608-0.844)	**0.824** (0.696-0.986)	**0.980** (0.794-1.22)	**1.10** (0.872-1.41)	**1.24** (0.946-1.63)	**1.38** (1.02-1.88)	**1.58** (1.11-2.26)	**1.74** (1.18-2.61)
3-hr	**0.403** (0.345-0.475)	**0.486** (0.416-0.574)	**0.598** (0.510-0.709)	**0.692** (0.584-0.828)	**0.822** (0.666-1.03)	**0.925** (0.731-1.18)	**1.03** (0.793-1.36)	**1.15** (0.852-1.57)	**1.32** (0.928-1.89)	**1.46** (0.984-2.18)
6-hr	**0.288** (0.247-0.339)	**0.350** (0.299-0.413)	**0.433** (0.369-0.512)	**0.502** (0.423-0.600)	**0.598** (0.484-0.746)	**0.675** (0.532-0.863)	**0.755** (0.578-0.995)	**0.841** (0.622-1.15)	**0.962** (0.677-1.38)	**1.06** (0.717-1.59)
12-hr	**0.189** (0.162-0.223)	**0.235** (0.201-0.277)	**0.295** (0.252-0.350)	**0.346** (0.292-0.414)	**0.416** (0.337-0.519)	**0.472** (0.372-0.604)	**0.529** (0.406-0.698)	**0.591** (0.437-0.806)	**0.678** (0.477-0.972)	**0.748** (0.505-1.12)
24-hr	**0.121** (0.111-0.134)	**0.154** (0.141-0.170)	**0.197** (0.181-0.219)	**0.233** (0.212-0.261)	**0.283** (0.250-0.326)	**0.322** (0.280-0.378)	**0.362** (0.308-0.435)	**0.405** (0.336-0.498)	**0.465** (0.372-0.593)	**0.513** (0.398-0.675)
2-day	**0.079** (0.073-0.088)	**0.100** (0.092-0.111)	**0.128** (0.118-0.143)	**0.152** (0.138-0.170)	**0.184** (0.163-0.213)	**0.210** (0.183-0.247)	**0.237** (0.201-0.284)	**0.265** (0.220-0.326)	**0.305** (0.244-0.389)	**0.337** (0.261-0.443)
3-day	**0.062** (0.057-0.068)	**0.078** (0.072-0.086)	**0.099** (0.091-0.110)	**0.117** (0.106-0.131)	**0.142** (0.125-0.163)	**0.161** (0.140-0.189)	**0.182** (0.155-0.218)	**0.203** (0.169-0.250)	**0.234** (0.187-0.298)	**0.258** (0.200-0.339)
4-day	**0.052** (0.048-0.057)	**0.065** (0.060-0.072)	**0.082** (0.076-0.092)	**0.097** (0.088-0.109)	**0.117** (0.104-0.135)	**0.133** (0.116-0.157)	**0.150** (0.127-0.180)	**0.167** (0.139-0.206)	**0.192** (0.153-0.245)	**0.211** (0.164-0.278)
7-day	**0.037** (0.034-0.041)	**0.047** (0.043-0.052)	**0.059** (0.054-0.066)	**0.069** (0.063-0.077)	**0.083** (0.073-0.095)	**0.093** (0.081-0.110)	**0.104** (0.089-0.125)	**0.116** (0.096-0.142)	**0.131** (0.105-0.168)	**0.144** (0.112-0.190)
10-day	**0.029** (0.027-0.032)	**0.037** (0.034-0.041)	**0.046** (0.042-0.051)	**0.054** (0.049-0.060)	**0.064** (0.057-0.074)	**0.072** (0.062-0.084)	**0.080** (0.068-0.096)	**0.088** (0.073-0.108)	**0.099** (0.080-0.127)	**0.109** (0.084-0.143)
20-day	**0.019** (0.018-0.021)	**0.024** (0.022-0.027)	**0.030** (0.028-0.033)	**0.035** (0.032-0.039)	**0.041** (0.036-0.047)	**0.045** (0.039-0.053)	**0.050** (0.042-0.060)	**0.054** (0.045-0.067)	**0.061** (0.048-0.077)	**0.065** (0.051-0.086)
30-day	**0.015** (0.014-0.017)	**0.019** (0.018-0.022)	**0.024** (0.022-0.027)	**0.028** (0.026-0.031)	**0.033** (0.029-0.038)	**0.036** (0.031-0.042)	**0.039** (0.033-0.047)	**0.043** (0.035-0.053)	**0.047** (0.038-0.060)	**0.050** (0.039-0.066)
45-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.018)	**0.020** (0.019-0.022)	**0.023** (0.021-0.026)	**0.027** (0.024-0.031)	**0.029** (0.025-0.034)	**0.032** (0.027-0.038)	**0.034** (0.028-0.042)	**0.037** (0.030-0.047)	**0.039** (0.031-0.052)
60-day	**0.012** (0.011-0.013)	**0.015** (0.013-0.016)	**0.018** (0.017-0.020)	**0.021** (0.019-0.023)	**0.024** (0.021-0.027)	**0.026** (0.023-0.030)	**0.028** (0.024-0.033)	**0.030** (0.025-0.037)	**0.032** (0.026-0.041)	**0.034** (0.026-0.045)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

LEGEND

- (E) PERVIOUS LANDSCAPE
- (E) POOL AREA
- (E) IMPERVIOUS HARDSCAPE
- (E) IMPERVIOUS BUILDING

TOTAL AREA	136,598 SQ FT
(E) PERVIOUS AREA	
LANDSCAPE:	125,151 SQ FT
(E) IMPERVIOUS AREA	
POOL:	244 SQ FT
HARDSCAPE:	8,230 SQ FT
BUILDINGS:	2,973 SQ FT
TOTAL:	11,447 SQ FT

0 60 120

GRAPHIC SCALE

DRAWING NAME: K:\2021\211523_12400_Skyline_Blvd\ENG\skexhibits.dwg
PLOT TIME: 02:22:22
PLOTTED BY: hemo

BKF
255 SHORELINE DRIVE
SUITE 200
REDWOOD CITY, CA 94065
(650) 482-6300
www.bkf.com

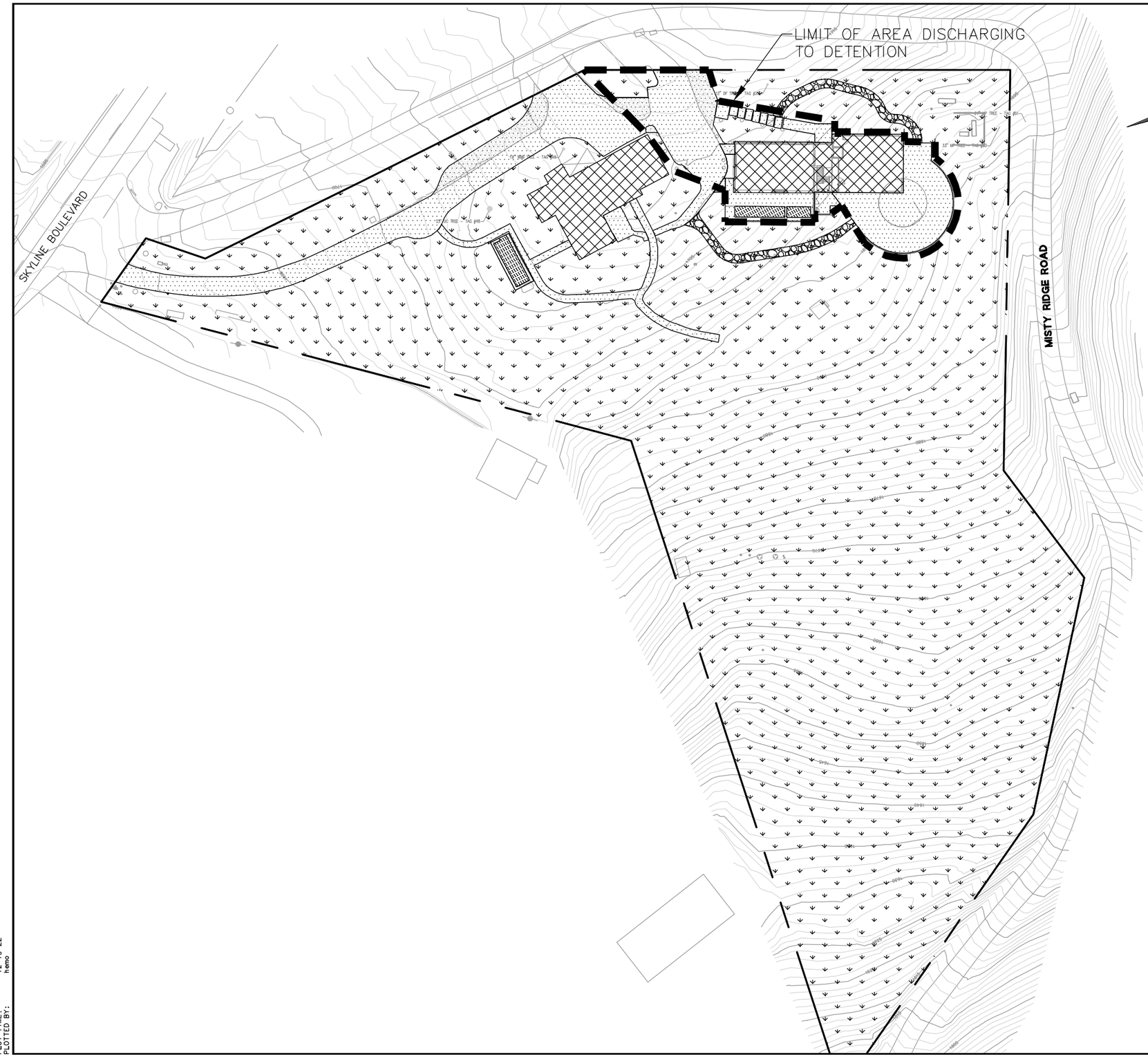
EXISTING IMPERVIOUS AREAS
12400 SKYLINE BLVD

WOODSIDE SAN MATEO COUNTY CALIFORNIA

No.	Revisions

Date: 02/22/2022
Scale: 1"=60'
Design: AHM
Drawn: AHM
Approved: D.L.
Job No: 211523-10

Drawing Number:
X-1
1 OF 2



LEGEND

- (P) PERVIOUS LANDSCAPE
- (P) SEMI-PERVIOUS HARDSCAPE
- (P) POOL AREA
- (P) IMPERVIOUS HARDSCAPE
- (P) IMPERVIOUS BUILDING

TOTAL AREA	136,598 SQ FT
(P) PERVIOUS AREA	
LANDSCAPE:	116,330 SQ FT
(P) SEMI-PERVIOUS AREA	
DECOMPOSED GRANITE:	1,062 SQ FT
(P) IMPERVIOUS AREA	
POOL:	505 SQ FT
HARDSCAPE:	13,166 SQ FT
BUILDINGS:	5,535 SQ FT
TOTAL:	19,206 SQ FT

0 60 120

GRAPHIC SCALE

BKF
255 SHORELINE DRIVE
SUITE 200
REDWOOD CITY, CA 94065
(650) 482-6300
www.bkf.com

PROPOSED IMPERVIOUS AREAS
12400 SKYLINE BLVD

WOODSIDE SAN MATEO COUNTY CALIFORNIA

No.	Revisions

Date: 12/15/2022
Scale: 1"=60'
Design: AHM
Drawn: AHM
Approved: DJL
Job No: 2211523-10

Drawing Number:
X-2
2 OF 2

DRAWING NAME: K:\2021\2211523_12400_Skyline_Blvd\ENG\skexhibits.dwg
PLOT TIME: 12:19:22
PLOTTED BY: hemo