WHITCHURCH ENGINEERING

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Fortuna, CA 95540
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Preliminary Hydrology Report

Proposed 5-Lot Residential Subdivision
APN: 511-031-018
1050 Myers Road
McKinleyville, CA 95519

Prepared for:
Jeffrey and Sadie Alves
4063 Central Avenue
McKinleyville, CA 95519

Prepared by:
Whitchurch Engineering, Inc.
610 9th Street
Fortuna, CA
02/14/2025

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Table of Tables

Acronyms and Abbreviations

APN	Assessor's Parcel Number
DMA	Drainage Management Area
INC	Incorporated
NOAA	National Oceanic and Atmospheric Administration
WDR	Waste Discharge Requirement
cfs	Cubic Feet Per Second
ft	feet
ft^2	square feet
ft^3	Cubic feet
hr	hour
in	inch
in/hr	inch/hour.
LF	Linear Feet
T_C	Time of Concentration

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1 Existing Site Conditions

The project site consists of a single concurrent parcel located at 1050 Myers Road, McKinleyville, CA (APN:511-031-018). The existing site is a relatively flat, 1.10-acre area with two existing residences with gravel driveways, and the rest of the property is covered in groomed, grass lawn. There is an additional gravel driveway south off of Myers Road the eastern lawn. (See Appendix A: Existing Site Conditions).

The existing project site generally slopes to the southwest corner of the site at slopes of approximately 0.5%-1%. Stormwater runoff remains onsite and infiltrates into the existing lawn and gravel coverage. Existing residences' downspouts are disconnected and are routed to the surrounding pervious surface coverage.

2 Proposed Site Conditions

The proposed project consists of the subdivision of the existing parcel into 5-separate for future single-family residential homes. The existing residences will be separated into two residential lots with a single residence on each parcel. The 3 new residential parcels will remain undeveloped until the current or future owners wish to build a new single-family residences. The proposed subdivision includes new sidewalks with a green planting strip, concrete gutter along the southern edge of Myers Road and the western edge of Halfway Avenue. Access to the existing residences is maintained by new concrete driveways and aprons. An asphalt driveway off of Myers Road (+/- 180 LF) provides access to the proposed southwest parcel. This driveway includes stone lined swales on each side of the driveway to infiltrate water in place. Halfway Avenue and Myers Road will both be widened to match the existing improved sections to the west and north of the subdivision. New utilities for all future residences including both a sewer and water lateral will be installed and capped for future usage. The total area of each proposed parcel and their proposed surface coverage are included in Table 1 and Table 2 below.

Table 1: Proposed Parcel Area

	Total Area (ft^2)	**Total Area (Acre)**
Parcel 1	6843	0.16
Parcel 2	6297	0.14
Parcel 3	14547	0.33
Parcel 4	7713	0.18
Parcel 5	12168	0.28
Total	47568	1.09

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Table 2: Existing and Proposed ground cover areas due to Proposed Subdivision

	Total Area (ft^2)		**Total Area (Acre)**	
Ground Cover Type	Pre-Construction	Post-Construction	Pre-Construction	Post-Construction
Grass/Pasture	43869	30483	1.01	0.70
Asphalt Paving	1945	5859	0.04	0.13
Pervious Paving	0	0	0.00	0.00
Concrete Paving	0	5773	0.00	0.13
Rooftop	1754	1754	0.04	0.04
Total	47568	47568	1.09	1.09

2 Runoff Calculations

Time of concentration of a given site is calculated using the Kerby Method, as follows:

$$T_c = 0.828(r * L/S^{0.5})^{0.467} \quad (1)$$

Where:

T_c = time of concentration (min)

r = roughness coefficient (dimensionless)

L = flow length (ft)

S = slope (ft/ft)

Runoff flow rate is calculated using the Rational Method in conjunction with the Time of Concentration. The Rational method is as follows.

$$Q = C * i * A \quad (2)$$

Where:

Q = flow rate of runoff (cfs)

C = Rational Method Runoff coefficient (dimensionless)

i = rainfall intensity (in/hr)

A = site area (acre)

Runoff coefficients represent the percentage of precipitation that will runoff of a given ground cover type. The runoff coefficients are found in Appendix C.

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Using the project site drainage areas, in combinations with the weighted runoff coefficients generated using the coefficients from the California State Water Resources Control Board (SWRCB), Equation 3 is used to calculate the flowrate of runoff resulting from the design storms.

$$Q_{pre/post} = C_{1,pre/post} * i * \mathrm{A}_{1,pre/post} \ldots + C_{n,pre/post} * i * \mathrm{A}_{n,pre/post} \quad (3)$$

Where:

$Q_{pre/post}$ = runoff flowrate pre/post construction (cfs)

$C_{n,pre/post}$ = runoff coefficient for the n^{th} surface type pre/post construction

i = rainfall intensity (in/hr)

$A_{n,pre/post}$ = area of the n^{th} surface type pre/post construction (acres)

The volume is then calculated for the post development conditions based on the impervious area and a higher runoff coefficient for the developed site using Equation 4.

$$V_{pre/post} = Q_{pre/post} * t \quad (4)$$

Where:

$V_{pre/post}$ = runoff volume pre/post-construction (ft^3)

t = duration of storm (seconds)

Alternatively, volumetric runoff can be calculated using project site drainage areas, weighted runoff coefficients, and design storm rainfall depth, as shown in Equation 5.

$$V_{pre/post} = A_{1,pre/post} * C_{1,\frac{pre}{post}} * d \ldots + A_{i,\frac{pre}{post}} * C_{i,pre/post} * d \quad (5)$$

Where:

$A_{pre/post}$ = area of the n^{th} surface type pre/post construction (ft^2)

$C_{n,pre/post}$ = runoff coefficient for the n^{th} surface type pre/post construction

d = rainfall depth (in)

The increase in volume of runoff is calculated as follows in Equation 6.

$$V_{increase} = V_{post} - V_{pre} \quad (6)$$

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2.1 Manning's Equation

Manning's equation is used to determine the maximum flow rate possible through an open channel or pipe given a velocity of flow and a cross-sectional area.

$$Q = VA = \left(\frac{1.49}{n}\right) AR_h^{\frac{2}{3}}\sqrt{S} \quad (7)$$

Where

Q = Flow Rate (CFS)

v = Velocity (ft/s)

A = Flow Area (ft^2)

n = Manning's Roughness Coefficient

R_h = Hydraulic Radius (ft)

S = Channel Slope (ft/ft)

This equation requires several other equations to calculate the flow rate through a trapezoidal open channel or circular pipe, including a specific equation for hydraulic radius and flow area. These equations are automatically calculated within FlowMaster.

3 Stormwater Runoff Analysis

Stormwater runoff analysis for this project was conducted per Humboldt County and the McKinleyville General Plan requirements. This project requires that post-construction runoff volumes do not exceed pre-construction conditions for a 100-year storm and stormwater peak flows do not increase from pre-construction conditions occurring during the 25-year storm.

3.1 Pre- and Post-Development Runoff Volume

The pre- and post- development site conditions were investigated and values for times of concentration (T_c) were determined using Equation 1 (See Table 3). The pre-development rainfall intensity was then interpolated from NOAA rainfall intensity values for the site (See Table 4). Equations 2 through Equations 5 were used to calculate runoff volumes for both Pre- and Post-development conditions using these interpolated rainfall intensities, ground cover types, areas, and runoff coefficients. These values are shown in Table 4.

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Table 3: Time of Concentration for Pre- and Post-Development Site Conditions

Site Condition	Time of Concentration (min)
Pre-Development	60.07
DMA 1 – Residential Lots	59.50
DMA 2 – Improved Halfway Avenue	1.30

The rational method requires a minimum storm length of 10-minutes. As Such the 10-minute storm was used for calculations where the time of concentration fell under the 10-minute threshold.

Table 4: Rainfall Intensity based on and interpolated from NOAA Data. *Denotes interpolated value.

Rainfall Intensity (in/hr)	
25-Year, 10-Minute Storm	2.19
100-Year, 10-Minute Storm	2.91

See Appendix D: NOAA Rainfall data for values listed in Table 4.

***Table 5:* Pre/Post Construction Runoff Flowrates for 25-year and 100-year design storms.**

	25-Year Runoff (cfs)		100-Year Runoff (cfs)	
	Pre-Dev	**Post-Dev**	**Pre-Dev**	**Post-Dev**
DMA 1	0.31	0.68	0.41	0.55
DMA 2	0.11	0.24	0.15	0.32
Whole Site	0.42	0.92	0.56	0.87

Table 6: Pre/Post Construction Runoff Volumes

	100-Year Runoff Volume (ft^3)	
	Pre-Dev	**Post-Dev**
DMA 1	365.31	818.83
DMA 2	134.62	398.11
Whole Site	499.93	1216.94

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4 Conclusion

- The project consists of the subdivision of a parcel into 5-separate parcels based both on splitting the two existing residences and providing 3 new single family residential parcels.
- New residences are shown on plans only as a proof of concept. No new residences are proposed within this project.
- Proposed improvements include new sidewalks along Myers Road and Halfway Avenue. Both roads will also be widen to match the existing roadway sections to the north on Halfway Avenue, and to the west on Myers Road
- Each of the 5 residential parcels will include a new concrete apron to provide access to the parcel from their respective adjacent roadways. This includes an extended asphalt driveway for the southwest parcel (Parcel 3).
- Sewer and water laterals are installed for future residential homes.
- The project results in the post-construction conditions including approximately 13,386 ft^2 of impervious paving and 30,483 ft^2 of pervious landscaping.
- The stormwater on site is separated into two DMAs based on whether water will be infiltrating in place or ultimately being routed into the existing storm drainage system beneath Halfway Avenue.
- DMA 1 includes the proposed residential areas within the bounds of the newly proposed sidewalks including the existing residences, and the pervious lawn coverage to remain until future single-family residences are built.
- DMA 2 includes the expanded roadways and gutters up to the center line of the existing roads, and the new sidewalks graded to route runoff to the gutters and storm drainage system.
- The DMA 1 pre-construction, 25-year storm event results in an estimated runoff flowrate of 0.31 cfs and a post-construction runoff flowrate of 0.68 cfs.
- The DMA 2 pre-construction, 25-year storm event results in an estimated runoff flowrate of 0.11 cfs and a post-construction runoff flowrate of 0.33 cfs.
- The DMA 1 pre-construction, 100-year storm event results in an estimated stormwater runoff volume of 365 ft^3 and a post-construction runoff volume of 819 ft^3.
- The DMA 2 pre-construction, 100-year storm event results in an estimated stormwater runoff volume of approximately 135 ft^3 and a post-construction runoff volume of 398 ft^3.
- DMA 1's increased stormwater flow rate and volume can be sequestered on site and infiltrated in place with the excess of pervious surface coverage. This has been confirmed via the Humboldt County Regulated Project Stormwater Calculator.
- DMA 2's increased stormwater flow rate and volume can be sequestered on site and infiltrated in place with overflows connected to the existing storm drainage beneath Halfway Avenue.
- There is approximately 550 ft^2 of pervious landscaping in DMA 2. These areas can be depressed a 1.5' to attain a storage volume of 550 ft^3 to adequately the increased stormwater with a 0.5' freeboard.
- Overflow from a larger than typical design storm will enter the existing storm drainage system.

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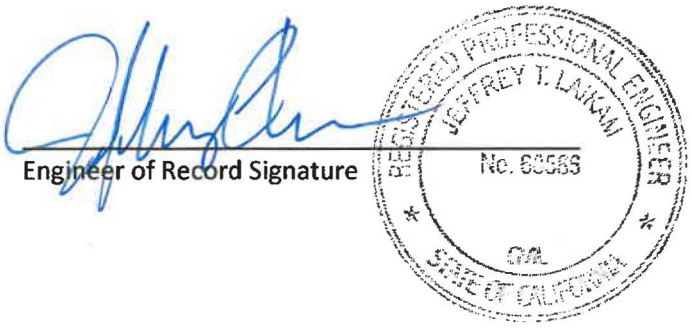
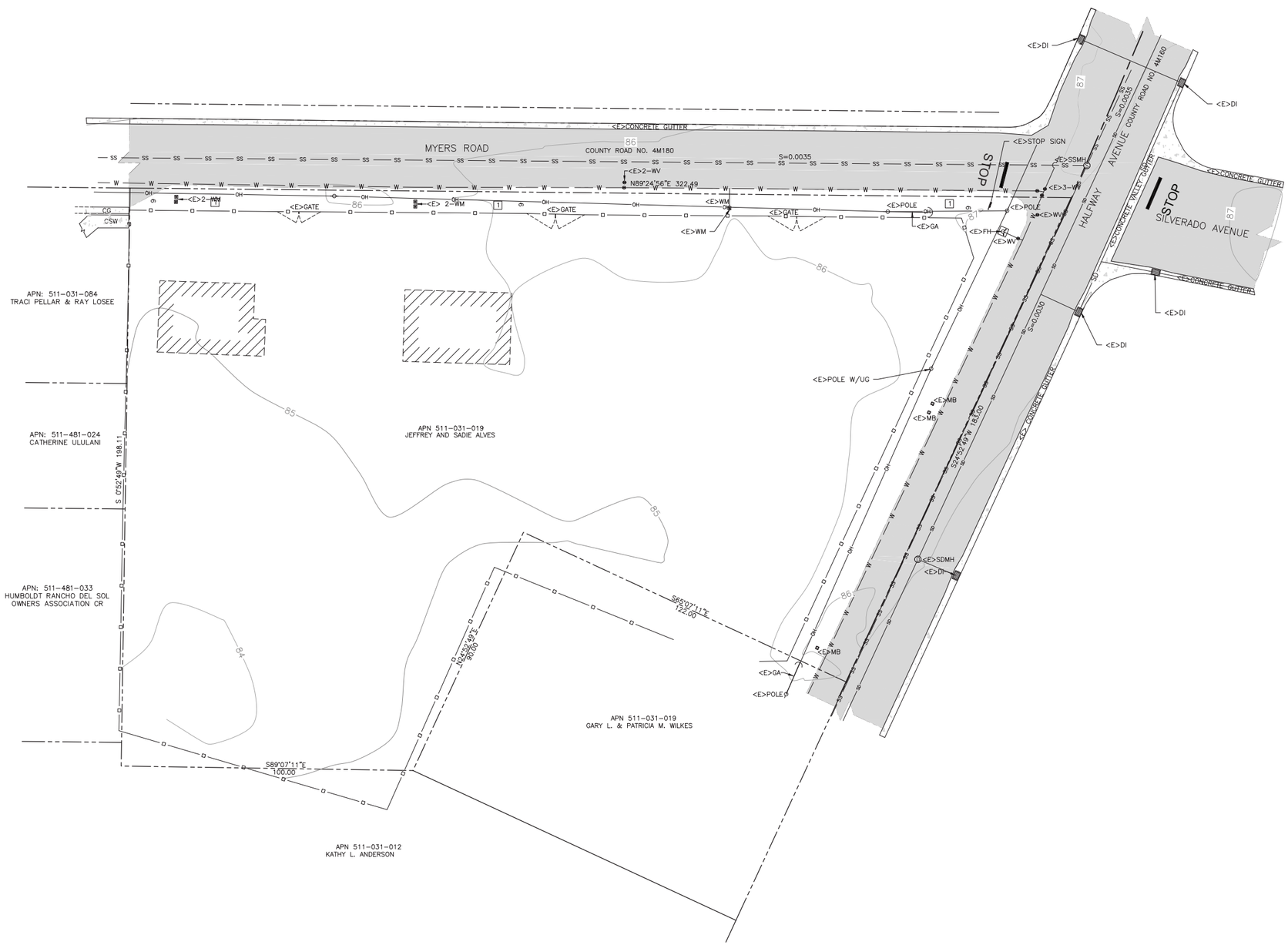
Please do not hesitate to contact this office with any questions or concerns regarding this preliminary hydrological analysis. This analysis will be revised for final design upon approval of the proposed subdivision application and before applying for the final building permits.



Engineer of Record Signature

2-24-2025
Date

Appendix A: Existing Site Conditions



EXISTING SITE CONDITIONS PLAN

SCALE: 1"=20'

NORTH

TOPOGRAPHIC SURVEY NOTES

1. THIS TENTATIVE MAP PROPOSED THE SUBDIVISION OF AN EXISTING 1.09 ACRE PARCEL INTO 5 PARCELS
2. WATER AND SEWER SERVICES ARE AVAILABLE FROM THE MCKINLEYVILLE COMMUNITY SERVICES DISTRICT.
3. DATUM: NAVD 88 PER ONSITE OPUS SOLUTION.
4. PROPERTY LINE INFORMATION: CALCULATED PROPOERTY LINES ARE SHOWN. A BOUNDARY SURVEY IS CURRENTLY IN PROGRESS.
5. THE PROPERTY MAY BE ENCUMBERED BY THE FOLLOWING RECORDED INSTRUMENTS.
   [1] BOOK 66 DEEDS, PAGE 174 – EASEMENT FOR A RIGHT OF WAY GRANTED TO HENRY MEYER – SHOWN HEREON.
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6. ADDRESS: 1050 METERS ROAD, MCKINLEYVILLE, CA 95519
7. ZONING: RS-5/AP,N
8. GROSS PARCEL AREA IS THE ENTIRE PARCEL. NET PARCEL AREAS EXCLUDE ROAD RIGHTS OF WAY AND ROAD EASEMENT AREAS.

LEGEND

- SURVEY CONTROL POINT
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY SEWER CLEAN OUT
- EXISTING STORM DRAIN MANHOLE
- EXISTING STORM DRAIN INLET
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING WATER METER
- EXISTING UTILITY METER BOX
- EXISTING UTILITY POLE
- EXISTING GUY ANCHOR
- EXISTING BUILDING
- EXISTING CONCRETE
- EXISTING ASPHALT PAVING
- EXISTING EDGE OF PAVEMENT
- EXISTING FENCELINE
- EXISTING UNDERGROUND SANITARY SEWER
- EXISTING UNDERGROUND STORM DRAIN
- EXISTING UNDERGROUND WATER LINE
- EXISTING OVERHEAD UTILITY
- EXISTING MAJOR CONTOUR AT 5' INTERVALS
- EXISTING MINOR CONTOUR AT 1' INTERVALS
- EXISTING PROPERTY LINE
- EXISTING CENTERLINE OF ROAD WAY

ABBREVIATIONS

AC	ASPHALT CONCRETE
APN	ASSESSOR'S PARCEL NUMBER
BLDG	BUILDING
BLDGCRN	BUILDING CORNER
BOW	BACK OF WALK
CC	CONCRETE
CF	CONCRETE FOOTING
CMP	CORRUGATED METAL PIPE
CP	CONTROL POINT
CS	CONCRETE SLAB
CTL	CENTERLINE
CUFT	CUBIC FEET
CUYD	CUBIC YARD
CW	CONCRETE WALL
DI	DROP INLET
DWY	DRIVEWAY
<E>	EXISTING
EB	ELECTRICAL BOX
ELV	ELEVATION
EM	ELECTRICAL METER
EP	EDGE OF PAVEMENT
EPAN	ELECTRICAL PANEL
FC	FACE CURB
FF	FINISHED FLOOR
FL	FLOWLINE
FOW	FRONT OF WALK
G	GAS
GAL	GALLON
GPAN	GAS PANEL
GM	GAS METER
GRD	GROUND
GV	GAS VALVE
HB	HOSE BIB
INV	INVERT
IP	IRON PIPE
L	LENGTH
LID	LOW IMPACT DESIGN
MON	MONUMENT
MT	MULTITRUNK
<N>	NEW
OG	ON GRADE
OH	OVER HEAD
OIP	OPEN IRON PIPE
<P>	PROPOSED
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS
RB	REBAR
SD	STORM DRAIN
SS	SANITARY SEWER
SSCO	SANITARY SEWER CLEANOUT
SSMH	SANITARY SEWER MANHOLE
STL	STEEL
SQFT	SQUARE FEET
TBM	TEMPORARY BENCHMARK
TC	TOP CURB
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TR	TREE
W	WATER
WM	WATER METER
WV	WATER VALVE

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EXISTING SITE CONDITIONS
1050 MYERS ROAD, MCKINLEYVILLA, CA 95519

For: JEFFREY ALVES

Date	JAN 08 '25
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Drawn	NTN
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Appendix B: Subdivision Site Plan

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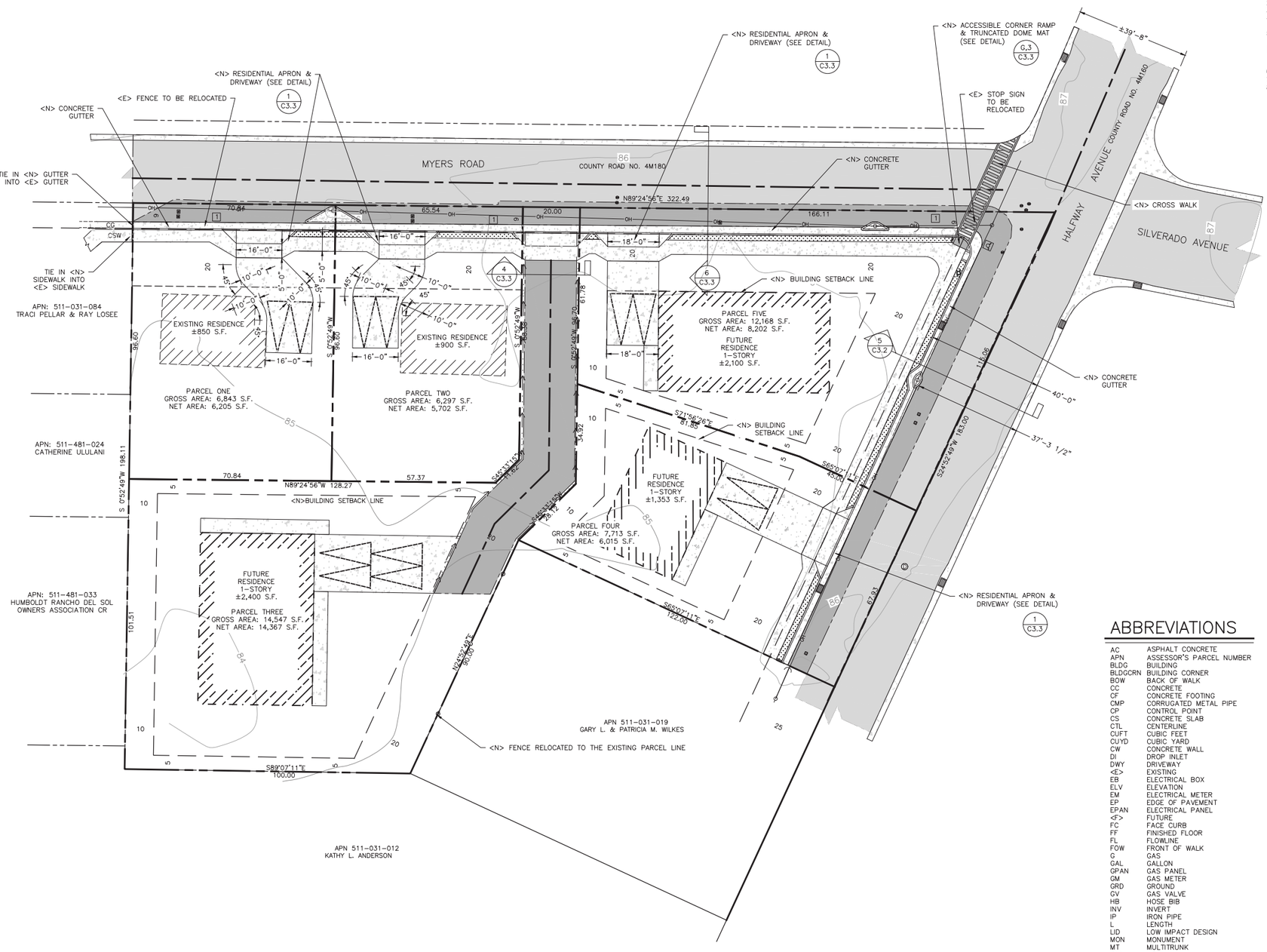

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- EXISTING CONCRETE
- EXISTING ASPHALT PAVING
- FUTURE BUILDING
- NEW CONCRETE
- NEW ASPHALT PAVING
- NEW LANDSCAPING
- NEW TRUNCATED DOME MAT
- EXISTING EDGE OF PAVEMENT
- EXISTING PROPERTY LINE
- 200 EXISTING MAJOR CONTOUR AT 5' INTERVALS
- 201 EXISTING MINOR CONTOUR AT 1' INTERVALS
- PROPERTY LINE SETBACK
- NEW EDGE OF PAVEMENT
- NEW FENCELINE
- NEW FLOWLINE
- NEW PROPERTY LINE
- NEW CENTERLINE OF ROAD WAY

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Appendix C: Drainage Calculation Tables of Coefficients

Table 7: Runoff Rational Method coefficients for surface conditions on site post-construction

Surface Type	Runoff Coefficient
Unimproved/Grass Areas	0.2
Concrete	0.9
Asphalt	0.9
Pervious Pavement	0.5
Roof	0.9

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Appendix D: NOAA Rainfall Data

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PDS-based 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	**1.61** (1.42-1.86)	**2.02** (1.76-2.33)	**2.58** (2.26-2.99)	**3.07** (2.65-3.59)	**3.79** (3.16-4.61)	**4.39** (3.56-5.46)	**5.03** (3.97-6.44)	**5.74** (4.38-7.58)	**6.78** (4.93-9.40)	**7.64** (5.35-11.0)
10-min	**1.16** (1.01-1.33)	**1.45** (1.27-1.67)	**1.85** (1.61-2.14)	**2.20** (1.90-2.57)	**2.72** (2.26-3.30)	**3.14** (2.55-3.91)	**3.61** (2.84-4.61)	**4.11** (3.14-5.44)	**4.85** (3.54-6.73)	**5.48** (3.84-7.90)
15-min	**0.932** (0.816-1.08)	**1.16** (1.02-1.34)	**1.49** (1.30-1.73)	**1.78** (1.53-2.08)	**2.19** (1.82-2.66)	**2.54** (2.06-3.16)	**2.91** (2.29-3.72)	**3.32** (2.53-4.38)	**3.92** (2.85-5.43)	**4.42** (3.10-6.36)
30-min	**0.624** (0.548-0.720)	**0.780** (0.682-0.902)	**1.00** (0.872-1.16)	**1.19** (1.03-1.39)	**1.47** (1.22-1.78)	**1.70** (1.38-2.12)	**1.95** (1.54-2.49)	**2.22** (1.70-2.94)	**2.62** (1.91-3.64)	**2.96** (2.07-4.27)
60-min	**0.438** (0.383-0.505)	**0.547** (0.478-0.631)	**0.700** (0.610-0.811)	**0.833** (0.720-0.975)	**1.03** (0.855-1.25)	**1.19** (0.965-1.48)	**1.36** (1.08-1.75)	**1.56** (1.19-2.06)	**1.84** (1.34-2.55)	**2.07** (1.45-2.99)
2-hr	**0.336** (0.294-0.387)	**0.412** (0.360-0.476)	**0.518** (0.452-0.600)	**0.610** (0.527-0.713)	**0.743** (0.618-0.903)	**0.853** (0.692-1.06)	**0.970** (0.765-1.24)	**1.10** (0.839-1.45)	**1.28** (0.936-1.78)	**1.44** (1.01-2.07)
3-hr	**0.289** (0.253-0.333)	**0.351** (0.308-0.406)	**0.439** (0.382-0.508)	**0.514** (0.444-0.601)	**0.622** (0.516-0.755)	**0.709** (0.576-0.884)	**0.804** (0.634-1.03)	**0.906** (0.692-1.20)	**1.05** (0.767-1.46)	**1.17** (0.822-1.69)
6-hr	**0.222** (0.195-0.257)	**0.269** (0.235-0.310)	**0.331** (0.289-0.384)	**0.385** (0.332-0.450)	**0.461** (0.383-0.560)	**0.522** (0.424-0.650)	**0.587** (0.463-0.751)	**0.656** (0.501-0.867)	**0.754** (0.549-1.05)	**0.834** (0.584-1.20)
12-hr	**0.164** (0.144-0.189)	**0.199** (0.174-0.229)	**0.245** (0.213-0.284)	**0.283** (0.245-0.332)	**0.337** (0.280-0.410)	**0.380** (0.308-0.473)	**0.424** (0.334-0.543)	**0.470** (0.359-0.622)	**0.536** (0.390-0.743)	**0.588** (0.412-0.848)
24-hr	**0.120** (0.107-0.137)	**0.146** (0.130-0.167)	**0.180** (0.161-0.206)	**0.209** (0.185-0.241)	**0.247** (0.212-0.294)	**0.278** (0.234-0.336)	**0.308** (0.254-0.382)	**0.341** (0.274-0.433)	**0.385** (0.298-0.508)	**0.420** (0.315-0.572)
2-day	**0.081** (0.072-0.092)	**0.099** (0.088-0.113)	**0.122** (0.109-0.140)	**0.141** (0.125-0.163)	**0.167** (0.143-0.199)	**0.187** (0.157-0.226)	**0.207** (0.170-0.256)	**0.227** (0.182-0.288)	**0.255** (0.197-0.336)	**0.276** (0.207-0.376)
3-day	**0.063** (0.056-0.072)	**0.077** (0.069-0.088)	**0.096** (0.086-0.110)	**0.111** (0.098-0.128)	**0.131** (0.113-0.156)	**0.146** (0.123-0.177)	**0.162** (0.133-0.200)	**0.177** (0.142-0.225)	**0.198** (0.153-0.262)	**0.215** (0.161-0.292)
4-day	**0.053** (0.047-0.060)	**0.065** (0.058-0.075)	**0.081** (0.072-0.093)	**0.094** (0.083-0.108)	**0.111** (0.095-0.132)	**0.123** (0.104-0.150)	**0.136** (0.112-0.169)	**0.149** (0.120-0.190)	**0.167** (0.129-0.220)	**0.180** (0.135-0.245)
7-day	**0.038** (0.034-0.043)	**0.047** (0.042-0.054)	**0.059** (0.052-0.067)	**0.068** (0.060-0.079)	**0.080** (0.069-0.095)	**0.089** (0.075-0.108)	**0.098** (0.081-0.122)	**0.107** (0.086-0.136)	**0.119** (0.092-0.158)	**0.129** (0.096-0.175)
10-day	**0.031** (0.028-0.035)	**0.038** (0.034-0.044)	**0.048** (0.043-0.055)	**0.055** (0.049-0.064)	**0.065** (0.056-0.077)	**0.072** (0.061-0.088)	**0.079** (0.065-0.098)	**0.087** (0.070-0.110)	**0.096** (0.074-0.127)	**0.103** (0.077-0.141)
20-day	**0.021** (0.019-0.024)	**0.026** (0.023-0.030)	**0.032** (0.029-0.037)	**0.037** (0.033-0.043)	**0.044** (0.037-0.052)	**0.048** (0.041-0.059)	**0.053** (0.043-0.065)	**0.057** (0.046-0.073)	**0.063** (0.048-0.083)	**0.067** (0.050-0.091)
30-day	**0.017** (0.015-0.020)	**0.021** (0.019-0.025)	**0.027** (0.024-0.031)	**0.031** (0.027-0.035)	**0.036** (0.030-0.042)	**0.039** (0.033-0.048)	**0.043** (0.035-0.053)	**0.046** (0.037-0.059)	**0.050** (0.039-0.066)	**0.053** (0.040-0.073)
45-day	**0.015** (0.013-0.017)	**0.018** (0.016-0.021)	**0.023** (0.020-0.026)	**0.026** (0.023-0.030)	**0.030** (0.026-0.036)	**0.033** (0.028-0.040)	**0.035** (0.029-0.044)	**0.038** (0.031-0.049)	**0.041** (0.032-0.055)	**0.044** (0.033-0.060)
60-day	**0.013** (0.012-0.015)	**0.016** (0.014-0.019)	**0.020** (0.018-0.023)	**0.023** (0.020-0.026)	**0.026** (0.022-0.031)	**0.028** (0.024-0.035)	**0.031** (0.025-0.038)	**0.033** (0.026-0.042)	**0.036** (0.027-0.047)	**0.037** (0.028-0.051)

[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.

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