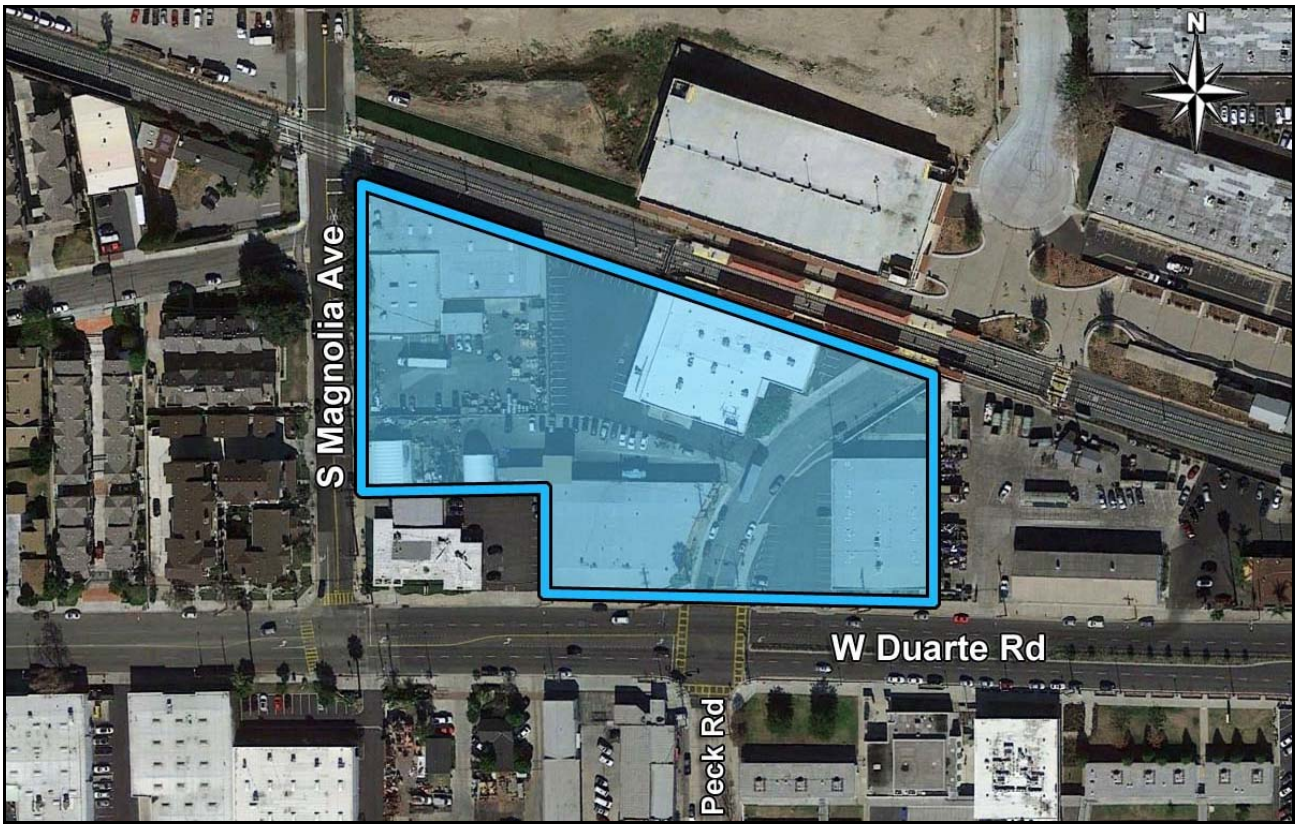
APPENDIX E

Preliminary LID Study

Preliminary LID Report

Station Square South

Monrovia, California



January 15, 2018

Prepared for

THE RICHMAN GROUP OF COMPANIES

Prepared by

KHR ASSOCIATES
Consulting Engineers - Surveyors - Planners

ATTESTATION

This report has been prepared by, and under the direction of, the undersigned, a duly Registered Civil Engineer in the State of California. Except as noted, the undersigned attests to the technical information contained herein, and has judged to be acceptable the qualifications of any technical specialists providing engineering data for this report, upon which findings, conclusions, and recommendations are based.

James H. Kawamura, P.E.
Registered Civil Engineer No. C30560
Exp. 3/31/18

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Section 1 Property Description

1.1 Existing Conditions

The project site is located at 205 and 225 West Duarte Road, 1725 Peck Road, and 1726 South Magnolia Avenue, in the City of Monrovia, California. The project site is bounded by the Metro Gold Line light rail and Monrovia Station to the north, commercial/industrial uses to the east, Duarte Road to the south, and Magnolia Avenue to the west. An existing animal hospital borders the southwest corner of the project site. Peck Road divides the project site, extending from Duarte Road north to the Metro Gold Line light rail, where it terminates.

1.2 Proposed Conditions

The proposed *Station Square South* multi-family residential project entails the demolition of several existing buildings and surface parking lots on six parcels of land totaling approximately 3.4 acres (3.8 acres with Peck Road), and the construction of a 5-story apartment building consisting of 296 dwelling units, partially wrapping around a 6-story parking structure containing 522 parking spaces. The portion of Peck Road between Duarte Road to the south and the Metro Gold Line light rail to the north will be vacated as part of the proposed project.

1.3 Feasibility of Infiltration

According to information taken from the Geotechnical Investigation by SCST, Inc., dated February 24, 2017, infiltration is considered feasible at the site since it is greater than 0.3 inches per hour. In-situ infiltration testing was performed at two locations, one at 10 feet below existing ground level and the other at 30 feet, and the infiltration rate was found to be 1.5 inches/hour. Furthermore, the proposed 100-feet deep drywells will comply with the County's requirement, outlined in GMED Policy GS 200.1, that stormwater infiltration shall be at least 10 feet above the groundwater elevation. As reported by SCST, Inc. in the Geotechnical Investigation, groundwater was not encountered during their testing and the historic high groundwater level at the site is approximately 200 feet below the ground surface.

Section 2 Hydrologic Setting

2.1 Watershed (Receiving Water)

The proposed project is located within the 834 square mile Los Angeles River watershed. The receiving waters directly affected by the proposed development include Peck Road Channel, Sawpit Wash, Peck Road Park Lake, Rio Hondo Channel (Reach 1 and Reach 2), Los Angeles River (Reach 1 and Reach 2), Los Angeles River Estuary (Queensway Bay), and San Pedro Bay.

2.2 Drainage

The drainage area for the proposed project will meet the requirements as conditioned by the City of Monrovia and the County of Los Angeles. On-site runoff will be collected and the first flush (85^{th} percentile (1.1 inches at the project site) or ¾ of an inch, whichever is greater during a

single rain event) will first be sent to CDS units for pretreatment, then storage tanks to hold the treated stormwater, and finally drywells for on-site infiltration.

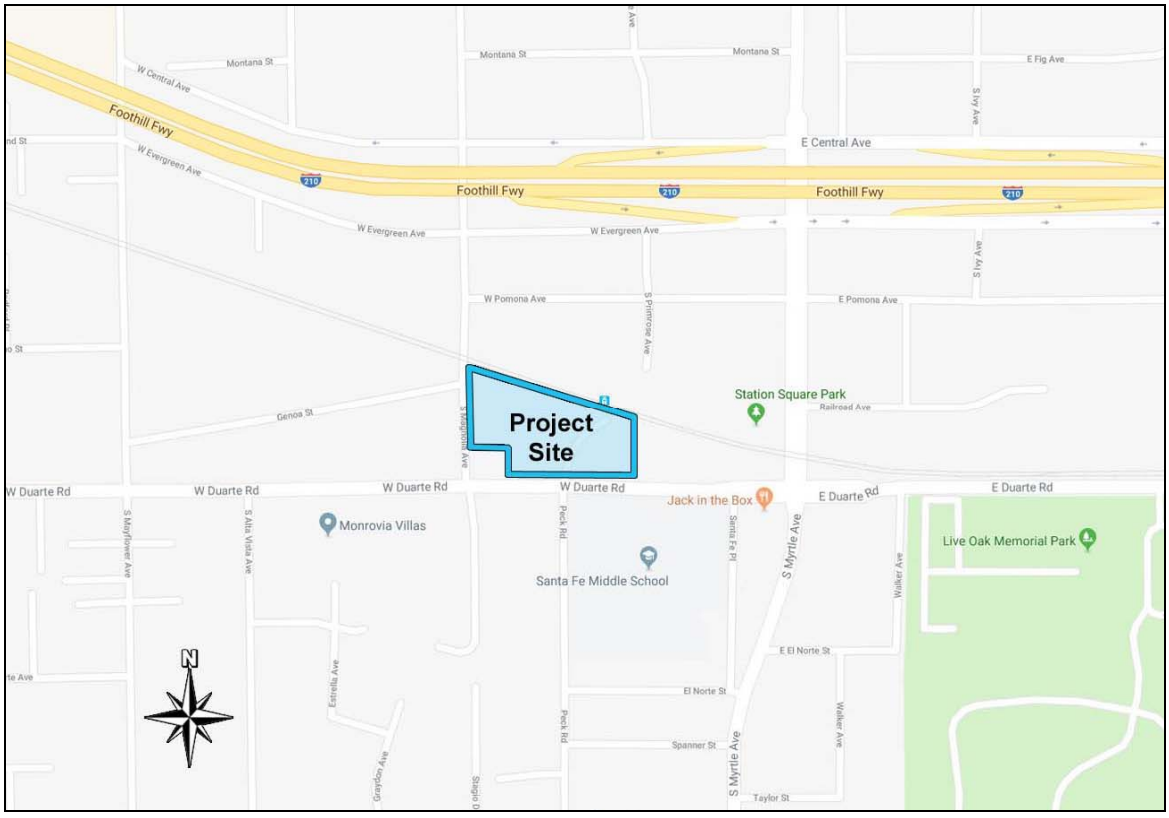
Below is a table that summarizes the results of the calculations for sizing of the proposed treatment (see appendix for drywell and storage tank calculations).

Summary of Volume Provided vs. Required

Subarea	SWQDv (ft^3)	$V_{drywell}$ (ft^3)	$V_{storage\ tank}$ (ft^3)	V_{total} Provided (ft^3)
A	1,426	653	792	1,445
B	2,602	653	1,951	2,604
C	3,172	653	2,545	3,198
D	2,210	653	1,583	2,236
E	1,925	653	1,272	1,925
F	2,210	653	1,583	2,236
Total	13,545			13,644

APPENDIX

Appendix 1
Area and Vicinity Map


Project Site
Station Square Park
Railroad Ave
Jack in the Box
Monrovia Villas
Santa Fe Middle School
Live Oak Memorial Park
Foothill Fwy
E Central Ave
W Duarte Rd
E Duarte Rd
W Evergreen Ave
W Pomona Ave
E Pomona Ave
Montana St
E Fig Ave
Genoa St
E El Norte St
El Norte St
Spanner St
Taylor St
S Myrtle Ave
Walker Ave
Peck Rd
N


S Magnolia Ave
W Duarte Rd
Peck Rd
N

Appendix 2
Preliminary LID Exhibit

DRYWELL & STORAGE TANK DATA

SUBAREA	DRYWELL DIAMETER	DRYWELL DEPTH	STORAGE TANK DIAMETER	STORAGE TANK LENGTH
A	4'	100'	6'	28'
B	4'	100'	6'	69'
C	4'	100'	6'	90'
D	4'	100'	6'	56'
E	4'	100'	6'	45'
F	4'	100'	6'	56'

LEGEND

- SUBAREA BOUNDARY
- X / X.XXAC — SUBAREA LABEL
- INFILTRATION FACILITY SETBACK AREA (5' FROM P/L OR R/W; 15' FROM BLDG. FOUNDATIONS)

MAGNOLIA AVENUE

METRO R/W

R/W N71°18'55"W 613.97'

P/L N89°35'00"E 190.01'

P/L N00°25'00"W 313.81'

P/L N00°25'00"W 102.87'

P/L N00°23'05"E 230.93'

DUARTE ROAD

PECK ROAD

PROP R/W

R/W D=00°31'46" R=12,673.18' L=117.13'

R/W D=00°47'15" R=12,673.18' L=174.20'

EX. 96" SD LACFCD PROJECT NO. 216

A 0.40AC

B 0.73AC

C 0.89AC

D 0.62AC

E 0.54AC

F 0.62AC

STORAGE TANK

DRYWELL

CDS PRE-TREATMENT

OVERFLOW/ DIVERSION WEIR

CATCH BASIN/ DIVERSION WEIR/ OVERFLOW

CATCH BASIN/ OVERFLOW

SD

0 10 20 40 60

SCALE:1"=20' DATE: 01/15/18

STATION SQUARE SOUTH

THE RICHMAN GROUP

C-2: PRELIMINARY LID EXHIBIT

MONROVIA, CALIFORNIA

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Appendix 3

Peak Flow Hydraulic Analysis

85th Percentile Storm

Peak Flow Hydrologic Analysis

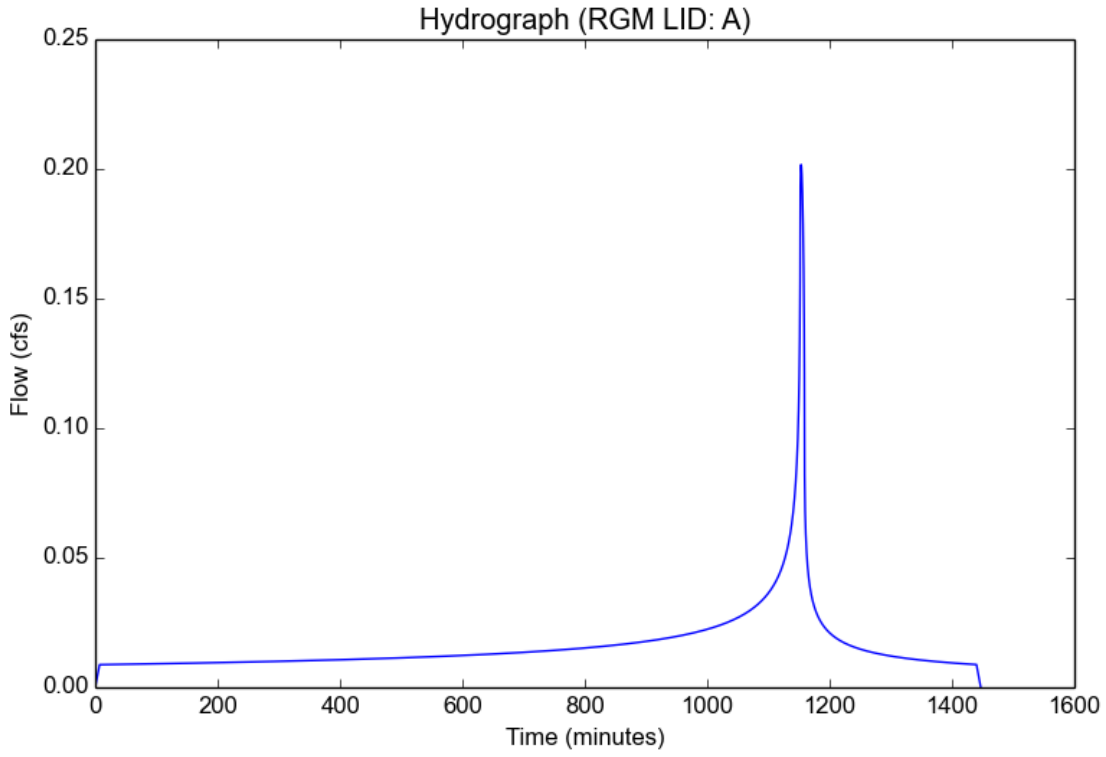
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - A.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	A
Area (ac)	0.4
Flow Path Length (ft)	112.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5603
Undeveloped Runoff Coefficient (Cu)	0.3659
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.2017
Burned Peak Flow Rate (cfs)	0.2017
24-Hr Clear Runoff Volume (ac-ft)	0.0327
24-Hr Clear Runoff Volume (cu-ft)	1425.6009



Peak Flow Hydrologic Analysis

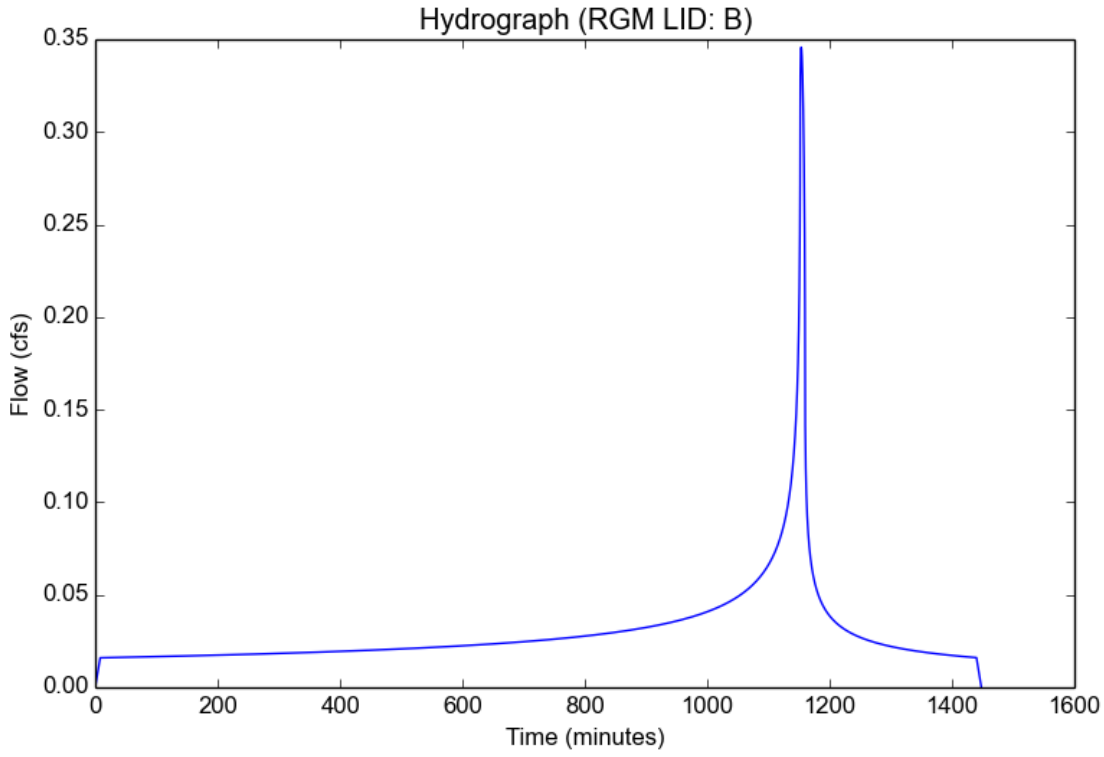
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - B.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	B
Area (ac)	0.73
Flow Path Length (ft)	123.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5262
Undeveloped Runoff Coefficient (Cu)	0.3419
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	0.3457
Burned Peak Flow Rate (cfs)	0.3457
24-Hr Clear Runoff Volume (ac-ft)	0.0597
24-Hr Clear Runoff Volume (cu-ft)	2601.7221



Peak Flow Hydrologic Analysis

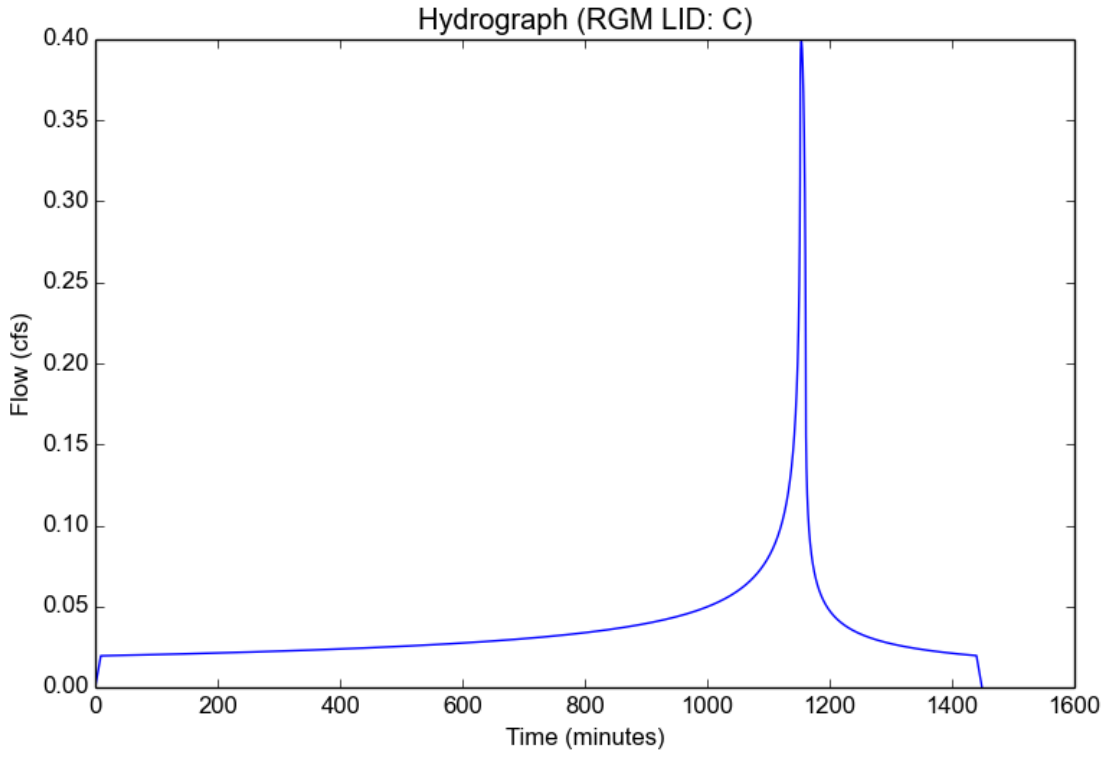
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - C.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	C
Area (ac)	0.89
Flow Path Length (ft)	174.0
Flow Path Slope (vft/hft)	0.03
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.4979
Undeveloped Runoff Coefficient (Cu)	0.3197
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	0.3988
Burned Peak Flow Rate (cfs)	0.3988
24-Hr Clear Runoff Volume (ac-ft)	0.0728
24-Hr Clear Runoff Volume (cu-ft)	3171.9632



Peak Flow Hydrologic Analysis

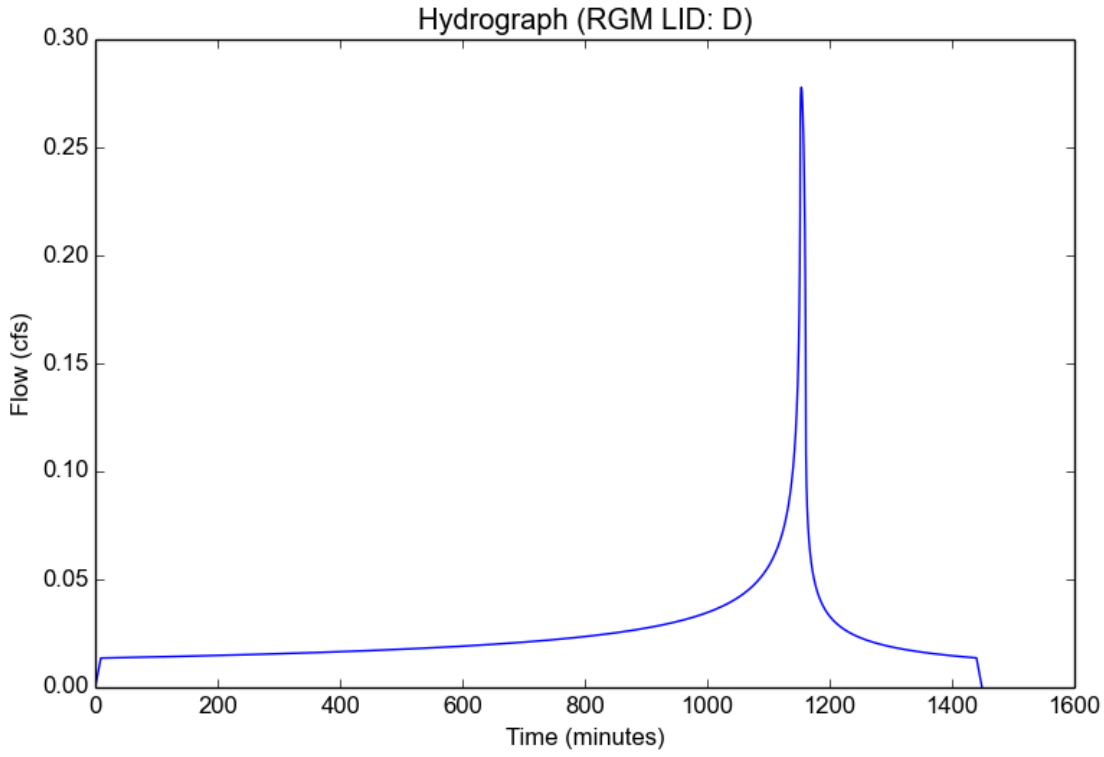
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - D.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	D
Area (ac)	0.62
Flow Path Length (ft)	144.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.4979
Undeveloped Runoff Coefficient (Cu)	0.3197
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	0.2778
Burned Peak Flow Rate (cfs)	0.2778
24-Hr Clear Runoff Volume (ac-ft)	0.0507
24-Hr Clear Runoff Volume (cu-ft)	2209.6823



Peak Flow Hydrologic Analysis

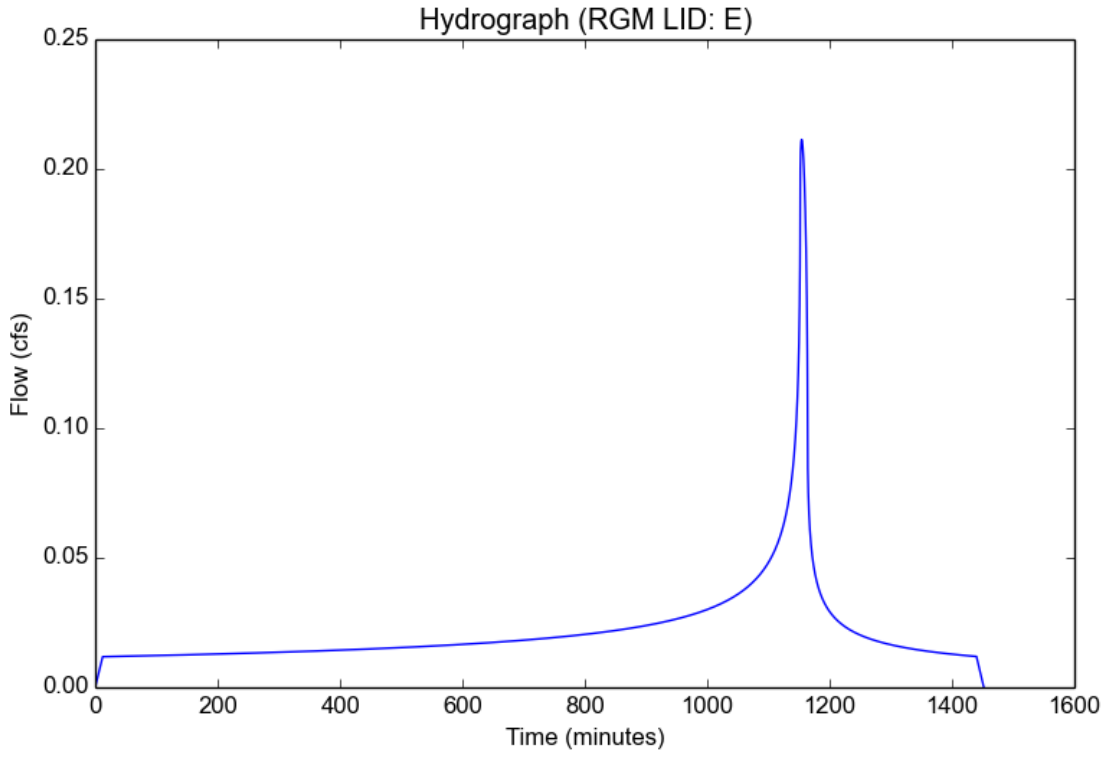
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - E.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	E
Area (ac)	0.54
Flow Path Length (ft)	270.0
Flow Path Slope (vft/hft)	0.03
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.4349
Undeveloped Runoff Coefficient (Cu)	0.2115
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	0.2114
Burned Peak Flow Rate (cfs)	0.2114
24-Hr Clear Runoff Volume (ac-ft)	0.0442
24-Hr Clear Runoff Volume (cu-ft)	1924.5635



Peak Flow Hydrologic Analysis

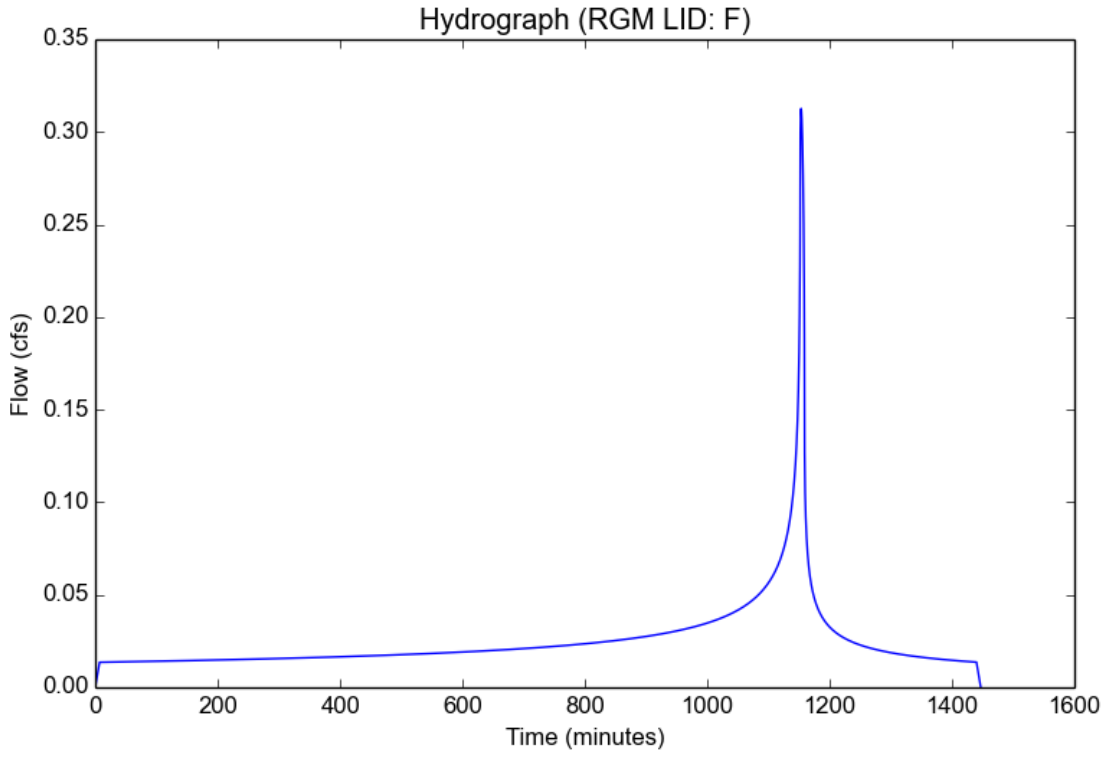
File location: R:/Richman Group/Monrovia/LID/HydroCalc/18.01.15/RGM LID - F.pdf
Version: HydroCalc 0.3.0-beta

Input Parameters

Project Name	RGM LID
Subarea ID	F
Area (ac)	0.62
Flow Path Length (ft)	115.0
Flow Path Slope (vft/hft)	0.03
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5603
Undeveloped Runoff Coefficient (Cu)	0.3659
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.3126
Burned Peak Flow Rate (cfs)	0.3126
24-Hr Clear Runoff Volume (ac-ft)	0.0507
24-Hr Clear Runoff Volume (cu-ft)	2209.6814



Appendix 4
Drywell and Storage Calculations

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea A

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	1,426	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 238 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea A

CMP Diameter:	6.00	feet
CMP_{Length}:	28	linear feet
V_{design} (CF) :	773	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 792 C.F.

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea B

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	2,602	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 434 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea B

CMP Diameter:	6.00	feet
CMP_{Length}:	69	linear feet
V_{design} (CF) :	1,949	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 1,951 C.F.

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea C

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	3,172	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 529 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea C

CMP Diameter:	6.00	feet
CMP_{Length}:	90	linear feet
V_{design} (CF) :	2,519	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 2,545 C.F.

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea D

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	2,210	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 368 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea D

CMP Diameter:	6.00	feet
CMP_{Length}:	56	linear feet
V_{design} (CF) :	1,557	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 1,583 C.F.

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea E

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	1,925	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 321 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea E

CMP Diameter:	6.00	feet
CMP_{Length}:	45	linear feet
V_{design} (CF) :	1,272	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 1,272 C.F.

LID CALCULATIONS DRYWELL INFILTRATION:

Subarea F

$K_{sat,measured}$:	1.50	in/hr	
Drywell Diameter:	4	feet	
$Drywell_{chamber}$:	20	linear feet	
$Drywell_{gravel}$:	80	linear feet	
FS (Factor of Safety):	1		
T_{max} (Max. Drawdown Time):	48	hr	
V_{design} (CF) =	2,210	C.F.	(based on HydroCalc)

Determine $K_{sat,design}$

$$K_{sat,design} = K_{sat,measured} \div FS$$
$$K_{sat,design} = 1.50 \text{ in/hr}$$

Determine A_{min}

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) \div (T \times K_{sat,design})$$
$$A_{min} = 368 \text{ S.F.}$$

Determine V_{actual}

$$V_{actual} = ((\pi r^2) \times Drywell_{chamber}) + ((\pi r^2 \times Drywell_{gravel}) \times 0.40)$$
$$V_{actual} = 653 \text{ C.F.}$$

Determine A_{actual}

$$A_{actual} = (2\pi r) \times (Drywell_{chamber} + Drywell_{gravel})$$
$$A_{actual} = 1,257 \text{ S.F.}$$

Determine T_{actual}

$$T_{actual} = (V_{actual} \times 12 \text{ in/ft}) \div (A_{actual} \times K_{sat,design})$$
$$T_{actual} = 4.16 \text{ hr}$$

LID CALCULATIONS STORAGE TANK:

Subarea F

CMP Diameter:	6.00	feet
CMP_{Length}:	56	linear feet
V_{design} (CF) :	1,557	C.F.

Determine V_{CMP}

$V_{CMP} = (\pi r^2) x CMP_{Length}$

$V_{CMP} =$ 1,583 C.F.