HYDROLOGY STUDY

For:
Latitude Business Park

Project Location:
NW Corner of Temescal Canyon Road and Tom Barnes Street
Corona, CA

(APN 279-121-004 thru 006
APN 279-122-001 thru 004
APN 279-123-001 thru 003
APN 279-125-003 thru 004
APN 279-134-001 thru 004)

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Prepared Date: 12/17/2019

Prepared under the supervision of:

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Kevin J. Richer
RCE 43714, Exp. 3/31/21
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Discussion

The purpose of this preliminary study is to determine the storm flows for the developed condition of the project site. A final hydrology study will be submitted later as part of design review and permitting for the phases of development which will show storm drain sizing and further consider the stormwater treatment BMPs, etc.

The project site is located on thirteen parcels that total 76.17 acres. These parcels will be re-subdivided through a subdivision map. The project proposes to disturb 68.68 acres of Tentative Parcel Map No. 37608. The project site is located at the northeast corner of Temescal Canyon Road and Tom Barnes Street. The whole site is undeveloped land, 0% impervious.

The site is bounded on the north by single-family residential lots, a nursery and undeveloped slope areas. The Interstate 15 Freeway abuts the property along the westerly boundary. Tom Barnes Street, an improved street, abuts the property to the south. Temescal Canyon Road, a partially improved street, abuts the project to the west. The project currently accepts flows from the north from a tributary area of approximately 18 acres in the unincorporated area of Riverside County. There are no tributary flows from the freeway right-of-way, Tom Barnes Street right-of-way or Temescal Canyon Road right-of-way. The current topography of the site forms a couple of sumps created by previous clay mining activities. The mining activities ceased and grading activities were conducted within the last 10-15 years to start filling in the borrow area created by the mine.

The project proposes to develop the site with fifteen buildings for commercial use, AC pavement parking areas, and landscaping throughout. Off-site run-on along the northerly boundary of the project will bypass the site through proposed underground storm drain pipe. Along the northerly boundary of the project site, a brow ditch is proposed on-site to intercept off-site run-on. This run-on is conveyed to proposed down drains that discharge into the proposed public storm drain system throughout the project site, and eventually into the public storm drain system within the right-of-way of Tom Barnes St. Each drainage area of the developed condition of the project site directs storm water runoff to proposed catch basin inlets that discharge into proposed underground storage systems and then into modular wetlands for treatment. The overflows of these modular wetlands discharge into the proposed public storm drain system that runs through the project site and then discharges into the public storm drain system of Tom Barnes St.

The calculations for the 100-year rational study were prepared using CivilDesign. According to the Hydrologic Soils Group Map for Riverside County Hydrology Manual, the soil type is a mixture of Type “B” and “C”. Soil testing shows the site is primarily underlain by clayey soils, so Type “C” is used for
the rational method calculations. The rainfall was calculated using the Corona rainfall data. The off-site runoff was assumed to be single-family ½ acre to approximate 40% impervious area. The project site was assumed to be “Commercial” to approximate 90% impervious area in most subareas, and “Apartments” to approximate 80% impervious area where the subarea includes graded slopes. The results of the Rational Study are summarized as follows:

<table>
<thead>
<tr>
<th></th>
<th>Q&lt;sub&gt;PRE&lt;/sub&gt; (CFS)</th>
<th>Q&lt;sub&gt;POST&lt;/sub&gt; (CFS)</th>
<th>T&lt;sub&gt;C,POST&lt;/sub&gt; (MIN)</th>
<th>ΔV (CF)</th>
<th>V&lt;sub&gt;STORAGE&lt;/sub&gt; (CF)</th>
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<td>100-YR</td>
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<td>252.65</td>
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</table>

The change in run-off volume due to the proposed development has been calculated as follows:

\[ ΔV = 1.5 (ΔQ) (T_{C,POST} \times 60) \]

This formula models an estimation of the change in storm water volume, hence it is multiplied by a factor of safety of 1.5. The underground storage systems were designed in accordance with the Riverside County Flood Control District LID Design Manual (2011) and the Technical Guidance Document (2012). These provide the volume of storage shown in the above table. See the LID design in Appendix F.

Due to the proposed development and increase in impervious area of the project site, the volume of storm water runoff (ΔV) generated by the project site increases from the volume of the pre-developed site. The volume of retention (V<sub>STORAGE</sub>) provided by the proposed underground storage systems is greater than the increase in said runoff (ΔV). Therefore, the project will not increase the discharge of stormwater runoff from the site.
Appendix A

Vicinity Map
Thomas Guide Map
Appendix B

Hydrology Manual Reference Data
- Soils Map
- Rainfall Data
<table>
<thead>
<tr>
<th>Duration Minutes</th>
<th>Frequency 10 Year</th>
<th>Frequency 100 Year</th>
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<td>Corona</td>
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<td>5</td>
<td>4.14 6.76</td>
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<td>6</td>
<td>3.13 6.08</td>
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<td>SLOPE = .580</td>
<td>SLOPE = .555</td>
<td>SLOPE = .480</td>
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Appendix C

Rational Study
Pre-Developed Condition
Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/15/19 File: 5957RU100A.out

JN5957 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA A

********* Hydrology Study Control Information *********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity = 2.220 (In/Hr)
10 year storm 60 minute intensity = 0.940 (In/Hr)
100 year storm 10 minute intensity = 3.430 (In/Hr)
100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450 (In/Hr)
Slope of intensity duration curve = 0.4800

Process from Point/Station 1.000 to Point/Station 2.000

**** INITIAL AREA EVALUATION ****
DA A1

Initial area flow distance = 459.000 (Ft.)
Top (of initial area) elevation = 978.700 (Ft.)
Bottom (of initial area) elevation = 944.000 (Ft.)
Difference in elevation = 34.700 (Ft.)
Slope = 0.07560 s(percent)= 7.56
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.171 min.
Rainfall intensity = 3.776 (In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 14.238 (CFS)
Total initial stream area = 4.350 (Ac.)
Pervious area fraction = 0.600
Process from Point/Station        2.000 to Point/Station        2.000
**** SUBAREA FLOW ADDITION ****  DA A2

SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Time of concentration = 8.17 min.
Rainfall intensity = 3.776 (In/Hr) for a 100.0 year storm
Subarea runoff = 3.371 (CFS) for 1.030 (Ac.)
Total runoff = 17.610 (CFS) Total area = 5.380 (Ac.)

Process from Point/Station        2.000 to Point/Station        3.000
**** IMPROVED CHANNEL TRAVEL TIME ****  DA A3

Upstream point elevation = 944.000 (Ft.)
Downstream point elevation = 913.400 (Ft.)
Channel length thru subarea = 982.000 (Ft.)
Channel base width = 0.000 (Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 33.511 (CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000 (Ft.)
Flow(q) thru subarea = 33.511 (CFS)
Depth of flow = 0.327 (Ft.), Average velocity = 3.136 (Ft/s)
Channel flow top width = 65.374 (Ft.)
Flow Velocity = 3.14 (Ft/s)
Travel time = 5.22 min.
Time of concentration = 13.39 min.

Sub-Channel No. 1 Critical depth = 0.371 (Ft.)
' ' ' Critical flow top width = 74.219 (Ft.)
' ' ' Critical flow velocity = 2.433 (Ft/s)
' ' ' Critical flow area = 13.771 (Sq.Ft)

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 94.40
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.979 (In/Hr) for a 100.0 year storm
Subarea runoff = 31.730 (CFS) for 12.150 (Ac.)
Total runoff = 49.340 (CFS) Total area = 17.530 (Ac.)
Depth of flow = 0.378 (Ft.), Average velocity = 3.455 (Ft/s)

Sub-Channel No. 1 Critical depth = 0.434 (Ft.)
' ' ' Critical flow top width = 86.719 (Ft.)
' ' ' Critical flow velocity = 2.624 (Ft/s)
' ' ' Critical flow area = 18.800 (Sq.Ft)
Process from Point/Station 3.000 to Point/Station 4.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 908.400(Ft.)
Downstream point/station elevation = 860.000(Ft.)
Pipe length = 645.00(Ft.)
Manning's N = 0.013
No. of pipes = 1
Required pipe flow = 49.340(CFS)
Given pipe size = 36.00(In.)
Calculated individual pipe flow = 49.340(CFS)
Normal flow depth in pipe = 12.77(In.)
Flow top width inside pipe = 34.45(In.)
Critical Depth = 27.42(In.)
Pipe flow velocity = 21.94(Ft/s)
Travel time through pipe = 0.49 min.
Time of concentration (TC) = 13.88 min.

Process from Point/Station 4.000 to Point/Station 5.000

**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 860.000(Ft.)
Downstream point elevation = 855.800(Ft.)
Channel length thru subarea = 377.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 57.422(CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 57.422(CFS)
Depth of flow = 0.485(Ft.), Average velocity = 2.440(Ft/s)
Channel flow top width = 97.023(Ft.)
Flow Velocity = 2.44(Ft/s)
Travel time = 2.58 min.
Time of concentration = 16.45 min.

Sub-Channel No. 1 Critical depth = 0.461(Ft.)
'     ' Critical flow top width = 92.188(Ft.)
'     ' Critical flow velocity= 2.703(Ft/s)
'     ' Critical flow area = 21.246(Sq.Ft)

Adding area flow to channel
UNEVELOPED (poor cover) subarea
Runoff Coefficient = 0.874
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 94.40
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.698(In/Hr) for a 100.0 year storm
Subarea runoff = 16.066(CFS) for 6.810(Ac.)
Total runoff = 65.406(CFS) Total area = 24.340(Ac.)
Depth of flow = 0.509(Ft.), Average velocity = 2.521(Ft/s)

Sub-Channel No. 1 Critical depth = 0.484(Ft.)
'     ' Critical flow top width = 96.875(Ft.)
'     ' Critical flow velocity= 2.788(Ft/s)
'     ' Critical flow area = 23.462(Sq.Ft)
End of computations, total study area = 24.34 (Ac.)
The following figures may be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.912
Area averaged RI index number = 82.2
Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/15/19  File: 5957RU100B.out

------------------------------------------------------------------------
JN5957 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA B
------------------------------------------------------------------------

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Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity = 2.220 (In/Hr)
10 year storm 60 minute intensity = 0.940 (In/Hr)
100 year storm 10 minute intensity = 3.430 (In/Hr)
100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450 (In/Hr)
Slope of intensity duration curve = 0.4800

Process from Point/Station 11.000 to Point/Station 12.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 299.000 (Ft.)
Top (of initial area) elevation = 994.000 (Ft.)
Bottom (of initial area) elevation = 954.000 (Ft.)
Difference in elevation = 40.000 (Ft.)
Slope = 0.13378  s (percent) = 13.38
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.141 min.
Rainfall intensity = 4.330 (In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.871
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 2.979 (CFS)
Total initial stream area = 0.790 (Ac.)
Pervious area fraction = 0.600
Process from Point/Station 12.000 to Point/Station 13.000
**** IMPROVED CHANNEL TRAVEL TIME **** DA B2

Upstream point elevation = 954.000(Ft.)
Downstream point elevation = 895.100(Ft.)
Channel length thru subarea = 776.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 8.219(CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 8.219(CFS)
Depth of flow = 0.163(Ft.), Average velocity = 3.082(Ft/s)
Channel flow top width = 32.661(Ft.)
Flow Velocity = 3.08(Ft/s)
Travel time = 4.20 min.
Time of concentration = 10.34 min.

Sub-Channel No. 1 Critical depth = 0.211(Ft.)
' ' ' Critical flow top width = 42.188(Ft.)
' ' ' Critical flow velocity= 1.847(Ft/s)
' ' ' Critical flow area = 4.449(Sq.Ft)

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 94.40
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.373(In/Hr) for a 100.0 year storm
Subarea runoff = 10.380(CFS) for 3.500(Ac.)
Total runoff = 13.360(CFS) Total area = 4.290(Ac.)
Depth of flow = 0.196(Ft.), Average velocity = 3.480(Ft/s)

Sub-Channel No. 1 Critical depth = 0.256(Ft.)
' ' ' Critical flow top width = 51.172(Ft.)
' ' ' Critical flow velocity= 2.041(Ft/s)
' ' ' Critical flow area = 6.546(Sq.Ft)

Process from Point/Station 13.000 to Point/Station 14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 890.100(Ft.)
Downstream point/station elevation = 859.000(Ft.)
Pipe length = 255.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 13.360(CFS)
Given pipe size = 36.00(In.)
Calculated individual pipe flow = 13.360(CFS)
Normal flow depth in pipe = 5.85(In.)
Flow top width inside pipe = 26.57(In.)
Critical Depth = 13.95(In.)
Pipe flow velocity = 17.89(Ft/s)
Travel time through pipe = 0.24 min.
Time of concentration (TC) = 10.58 min.
Process from Point/Station 14.000 to Point/Station 15.000
**** IMPROVED CHANNEL TRAVEL TIME **** DA B3

Upstream point elevation = 859.000(Ft.)
Downstream point elevation = 845.400(Ft.)
Channel length thru subarea = 549.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 43.247(CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 43.247(CFS)
Depth of flow = 0.375(Ft.), Average velocity = 3.067(Ft/s)
Channel flow top width = 75.098(Ft.)
Flow Velocity = 3.07(Ft/s)
Travel time = 2.98 min.
Time of concentration = 13.56 min.

Sub-Channel No. 1 Critical depth = 0.410(Ft.)
' ' ' ' Critical flow top width = 82.031(Ft.)
' ' ' ' Critical flow velocity= 2.571(Ft/s)
' ' ' ' Critical flow area = 16.823(Sq.Ft)

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 94.40
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.961(In/Hr) for a 100.0 year storm
Subarea runoff = 59.722(CFS) for 23.010(Ac.)
Total runoff = 73.082(CFS) Total area = 27.300(Ac.)
Depth of flow = 0.457(Ft.), Average velocity = 3.497(Ft/s)

Sub-Channel No. 1 Critical depth = 0.508(Ft.)
' ' ' ' Critical flow top width = 101.563(Ft.)
' ' ' ' Critical flow velocity= 2.834(Ft/s)
' ' ' ' Critical flow area = 25.787(Sq.Ft)

Process from Point/Station 15.000 to Point/Station 16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 842.400(Ft.)
Downstream point/station elevation = 842.000(Ft.)
Pipe length = 60.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 73.082(CFS)
Given pipe size = 36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
2.810(Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 0.720(Ft.)
Minor friction loss = 2.490(Ft.) K-factor = 1.50
Pipe flow velocity = 10.34(Ft/s)
Travel time through pipe = 0.10 min.
Time of concentration (TC) = 13.65 min.

+----------------------------------------+----------------------------------------+
| Process from Point/Station 16.000 to Point/Station 17.000 |
| **** IMPROVED CHANNEL TRAVEL TIME **** | DA B4 |
+----------------------------------------+----------------------------------------+
Upstream point elevation = 842.000(Ft.)
Downstream point elevation = 835.100(Ft.)
Channel length thru subarea = 1258.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 97.839(CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 97.839(CFS)
Depth of flow = 0.677(Ft.), Average velocity = 2.137(Ft/s)
Channel flow top width = 135.320(Ft.)
Flow Velocity = 2.14(Ft/s)
Travel time = 9.81 min.
Time of concentration = 23.47 min.

Sub-Channel No. 1 Critical depth = 0.570(Ft.)
Critical flow top width = 114.063(Ft.)
Critical flow velocity = 3.008(Ft/s)
Critical flow area = 32.526(Sq.Ft)

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.870
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 94.40
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.276(In/Hr) for a 100.0 year storm
Subarea runoff = 49.439(CFS) for 24.980(Ac.)
Total runoff = 122.521(CFS) Total area = 52.280(Ac.)
Depth of flow = 0.736(Ft.), Average velocity = 2.261(Ft/s)
Sub-Channel No. 1 Critical depth = 0.621(Ft.)
Critical flow top width = 124.219(Ft.)
Critical flow velocity = 3.176(Ft/s)
Critical flow area = 38.576(Sq.Ft)

+----------------------------------------+----------------------------------------+
| Process from Point/Station 17.000 to Point/Station 17.000 |
| **** SUBAREA FLOW ADDITION **** | DA B5 |
+----------------------------------------+----------------------------------------+
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Time of concentration = 23.47 min.
Rainfall intensity = 2.276(In/Hr) for a 100.0 year storm
Subarea runoff = 19.703 (CFS) for 10.220 (Ac.)
Total runoff = 142.224 (CFS) Total area = 62.500 (Ac.)
End of computations, total study area = 62.50 (Ac.)
The following figures may be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.930
Area averaged RI index number = 83.0
Appendix D

Rational Study

Post-Developed Condition
JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA A

********* Hydrology Study Control Information *********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++++++ Initial Area Evaluation +++++

Process from Point/Station 1.000 to Point/Station 2.000

Initial area flow distance = 492.000(Ft.)
Top (of initial area) elevation = 978.700(Ft.)
Bottom (of initial area) elevation = 939.500(Ft.)
Difference in elevation = 39.200(Ft.)
Slope = 0.07967 s(percent) = 7.97
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.313 min.
Rainfall intensity = 3.744(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 24.955(CFS)
Total initial stream area = 7.690(Ac.)
Pervious area fraction = 0.600
Process from Point/Station 2.000 to Point/Station 3.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation =  896.490(Ft.)
Downstream point/station elevation =  887.500(Ft.)
Pipe length =  612.00(Ft.)  Manning's N = 0.012
No. of pipes = 1  Required pipe flow =  24.955(CFS)
Given pipe size =  24.00(In.)
Calculated individual pipe flow =  24.955(CFS)
Normal flow depth in pipe =  16.85(In.)
Flow top width inside pipe =  21.95(In.)
Critical Depth =  21.13(In.)
Pipe flow velocity =  10.59(Ft/s)
Travel time through pipe =  0.96 min.
Time of concentration (TC) =  9.28 min.

Process from Point/Station 3.000 to Point/Station 3.000

**** SUBAREA FLOW ADDITION **** DA A2

COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100;  Impervious fraction =  0.900
Time of concentration =  9.28 min.
Rainfall intensity =  3.553(In/Hr) for a  100.0 year storm
Subarea runoff =  14.612(CFS) for  4.600(Ac.)
Total runoff =  39.568(CFS)  Total area =  12.290(Ac.)

APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200;  Impervious fraction =  0.800
Time of concentration =  9.28 min.
Rainfall intensity =  3.553(In/Hr) for a  100.0 year storm
Subarea runoff =  11.992(CFS) for  3.800(Ac.)
Total runoff =  51.560(CFS)  Total area =  16.090(Ac.)

Process from Point/Station 3.000 to Point/Station 4.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation =  887.500(Ft.)
Downstream point/station elevation =  877.000(Ft.)
Pipe length =  210.00(Ft.)  Manning's N = 0.012
No. of pipes = 1  Required pipe flow =  51.560(CFS)
Given pipe size =  24.00(In.)
Calculated individual pipe flow = 51.560(CFS)
Normal flow depth in pipe = 18.52(In.)
Flow top width inside pipe = 20.15(In.)
Critical depth could not be calculated.
Pipe flow velocity = 19.84(Ft/s)
Travel time through pipe = 0.18 min.
Time of concentration (TC) = 9.45 min.

APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 9.45 min.
Rainfall intensity = 3.521(In/Hr) for a 100.0 year storm
Subarea runoff = 20.764(CFS) for 6.640(Ac.)
Total runoff = 72.324(CFS) Total area = 22.730(Ac.)

COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 9.84 min.
Rainfall intensity = 3.453(In/Hr) for a 100.0 year storm
Subarea runoff = 5.989(CFS) for 1.940(Ac.)
Total runoff = 78.313(CFS) Total area = 24.670(Ac.)
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 9.84 min.
Rainfall intensity = 3.453(In/Hr) for a 100.0 year storm
Subarea runoff = 10.426(CFS) for 3.400(Ac.)
Total runoff = 88.740(CFS) Total area = 28.070(Ac.)

-----------------------------------------------

COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 10.12 min.
Rainfall intensity = 3.406(In/Hr) for a 100.0 year storm
Subarea runoff = 6.029(CFS) for 1.980(Ac.)
Total runoff = 94.769(CFS) Total area = 30.050(Ac.)
End of computations, total study area = 30.05 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.274
Area averaged RI index number = 69.0
Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/30/19 File: 5957rd100b.out

----------------------------------------------------------------------
JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA B
----------------------------------------------------------------------

********** Hydrology Study Control Information **********

English (in-lb) Units used in input data file

----------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity =  2.220(In/Hr)
10 year storm 60 minute intensity =  0.940(In/Hr)
100 year storm 10 minute intensity =  3.430(In/Hr)
100 year storm 60 minute intensity =  1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.450(In/Hr)
Slope of intensity duration curve = 0.4800

----------------------------------------------------------------------
Process from Point/Station  7.000 to Point/Station   8.000
**** INITIAL AREA EVALUATION ****  DA B1

Initial area flow distance =  497.000(Ft.)
Top (of initial area) elevation =  871.200(Ft.)
Bottom (of initial area) elevation =  864.200(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =  0.01408 s(percent)=  1.41
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.078 min.
Rainfall intensity =      3.590(In/Hr) for a   100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff =  9.121(CFS)
Total initial stream area =  2.860(Ac.)
Pervious area fraction = 0.200

----------------------------------------------------------------------
Process from Point/Station 8.000 to Point/Station 8.000
**** SUBAREA FLOW ADDITION **** DA B2

COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 9.08 min.
Rainfall intensity = 3.590 (In/Hr) for a 100.0 year storm
Subarea runoff = 1.926 (CFS) for 0.600 (Ac.)
Total runoff = 11.047 (CFS) Total area = 3.460 (Ac.)

-------------------------------

Process from Point/Station 8.000 to Point/Station 9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 861.700 (Ft.)
Downstream point/station elevation = 860.400 (Ft.)
Pipe length = 261.00 (Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 11.047 (CFS)
Given pipe size = 24.00 (In.)
Calculated individual pipe flow = 11.047 (CFS)
Normal flow depth in pipe = 13.95 (In.)
Flow top width inside pipe = 23.68 (In.)
Critical Depth = 14.31 (In.)
Pipe flow velocity = 5.84 (Ft/s)
Travel time through pipe = 0.74 min.
Time of concentration (TC) = 9.82 min.
End of computations, total study area = 3.46 (Ac.)
The following figures may be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.183
Area averaged RI index number = 69.0
JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA C AND D

********** Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on Riverside County Flood Control & Water Conservation District 1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1) For the [ Corona ] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

Process from Point/Station 11.000 to Point/Station 12.000

**** INITIAL AREA EVALUATION **** DA C1

Initial area flow distance = 916.000(Ft.)
Top (of initial area) elevation = 993.000(Ft.)
Bottom (of initial area) elevation = 877.500(Ft.)
Difference in elevation = 115.500(Ft.)
Slope = 0.12609 s(percent)= 12.61
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.725 min.
Rainfall intensity = 3.473(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 21.910(CFS)
Total initial stream area = 7.300(Ac.)
Pervious area fraction = 0.600
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Time of concentration = 9.72 min.
Rainfall intensity = 3.473 (In/Hr) for a 100.0 year storm
Subarea runoff = 7.774 (CFS) for 2.590 (Ac.)
Total runoff = 29.684 (CFS) Total area = 9.890 (Ac.)

Upstream point elevation = 877.500 (Ft.)
Downstream point elevation = 862.500 (Ft.)
Channel length thru subarea = 443.000 (Ft.)
Channel base width = 4.500 (Ft.)
Slope or 'Z' of left channel bank = 2.000
Slope or 'Z' of right channel bank = 1.000
Estimated mean flow rate at midpoint of channel = 32.078 (CFS)
Manning's 'N' = 0.013
Maximum depth of channel = 1.500 (Ft.)
Flow(q) thru subarea = 32.078 (CFS)
Depth of flow = 0.513 (Ft.), Average velocity = 11.872 (Ft/s)
Channel flow top width = 6.038 (Ft.)
Flow Velocity = 11.87 (Ft/s)
Travel time = 0.62 min.
Time of concentration = 10.35 min.
Sub-Channel No. 1 Critical depth = 1.031 (Ft.)
    Critical flow top width = 7.594 (Ft.)
    Critical flow velocity= 5.144 (Ft/s)
    Critical flow area = 6.236 (Sq.Ft)

Adding area flow to channel
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.863
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Rainfall intensity = 3.371 (In/Hr) for a 100.0 year storm
Subarea runoff = 4.714 (CFS) for 1.620 (Ac.)
Total runoff = 34.398 (CFS) Total area = 11.510 (Ac.)
Depth of flow = 0.534 (Ft.), Average velocity = 12.149 (Ft/s)
Sub-Channel No. 1 Critical depth = 1.078 (Ft.)
    Critical flow top width = 7.734 (Ft.)
    Critical flow velocity= 5.216 (Ft/s)
    Critical flow area = 6.595 (Sq.Ft)
Process from Point/Station 13.000 to Point/Station 14.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 850.830(Ft.)
Downstream point/station elevation = 848.750(Ft.)
Pipe length = 208.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 34.398(CFS)
Given pipe size = 24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
2.947(Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 4.096(Ft.)
Minor friction loss = 0.931(Ft.) K-factor = 0.50
Critical depth could not be calculated.
Pipe flow velocity = 10.95(Ft/s)
Travel time through pipe = 0.32 min.
Time of concentration (TC) = 10.66 min.

Process from Point/Station 14.000 to Point/Station 14.000

**** SUBAREA FLOW ADDITION ****

APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 10.66 min.
Rainfall intensity = 3.323(In/Hr) for a 100.0 year storm
Subarea runoff = 3.097(CFS) for 1.050(Ac.)
Total runoff = 37.495(CFS) Total area = 12.560(Ac.)

Process from Point/Station 14.000 to Point/Station 15.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 848.750(Ft.)
Downstream point/station elevation = 844.600(Ft.)
Pipe length = 133.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 37.495(CFS)
Given pipe size = 24.00(In.)
Calculated individual pipe flow = 37.495(CFS)
Normal flow depth in pipe = 17.25(In.)
Flow top width inside pipe = 21.58(In.)
Critical depth could not be calculated.
Pipe flow velocity = 15.51(Ft/s)
Travel time through pipe = 0.14 min.
Time of concentration (TC) = 10.81 min.

Process from Point/Station 11.000 to Point/Station 15.000

**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 12.560(Ac.)
Runoff from this stream = 37.495(CFS)
Time of concentration = 10.81 min.
Rainfall intensity = 3.302(In/Hr)
Program is now starting with Main Stream No. 2

++++++

Process from Point/Station 21.000 to Point/Station 22.000
**** INITIAL AREA EVALUATION **** DA D1

Initial area flow distance = 998.000(Ft.)
Top (of initial area) elevation = 873.300(Ft.)
Bottom (of initial area) elevation = 861.000(Ft.)
Difference in elevation = 12.300(Ft.)
Slope = 0.01232 \( s(\text{percent}) = 1.23 \)
TC = \( k(0.323)*[(\text{length}^3)/(\text{elevation change})]^{0.2} \)
Initial area time of concentration = 12.323 min.
Rainfall intensity = 3.100(In/Hr) for a 100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 23.365(CFS)
Total initial stream area = 8.500(Ac.)
Pervious area fraction = 0.200

++++++

Process from Point/Station 22.000 to Point/Station 22.000
**** SUBAREA FLOW ADDITION **** DA D2

APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 12.32 min.
Rainfall intensity = 3.100(In/Hr) for a 100.0 year storm
Subarea runoff = 3.738(CFS) for 1.360(Ac.)
Total runoff = 27.103(CFS) Total area = 9.860(Ac.)

++++++

Process from Point/Station 22.000 to Point/Station 23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 846.810(Ft.)
Downstream point/station elevation = 845.620(Ft.)
Pipe length = 239.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 27.103(CFS)
Given pipe size = 24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is 2.310(Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 2.922(Ft.)
Minor friction loss = 0.578(Ft.) K-factor = 0.50
Critical depth could not be calculated.
Pipe flow velocity = 8.63(Ft/s)
Travel time through pipe = 0.46 min.
Time of concentration (TC) = 12.78 min.

+++
Process from Point/Station 23.000 to Point/Station 23.000
**** SUBAREA FLOW ADDITION **** DA D3

APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 12.78 min.
Rainfall intensity = 3.046(In/Hr) for a 100.0 year storm
Subarea runoff = 5.481(CFS) for 2.030(Ac.)
Total runoff = 32.584(CFS) Total area = 11.890(Ac.)

+++
Process from Point/Station 23.000 to Point/Station 23.000
**** SUBAREA FLOW ADDITION **** DA D4

COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 12.78 min.
Rainfall intensity = 3.046(In/Hr) for a 100.0 year storm
Subarea runoff = 4.407(CFS) for 1.620(Ac.)
Total runoff = 36.991(CFS) Total area = 13.510(Ac.)

+++
Process from Point/Station 23.000 to Point/Station 15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 845.620(Ft.)
Downstream point/station elevation = 844.600(Ft.)
Pipe length = 202.000(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 36.991(CFS)
Given pipe size = 24.000(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is 4.657(Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 4.601(Ft.)
Minor friction loss = 1.076(Ft.) K-factor = 0.50
Critical depth could not be calculated.
Pipe flow velocity = 11.77(Ft/s)
Travel time through pipe = 0.29 min.
Time of concentration (TC) = 13.07 min.
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 13.510(Ac.)
Runoff from this stream = 36.991(CFS)
Time of concentration = 13.07 min.
Rainfall intensity = 3.013(In/Hr)

Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.495</td>
<td>10.81</td>
<td>3.302</td>
</tr>
<tr>
<td>2</td>
<td>36.991</td>
<td>13.07</td>
<td>3.013</td>
</tr>
</tbody>
</table>

Largest stream flow has longer or shorter time of concentration
\[ Q_p = Q_a + \frac{Q_a}{T_a} \]
\[ Q_p = 37.495 + 36.991 \times 0.827 = 68.078 \]

Total of 2 main streams to confluence:
Flow rates before confluence point:
37.495 36.991
Area of streams before confluence:
12.560 13.510

Results of confluence:
Total flow rate = 68.078(CFS)
Time of concentration = 10.806 min.
Effective stream area after confluence = 26.070(Ac.)

Upstream point/station elevation = 843.600(Ft.)
Downstream point/station elevation = 843.000(Ft.)
Pipe length = 791.00(Ft.)
Manning’s N = 0.012
No. of pipes = 1
Required pipe flow = 68.078(CFS)
Given pipe size = 36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is 8.580(Ft.)
Pipe friction loss = 7.019(Ft.)
Critical depth could not be calculated.
Pipe flow velocity = 9.63(Ft/s)
Travel time through pipe = 1.37 min.
Time of concentration (TC) = 12.17 min.
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 12.17 min.
Rainfall intensity = 3.118 (In/Hr) for a 100.0 year storm
Subarea runoff = 34.369 (CFS) for 12.430 (Ac.)
Total runoff = 102.447 (CFS) Total area = 38.500 (Ac.)
End of computations, total study area = 38.50 (Ac.)
The following figures may be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.315
Area averaged RI index number = 69.0
Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/01/19 File: 5957RD100EP.out

-----------------------------------------------
JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA E AND F

-----------------------------------------------

********** Hydrology Study Control Information **********

English (in-lb) Units used in input data file

-----------------------------------------------

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220 (In/Hr)
10 year storm 60 minute intensity = 0.940 (In/Hr)
100 year storm 10 minute intensity = 3.430 (In/Hr)
100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450 (In/Hr)
Slope of intensity duration curve = 0.4800

-----------------------------------------------

Process from Point/Station 31.000 to Point/Station 32.000

**** INITIAL AREA EVALUATION **** DA E1

Initial area flow distance = 293.000 (Ft.)
Top (of initial area) elevation = 855.500 (Ft.)
Bottom (of initial area) elevation = 848.500 (Ft.)
Difference in elevation = 7.000 (Ft.)
Slope = 0.02389 s (percent) = 2.39
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.612 min.
Rainfall intensity = 4.180 (In/Hr) for a 100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 8.221 (CFS)
Total initial stream area = 2.210 (Ac.)
Pervious area fraction = 0.200
**Process from Point/Station 32.000 to Point/Station 33.000**

**** PIPEFLOW TRAVEL TIME (User specified size) ****

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream point/station elevation</td>
<td>835.800(Ft.)</td>
</tr>
<tr>
<td>Downstream point/station elevation</td>
<td>831.860(Ft.)</td>
</tr>
<tr>
<td>Pipe length</td>
<td>394.00(Ft.)</td>
</tr>
<tr>
<td>No. of pipes</td>
<td>1</td>
</tr>
<tr>
<td>Given pipe size</td>
<td>36.00(In.)</td>
</tr>
<tr>
<td>Calculated individual pipe flow</td>
<td>8.221(CFS)</td>
</tr>
<tr>
<td>Normal flow depth in pipe</td>
<td>8.20(In.)</td>
</tr>
<tr>
<td>Flow top width inside pipe</td>
<td>30.20(In.)</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>10.83(In.)</td>
</tr>
<tr>
<td>Pipe flow velocity</td>
<td>6.79(Ft/s)</td>
</tr>
<tr>
<td>Travel time through pipe</td>
<td>0.97 min.</td>
</tr>
</tbody>
</table>

**Process from Point/Station 33.000 to Point/Station 33.000**

**** SUBAREA FLOW ADDITION **** DA E2

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff Coefficient</td>
<td>0.889</td>
</tr>
<tr>
<td>Decimal fraction soil group A</td>
<td>0.000</td>
</tr>
<tr>
<td>Decimal fraction soil group B</td>
<td>0.000</td>
</tr>
<tr>
<td>Decimal fraction soil group C</td>
<td>1.000</td>
</tr>
<tr>
<td>RI index for soil (AMC 3)</td>
<td>84.40</td>
</tr>
<tr>
<td>Pervious area fraction</td>
<td>0.200</td>
</tr>
<tr>
<td>Impervious fraction</td>
<td>0.800</td>
</tr>
<tr>
<td>Time of concentration</td>
<td>7.58 min.</td>
</tr>
<tr>
<td>Rainfall intensity</td>
<td>3.914(In/Hr)for a 100.0 year storm</td>
</tr>
<tr>
<td>Subarea runoff</td>
<td>3.725(CFS)  for 1.070(Ac.)</td>
</tr>
<tr>
<td>Total runoff</td>
<td>11.946(CFS) for 3.280(Ac.)</td>
</tr>
</tbody>
</table>

**Process from Point/Station 33.000 to Point/Station 34.000**

**** PIPEFLOW TRAVEL TIME (User specified size) ****

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream point/station elevation</td>
<td>831.860(Ft.)</td>
</tr>
<tr>
<td>Downstream point/station elevation</td>
<td>829.970(Ft.)</td>
</tr>
<tr>
<td>Pipe length</td>
<td>189.00(Ft.)</td>
</tr>
<tr>
<td>Given pipe size</td>
<td>36.00(In.)</td>
</tr>
<tr>
<td>Calculated individual pipe flow</td>
<td>11.946(CFS)</td>
</tr>
<tr>
<td>Normal flow depth in pipe</td>
<td>9.90(In.)</td>
</tr>
<tr>
<td>Flow top width inside pipe</td>
<td>32.15(In.)</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>13.16(In.)</td>
</tr>
<tr>
<td>Pipe flow velocity</td>
<td>7.56(Ft/s)</td>
</tr>
<tr>
<td>Travel time through pipe</td>
<td>0.42 min.</td>
</tr>
</tbody>
</table>

**Process from Point/Station 34.000 to Point/Station 34.000**

**** SUBAREA FLOW ADDITION **** DA E3

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff Coefficient</td>
<td>0.889</td>
</tr>
<tr>
<td>Decimal fraction soil group A</td>
<td>0.000</td>
</tr>
<tr>
<td>Decimal fraction soil group B</td>
<td>0.000</td>
</tr>
<tr>
<td>Decimal fraction soil group C</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 8.00 min.
Rainfall intensity = 3.815 (In/Hr) for a 100.0 year storm
Subarea runoff = 4.579 (CFS) for 1.350 (Ac.)
Total runoff = 16.525 (CFS) Total area = 4.630 (Ac.)

=================================================================================================
Process from Point/Station 34.000 to Point/Station 35.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 829.970 (Ft.)
Downstream point/station elevation = 828.690 (Ft.)
Pipe length = 128.00 (Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 16.525 (CFS)
Given pipe size = 36.00 (In.)
Calculated individual pipe flow = 16.525 (CFS)
Normal flow depth in pipe = 11.71 (In.)
Flow top width inside pipe = 33.73 (In.)
Critical Depth = 15.58 (In.)
Pipe flow velocity = 8.29 (Ft/s)
Travel time through pipe = 0.26 min.
Time of concentration (TC) = 8.25 min.

=================================================================================================
Process from Point/Station 35.000 to Point/Station 35.000
**** SUBAREA FLOW ADDITION **** DA E4

COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 8.25 min.
Rainfall intensity = 3.758 (In/Hr) for a 100.0 year storm
Subarea runoff = 9.814 (CFS) for 2.920 (Ac.)
Total runoff = 26.339 (CFS) Total area = 7.550 (Ac.)

=================================================================================================
Process from Point/Station 31.000 to Point/Station 35.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 7.550 (Ac.)
Runoff from this stream = 26.339 (CFS)
Time of concentration = 8.25 min.
Rainfall intensity = 3.758 (In/Hr)
Program is now starting with Main Stream No. 2

=================================================================================================
Process from Point/Station 41.000 to Point/Station 42.000
**** INITIAL AREA EVALUATION **** DA F1

Initial area flow distance = 815.000 (Ft.)
Top (of initial area) elevation = 857.600(Ft.)
Bottom (of initial area) elevation = 844.100(Ft.)
Difference in elevation = 13.500(Ft.)
Slope = 0.01656 s(percent)= 1.66
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.948 min.
Rainfall intensity = 3.435(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 11.946(CFS)
Total initial stream area = 3.890(Ac.)
Pervious area fraction = 0.100

Process from Point/Station 42.000 to Point/Station 43.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
Upstream point/station elevation = 835.170(Ft.)
Downstream point/station elevation = 829.490(Ft.)
Pipe length = 568.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 11.946(CFS)
Given pipe size = 36.00(In.)
Calculated individual pipe flow = 11.946(CFS)
Normal flow depth in pipe = 9.90(In.)
Flow top width inside pipe = 32.15(In.)
Critical Depth = 13.16(In.)
Pipe flow velocity = 7.56(Ft/s)
Travel time through pipe = 1.25 min.
Time of concentration (TC) = 11.20 min.

Process from Point/Station 43.000 to Point/Station 43.000
**** SUBAREA FLOW ADDITION **** DA F2
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil (AMC 3) = 84.40
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 11.20 min.
Rainfall intensity = 3.245(In/Hr) for a 100.0 year storm
Subarea runoff = 12.848(CFS) for 4.430(Ac.)
Total runoff = 24.794(CFS) Total area = 8.320(Ac.)

Process from Point/Station 43.000 to Point/Station 35.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
Upstream point/station elevation = 829.490(Ft.)
Downstream point/station elevation = 828.690(Ft.)
Pipe length = 80.00(Ft.) Manning's N = 0.012
No. of pipes = 1  Required pipe flow =  24.794 (CFS)
Given pipe size =  36.00 (In.)
Calculated individual pipe flow =  24.794 (CFS)
Normal flow depth in pipe =  14.54 (In.)
Flow top width inside pipe =  35.33 (In.)
Critical Depth =  19.27 (In.)
Pipe flow velocity =  9.27 (Ft/s)
Travel time through pipe =  0.14 min.
Time of concentration (TC) =  11.34 min.

+++++++
Process from Point/Station 41.000 to Point/Station 35.000
+++++++
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =  8.320 (Ac.)
Runoff from this stream =  24.794 (CFS)
Time of concentration =  11.34 min.
Rainfall intensity = 3.225 (In/Hr)
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26.339</td>
<td>8.25</td>
<td>3.758</td>
</tr>
<tr>
<td>2</td>
<td>24.794</td>
<td>11.34</td>
<td>3.225</td>
</tr>
</tbody>
</table>

Largest stream flow has longer or shorter time of concentration
Qp = 26.339 + sum of Qa Tb/Ta
24.794 * 0.727 = 18.037
Qp = 44.376

Total of 2 main streams to confluence:
Flow rates before confluence point:
26.339  24.794
Area of streams before confluence:
7.550  8.320

Results of confluence:
Total flow rate = 44.376 (CFS)
Time of concentration = 8.253 min.
Effective stream area after confluence = 15.870 (Ac.)

+++++++
Process from Point/Station 35.000 to Point/Station 36.000
+++++++
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 828.690 (Ft.)
Downstream point/station elevation = 828.200 (Ft.)
Pipe length = 70.00 (Ft.)  Manning's N = 0.012
No. of pipes = 1  Required pipe flow =  44.376 (CFS)
Given pipe size =  36.00 (In.)
Calculated individual pipe flow =  44.376 (CFS)
Normal flow depth in pipe =  22.92 (In.)
Flow top width inside pipe =  34.63 (In.)
Critical Depth =  26.04 (In.)
Pipe flow velocity =  9.35 (Ft/s)
Travel time through pipe =  0.12 min.
Time of concentration (TC) = 8.38 min.
End of computations, total study area = 15.87 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.129
Area averaged RI index number = 69.0
Appendix E

Hydraulic Design
**Box Inlets**

\[
\frac{Q}{P} = 3.0 \ H^{3/2} \quad \text{Assume 25\% clogging}
\]

**Curb Inlets**

\[
Q = 3.087 \ L \ H^{3/2} \quad \text{WEIR CONDITION} \quad H = d + 4" 
\]

\[
Q = 7.0 \ A \sqrt{zh} \quad \text{ORIFICE CONDITION}
\]

**Node (2)**

\[
Q_{100} = 24.96 \text{ CFS} \quad \text{CURB INLET}
\]

**PER MASS GRADING STUDY:** \( Q_{\text{MAX}} = 7.6 \text{ CFS in BROW DITCH} \)

**TRY**

\[
A = 0.903 \text{ SF} \quad R = 0.330 \text{ LF} \quad s = 0.020 \quad M = 0.013
\]

\[
Q = (0.903) \left( \frac{1.1426}{0.013} \right) \left( 0.330^{2/3} \right) (0.020^{1/2}) = 7.0 \text{ CFS} \approx Q_{\text{MAX}}
\]

\[
H = 0.85 + \frac{4}{12} - \frac{3}{12} = 0.93 \text{ LF}
\]

\[
24.96 = (7.0)(0.5) \sqrt{2(0.93)(0.93)} 
\]

\[
L = 0.92 \text{ LF}
\]

\[
: \text{ 2 LF OPENING MIN.}
\]

**Node (2A)**

\[
Q_{100} = 14.61 \text{ CFS} \quad \text{2 EA CURB INLETS} \rightarrow Q_{100} = 7.30 \text{ CFS EACH}
\]

**6" CURB AND GUTTER**

**TRY**

\[
A = 3.12 \text{ SF} \quad R = 0.174 \text{ LF} \quad s = 0.005 \quad M = 0.013
\]

\[
Q = (3.12) \left( \frac{1.1426}{0.013} \right) \left( 0.174^{2/3} \right) (0.005^{1/2}) = 7.8 \text{ CFS} \approx Q_{100}
\]

\[
H = 0.43 + 0.33 = 0.76 \text{ LF}
\]

\[
7.30 = 3.087 (0.76^{3/2}) L \quad L = 3.6 \text{ LF}
\]

\[
: \text{ OPENING = 4 LF}
\]
NODE (3B)

\[ Q_{100} = 11.99 \text{ CFS} \]

2EA BOX INLETS \( \rightarrow Q_{1,00} = 6.00 \text{ CFS EACH} \)

\[ \begin{align*}
6'' & \text{ C}^3 \text{ G} \\
H & = 0.4 \text{ LF}
\end{align*} \]

\[ P = \frac{6.0}{(-75\%)(3.0)(0.4^{3/2})} = 10.5 \text{ CF} \]

\[ S = \frac{10.5}{4} = 2.6 \text{ LF} \]

\[ \therefore 36'' \times 36'' \text{ G RATE (2EA)} \]

NODE (4)

\[ Q_{100} = 20.76 \text{ CFS} \]

2EA CURB INLETS \( \rightarrow Q_{100} = 10.4 \text{ CFS EA} \)

\[ 6'' \text{ C}^3 \text{ G} \]

\[ d = 0.48 \text{ LF} \quad A = 4.06 \text{ SF} \quad R = 0.198 \text{ LF} \]

\[ S = 0.005 \quad M = 0.013 \]

\[ Q = (4.06)(\frac{1.406}{0.013})(0.198^{2/3})(0.005^{1/2}) = 11.1 \text{ CFS} \approx Q_{100} \]

\[ H = 0.48 + 0.33 = 0.81 \text{ LF} \]

\[ 10.4 = 3.087 (0.81^{3/2}) \]

\[ L = 4.6 \text{ LF} \]

\[ \therefore \text{ OPENING} = 5 \text{ LF} \]

NODE (5A)

\[ Q_{100} = 5.99 \text{ CFS} \]

\[ 6'' \text{ C}^3 \text{ G} \]

BOX INLET

36''x36'' G RATE (ESTIMATED FROM NODE (3B))

NODE (5B)

\[ Q_{100} = 10.42 \text{ CFS} \]

\[ 6'' \text{ C}^3 \text{ G} \]

CURB INLET

OPENING = 5 LF (SEE NODE (4))

NODE (6)

\[ Q_{100} = 6.03 \text{ CFS} \]

\[ 6'' \text{ C}^3 \text{ G} \]

BOX INLET

36''x36'' G RATE (SEE NODE (3B))
NODE 8A
Q_{100} = 11.05 \text{ CFS} \quad \text{CURB INLET}

\begin{align*}
\text{TR} & \quad 0 = 0.48 \text{ LF} \\
A & = 4.06 \text{ SF} \quad R = 0.198 \text{ CF} \\
\bar{s} & = 0.005 \quad \eta = 0.013 \\
Q & = \left(4.06\left(\frac{1.486}{0.013}\right)\left(0.198^{2/3}\right)\left(0.005^{1/2}\right)\right) = 11.1 \text{ CFS} \approx Q_{100}
\end{align*}

H = 0.48 + 0.33 = 0.81 \text{ LF}

11.05 = 3.087 (0.81^{3/2}) L \quad L = 4.9 \text{ LF} \quad \therefore \text{OPENING} = 5.0 \text{ LF}

NODE 8B
Q_{100} = 1.93 \text{ CF} \quad \text{BOX INLET}

\begin{align*}
\text{TR} & \quad 0 = 0.4 \text{ LF} \\
A & = 1.93 \text{ SF} \quad R = 3.14 \text{ LF} \quad s = \frac{3.14}{4} = 0.8 \text{ LF}
\end{align*}

\therefore \text{18"x18" GRATE}

NODE 13
Q_{100} = 34.41 \text{ CFS} \quad \text{CURB INLET}

\text{TR} \quad 0 = 1.42 \text{ LF} \\
A = 3.62 \text{ SF} \quad R = 0.584 \quad s = 0.020 \quad \eta = 0.013

\begin{align*}
Q & = \left(3.62\left(\frac{1.486}{0.013}\right)\left(0.584^{2/3}\right)\left(0.020^{1/2}\right)\right) = 34.1 \text{ CFS} \approx Q_{100}
\end{align*}

H = 1.42 + 4/12 - 2/12 = 1.50 \text{ LF}

34.4 = (7.1)(0.5) L \sqrt{(2)(3.2)(1.5)} \quad L = 1.0 \text{ LF} \quad s = 1 \text{ LF}

\therefore \text{OPENING} = 1 \text{ LF}
NODE (4)

\[ Q_{100} = 3.10 \text{ CFS} \quad \text{BOX INLET} \]

6" C³ G

\[ H = 0.4 \text{ LF} \quad P = \frac{3.10}{(75^\circ\text{N})(3.0)(0.4^{3/2})} = 5.4 \text{ LF} \quad S = \frac{5.4}{4} = 1.4 \text{ LF} \]

\[ : 18" \times 18" \text{ GRATE} \]

NODE (6)

\[ Q_{100} = 34.37 \text{ CFS} \quad \text{3EA CURB INLETS} \rightarrow Q_{100} = 11.5 \text{ CFS EACH} \]

6" C³ G

\[ \text{OPENING} = 5.0 \text{ LF} \quad (\text{SEE NODE 8A}) \]

NODE (22A)

\[ Q_{100} = 23.36 \text{ CFS} \quad \text{2EA CURB INLETS} \rightarrow Q_{100} = 11.7 \text{ CFS} \]

6" C³ G

\[ \text{Ttry} \quad d = 0.49 \text{ LF} \quad A = 4.26 \text{ SF} \quad R = 0.203 \text{ LF} \quad S = 0.005 \quad \eta = 0.013 \]

\[ Q = (4.26) \left(\frac{1.1486}{0.013}\right) (0.203^{2/3}) (0.005^{1/2}) = 11.9 \text{ CFS} \approx Q_{100} \]

\[ H = 0.49 + 0.33 = 0.82 \text{ LF} \]

\[ 11.7 \approx 3.087 (0.023^{3/2}) L \quad L = 5.10 \text{ LF} \quad : \text{OPENING} = 5.5 \text{ LF} \]

NODE (22B)

\[ Q_{100} = 3.74 \text{ CFS} \quad \text{BOX INLET} \]

6" C³ G

\[ H = 0.44 \text{ LF} \quad P = \frac{3.74}{(75^\circ\text{N})(3.0)(0.4^{3/2})} = 6.10 \text{ LF} \quad S = \frac{6.10}{4} = 1.6 \text{ LF} \]

\[ : 24" \times 24" \text{ GRATE} \]
NODE 23A

\[ Q_{100} = 5.48 \text{ CFS} \quad \text{Box Inlet} \]
\[ 6'' \ C^3 G \quad H = 0.4 \text{ LF} \quad P = \frac{5.48}{(75^\circ 10^\prime)(3.0)(0.4312)} = 9.6 \text{ LF} \quad S = \frac{9.6}{4} = 2.4 \text{ LF} \]
\[ \therefore 30'' \times 30'' \text{ Grate} \]

NODE 23B

\[ Q_{100} = 4.41 \text{ CFS} \quad \text{Box Inlet} \]
\[ 6'' \ C^3 G \quad H = 0.4 \text{ LF} \quad P = \frac{4.41}{(75^\circ 10^\prime)(3.0)(0.4312)} = 7.7 \text{ LF} \quad S = \frac{7.7}{4} = 1.9 \text{ LF} \]
\[ \therefore 24'' \times 24'' \text{ Grate} \]

NODE 32

\[ Q_{100} = 8.22 \text{ CFS} \quad \text{Curb Inlet} \]
\[ 6'' \ C^3 G \]
\[ \text{Torr d = 0.44 LF} \quad A = 3.3 \text{ SF} \quad R = 0.179 \text{ LF} \quad S = 0.005 \quad H = 0.1013 \]
\[ Q = (3.3)\left(\frac{1.48}{0.013}\right)(0.179213)(0.00512) = 8.4 \text{ CFS} \approx Q_{100} \]
\[ H = 0.44 + 0.33 = 0.77 \text{ LF} \]
\[ 8.22 = 3.087(0.77312) \quad L = 3.9 \text{ LF} \quad \therefore \text{Opening} = 4 \text{ LF} \]

NODE 33

\[ Q_{100} = 3.72 \text{ CFS} \quad \text{Box Inlet} \]
\[ 6'' \ C^3 G \quad H = 0.4 \text{ LF} \quad P = \frac{3.72}{(75^\circ 10^\prime)(3.0)(0.4312)} = 6.5 \text{ LF} \quad S = \frac{6.5}{4} = 1.6 \text{ LF} \]
\[ \therefore 24'' \times 24'' \text{ Grate} \]
NODE 34

\[ Q_{100} = 4.58 \text{ CFS} \]  BOX INLET

\[ 6'' \times 3'' \text{ G} \quad H = 0.4 \text{ LF} \quad P = \frac{4.58}{(759/4)(3.0)(0.4^{3/2})} = \frac{8.04 \text{ LF}}{5} = 2.0 \text{ LF} \]

\[ \therefore 24'' \times 24'' \text{ G RATE} \]

NODE 35

\[ Q_{100} = 9.81 \text{ CFS} \]  CURB INLET  6'' C 3/4 G

TRY \[ a = 0.416 \text{ LF} \quad A = 3.67 \text{ SF} \quad R = 0.188 \quad S = 0.005 \quad m = 0.012 \]

\[ Q = (2.67)(\frac{1.486}{0.03})(0.188^{2/3})(0.005^{1/2}) = 9.7 \text{ CFS} \sim Q_{100} \]

\[ H = 0.416 + 0.33 = 0.79 \text{ LF} \]

\[ 9.81 = 3.087 \times (0.78^{3/2}) \quad L = 4.6 \text{ LF} \quad \text{OPENING} = 5 \text{ LF} \]

NODE 42

\[ Q_{100} = 11.95 \text{ CFS} \]  CURB INLET  6'' C 3/4 G

OPENING = 5.5 LF (SEE NODE 22A)

NODE 43

\[ Q_{100} = 12.85 \text{ CFS} \]  CURB INLET  6'' C 3/4 G

OPENING = 5.5 LF (SEE NODE 4)
STORM DRAIN PIPES

PER KING'S TABLE 6-2 FOR OPEN FLOW CONDITION

NODE 2 TO 4

\[ Q_{100} = 51.56 \text{ CFS} \quad \eta = 0.012 \quad S = 0.024 \quad = 30'' \quad \phi \quad \text{MIN.} \]

NODE 4 TO 6

\[ Q_{100} = 94.77 \text{ CFS} \quad \eta = 0.012 \quad S = 0.030 \quad = 36'' \quad \phi \quad \text{MIN.} \]

NODE 13 TO 15

\[ Q_{100} = 37.50 \text{ CFS} \quad \eta = 0.012 \quad S = 0.018 \quad = 30'' \quad \phi \quad \text{MIN.} \]

NODE 15 TO 16

\[ Q_{100} = 68.08 \text{ CFS} \quad \eta = 0.012 \quad S = 0.010 \quad = 36'' \quad \phi \quad \text{MIN.} \]

NODE 22 TO 15

\[ Q_{100} = 36.99 \text{ CFS} \quad \eta = 0.012 \quad S = 0.010 \quad = 30'' \quad \phi \quad \text{MIN.} \]

NODE 32 TO 35

\[ Q_{100} = 16.53 \text{ CFS} \quad \eta = 0.012 \quad S = 0.010 \quad = 24'' \quad \phi \quad \text{MIN.} \]

NODE 42 TO 35

\[ Q_{100} = 24.79 \text{ CFS} \quad \eta = 0.012 \quad S = 0.010 \quad = 24'' \quad \phi \quad \text{MIN.} \]

NODE 35 TO 36

\[ Q_{100} = 44.38 \text{ CFS} \quad \eta = 0.012 \quad S = 0.007 \quad = 36'' \quad \phi \quad \text{MIN.} \]
W'LY NODE ②

\[ Q_{100} = 24.96 \times \frac{1}{2} = 12.5 \text{ CFS} \]

\[ S = 0.020 \quad \eta = 0.013 \quad B = 375'' \quad D = 15'' \quad WP = 4.02 \text{ LF} \quad A = 1.95 \text{ SF} \]

\[ Q = \frac{1.4960}{\text{CHANNEL} \times 0.013} \times \left( \frac{1.95}{4.02} \right)^{2/3} \times \left( 0.020 \right)^{1/2} \times (1.95) = 19.5 \text{ CFS} > Q_{100} \checkmark \]

E'LY NODE ②

\[ Q_{100} = 12.5 \text{ CFS} < Q_{\text{CHANNEL}} \]

W'LY NODE ②

\[ Q_{100} = 7.74 \text{ CFS} < Q_{\text{CHANNEL}} \]

NODE ② TO ③

\[ Q_{100} = 34.40 \text{ CFS} \]

\[ S = 0.020 \quad \eta = 0.013 \quad B = 54'' \quad D = 18'' \quad WP = 5.48 \text{ LF} \quad A = 3.38 \text{ SF} \]

\[ Q_{\text{CHANNEL}} = \frac{1.4960}{0.013} \times \left( \frac{3.38}{5.48} \right)^{2/3} \times \left( 0.020 \right)^{1/2} \times (3.38) = 39.16 \text{ CFS} > Q_{100} \checkmark \]
Appendix F

LID Storage

Design
DA 1

\[ V_{\text{BMP}} = 19,233 \text{ CF} \]

\[ V_{\text{TRENCH}} = (7 \text{ LF})(4.4035 \text{ SF}) = 30,821 \text{ CF} \]

\[ V_{\text{PIPES}} = \frac{\gamma V_{\text{SLF}}^2}{4} (591 \text{ LF}) = 11,604.3 \text{ CF} \]

\[ V_{\text{GRAVEL}} = (40\%)(30,821 - 11,604.3) = 7,686.7 \text{ CF} \]

\[ \text{STORAGE} = 11,604.3 + 7,686.7 = 19,291 \text{ CF} \]

\[ \Rightarrow 37 \text{ LF} \times 119 \text{ LF} \]

FOOTPRINT

DA 2

\[ V_{\text{BMP}} = 8,376 \text{ CF} \]

\[ V_{\text{TRENCH}} = (7 \text{ LF})(19.55 \text{ SF}) = 13,085 \text{ CF} \]

\[ V_{\text{PIPES}} = \frac{\gamma V_{\text{SLF}}^2}{4} (251 \text{ LF}) = 4,928.4 \text{ CF} \]

\[ V_{\text{GRAVEL}} = (40\%)(13,085 - 4,928.4) = 3,502.7 \text{ CF} \]

\[ \text{STORAGE} = 4,928.4 + 3,502.7 = 8,431 \text{ CF} \]

\[ \Rightarrow 23 \text{ LF} \times 25 \text{ LF} \]

FOOTPRINT
DA 3

\[ V_{BMP} = 3,148 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF})(752 \text{ SF}) = 5,264 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (90 \text{ LF}) = 1,176.7 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (5,264 - 1,176.7) = 1,398.7 \text{ CF} \]

\[ \text{STORAGE} = 1,176.7 + 1,398.7 = 3,175.4 \text{ CF} \rightarrow 2 \text{EA. ROWS OF SLE & CMP; } \]

\[ 160 \text{ LF} \times 4.7 \text{ LF FOOTPRINT} \]

DA 4

\[ V_{BMP} = 60,726 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF})(1,554 \text{ SF}) = 10,878 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (200 \text{ LF}) = 4,044.8 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (10,878 - 4,044.8) = 2,733.3 \text{ CF} \]

\[ \text{STORAGE} = 4,044.8 + 2,733.3 = 6,778 \text{ CF} \rightarrow 5 \text{EA. ROWS OF SLE & CMP; } \]

\[ 37 \text{ LF} \times 4.2 \text{ LF FOOTPRINT} \]

DA 5

\[ V_{BMP} = 3,316 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF})(800 \text{ SF}) = 5,600 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (96 \text{ LF}) = 1,885.0 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (5,600 - 1,885.0) = 1,180.0 \text{ CF} \]

\[ \text{STORAGE} = 1,885.0 + 1,180.0 = 3,065 \text{ CF} \rightarrow 2 \text{EA. ROWS OF SLE & CMP; } \]

\[ 16 \text{ LF} \times 50 \text{ LF FOOTPRINT} \]
DA 6

\[ V_{\text{BMP}} = 4,028 \text{ CF} \]

\[ V_{\text{TRENCH}} = (7 \text{ LF}) (960 \text{ SF}) = 6,720 \text{ CF} \]

\[ V_{\text{PIPES}} = \frac{\gamma (5 \text{ LF})^2}{4} (110 \text{ LF}) = 2,277.7 \text{ CF} \]

\[ V_{\text{GRAVEL}} = (40\%) (6,720 - 2,277.7) = 1,776.9 \text{ CF} \]

\[ \text{STORAGE} = 2,277.7 + 1,776.9 = 4,054 \text{ CF} \rightarrow 2\text{EA ROWS OF 5LF \& CMP} \]

16 LF x 60 LF FOOTPRINT

DA 7

\[ V_{\text{BMP}} = 2,334 \text{ CF} \]

\[ V_{\text{TRENCH}} = (7 \text{ LF}) (560 \text{ SF}) = 3,920 \text{ CF} \]

\[ V_{\text{PIPES}} = \frac{\gamma (5 \text{ LF})^2}{4} (660 \text{ LF}) = 1,295.9 \text{ CF} \]

\[ V_{\text{GRAVEL}} = (40\%) (3,920 - 1,295.9) = 1049.6 \text{ CF} \]

\[ \text{STORAGE} = 1,295.9 + 1049.6 = 2,345 \text{ CF} \rightarrow 2\text{EA ROWS OF 5LF \& CMP} \]

16 LF x 35 LF
DA 8

\[ V_{BMP} = 28,388 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF}) (6438 \text{ SF}) = 41,066 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (884 \text{ LF}) = 17,357.3 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (45,066 - 17,357.3) = 11,083.5 \text{ CF} \]

\[ STORAGE = 17,357.3 + 11,083.5 = 28,440 \text{ CF} \]

\[ \rightarrow 8 \text{ EA ROWS OF 5LF CMP; 5LF X 111 LF FOOTPRINT} \]

DA 9

\[ V_{BMP} = 8,173 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF}) (1909 \text{ SF}) = 13,363 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (245 \text{ LF}) = 4,810.6 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (13,363 - 4,810.6) = 3,421.0 \text{ CF} \]

\[ STORAGE = 4,810.6 + 3,421.0 = 8,231 \text{ CF} \]

\[ \rightarrow 3 \text{ EA ROWS OF 5LF CMP; 23 LF X 63 LF FOOTPRINT} \]

DA 10

\[ V_{BMP} = 11,780 \text{ CF} \]

\[ V_{TRENCH} = (7 \text{ LF}) (2737 \text{ SF}) = 19,159 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5 \text{ LF})^2}{4} (353 \text{ LF}) = 6,931.1 \text{ CF} \]

\[ V_{GRAVEL} = (40\%) (19,159 - 6,931.1) = 4,891.1 \text{ CF} \]

\[ STORAGE = 6,931.1 + 4,891.1 = 11,822 \text{ CF} \]

\[ \rightarrow 3 \text{ EA ROWS OF 5LF CMP; FOOTPRINT} \]
DA 11

\[ V_{BMP} = 17,228 \text{ CF} \]

\[ V_{TRENCH} = (7\text{LF})(4,048\text{ SF}) = 28,336 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5\text{LF})^2}{4} (502\text{ LF}) = 9,856.7 \text{ CF} \]

\[ V_{GRAVEL} = (40\%)(28,336 - 9,856.7) = 7,391.7 \text{ CF} \]

\[ STORAGE = 9,856.7 + 7,391.7 = 17,248 \text{ CF} \rightarrow 2\text{EA. ROWS OF SLEP CMP; } 16\text{LF} \times 253\text{LF FOOTPRINT} \]

DA 12

\[ V_{BMP} = 12,493 \text{ CF} \]

\[ V_{TRENCH} = (7\text{LF})(2,886\text{ SF}) = 20,202 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5\text{LF})^2}{4} (386\text{ LF}) = 7,579.1 \text{ CF} \]

\[ V_{GRAVEL} = (40\%)(20,202 - 7,579.1) = 5,049.2 \text{ CF} \]

\[ STORAGE = 7,579.1 + 5,049.2 = 12,628 \text{ CF} \rightarrow 3\text{EA. ROWS OF SLEP CMP; } 37.4\text{LF} \times 74\text{LF FOOTPRINT} \]

DA 13

\[ V_{BMP} = 10,188 \text{ CF} \]

\[ V_{TRENCH} = (7\text{LF})(2,369\text{ SF}) = 16,583 \text{ CF} \]

\[ V_{PIPES} = \frac{\pi (5\text{LF})^2}{4} (305\text{ LF}) = 5,928.7 \text{ CF} \]

\[ V_{GRAVEL} = (40\%)(16,583 - 5,928.7) = 4,237.7 \text{ CF} \]

\[ STORAGE = 5,928.7 + 4,237.7 = 10,126 \text{ CF} \rightarrow 3\text{EA. ROWS OF SLEP CMP; } 23\text{LF} \times 103\text{LF FOOTPRINT} \]
\[ V_{\text{BMP}} = 9,854 \text{ CF} \]

\[ V_{\text{TRENCH}} = (7\text{ LF})(2,320 \text{ SF}) = 16,240 \text{ CF} \]

\[ V_{\text{PIPES}} = \frac{\pi(5.4\text{ LF})^2}{4} (286 \text{ LF}) = 5,615.6 \text{ CF} \]

\[ V_{\text{GRAVEL}} = (40\%)(16,240 - 5,615.6) = 4,249.8 \text{ CF} \]

\[ \text{STORAGE} = 5,615.6 + 4,249.8 = 9,865 \text{ CF} \quad \rightarrow \quad 2\text{EA. ROWS OF 5 LF CMP; 16 LF X 14 SF FOOTPRINT} \]
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

**Legend:**
- Required Entries
- Calculated Cells

**Note:** this worksheet shall *only* be used in conjunction with BMP designs from the LID BMP Design Handbook.

**BMP Identification**

**BMP NAME / ID** DA1

*Must match Name/ID used on BMP Design Calculation Sheet*

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

**Drainage Management Area Tabulation**

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Imperious Fraction, $I_i$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
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<td>Roofs</td>
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<td>1B</td>
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<td>129458.6</td>
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<td>1C</td>
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<td>0.11</td>
<td>16783.5</td>
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| Total       |                        |                           |                                    |                   |                          |                        |                                           |                                 |

**Total**

| 456548 |

Notes:
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

#### Required Entries

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<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, $I_e$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas $\times$ Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
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<tr>
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**Total**: 178290

**Total** **125626.3**

**0.80**

**8375.1**

**8,431**

**Notes:**

- BMP Identification
  - **BMP NAME / ID**: DA2
  - **Must match Name/ID used on BMP Design Calculation Sheet**

- **Design Rainfall Depth**
  - $D_{85} = 0.80$ inches

- **Drainage Management Area Tabulation**
  - 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E
  - **Insert additional rows if needed to accommodate all DMAs draining to the BMP**

- **Legend:**
  - **Required Entries**
  - **Calculated Cells**

- **Company Name**: Land Development Design Company, LLC
- **Designed by**: Kevin J. Richer
- **Company Project Number/Name**: Latitude Business Park
- **Case No**: 2019-0012
- **Date**: 11/4/2019

**Note**: This worksheet shall only be used in conjunction with BMP designs from the LID BMP Design Handbook.
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

**Legend:**

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<tr>
<td>85th Percentile</td>
<td>24-hour Rainfall Depth</td>
</tr>
<tr>
<td>from the Isohyetal Map in Handbook Appendix E</td>
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</tr>
</tbody>
</table>

- **BMP Identification**
  - **BMP NAME / ID**: DA3
  - **Must match Name/ID used on BMP Design Calculation Sheet**

- **Design Rainfall Depth**
  - $D_{85} = 0.80$ inches

#### Drainage Management Area Tabulation

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Imperious Fraction, $I_i$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
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<tbody>
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<td>2665.1</td>
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</table>

**Total**: 74067

- **Notes:**

- BMP NAME / ID: DA3
- **BMP NAME / ID** must match Name/ID used on BMP Design Calculation Sheet
- 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

Legend:
- Required Entries
- Calculated Cells

**Insert additional rows if needed to accommodate all DMAs draining to the BMP**

- Designed by Kevin J. Richer Case No 2019-0012
- Company Project Number/Name: Latitude Business Park

**Notes:**

- BMP NAME / ID: DA3
- **BMP NAME / ID** must match Name/ID used on BMP Design Calculation Sheet
- 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

Legend:
- Required Entries
- Calculated Cells

**Insert additional rows if needed to accommodate all DMAs draining to the BMP**

- Designed by Kevin J. Richer Case No 2019-0012
- Company Project Number/Name: Latitude Business Park

**Notes:**
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

<table>
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<th>Company Name</th>
<th>Land Development Design Company, LLC</th>
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<tr>
<td>Designed by</td>
<td>Kevin J. Richer</td>
</tr>
<tr>
<td>Company Project Number/Name</td>
<td>Latitude Business Park</td>
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<tr>
<td>Date</td>
<td>11/4/2019</td>
</tr>
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<td>Case No</td>
<td>2019-0012</td>
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</table>

#### BMP Identification

BMP NAME / ID **DA4**

*Must match Name/ID used on BMP Design Calculation Sheet*

#### Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

#### Drainage Management Area Tabulation

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, $I_I$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
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<tbody>
<tr>
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**Total**

152194

100890.2

0.80

6726

6,778

#### Notes:

- **Legend:**
  - Required Entries
  - Calculated Cells

- **Notes:**
  - Total 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E
  - Insert additional rows if needed to accommodate all DMAs draining to the BMP
  - **Legend:**
    - Required Entries
    - Calculated Cells
  - **Company Name Land Development Design Company, LLC**
  - **Designed by Kevin J. Richer**
  - **Case No 2019-0012**
### Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

(Notes this worksheet shall only be used in conjunction with BMP designs from the LID BMP Design Handbook)

<table>
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<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, I_{eff}</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, V_{BMP} (cubic feet)</th>
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<td>3371</td>
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<tr>
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<td>18783</td>
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<td>0.11</td>
<td>2074.7</td>
<td>0.80</td>
<td>3315.8</td>
<td>3371</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, I_{eff}</th>
<th>DMA Runoff Factor</th>
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<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, V_{BMP} (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
</tr>
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<tbody>
<tr>
<td>5A</td>
<td>27224</td>
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<tr>
<td>5B</td>
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<td>Concrete or Asphalt</td>
<td>1</td>
<td>0.89</td>
<td>23378.4</td>
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<td>5C</td>
<td>18783</td>
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<td>0.80</td>
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<td>3371</td>
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<td>1</td>
<td>0.89</td>
<td>24283.8</td>
<td>0.80</td>
<td>3315.8</td>
<td>3371</td>
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<tr>
<td>5B</td>
<td>26209</td>
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<td>0.89</td>
<td>23378.4</td>
<td>0.80</td>
<td>3315.8</td>
<td>3371</td>
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<tr>
<td>5C</td>
<td>18783</td>
<td>Ornamental Landscaping</td>
<td>0.1</td>
<td>0.11</td>
<td>2074.7</td>
<td>0.80</td>
<td>3315.8</td>
<td>3371</td>
</tr>
</tbody>
</table>

**Notes:**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

Design Rainfall Depth

\[ D_{85} = 0.80 \text{ inches} \]
### Drainage Management Area Tabulation

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

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<th>Design Capture Volume, ( V_{BMP} ) (cubic feet)</th>
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<td>3864.5</td>
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</table>

**Total**

- DMA Area: 98,375 square feet
- Total: 60,407.5 cubic feet
- Design Capture Volume: 4,027.2 cubic feet
- Proposed Volume on Plans: 4,054 cubic feet

**Notes:**

- **Santa Ana Watershed** - BMP Design Volume, \( V_{BMP} \)
- **Legend:**
  - **Required Entries**
  - **Calculated Cells**

**BMP Identification**

**BMP NAME / ID** DA6

*Must match Name/ID used on BMP Design Calculation Sheet*

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

\[ D_{85} = 0.80 \text{ inches} \]**

**Notes:**

- **BMP Identification**
- **Drainage Management Area Tabulation**
- **Notes:**
  - BMP NAME / ID: DA6
  - Design Rainfall Depth: \( D_{85} = 0.80 \) inches
  - Total DMA Area: 98,375 square feet
  - Total Design Capture Volume: 4,027.2 cubic feet
  - Proposed Volume on Plans: 4,054 cubic feet

**Designed by Kevin J. Richer**

**Company Project Number/Name** Latitude Business Park

**Date** 11/4/2019

**Case No** 2019-0012
**Santa Ana Watershed** - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

(NOTE: This worksheet shall only be used in conjunction with BMP designs from the **LID BMP Design Handbook**)

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<th>Effective Imperious Fraction, $I_i$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
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**Notes:**
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)  

**Legend:**  
- **Required Entries**  
- **Calculated Cells**  

**Company Name:** Land Development Design Company, LLC  
**Designed by:** Kevin J. Richer  
**Company Project Number/Name:** Latitude Business Park  
**Date:** 11/4/2019  
**Case No:** 2019-0012

#### BMP Identification

**BMP NAME / ID** DA8  

*Must match Name/ID used on BMP Design Calculation Sheet*

#### Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E  

$D_{85} = 0.80$ inches

#### Drainage Management Area Tabulation

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

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<tr>
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<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
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<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
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<tr>
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**Notes:**
## Santa Ana Watershed - BMP Design Volume, \( V_{\text{BMP}} \) (Rev. 10-2011)

(Note this worksheet shall only be used in conjunction with BMP designs from the LID BMP Design Handbook.)

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<thead>
<tr>
<th>Company Name</th>
<th>Land Development Design Company, LLC</th>
</tr>
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<tbody>
<tr>
<td>Designed by</td>
<td>Kevin J. Richer</td>
</tr>
<tr>
<td>Company Project Number/Name</td>
<td>Latitude Business Park</td>
</tr>
<tr>
<td>Date</td>
<td>11/4/2019</td>
</tr>
<tr>
<td>Case No</td>
<td>2019-0012</td>
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### BMP Identification

**BMP NAME / ID** DA9

*Must match Name/ID used on BMP Design Calculation Sheet*

### Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Imperious Fraction, ( I_f )</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, ( V_{\text{BMP}} ) (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
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### Notes:

- Designed by Kevin J. Richer Case No 2019-0012
- BMP NAME / ID DA9
- Must match Name/ID used on BMP Design Calculation Sheet
- 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E
- Insert additional rows if needed to accommodate all DMAs draining to the BMP

Legend:

- Required Entries
- Calculated Cells

**Legend:**

- BMP NAME / ID
- DMA Type/ID
- DMA Area (square feet)
- Post-Project Surface Type
- Effective Imperious Fraction, \( I_f \)
- DMA Runoff Factor
- DMA Areas x Runoff Factor
- Design Storm Depth (in)
- Design Capture Volume, \( V_{\text{BMP}} \) (cubic feet)
- Proposed Volume on Plans (cubic feet)

**Legend:**

- Required Entries
- Calculated Cells

Company Name Land Development Design Company, LLC

Date 11/4/2019

Case No 2019-0012
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

**Legend:**
- Required Entries
- Calculated Cells

**Notes:**
- BMP Identification
  - **BMP NAME / ID** DA10
  - Must match Name/ID used on BMP Design Calculation Sheet

**Drainage Management Area Tabulation**

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<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
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<th>DMA Areas x Runoff Factor</th>
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<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
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<td></td>
<td></td>
<td>176699.3</td>
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<td>11780</td>
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</table>

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

**Insert additional rows if needed to accommodate all DMAs draining to the BMP**

**Company Name** Land Development Design Company, LLC

**Designed by** Kevin J. Richer

**Company Project Number/Name** Latitude Business Park

**Date** 11/4/2019

**Case No** 2019-0012

**Latitude Business Park**

**Company Name Land Development Design Company, LLC**

**Designed by Kevin J. Richer**

**Case No 2019-0012**

**Latitude Business Park**

**Total** 176699.3

**Notes:**

- BMP Identification
- **BMP NAME / ID** DA10
- Must match Name/ID used on BMP Design Calculation Sheet

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

**Insert additional rows if needed to accommodate all DMAs draining to the BMP**

**Company Name Land Development Design Company, LLC**

**Designed by Kevin J. Richer**

**Case No 2019-0012**

**Latitude Business Park**

**Company Name Land Development Design Company, LLC**

**Designed by Kevin J. Richer**

**Case No 2019-0012**

**Latitude Business Park**

**Total** 176699.3
**Santa Ana Watershed** - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

**Legend:**
- Required Entries
- Calculated Cells

(Note this worksheet shall *only* be used in conjunction with BMP designs from the **LID BMP Design Handbook**.)

| Company Name | Land Development Design Company, LLC |
| Designed by | Kevin J. Richer |
| Company Project Number/Name | Latitude Business Park |

| BMP NAME / ID | DA11 |
| Must match Name/ID used on BMP Design Calculation Sheet |

### Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

### Drainage Management Area Tabulation

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

<table>
<thead>
<tr>
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<th>DMA Area (square feet)</th>
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<th>Effective Impervious Fraction, $I_\text{e}$</th>
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<th>DMA Areas x Runoff Factor</th>
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<th>Design Capture Volume, $V_{BMP}$ (cubic feet)</th>
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**Total**

| 443710 | 258408.2 | 0.80 | 17227.2 | 17,248 |

**Notes:**
### Santa Ana Watershed - BMP Design Volume, $V_{BMP}$

(Rev. 10-2011)

**Legend:**

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(Note this worksheet shall only be used in conjunction with BMP designs from the LID BMP Design Handbook.)

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**BMP Identification**

**BMP NAME / ID** DA12

Must match Name/ID used on BMP Design Calculation Sheet

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

**Drainage Management Area Tabulation**

Insert additional rows if needed to accommodate all DMAs draining to the BMP

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<tr>
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**Total**

287212

187390.9

0.80

12492.7

12,628

**Notes:**

BMP NAME / ID DA12

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

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Drainage Management Area Tabulation

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<td>Roofs</td>
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**Total**

287212

187390.9

0.80

12492.7

12,628

Notes:
Santa Ana Watershed - BMP Design Volume, V_{BMP}
(Rev. 10-2011)

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<th>DMA Type/ID</th>
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<tr>
<td>13C</td>
<td>65,749</td>
<td>Ornamental Landscaping</td>
<td>0.1</td>
<td>0.11</td>
<td>7262.5</td>
<td>7262.5</td>
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<td></td>
</tr>
</tbody>
</table>

Total: 228924 152814.6 0.80 10187.6 10,226

Notes:
###Santa Ana Watershed - BMP Design Volume, $V_{\text{BMP}}$

(Rev. 10-2011)

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, $I_e$</th>
<th>DMA Runoff Factor</th>
<th>DMA Areas x Runoff Factor</th>
<th>Design Storm Depth (in)</th>
<th>Design Capture Volume, $V_{\text{BMP}}$ (cubic feet)</th>
<th>Proposed Volume on Plans (cubic feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14A</td>
<td>44,578</td>
<td>Roofs</td>
<td>1</td>
<td>0.89</td>
<td>39,763.6</td>
<td>147,807.1</td>
<td>0.80</td>
<td>9,853.8</td>
</tr>
<tr>
<td>14B</td>
<td>108,672</td>
<td>Concrete or Asphalt</td>
<td>1</td>
<td>0.89</td>
<td>96,935.4</td>
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<td></td>
<td></td>
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<tr>
<td>14C</td>
<td>100,564</td>
<td>Ornamental Landscaping</td>
<td>0.1</td>
<td>0.11</td>
<td>11,108.1</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Note this worksheet shall only be used in conjunction with BMP designs from the LID BMP Design Handbook.**

**BMP Identification**

**BMP NAME / ID** DA14

*Must match Name/ID used on BMP Design Calculation Sheet*

**Design Rainfall Depth**

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

$D_{85} = 0.80$ inches

**Drainage Management Area Tabulation**

*Insert additional rows if needed to accommodate all DMAs draining to the BMP*

Total

<table>
<thead>
<tr>
<th>DMA Type/ID</th>
<th>DMA Area (square feet)</th>
<th>Post-Project Surface Type</th>
<th>Effective Impervious Fraction, $I_e$</th>
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<th>DMA Areas x Runoff Factor</th>
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<td>0.11</td>
<td>11,108.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total       | 253,814               |                           |                                       | 147,807.1        |                            | 0.80                  | 9,853.8                     | 9,865                           |

**Notes:**

*Designed by Kevin J. Richer Case No 2019-0012*