Appendix E

Preliminary Drainage Study

Rio Rockwell Site

PRELIMINARY
DRAINAGE STUDY
FOR
RIO ROCKWELL

OCEANSIDE, CA

J.N. 181041-5

Prepared: March 4, 2020

PERMIT APPLICATION NO: GPA 18-00001

O'Day Consultants, Inc.
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Carlsbad, CA 92008-7317
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_____

George O'Day, RCE 32014 Date
Expires 12/31/20

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INTRODUCTION

Rio Rockwell is a proposed 104 lot Residential Estate development on an 11.5 acre parcel of land, located on the south side of the San Luis River Basin and to the north of Old Grove Road and to the west of Frazee Road in Oceanside, CA. The proposed development includes buildings, driveways, patios, and street improvements. See Attachment 1 for Vicinity Map.

The land use designation is Medium Density Residential with less than 10.9 dwelling units per acre. When calculating the runoff coefficient for the site, it was determined that the C-value for a medium density residential = 0.6 (per the San Diego Hydrology Manual) was smaller than the C-value used to determine the design capture volume = 0.71. We used the more conservative value of 0.71 in our calculations for the onsite hydrology and 0.87 for the offsite hydrology. See Attachment 6 for the breakdown in surface area, and associated Storm Water Quality Management Plan (SQWMP) Attachment 1 for calculations of said C-values.

The site runoff generally drains from the south to the north to the San Luis River Basin. There is also a rip rap lined swale at the western edge of the property that drains northerly towards the San Luis Rey River. There is also a drainage structure that lies partially on the east side of the property. This drainage structure drains northerly to the San Luis River as well and only receives a very small amount of water from on-site.

Attachment 3, shows the site limits and existing drainage conditions. The existing soil is Type 'A' per the Soils Hydrologic Group Map, located in Attachment 2. Because the site will be mostly fill, soil Type 'D' was used for the proposed condition for a more conservative design consideration.

Attachment 4, shows the site proposed onsite drainage conditions. The proposed condition shows all runoff from onsite improvements being directed to gutters and storm drains where it outfalls to a buried storage arch chambers with open bottoms to allow for infiltration through Type 'A' hydrologic soil. Through percolation tests, infiltration rates were to found to be between 2.3 in/hr to 0.77 in/hr. A conservative infiltration rate of 0.77 in/hr was used in sizing the BMP. The treatment/storage BMP was sized to contain the entirety of the required design capture volume. The excess produced when the BMP becomes full is released through a riser located at the west end of the BMP that discharges directly to the drainage swale on the western end of the property which ultimately connects to the San Luis River. This riser will be designed to release excess water when there is 2 inches of freeboard in the arch chambers, to maximize the infiltration capacity of

the BMP and surrounding Type 'A' hydrologic soil. See Attachment 6 for details on the BMP sizing and dimensions.

Offsite improvements include portions of Frazee Road and Old Grove Road being repaved in order to relocate existing sewer and water mains, and will be realigned to run along Old Grove Road and Frazee Road. In addition, an offsite roundabout will be constructed at the intersection of Old Grove Road and Frazee Road. No increase in runoff is expected to occur from this construction. Attachment 5, shows the site proposed offsite drainage conditions. Due to the existing drainage patterns and drainage structures in the public right-of-way, it is unfeasible to fully capture all the runoff produced in the offsite area of work. Any runoff we are able to fully capture and treat are conveyed towards curb & gutters and directed into bio-swales located behind the sidewalks along Old Grove Road and Frazee Road. The bio-swales will utilize sand and gravel layers to allow for storage of the design capture volumes for offsite runoff. The bottom of the bio-swale will remain open to allow for infiltration. In addition, a series of check dams will be utilized to allow for runoff to infiltrate into the soil before it enters the existing storm drain systems. Any excess runoff unable to infiltrate will be captured in perforated pipe and run along the bottom of the gravel layer and be directed into the existing drainage systems. The treatment/storage BMP was sized to contain the entirety of the required design capture volume. If the system were to ever become fully saturated/clogged, the runoff will not be able to enter the bio-swale and will run the course of the curb & gutter towards the existing curb inlets along Old Grove Road and Frazee Road. See Attachment 6 for details on the BMP sizing and dimensions.

Using the Rational Method, this study addresses the on-site flows after the on-site flows have been routed through treatment basins to comply with State and Federal regulations for storm water treatment. A Storm Water Quality Management Plan (SWQMP) has been prepared for this project by O'Day Consultants dated March 4, 2020. This, coupled with hydraulic analysis, established a quantity of runoff leaving the site.

It is the intent of this study to capture the delta of the increased Q of the proposed condition so that the storm water flows leaving the site are not increased from the pre-developed condition. Please refer to the Conclusion section in this report.

As mention previously, a small portion of the proposed area of work will remain untreated. These portions occur along the eastern ingress and egress area along Frazee Road and areas around the proposed roundabout that drain away from the site. The runoff produced here is unfeasible to capture and treat due to existing drainage conveyances of the road and limited room along the

public right-of-way. This runoff will be collected into the surrounding curb and gutters located along Frazee Road and Old Grove Road.

RATIONAL METHOD DESCRIPTION

The rational method, as described in the 2003 San Diego County Hydrology Manual, was used to generate surface runoff flows, which were then used to size the drainage facilities.

The basic equation: Q = CIA

C = runoff coefficient (varies with surface)

I = intensity (varies with time of concentration)

A = Area in acres

The design storm for this project is the 100-year event. A computer program developed by CivilCADD/Civildesign Engineering Software, ©1999 Version 2.1, was used to calculate the site Hydrology using the rational method. CivilCADD was also used to calculate the velocities for the concentrated swales, which was then used to calculate the time of concentrations.

CALCULATIONS

Existing Condition calculations are in Attachment 3. The Proposed Onsite Condition Drainage calculations are in Attachment 4. The Proposed Offsite Condition Drainage calculations are in Attachment 5.

CONCLUSION

Table 1 shows the comparison between the existing onsite condition and the proposed onsite condition. Table 2 shows the expected offsite runoff being produced within the area of work.

Table 1 Summary of Onsite Results

Description of Condition	Yr Storm	Q (cfs)	Tc (min)	Qp (cfs)	Area (ac)
Existing Condition (above POC):	100	8.9	7.0		7.75
Proposed Condition (above POC):	100	11.06	13.61	7.68	7.75
Self-mitigating area (downstream of POC) (Unchanged):					3.79
Total Site Condition:					11.54

Table 2 Summary of Offsite Results

Description of Condition	Yr Storm	Q (cfs)	Tc (min)	Area (ac)
DMA X	100	3.53	8.93	0.83
DMA Y	100	1.86	4.98	0.30
Untreated Area	-	-	-	0.60
Total Site Condition:				1.73

Due to the increased impervious surface being introduced the total Q flowing off the site after development will be more than the total Q flowing off the site in the existing condition; however, the Qp (Peak flow rate) leaving the BMP will be slightly less than the existing condition. Onsite and offsite storage facilities are sized to capture and detain the required design capture volume. Due to direct discharge to the San Luis Rey River, the project is not subjected to Hydromodification flow control regulations. The site will be raised above the Base Flood Elevations of the adjacent upper pond, (based upon FIRM maps 06073C0752 F and 06073C0756 F). Site development will reduce the maximum flows to the upper pond, therefore operation of the upper pond will not be impacted, or affect the graded site. Lastly, the entirety of the site is

located within the flood plain of the San Luis Rey River. FEMA maps indicates it being within a Zone A99 and Zone 0.2PCT flood hazard area. If the improvements are found to impact the flood zone significantly, a conditional letter of map revision (CLOMR) would be prepared.

Declaration of Responsible Charge

I hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge over the design of this project as defined in section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the City of Oceanside is confined to a review only and does not relieve me, as the Engineer of Work, of my responsibilities for the project design.

O'Day Consultants, Inc.
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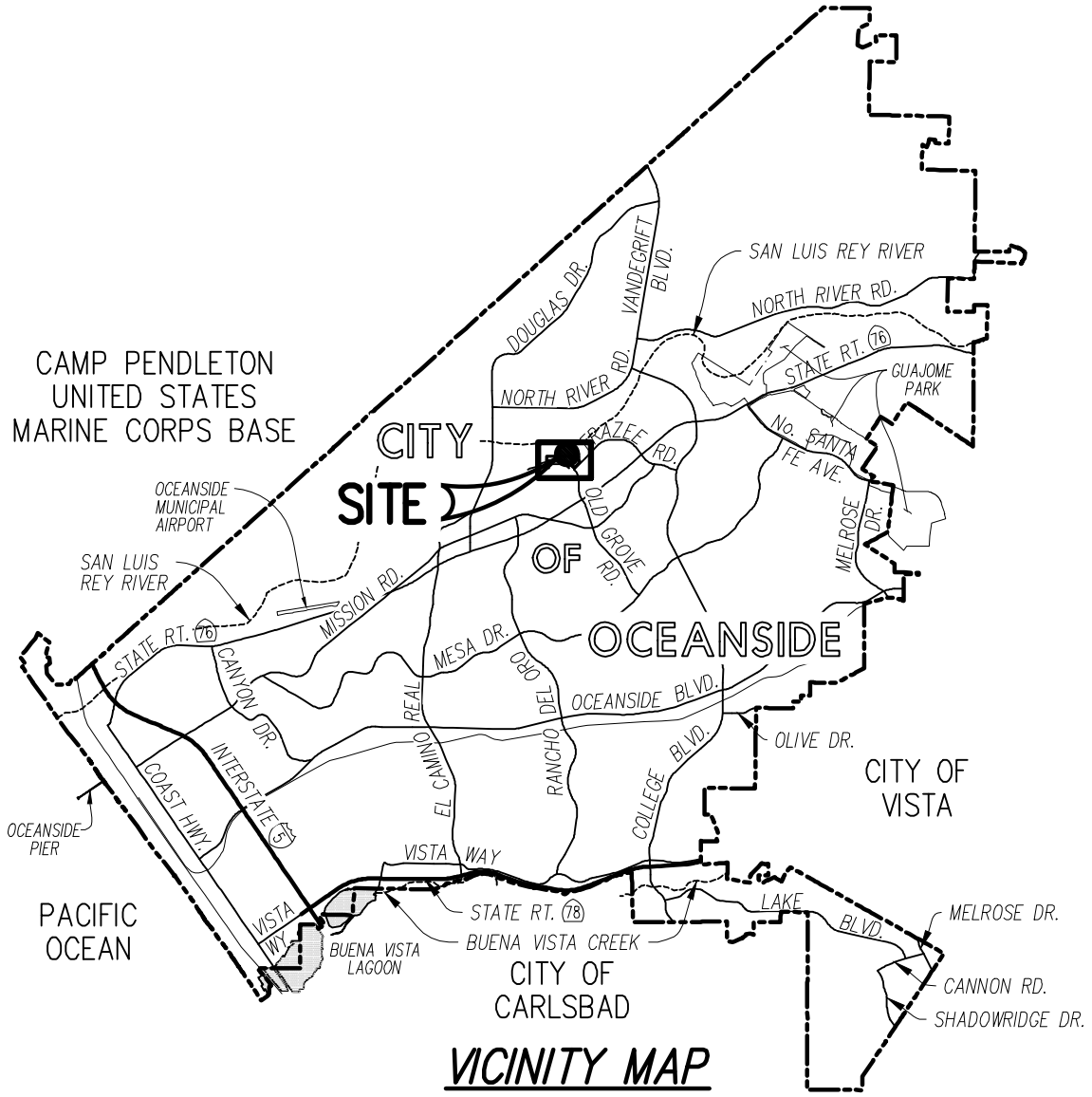
(760) 931-7700

_____ Date: _____

George O'Day
R.C.E. No. 32014 Exp. 12/31/20

ATTACHMENT 1
VICINITY MAP



VICINITY MAP

NOT TO SCALE

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Civil Engineering
Planning
Processing
Surveying

G:\181041\Stormwater_Site\1841VMAP.dwg Feb 05, 2019 3:16pm
Xrefs: 1841A-VICM

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Site: 2.7 in/hr

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Site: 5.1 in/hr

Orange County

Riverside County

Imperial County

Mexico

Pacific Ocean

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
POWAY
S.D. COUNTY
DEL MAR
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
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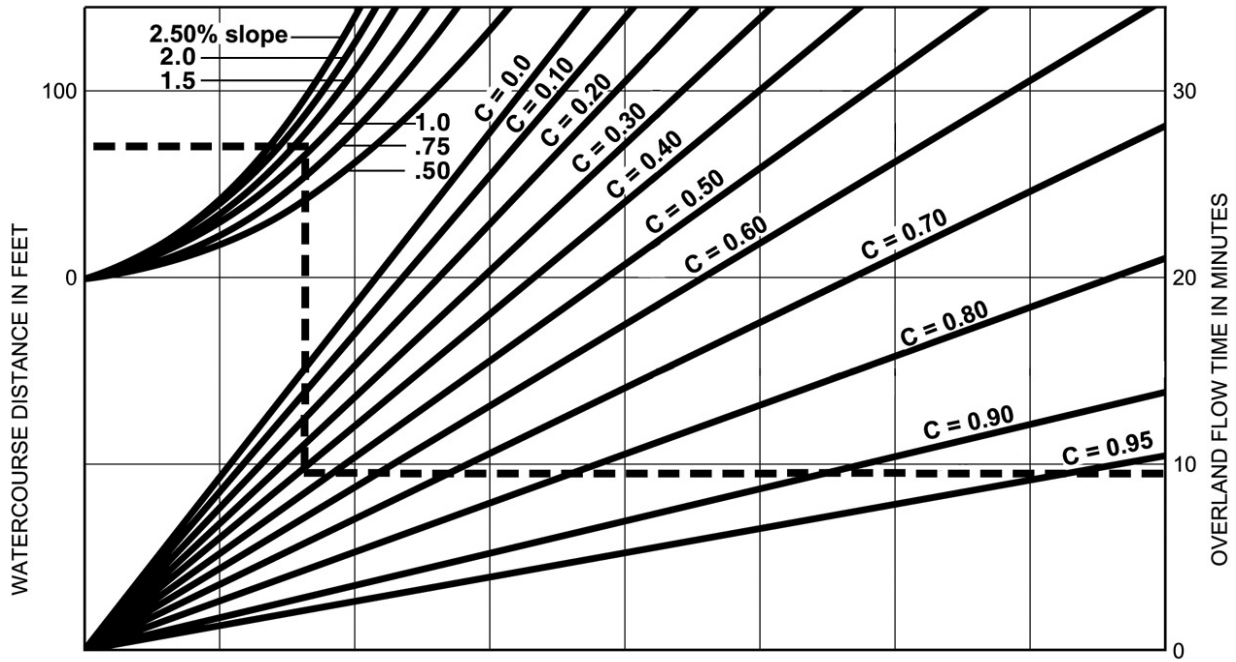
N W E S

3 0 3 Miles



EXAMPLE:

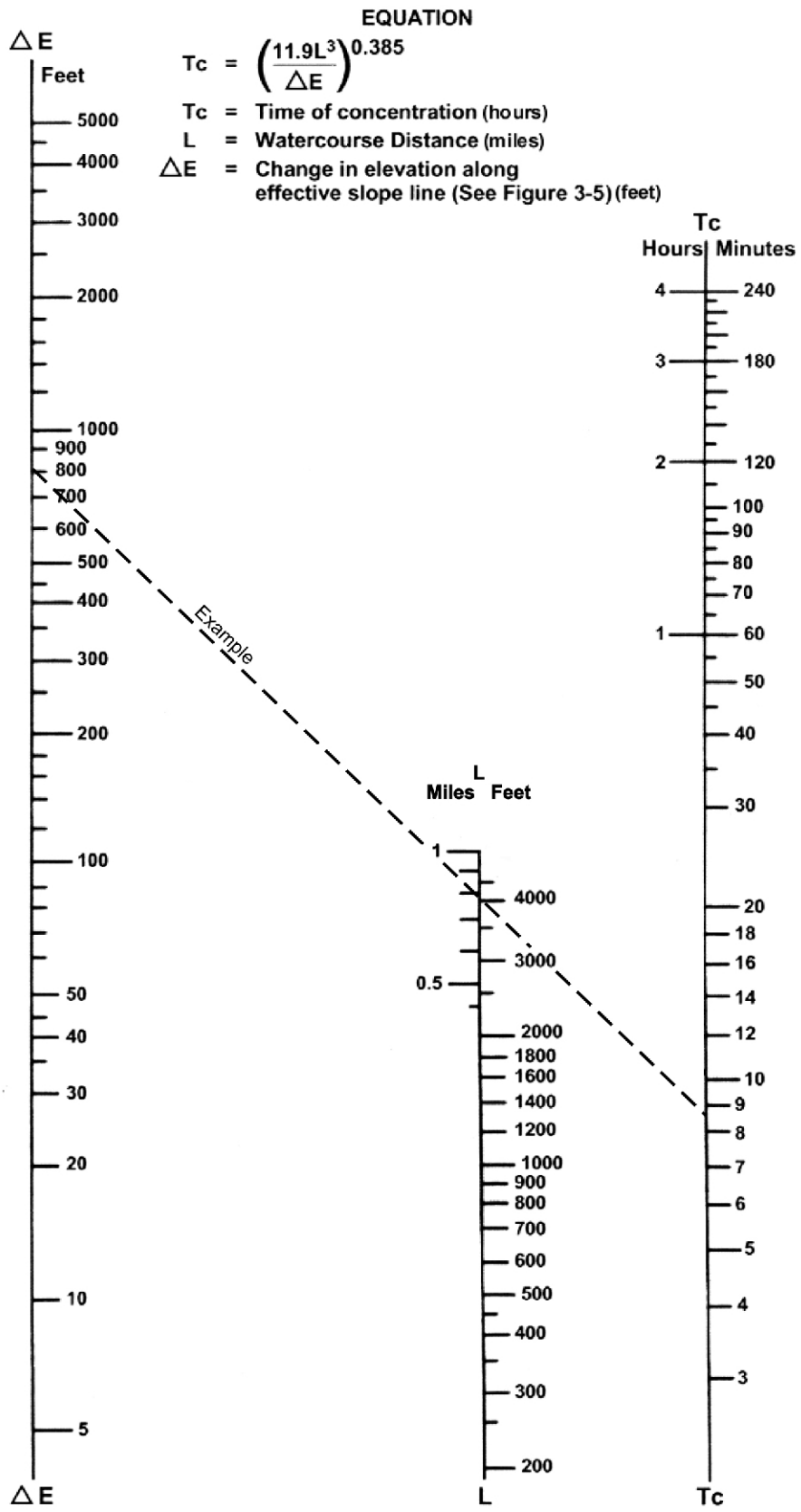
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

LEGEND

SUBDIVISION LINE.....

DRAINAGE AREA.....

POINT OF COMPLIANCE (POC).....
AREA NUMBER

NODE IDENTIFIER..... 100/73.5

PRELIMINARY DRAINAGE STUDY
EXISTING CONDITION

PREPARED: JANUARY 3, 2020

SHEET 1 OF 1

NOTE!!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

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Civil Engineering
Planning
Processing
Surveying

DESIGNED BY: A.M. DATE: FEB 2019
DRAWN BY: J.S. SCALE: 1" = 60'
PROJECT MGR.: G.O. JOB NO.: 181041

ENGINEER OF WORK:

DATE:

GEORGE O'DAY RCE: 32014

G:\181041\Stormwater_Site\Hydrology\1841-Hydro-Exist[3rd].dwg Jan 02, 2020 9:57am
Xrefs: 1841A-TOPO-VA; 1841A-MAPG; 1841A-ROAD-Roundabout-Opt2; 1841A-TM-ANNO-ALT2; 1841A-UTIL; 1841A-SITE-CIVIL

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 12/31/19

Rio Rockwell Existing Condition
G:\181041\Stormwater_Site\Hydrology\CivilCADD\1841Exist3.out.docx

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

Program License Serial Number 6218

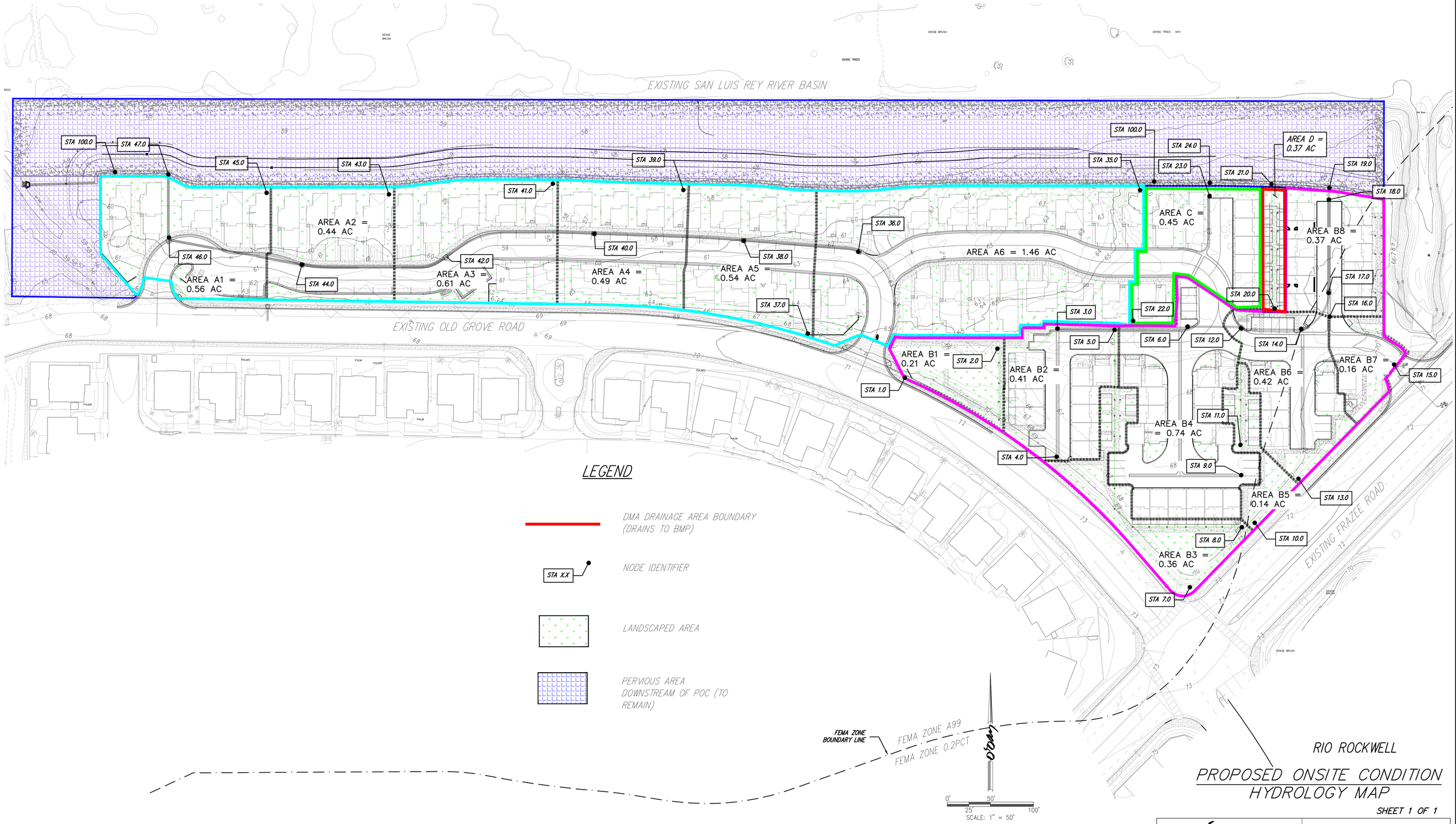
Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.100
P6/P24 = 52.9%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.200
Initial subarea total flow distance = 586.000(Ft.)
Highest elevation = 73.500(Ft.)
Lowest elevation = 58.500(Ft.)
Elevation difference = 15.000(Ft.) Slope = 2.560 %
Top of Initial Area Slope adjusted by User to 12.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.50 %, in a development type of
Permanent Open Space

In Accordance With Figure 3-3
Initial Area Time of Concentration = 6.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2000)*(100.000^.5)/(12.500^(1/3)]= 6.98
Rainfall intensity (I) = 5.736(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.200
Subarea runoff = 8.891(CFS)
Total initial stream area = 7.750(Ac.)
End of computations, total study area = 7.750 (Ac.)



LEGEND

- DMA DRAINAGE AREA BOUNDARY (DRAINS TO BMP)
- STA X.X — NODE IDENTIFIER
- LANDSCAPED AREA
- PERVIOUS AREA DOWNSTREAM OF POC (TO REMAIN)

FEMA ZONE BOUNDARY LINE — FEMA ZONE A99 / FEMA ZONE 0.2PCT

0' 50' 25' 100'
SCALE: 1" = 50'

NOTE!!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

RIO ROCKWELL

PROPOSED ONSITE CONDITION HYDROLOGY MAP

SHEET 1 OF 1

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Processing
Surveying

DESIGNED BY: P.K. DATE: MAR 2020
DRAWN BY: C.E. SCALE: AS SHOWN
PROJECT MGR.: G.O. JOB NO.: 181041

ENGINEER OF WORK:
DATE:
GEORGE O'DAY RCE: 32014

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 02/27/20

RIO ROCKWELL
POST-CONSTRUCTION HYDROLOGY STUDY
JN 181041
CALCULATED BY: PK

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

Program License Serial Number 6218

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.100
P6/P24 =   52.9%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   1.000 to Point/Station   2.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL   ]
(24.0 DU/A or Less   )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance = 112.000(Ft.)
Highest elevation =   71.600(Ft.)
Lowest elevation =   69.500(Ft.)
Elevation difference =   2.100(Ft.) Slope = 1.875 %
Top of Initial Area Slope adjusted by User to 1.000 %
Bottom of Initial Area Slope adjusted by User to 1.000 %

```
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  65.000^.5)/(   1.000^(1/3)]=   5.66
The initial area total distance of  112.00 (Ft.) entered leaves a
remaining distance of   47.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.89 minutes
for a distance of  47.00 (Ft.) and a slope of  1.00 %
with an elevation difference of   0.47(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.891 Minutes
Tt=[(11.9*0.0089^3)/(  0.47)]^.385=  0.89
Total initial area Ti =   5.66 minutes from Figure 3-3 formula plus
  0.89 minutes from the Figure 3-4 formula =   6.55 minutes
Rainfall intensity (I) =      5.976(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      0.891(CFS)
Total initial stream area =        0.210(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    69.500(Ft.)
Downstream point/station elevation =    68.500(Ft.)
Pipe length  =    77.40(Ft.) Slope =   0.0129  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     0.891(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     0.891(CFS)
Normal flow depth in pipe =    4.23(In.)
Flow top width inside pipe =    7.99(In.)
Critical Depth =    5.37(In.)
Pipe flow velocity =      4.76(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     6.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        3.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.822(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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```
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =     6.82 min.
Rainfall intensity =      5.822(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      0.441
Subarea runoff =      1.676(CFS) for      0.411(Ac.)
Total runoff =      2.567(CFS)  Total area =       0.621(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.621(Ac.)
Runoff from this stream =      2.567(CFS)
Time of concentration =    6.82 min.
Rainfall intensity =     5.822(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =   92.000(Ft.)
Highest elevation =   72.000(Ft.)
Lowest elevation =   71.700(Ft.)
Elevation difference =    0.300(Ft.) Slope =  0.326 %
Top of Initial Area Slope adjusted by User to  1.000 %
Bottom of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  65.000^.5)/(   1.000^(1/3)]=   5.66
```

```
The initial area total distance of   92.00 (Ft.) entered leaves a
remaining distance of   27.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.58 minutes
for a distance of  27.00 (Ft.) and a slope of  1.00 %
with an elevation difference of   0.27(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.582 Minutes
Tt=[(11.9*0.0051^3)/(  0.27)]^.385=  0.58
Total initial area Ti =   5.66 minutes from Figure 3-3 formula plus
  0.58 minutes from the Figure 3-4 formula =   6.24 minutes
Rainfall intensity (I) =      6.166(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      1.576(CFS)
Total initial stream area =        0.360(Ac.)


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Process from Point/Station        8.000 to Point/Station        5.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    71.700(Ft.)
Downstream point/station elevation =    68.100(Ft.)
Pipe length  =   366.00(Ft.) Slope =   0.0098  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     1.576(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.576(CFS)
Normal flow depth in pipe =    5.11(In.)
Flow top width inside pipe =   11.87(In.)
Critical Depth =    6.39(In.)
Pipe flow velocity =      4.94(Ft/s)
Travel time through pipe =    1.23 min.
Time of concentration (TC) =     7.48 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        5.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    68.500(Ft.)
Downstream point/station elevation =    68.100(Ft.)
Pipe length  =    66.00(Ft.) Slope =   0.0061  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     1.576(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.576(CFS)
Normal flow depth in pipe =    4.92(In.)
Flow top width inside pipe =   16.04(In.)
Critical Depth =    5.65(In.)
Pipe flow velocity =      4.03(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     7.75 min.
```

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Process from Point/Station        5.000 to Point/Station        5.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.360(Ac.)
Runoff from this stream =      1.576(CFS)
Time of concentration =    7.75 min.
Rainfall intensity =     5.363(In/Hr)


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Process from Point/Station        9.000 to Point/Station        6.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =  284.000(Ft.)
Highest elevation =   72.100(Ft.)
Lowest elevation =   67.600(Ft.)
Elevation difference =    4.500(Ft.) Slope =  1.585 %
Top of Initial Area Slope adjusted by User to  1.000 %
Bottom of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  65.000^.5)/(   1.000^(1/3)]=   5.66
The initial area total distance of  284.00 (Ft.) entered leaves a
remaining distance of  219.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.92 minutes
for a distance of 219.00 (Ft.) and a slope of  1.00 %
with an elevation difference of   2.19(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.916 Minutes
Tt=[(11.9*0.0415^3)/(  2.19)]^.385=  2.92
Total initial area Ti =   5.66 minutes from Figure 3-3 formula plus
  2.92 minutes from the Figure 3-4 formula =   8.58 minutes
Rainfall intensity (I) =      5.023(In/Hr) for a   100.0 year storm
```

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Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      2.646(CFS)
Total initial stream area =        0.742(Ac.)


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Process from Point/Station        5.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    68.100(Ft.)
Downstream point/station elevation =    67.600(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0059  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     2.646(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.646(CFS)
Normal flow depth in pipe =    6.49(In.)
Flow top width inside pipe =   17.29(In.)
Critical Depth =    7.40(In.)
Pipe flow velocity =      4.61(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =     8.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.742(Ac.)
Runoff from this stream =      2.646(CFS)
Time of concentration =    8.88 min.
Rainfall intensity =     4.911(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.646      8.88                  4.911
Qmax(1) =
           1.000 *    1.000 *     2.646) + =       2.646

Total of 1 streams to confluence:
Flow rates before confluence point:
       2.646
Maximum flow rates at confluence using above data:
        2.646
Area of streams before confluence:
        0.742
Results of confluence:
```

```
Total flow rate =      2.646(CFS)
Time of concentration =     8.882 min.
Effective stream area after confluence =      0.742(Ac.)


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Process from Point/Station        6.000 to Point/Station       12.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    67.600(Ft.)
Downstream point/station elevation =    67.300(Ft.)
Pipe length  =    62.80(Ft.) Slope =   0.0048  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     2.646(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.646(CFS)
Normal flow depth in pipe =    6.86(In.)
Flow top width inside pipe =   17.48(In.)
Critical Depth =    7.40(In.)
Pipe flow velocity =      4.28(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     9.13 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.825(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =     9.13 min.
Rainfall intensity =      4.825(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      0.628
Subarea runoff =      0.386(CFS) for      0.143(Ac.)
Total runoff =      3.032(CFS)  Total area =       0.885(Ac.)


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Process from Point/Station       11.000 to Point/Station       12.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    71.600(Ft.)
Downstream point/station elevation =    67.300(Ft.)
```

```
Pipe length  =   137.00(Ft.) Slope =   0.0314  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     3.032(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.032(CFS)
Normal flow depth in pipe =    5.33(In.)
Flow top width inside pipe =   11.92(In.)
Critical Depth =    8.95(In.)
Pipe flow velocity =      9.01(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     9.38 min.


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Process from Point/Station       12.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.885(Ac.)
Runoff from this stream =      3.032(CFS)
Time of concentration =    9.38 min.
Rainfall intensity =     4.741(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.032      9.38                4.741
Qmax(1) =
           1.000 *    1.000 *     3.032) + =       3.032

Total of 1 streams to confluence:
Flow rates before confluence point:
       3.032
Maximum flow rates at confluence using above data:
        3.032
Area of streams before confluence:
        0.885
Results of confluence:
Total flow rate =      3.032(CFS)
Time of concentration =     9.381 min.
Effective stream area after confluence =      0.885(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =    67.300(Ft.)
Downstream point/station elevation =    67.000(Ft.)
```

```
Pipe length  =    69.30(Ft.) Slope =   0.0043  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     3.032(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.032(CFS)
Normal flow depth in pipe =    7.59(In.)
Flow top width inside pipe =   17.78(In.)
Critical Depth =    7.95(In.)
Pipe flow velocity =      4.28(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     9.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.655(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =     9.65 min.
Rainfall intensity =      4.655(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      0.929
Subarea runoff =      1.291(CFS) for      0.423(Ac.)
Total runoff =      4.323(CFS)  Total area =       1.308(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.308(Ac.)
Runoff from this stream =      4.323(CFS)
Time of concentration =    9.65 min.
Rainfall intensity =     4.655(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        4.323      9.65                4.655
Qmax(1) =
```

```
          1.000 *    1.000 *     4.323) + =       4.323

Total of 1 streams to confluence:
Flow rates before confluence point:
       4.323
Maximum flow rates at confluence using above data:
        4.323
Area of streams before confluence:
        1.308
Results of confluence:
Total flow rate =      4.323(CFS)
Time of concentration =     9.651 min.
Effective stream area after confluence =      1.308(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    67.000(Ft.)
Downstream point/station elevation =    66.700(Ft.)
Pipe length  =    56.40(Ft.) Slope =   0.0053  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     4.323(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.323(CFS)
Normal flow depth in pipe =    8.76(In.)
Flow top width inside pipe =   17.99(In.)
Critical Depth =    9.57(In.)
Pipe flow velocity =      5.06(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =     9.84 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.598(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =     9.84 min.
Rainfall intensity =      4.598(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      1.043
```

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Subarea runoff =      0.473(CFS) for      0.161(Ac.)
Total runoff =      4.796(CFS)  Total area =       1.469(Ac.)


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Process from Point/Station       16.000 to Point/Station       17.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.469(Ac.)
Runoff from this stream =      4.796(CFS)
Time of concentration =    9.84 min.
Rainfall intensity =     4.598(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        4.796      9.84                  4.598
Qmax(1) =
           1.000 *    1.000 *     4.796) + =       4.796

Total of 1 streams to confluence:
Flow rates before confluence point:
       4.796
Maximum flow rates at confluence using above data:
        4.796
Area of streams before confluence:
        1.469
Results of confluence:
Total flow rate =      4.796(CFS)
Time of concentration =     9.836 min.
Effective stream area after confluence =      1.469(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    66.700(Ft.)
Downstream point/station elevation =    66.200(Ft.)
Pipe length  =   106.30(Ft.) Slope =   0.0047  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     4.796(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.796(CFS)
Normal flow depth in pipe =    9.67(In.)
Flow top width inside pipe =   17.95(In.)
Critical Depth =   10.10(In.)
Pipe flow velocity =      4.96(Ft/s)
```

```
Travel time through pipe =    0.36 min.
Time of concentration (TC) =    10.19 min.


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Process from Point/Station       16.000 to Point/Station       18.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.493(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    10.19 min.
Rainfall intensity =      4.493(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      1.307
Subarea runoff =      1.078(CFS) for      0.372(Ac.)
Total runoff =      5.873(CFS)  Total area =       1.841(Ac.)


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Process from Point/Station       18.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.841(Ac.)
Runoff from this stream =      5.873(CFS)
Time of concentration =   10.19 min.
Rainfall intensity =     4.493(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.873     10.19                4.493
Qmax(1) =
           1.000 *    1.000 *     5.873) + =       5.873

Total of 1 streams to confluence:
Flow rates before confluence point:
       5.873
Maximum flow rates at confluence using above data:
        5.873
Area of streams before confluence:
```

```
        1.841
Results of confluence:
Total flow rate =      5.873(CFS)
Time of concentration =    10.193 min.
Effective stream area after confluence =      1.841(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    66.200(Ft.)
Downstream point/station elevation =    66.000(Ft.)
Pipe length  =    14.00(Ft.) Slope =   0.0143  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     5.873(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.873(CFS)
Normal flow depth in pipe =    7.88(In.)
Flow top width inside pipe =   17.86(In.)
Critical Depth =   11.24(In.)
Pipe flow velocity =      7.91(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    10.22 min.


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Process from Point/Station       19.000 to Point/Station      100.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.841(Ac.)
Runoff from this stream =      5.873(CFS)
Time of concentration =   10.22 min.
Rainfall intensity =     4.485(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.873     10.22                4.485
Qmax(1) =
           1.000 *    1.000 *     5.873) + =       5.873

Total of 1 main streams to confluence:
Flow rates before confluence point:
       5.873
Maximum flow rates at confluence using above data:
        5.873
```

```
Area of streams before confluence:
        1.841


Results of confluence:
Total flow rate =      5.873(CFS)
Time of concentration =    10.223 min.
Effective stream area after confluence  =      1.841(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =  131.700(Ft.)
Highest elevation =   70.900(Ft.)
Lowest elevation =   70.300(Ft.)
Elevation difference =    0.600(Ft.) Slope =  0.456 %
Top of Initial Area Slope adjusted by User to  0.500 %
Bottom of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.25 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  50.000^.5)/(   0.500^(1/3)]=   6.25
The initial area total distance of  131.70 (Ft.) entered leaves a
remaining distance of   81.70 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.78 minutes
for a distance of  81.70 (Ft.) and a slope of  0.50 %
with an elevation difference of   0.41(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.782 Minutes
Tt=[(11.9*0.0155^3)/(  0.41)]^.385=  1.78
Total initial area Ti =   6.25 minutes from Figure 3-3 formula plus
  1.78 minutes from the Figure 3-4 formula =   8.04 minutes
Rainfall intensity (I) =      5.238(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      1.376(CFS)
Total initial stream area =        0.370(Ac.)
```

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Process from Point/Station       21.000 to Point/Station      100.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.370(Ac.)
Runoff from this stream =      1.376(CFS)
Time of concentration =    8.04 min.
Rainfall intensity =     5.238(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        1.376      8.04                 5.238
Qmax(1) =
           1.000 *    1.000 *     1.376) + =       1.376

Total of 1 main streams to confluence:
Flow rates before confluence point:
       1.376
Maximum flow rates at confluence using above data:
        1.376
Area of streams before confluence:
        0.370


Results of confluence:
Total flow rate =      1.376(CFS)
Time of concentration =     8.036 min.
Effective stream area after confluence  =      0.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =  174.200(Ft.)
```

```
Highest elevation =   71.300(Ft.)
Lowest elevation =   69.300(Ft.)
Elevation difference =    2.000(Ft.) Slope =  1.148 %
Top of Initial Area Slope adjusted by User to  0.500 %
Bottom of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.25 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  50.000^.5)/(   0.500^(1/3)]=   6.25
The initial area total distance of  174.20 (Ft.) entered leaves a
remaining distance of  124.20 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.46 minutes
for a distance of 124.20 (Ft.) and a slope of  0.50 %
with an elevation difference of   0.62(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.460 Minutes
Tt=[(11.9*0.0235^3)/(  0.62)]^.385=  2.46
Total initial area Ti =   6.25 minutes from Figure 3-3 formula plus
  2.46 minutes from the Figure 3-4 formula =   8.71 minutes
Rainfall intensity (I) =      4.972(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      1.595(CFS)
Total initial stream area =        0.452(Ac.)


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Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    69.300(Ft.)
Downstream point/station elevation =    65.000(Ft.)
Pipe length  =    15.00(Ft.) Slope =   0.2867  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     1.595(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.595(CFS)
Normal flow depth in pipe =    2.16(In.)
Flow top width inside pipe =    9.22(In.)
Critical Depth =    6.44(In.)
Pipe flow velocity =     16.58(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     8.73 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station      100.000
**** CONFLUENCE OF MAIN STREAMS ****
```

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.452(Ac.)
Runoff from this stream =      1.595(CFS)
Time of concentration =    8.73 min.
Rainfall intensity =     4.966(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.595      8.73                 4.966
Qmax(1) =
           1.000 *    1.000 *     1.595) + =       1.595

Total of 1 main streams to confluence:
Flow rates before confluence point:
       1.595
Maximum flow rates at confluence using above data:
        1.595
Area of streams before confluence:
        0.452


Results of confluence:
Total flow rate =      1.595(CFS)
Time of concentration =     8.729 min.
Effective stream area after confluence  =      0.452(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       36.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =  335.700(Ft.)
Highest elevation =   70.900(Ft.)
Lowest elevation =   67.500(Ft.)
Elevation difference =    3.400(Ft.) Slope =  1.013 %
Top of Initial Area Slope adjusted by User to  0.500 %
Bottom of Initial Area Slope adjusted by User to  0.500 %
```

```
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.25 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(  50.000^.5)/(   0.500^(1/3)]=   6.25
The initial area total distance of  335.70 (Ft.) entered leaves a
remaining distance of  285.70 (Ft.)
Using Figure 3-4, the travel time for this distance is   4.67 minutes
for a distance of 285.70 (Ft.) and a slope of  0.50 %
with an elevation difference of   1.43(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    4.672 Minutes
Tt=[(11.9*0.0541^3)/(  1.43)]^.385=  4.67
Total initial area Ti =   6.25 minutes from Figure 3-3 formula plus
  4.67 minutes from the Figure 3-4 formula =  10.93 minutes
Rainfall intensity (I) =      4.297(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      4.466(CFS)
Total initial stream area =        1.464(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    67.500(Ft.)
Downstream point/station elevation =    66.800(Ft.)
Pipe length  =   134.40(Ft.) Slope =   0.0052  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     4.466(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.466(CFS)
Normal flow depth in pipe =    8.99(In.)
Flow top width inside pipe =   18.00(In.)
Critical Depth =    9.73(In.)
Pipe flow velocity =      5.07(Ft/s)
Travel time through pipe =    0.44 min.
Time of concentration (TC) =    11.37 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       37.000 to Point/Station       38.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.188(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    11.37 min.
Rainfall intensity =      4.188(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      1.423
Subarea runoff =      1.493(CFS) for      0.540(Ac.)
Total runoff =      5.959(CFS)  Total area =       2.004(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       38.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.004(Ac.)
Runoff from this stream =      5.959(CFS)
Time of concentration =   11.37 min.
Rainfall intensity =     4.188(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.959     11.37                4.188
Qmax(1) =
           1.000 *    1.000 *     5.959) + =       5.959

Total of 1 streams to confluence:
Flow rates before confluence point:
       5.959
Maximum flow rates at confluence using above data:
        5.959
Area of streams before confluence:
        2.004
Results of confluence:
Total flow rate =      5.959(CFS)
Time of concentration =    11.369 min.
Effective stream area after confluence =      2.004(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    66.800(Ft.)
```

```
Downstream point/station elevation =    65.900(Ft.)
Pipe length  =   173.70(Ft.) Slope =   0.0052  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     5.959(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.959(CFS)
Normal flow depth in pipe =   10.75(In.)
Flow top width inside pipe =   17.66(In.)
Critical Depth =   11.32(In.)
Pipe flow velocity =      5.41(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    11.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       39.000 to Point/Station       40.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.066(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    11.90 min.
Rainfall intensity =      4.066(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      1.772
Subarea runoff =      1.246(CFS) for      0.492(Ac.)
Total runoff =      7.205(CFS)  Total area =       2.496(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.496(Ac.)
Runoff from this stream =      7.205(CFS)
Time of concentration =   11.90 min.
Rainfall intensity =     4.066(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        7.205     11.90                4.066
```

```
Qmax(1) =
          1.000 *    1.000 *     7.205) + =       7.205

Total of 1 streams to confluence:
Flow rates before confluence point:
       7.205
Maximum flow rates at confluence using above data:
        7.205
Area of streams before confluence:
        2.496
Results of confluence:
Total flow rate =      7.205(CFS)
Time of concentration =    11.903 min.
Effective stream area after confluence =      2.496(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       42.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    65.900(Ft.)
Downstream point/station elevation =    65.000(Ft.)
Pipe length  =   180.00(Ft.) Slope =   0.0050  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     7.205(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     7.205(CFS)
Normal flow depth in pipe =   12.41(In.)
Flow top width inside pipe =   16.66(In.)
Critical Depth =   12.47(In.)
Pipe flow velocity =      5.54(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    12.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       41.000 to Point/Station       42.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.951(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    12.44 min.
Rainfall intensity =      3.951(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
```

```
(Q=KCIA) is C = 0.710  CA =      2.206
Subarea runoff =      1.510(CFS) for      0.611(Ac.)
Total runoff =      8.715(CFS)  Total area =       3.107(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       42.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.107(Ac.)
Runoff from this stream =      8.715(CFS)
Time of concentration =   12.44 min.
Rainfall intensity =     3.951(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        8.715     12.44                 3.951
Qmax(1) =
           1.000 *    1.000 *     8.715) + =       8.715

Total of 1 streams to confluence:
Flow rates before confluence point:
       8.715
Maximum flow rates at confluence using above data:
        8.715
Area of streams before confluence:
        3.107
Results of confluence:
Total flow rate =      8.715(CFS)
Time of concentration =    12.445 min.
Effective stream area after confluence =      3.107(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       44.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    65.000(Ft.)
Downstream point/station elevation =    63.300(Ft.)
Pipe length  =   170.60(Ft.) Slope =   0.0100  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     8.715(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     8.715(CFS)
Normal flow depth in pipe =    9.43(In.)
Flow top width inside pipe =   23.44(In.)
Critical Depth =   12.62(In.)
```

```
Pipe flow velocity =      7.60(Ft/s)
Travel time through pipe =    0.37 min.
Time of concentration (TC) =    12.82 min.


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Process from Point/Station       43.000 to Point/Station       44.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.876(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    12.82 min.
Rainfall intensity =      3.876(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      2.517
Subarea runoff =      1.040(CFS) for      0.438(Ac.)
Total runoff =      9.756(CFS)  Total area =       3.545(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       44.000 to Point/Station       44.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.545(Ac.)
Runoff from this stream =      9.756(CFS)
Time of concentration =   12.82 min.
Rainfall intensity =     3.876(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.756     12.82                3.876
Qmax(1) =
           1.000 *    1.000 *     9.756) + =       9.756

Total of 1 streams to confluence:
Flow rates before confluence point:
       9.756
Maximum flow rates at confluence using above data:
        9.756
```

```
Area of streams before confluence:
        3.545
Results of confluence:
Total flow rate =      9.756(CFS)
Time of concentration =    12.819 min.
Effective stream area after confluence =      3.545(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       44.000 to Point/Station       46.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =    63.300(Ft.)
Downstream point/station elevation =    62.500(Ft.)
Pipe length  =   157.00(Ft.) Slope =   0.0051  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =     9.756(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     9.756(CFS)
Normal flow depth in pipe =   12.16(In.)
Flow top width inside pipe =   24.00(In.)
Critical Depth =   13.41(In.)
Pipe flow velocity =      6.11(Ft/s)
Travel time through pipe =    0.43 min.
Time of concentration (TC) =    13.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       45.000 to Point/Station       46.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.795(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Time of concentration =    13.25 min.
Rainfall intensity =      3.795(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.710  CA =      2.915
Subarea runoff =      1.307(CFS) for      0.561(Ac.)
Total runoff =     11.062(CFS)  Total area =       4.106(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       46.000 to Point/Station       47.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
```

```
Upstream point/station elevation =    62.500(Ft.)
Downstream point/station elevation =    61.800(Ft.)
Pipe length  =   136.00(Ft.) Slope =   0.0051  Manning's N = 0.011
No. of pipes = 1  Required pipe flow  =    11.062(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    11.062(CFS)
Normal flow depth in pipe =   13.08(In.)
Flow top width inside pipe =   23.90(In.)
Critical Depth =   14.31(In.)
Pipe flow velocity =      6.32(Ft/s)
Travel time through pipe =    0.36 min.
Time of concentration (TC) =    13.61 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       47.000 to Point/Station      100.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.106(Ac.)
Runoff from this stream =     11.062(CFS)
Time of concentration =   13.61 min.
Rainfall intensity =     3.730(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.062     13.61                3.730
Qmax(1) =
           1.000 *    1.000 *    11.062) + =      11.062

Total of 1 main streams to confluence:
Flow rates before confluence point:
      11.062
Maximum flow rates at confluence using above data:
       11.062
Area of streams before confluence:
        4.106


Results of confluence:
Total flow rate =     11.062(CFS)
Time of concentration =    13.605 min.
Effective stream area after confluence  =      4.106(Ac.)
End of computations, total study area =          7.750 (Ac.)
```

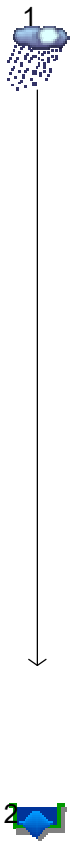
Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	A+B+C+D										unitless
	2	85th Percentile 24-hr Storm Depth	0.65										inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	227,416										sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	98,386										sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	325,802	0	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	12,706	0	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.72	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	12,706	0	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	234,577	0	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	12,706	0	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3



Legend

Hyd.	Origin	Description
1	Manual	Rio Rockwell Onsite 100yr
2	Reservoir	Infiltration BMP

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	11.06	Rio Rockwell Onsite 100yr
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	7.676	Infiltration BMP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	11.06	1	252	28,887	------	------	------	Rio Rockwell Onsite 100yr
2	Reservoir	7.676	1	257	17,733	1	59.70	12,819	Infiltration BMP

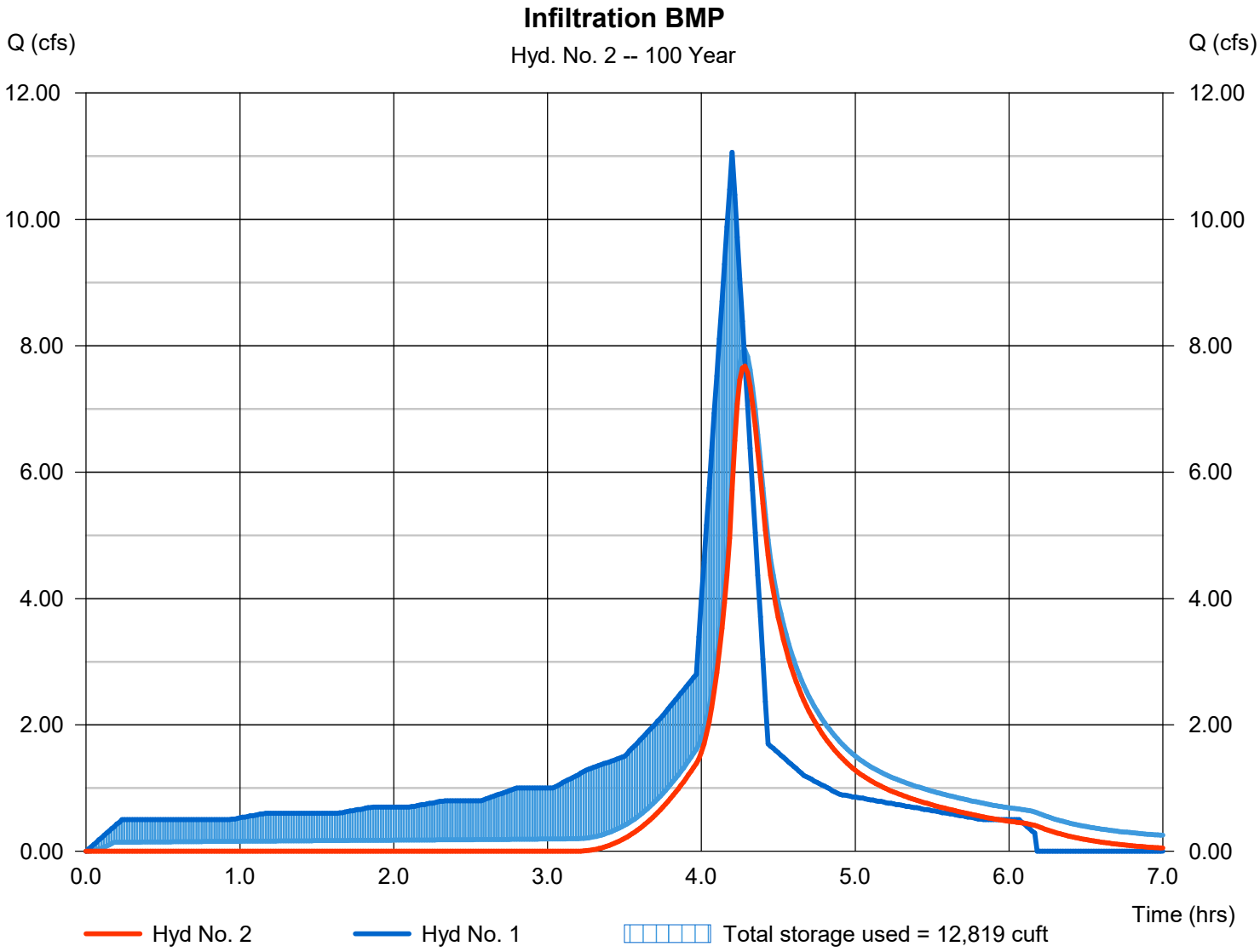
Hydrograph Report

Hyd. No. 2

Infiltration BMP

Hydrograph type	=	Reservoir	Peak discharge	=	7.676 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.28 hrs
Time interval	=	1 min	Hyd. volume	=	17,733 cuft
Inflow hyd. No.	=	1 - Rio Rockwell Onsite 100yr	Max. Elevation	=	59.70 ft
Reservoir name	=	Infiltration BMP	Max. Storage	=	12,819 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - Infiltration BMP

Pond Data

UG Chambers -Invert elev. = 58.00 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 7.12 ft, No. Barrels = 210, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 57.50 ft, Width = 5.25 ft, Height = 3.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	57.50	n/a	0	0
0.30	57.80	n/a	942	942
0.60	58.10	n/a	1,323	2,266
0.90	58.40	n/a	2,080	4,345
1.20	58.70	n/a	2,057	6,403
1.50	59.00	n/a	2,017	8,420
1.80	59.30	n/a	1,957	10,377
2.10	59.60	n/a	1,873	12,250
2.40	59.90	n/a	1,757	14,007
2.70	60.20	n/a	1,593	15,600
3.00	60.50	n/a	1,309	16,909

Culvert / Orifice Structures

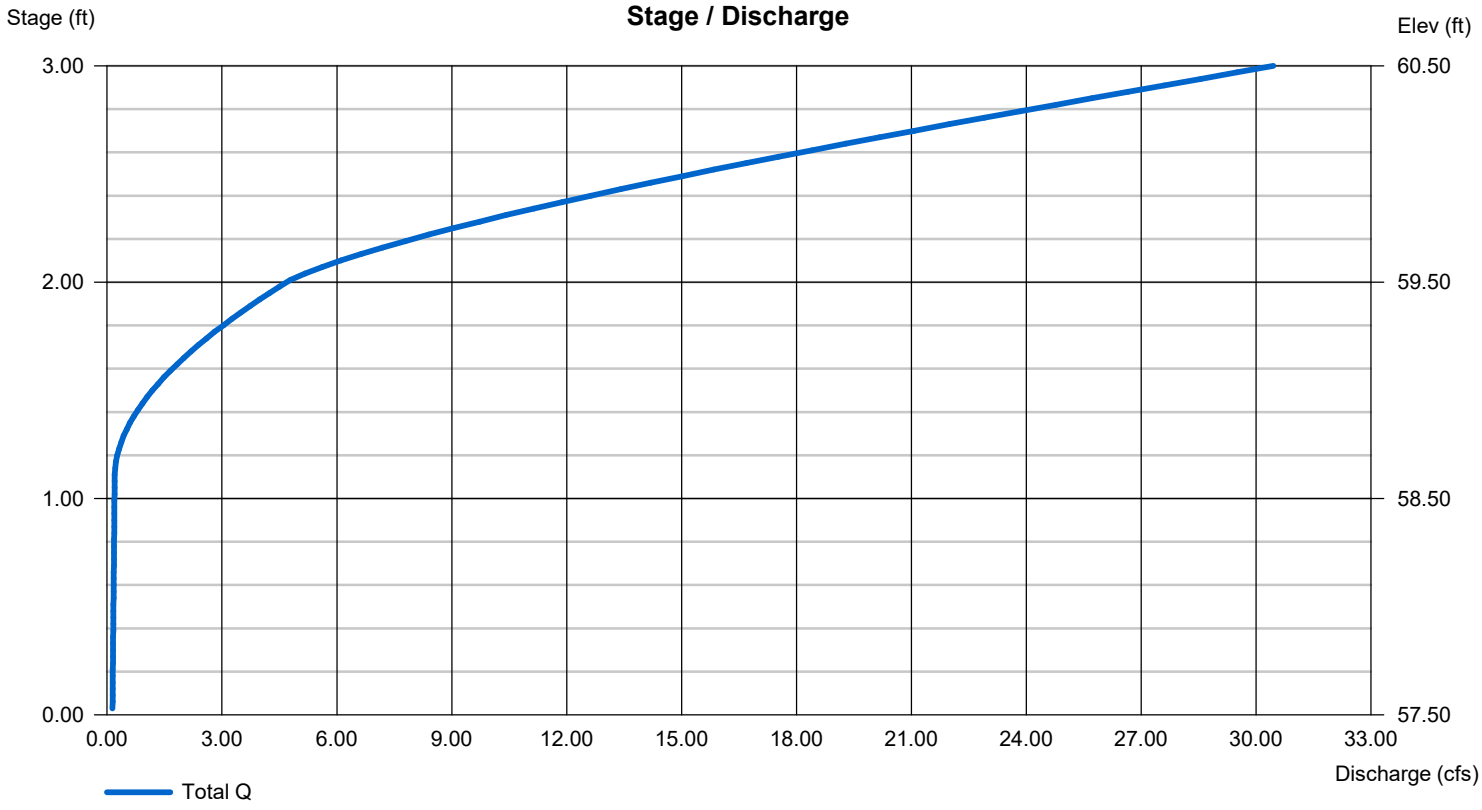
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 58.60	0.00	0.00	0.00
Length (ft)	= 77.00	0.00	0.00	0.00
Slope (%)	= 4.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

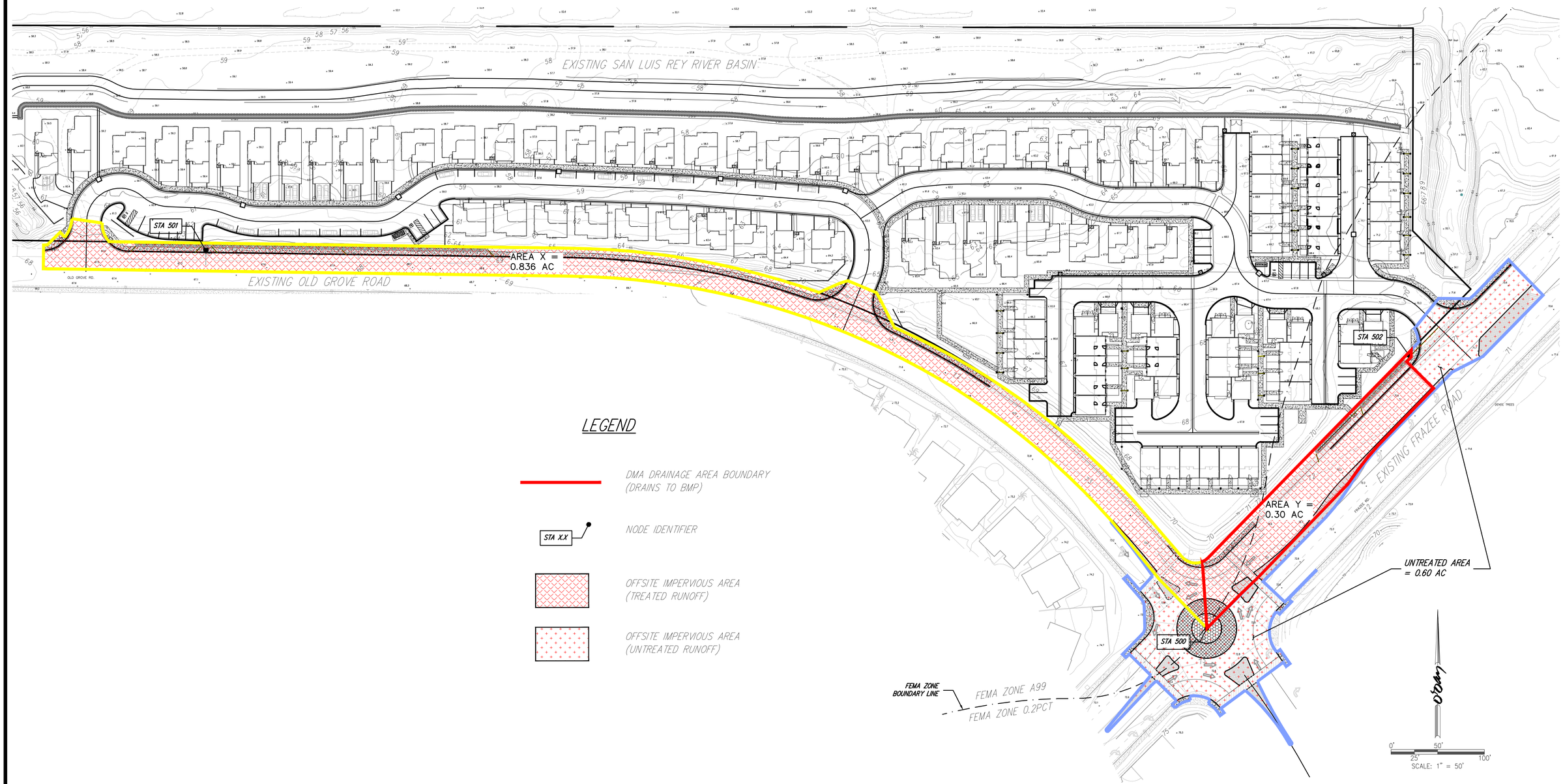
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.71	0.00	0.00	0.00
Crest El. (ft)	= 59.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.770 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).





LEGEND

DMA DRAINAGE AREA BOUNDARY (DRAINS TO BMP)

STA X.X — NODE IDENTIFIER

OFFSITE IMPERVIOUS AREA (TREATED RUNOFF)

OFFSITE IMPERVIOUS AREA (UNTREATED RUNOFF)

NOTE!!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

RIO ROCKWELL

PROPOSED OFFSITE CONDITION HYDROLOGY MAP

SHEET 1 OF 1

REGISTERED PROFESSIONAL ENGINEER — GEORGE ODAY — NO. 32014 — CIVIL — STATE OF CALIFORNIA

O'Day CONSULTANTS
2710 Loker Avenue West
Suite 100 Carlsbad,
California 92010
760-931-7700 Fax:
760-931-8680
ODayConsultants.com

Civil Engineering
Planning
Processing
Surveying

DESIGNED BY:	P.K.	DATE:	MAR 2020
DRAWN BY:	C.E.	SCALE:	AS SHOWN
PROJECT MGR.:	G.O.	JOB NO.:	181041

ENGINEER OF WORK:

DATE:

GEORGE O'DAY RCE: 32014

G:\181041\Stormwater_Site\Hydrology\1841 – Hydro-Prop [4th].dwg Mar 03, 2020 10:35am
Xrefs: 1841A-ROAD-Roundabout; 1841A-BNDY; 1841A-TOPO-VA; 1841A-SITE-CIVIL; 1841A-HYDR; 1841A-DETL

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 02/27/20

RIO ROCKWELL
OFF-SITE POST-CONSTRUCTION HYDROLOGY STUDY
JN 181041
CALCULATED BY: PK

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

Program License Serial Number 6218

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.100
P6/P24 =   52.9%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   500.000 to Point/Station   501.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type   ]
(General Industrial   )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 1231.580(Ft.)
Highest elevation =   75.000(Ft.)
Lowest elevation =   66.600(Ft.)
Elevation difference =   8.400(Ft.) Slope = 0.682 %
Top of Initial Area Slope adjusted by User to 2.000 %
Bottom of Initial Area Slope adjusted by User to 4.000 %

```
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   2.00 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.75 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  70.000^.5)/(   2.000^(1/3)]=   2.75
The initial area total distance of 1231.58 (Ft.) entered leaves a
remaining distance of 1161.58 (Ft.)
Using Figure 3-4, the travel time for this distance is   6.18 minutes
for a distance of 1161.58 (Ft.) and a slope of  4.00 %
with an elevation difference of  46.46(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    6.179 Minutes
Tt=[(11.9*0.2200^3)/( 46.46)]^.385=  6.18
Total initial area Ti =   2.75 minutes from Figure 3-3 formula plus
  6.18 minutes from the Figure 3-4 formula =   8.93 minutes
Rainfall intensity (I) =      4.894(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      3.534(CFS)
Total initial stream area =        0.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      501.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.830(Ac.)
Runoff from this stream =      3.534(CFS)
Time of concentration =    8.93 min.
Rainfall intensity =     4.894(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.534      8.93                4.894
Qmax(1) =
           1.000 *    1.000 *     3.534) + =       3.534

Total of 1 main streams to confluence:
Flow rates before confluence point:
       3.534
Maximum flow rates at confluence using above data:
        3.534
Area of streams before confluence:
```

```
        0.830


Results of confluence:
Total flow rate =      3.534(CFS)
Time of concentration =     8.928 min.
Effective stream area after confluence  =      0.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                         ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =  378.480(Ft.)
Highest elevation =   75.000(Ft.)
Lowest elevation =   71.000(Ft.)
Elevation difference =    4.000(Ft.) Slope =  1.057 %
Top of Initial Area Slope adjusted by User to  2.000 %
Bottom of Initial Area Slope adjusted by User to  4.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   2.00 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.75 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  70.000^.5)/(   2.000^(1/3)]=   2.75
The initial area total distance of  378.48 (Ft.) entered leaves a
remaining distance of  308.48 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.23 minutes
for a distance of 308.48 (Ft.) and a slope of  4.00 %
with an elevation difference of  12.34(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.226 Minutes
Tt=[(11.9*0.0584^3)/( 12.34)]^.385=  2.23
Total initial area Ti =   2.75 minutes from Figure 3-3 formula plus
  2.23 minutes from the Figure 3-4 formula =   4.98 minutes
Calculated TC of    4.975 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      1.857(CFS)
```

```
Total initial stream area =        0.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      502.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.300(Ac.)
Runoff from this stream =      1.857(CFS)
Time of concentration =    4.98 min.
Rainfall intensity =     7.114(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.857      4.98                 7.114
Qmax(1) =
           1.000 *    1.000 *     1.857) + =       1.857

Total of 1 main streams to confluence:
Flow rates before confluence point:
       1.857
Maximum flow rates at confluence using above data:
        1.857
Area of streams before confluence:
        0.300


Results of confluence:
Total flow rate =      1.857(CFS)
Time of concentration =     4.975 min.
Effective stream area after confluence  =      0.300(Ac.)
End of computations, total study area =          1.130 (Ac.)
```

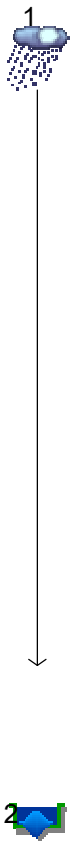
Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	X	Y									unitless
	2	85th Percentile 24-hr Storm Depth	0.65	0.65									inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	36,330	13,156									sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	36,330	13,156	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	1,771	641	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.90	0.90	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	1,771	641	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	32,697	11,840	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	1,771	641	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	Manual	DMA X 100yr
2	Reservoir	Bio-Swale DMA X

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	3.530	DMA X 100yr
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	1.212	Bio-Swale DMA X

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

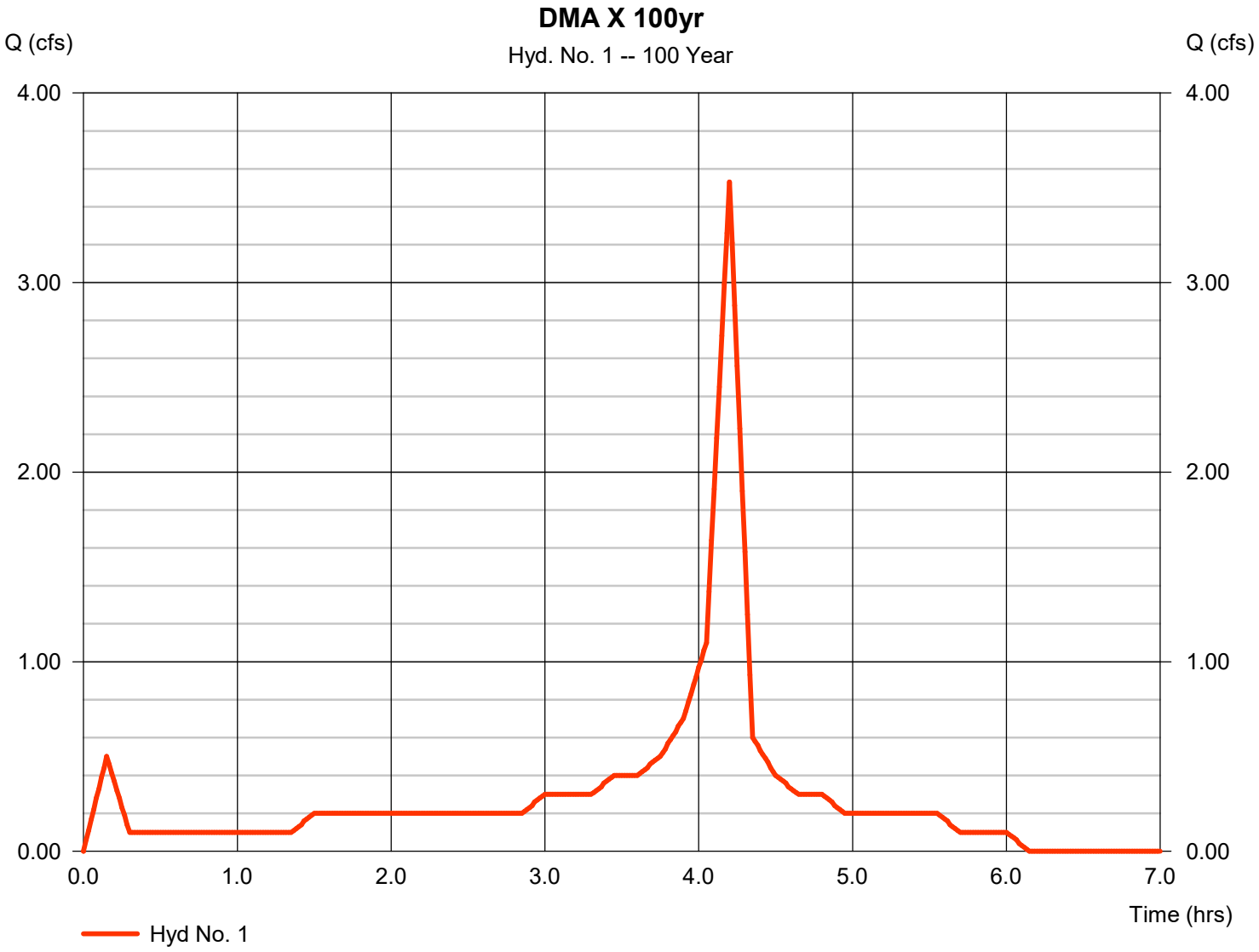
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	3.530	1	252	7,415	------	------	------	DMA X 100yr
2	Reservoir	1.212	1	259	7,412	1	66.67	1,773	Bio-Swale DMA X

Hydrograph Report

Hyd. No. 1

DMA X 100yr

Hydrograph type	= Manual	Peak discharge	= 3.530 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.20 hrs
Time interval	= 1 min	Hyd. volume	= 7,415 cuft



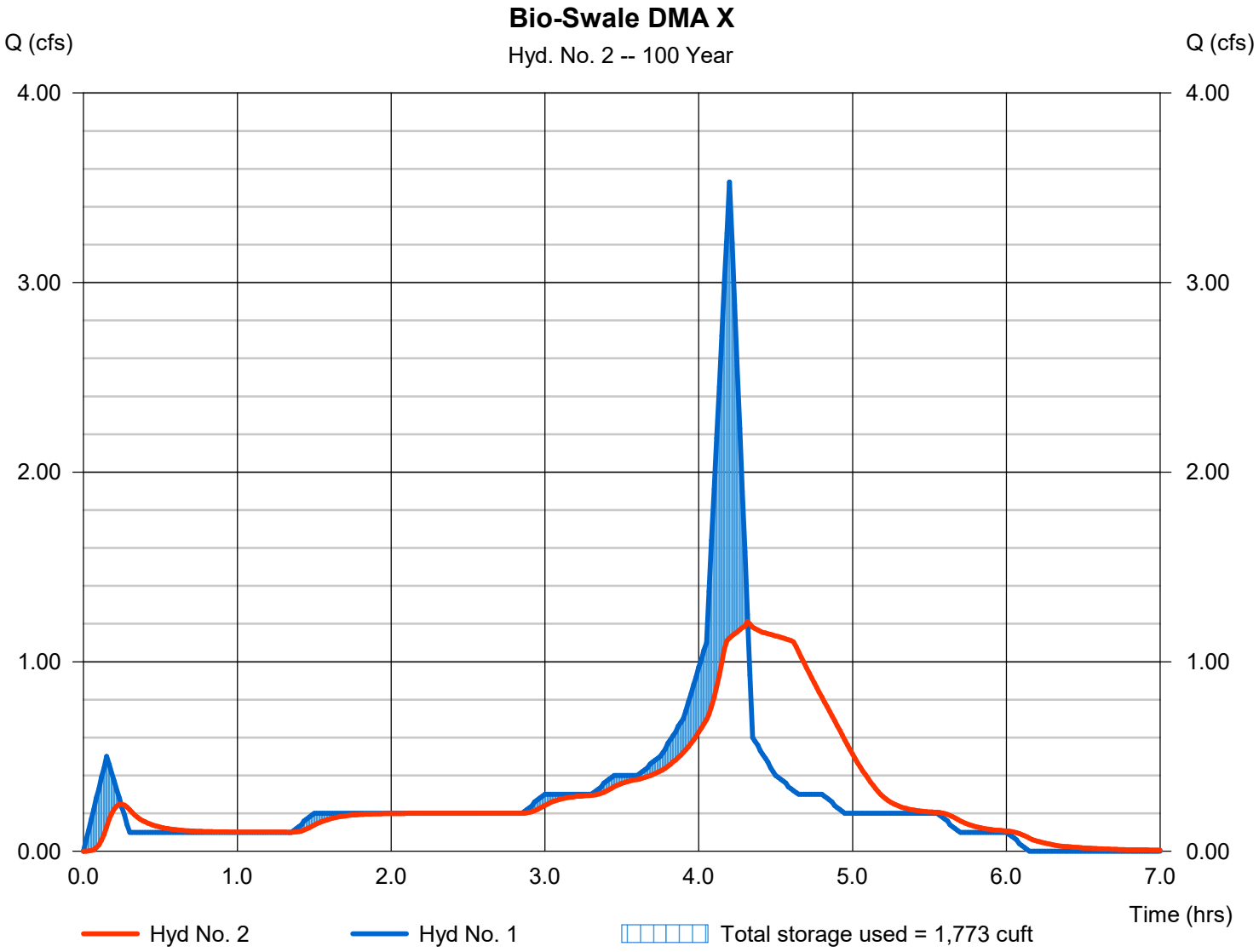
Hydrograph Report

Hyd. No. 2

Bio-Swale DMA X

Hydrograph type	=	Reservoir	Peak discharge	=	1.212 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.32 hrs
Time interval	=	1 min	Hyd. volume	=	7,412 cuft
Inflow hyd. No.	=	1 - DMA X 100yr	Max. Elevation	=	66.67 ft
Reservoir name	=	Biofiltration Swale DMA X	Max. Storage	=	1,773 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Biofiltration Swale DMA X

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	63.00	n/a	0	0
0.50	63.50	n/a	270	270
1.00	64.00	n/a	270	539
1.50	64.50	n/a	270	809
2.00	65.00	n/a	270	1,078
2.50	65.50	n/a	270	1,348
3.00	66.00	n/a	270	1,618
3.67	66.67	n/a	157	1,775

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 5.65	0.00	0.00	0.00
Span (in)	= 5.65	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 63.00	0.00	0.00	0.00
Length (ft)	= 190.00	0.00	0.00	0.00
Slope (%)	= 5.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

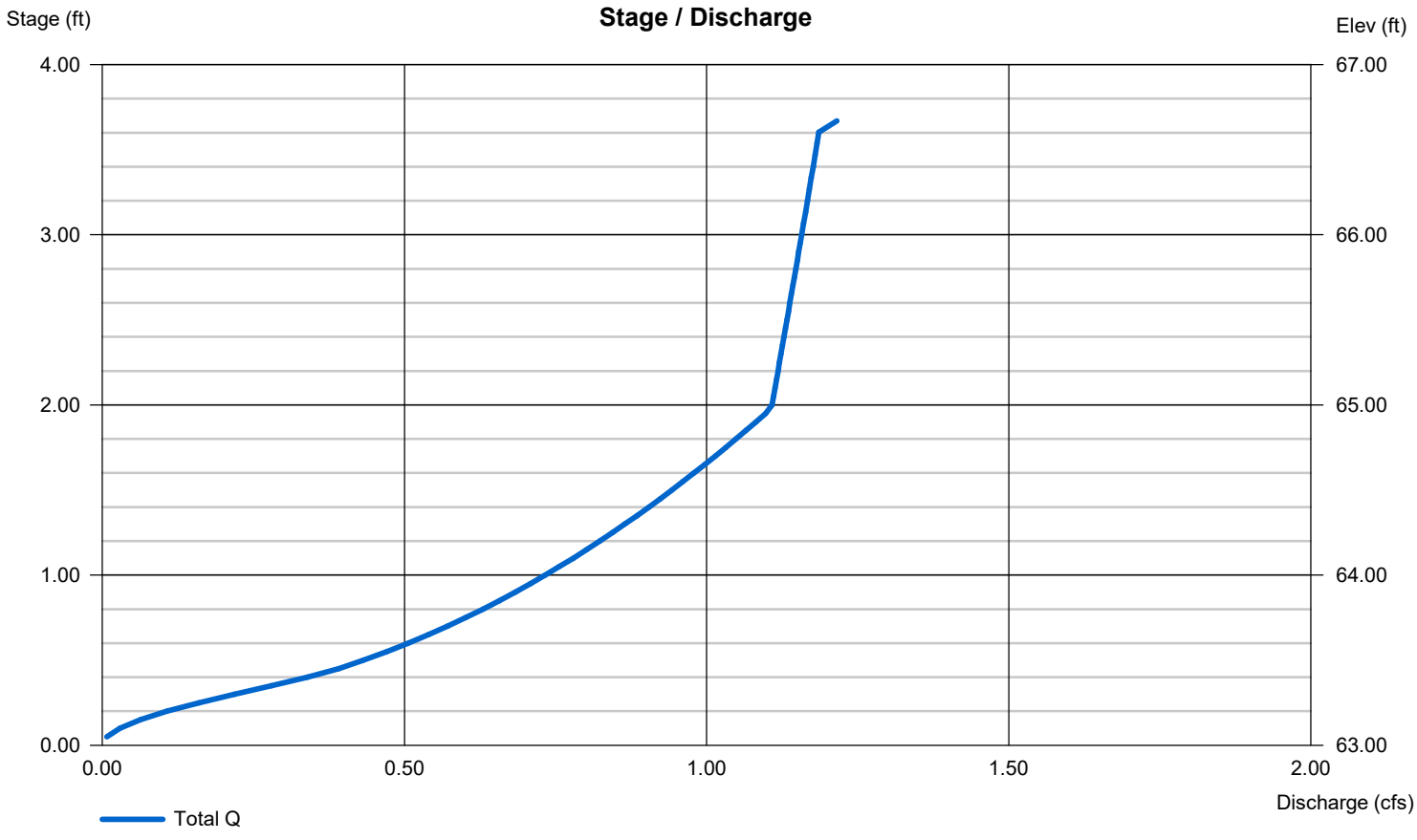
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 66.66	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

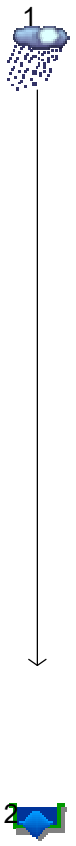
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	Manual	DMA Y 100YR
2	Reservoir	Bio-Swale DMA Y

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	1.860	DMA Y 100YR
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	0.457	Bio-Swale DMA Y

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	1.860	1	245	2,747	------	------	------	DMA Y 100YR
2	Reservoir	0.457	1	249	2,745	1	72.00	645	Bio-Swale DMA Y

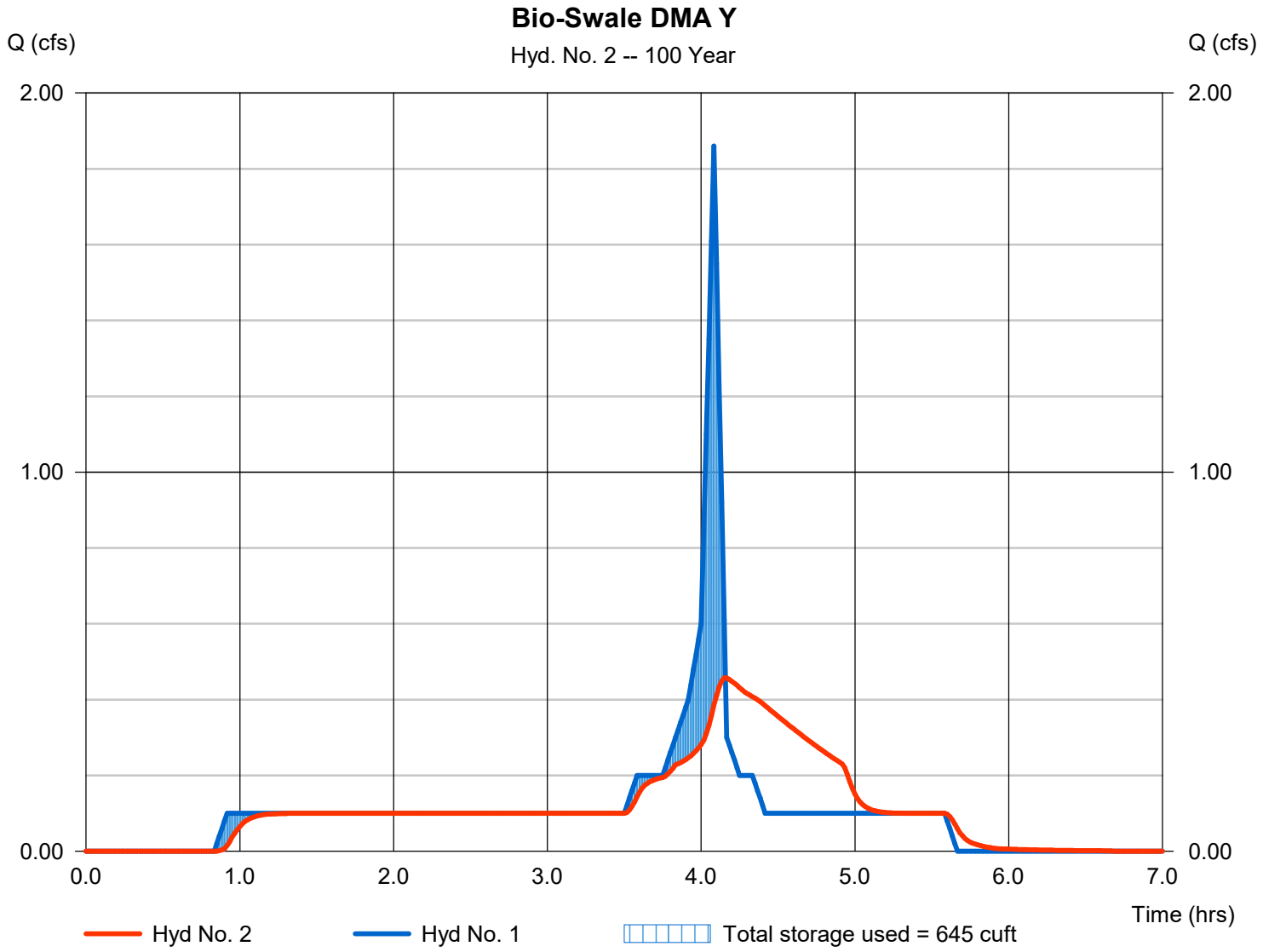
Hydrograph Report

Hyd. No. 2

Bio-Swale DMA Y

Hydrograph type	=	Reservoir	Peak discharge	=	0.457 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.15 hrs
Time interval	=	1 min	Hyd. volume	=	2,745 cuft
Inflow hyd. No.	=	1 - DMA Y 100YR	Max. Elevation	=	72.00 ft
Reservoir name	=	Bio-Swale DMA Y	Max. Storage	=	645 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Bio-Swale DMA Y

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	68.33	n/a	0	0
0.50	68.83	n/a	94	94
1.00	69.33	n/a	94	187
1.50	69.83	n/a	94	281
2.00	70.33	n/a	94	374
2.50	70.83	n/a	94	468
3.00	71.33	n/a	94	562
3.67	72.00	n/a	84	646

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 4.33	0.00	0.00	0.00
Span (in)	= 4.33	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 68.33	0.00	0.00	0.00
Length (ft)	= 104.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

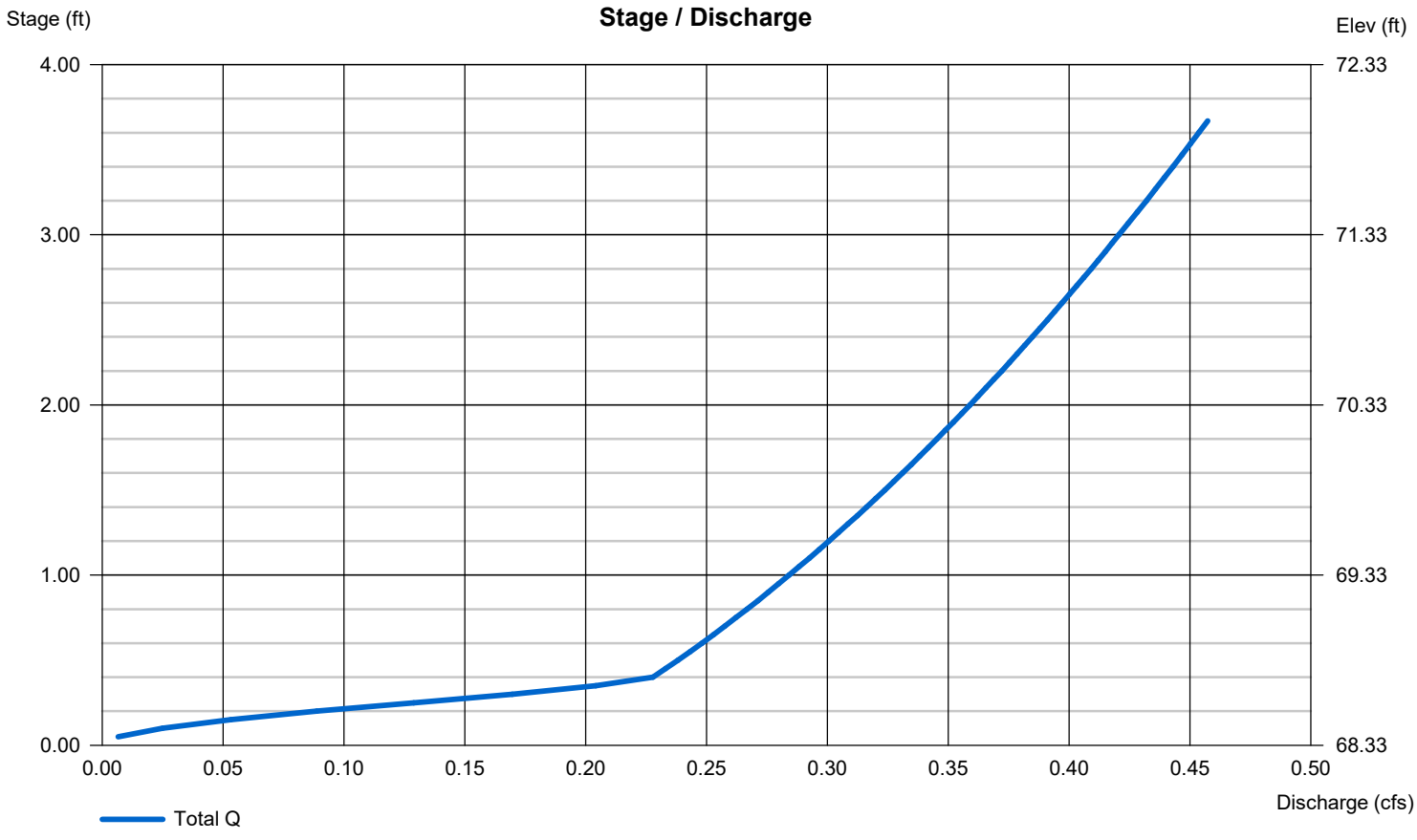
Weir Structures

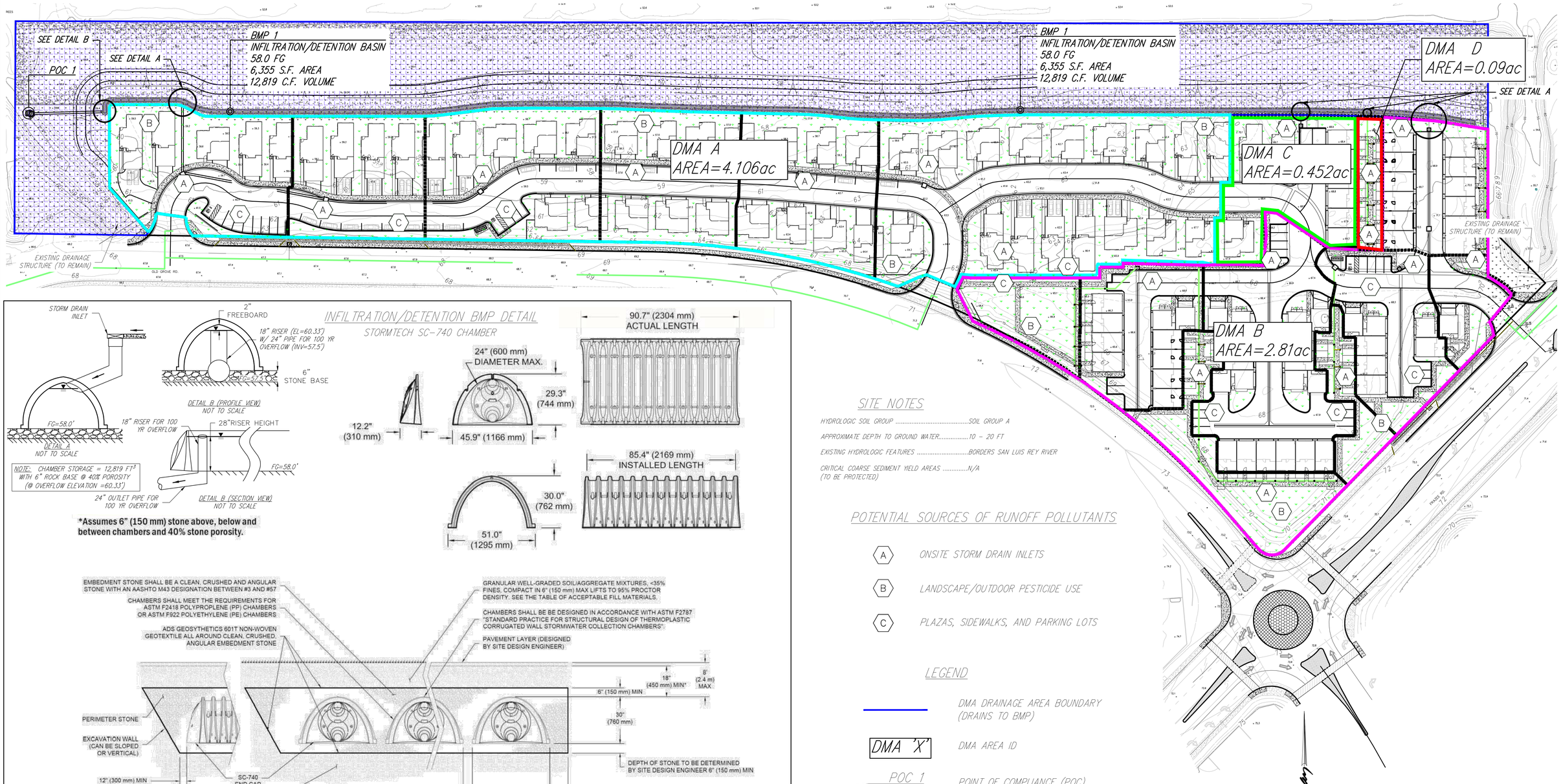
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 72.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).





INFILTRATION/DETENTION BMP DETAIL

STORMTECH SC-740 CHAMBER

*DETAIL PER ADVANCED DRAINAGE SYSTEMS, INC. (09/2017)

SITE NOTES

HYDROLOGIC SOIL GROUP .....SOIL GROUP A

APPROXIMATE DEPTH TO GROUND WATER.....10 - 20 FT

EXISTING HYDROLOGIC FEATURES .....BORDERS SAN LUIS REY RIVER

CRITICAL COARSE SEDIMENT YIELD AREAS .....N/A (TO BE PROTECTED)

POTENTIAL SOURCES OF RUNOFF POLLUTANTS

A — ONSITE STORM DRAIN INLETS

B — LANDSCAPE/OUTDOOR PESTICIDE USE

C — PLAZAS, SIDEWALKS, AND PARKING LOTS

LEGEND

DMA DRAINAGE AREA BOUNDARY (DRAINS TO BMP)

DMA 'X' — DMA AREA ID

POC 1 — POINT OF COMPLIANCE (POC)

SELF MITIGATING AREA

LANDSCAPED AREA

DESIGN CAPTURE VOLUME SIZING:

DMA	d (in) (85th Percentile)	ROOF (SF)	ASPHALT/ CONCRETE (SF)	LANDSCAPE (SF)	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	C (RUNOFF FACTOR) (UNITLESS)	DCV (DESIGN CAPTURE VOLUME) (CF)
A	0.65	58,231	60,758	59,932	178,921	4.106		
B		30,850	61,175	30,918	122,943	2.82		
C		6,524	8,777	4,865	20,166	0.46		
D		0.00	1,101	2,671	3,772	0.09		
ONSITE TOTAL		95,605	131,811	98,386	325,802	7.48	0.71	12,706

NOTE!!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

RIO ROCKWELL

ONSITE DMA EXHIBIT

ATTACHMENT 1a

SHEET 1 OF 1

REGISTERED PROFESSIONAL ENGINEER GEORGE O'DAY NO. 32014 CIVIL STATE OF CALIFORNIA

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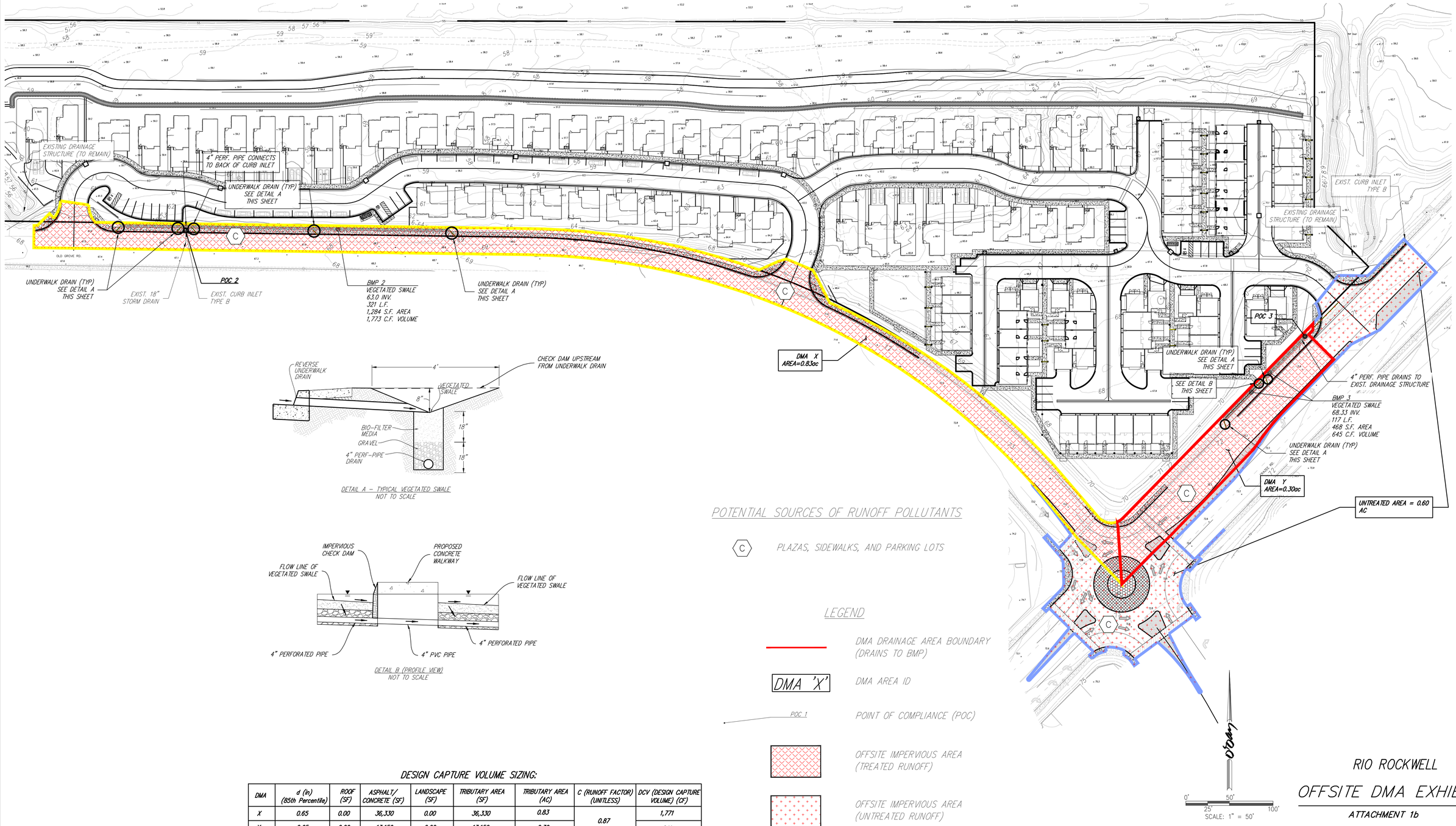
Civil Engineering
Planning
Processing
Surveying

DESIGNED BY: P.K. DATE: MAR 2020
DRAWN BY: C.E. SCALE: AS SHOWN
PROJECT MGR.: G.O. JOB NO.: 181041

ENGINEER OF WORK:

GEORGE O'DAY DATE: RCE: 32014

G:\181041\Stormwater_Site\Hydrology\1841 - Hydro-Prop [4th].dwg Mar 03, 2020 12:48pm
Xrefs: 1841A-ROAD-Roundabout; 1841A-BNDY; 1841A-TOPO-VA; 1841A-SITE-CIVIL; 1841A-HYDR; 1841A-DETL



DETAIL A – TYPICAL VEGETATED SWALE
NOT TO SCALE

DETAIL B (PROFILE VIEW)
NOT TO SCALE

POTENTIAL SOURCES OF RUNOFF POLLUTANTS

C — PLAZAS, SIDEWALKS, AND PARKING LOTS

LEGEND

- DMA DRAINAGE AREA BOUNDARY (DRAINS TO BMP)
- DMA 'X' — DMA AREA ID
- POC 1 — POINT OF COMPLIANCE (POC)
- OFFSITE IMPERVIOUS AREA (TREATED RUNOFF)
- OFFSITE IMPERVIOUS AREA (UNTREATED RUNOFF)

DESIGN CAPTURE VOLUME SIZING:

DMA	d (in) (85th Percentile)	ROOF (SF)	ASPHALT/ CONCRETE (SF)	LANDSCAPE (SF)	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	C (RUNOFF FACTOR) (UNITLESS)	DCV (DESIGN CAPTURE VOLUME) (CF)
X	0.65	0.00	36,330	0.00	36,330	0.83	0.87	1,771
Y	0.65	0.00	13,156	0.00	13,156	0.30		641

NOTE!!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

RIO ROCKWELL

OFFSITE DMA EXHIBIT

ATTACHMENT 1b

SHEET 1 OF 1

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ENGINEER OF WORK:

DATE:
GEORGE O'DAY RCE: 32014

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Xrefs: 1841A-ROAD-Roundabout; 1841A-BNDY; 1841A-TOPO-VA; 1841A-SITE-CIVIL; 1841A-HYDR; 1841A-DETL