

APPENDIX
HYDROLOGIC AND HYDRAULIC
CALCULATIONS



R. M. TOWILL CORPORATION

2024 N King Street, Suite 200, Honolulu, Hawaii 96819
Ph. (808) 842-1133 Fax (808) 842-1937

Project: Miki Industrial Job No. _____
Location: Lanai Prepared By: DAA Date: 2021-05-18
Item: Runoff Calculations Checked By: GR Date: 2021-05-18

Purpose: Determine the existing runoff from project site.

Assumptions

Rational Method

Runoff Coefficient, C

RUNOFF COEFFICIENT FOR SMALL AGRICULTURAL AREAS

Watershed Characteristics	Description	Value
Infiltration	Medium	0.07
Relief	Rolling	0.03
Vegetal Cover	Good	0.03
Development Type	Agricultural	0.15
Sum		0.28

Small agricultural areas = 0.28
Solar Farm Areas = 0.34 (drain area 1)
Light Industrial Areas = 0.8 (drain area 3)
Heavy Industrial Areas = 0.9 (drain area 2)

Rainfall Intensity, I (10 Year-1 hr)

I = 1.85 in /hr NOAA Data
See TC spreadsheet for adjusted rainfall intensities.

SCS Method

Curve No. (CN)

Existing Condition 65
Proposed Condition 78

RESULTS

Calculate Peak Runoff, Q

EXISTING CONDITION

Drainage Area Name	Area (Acres)	C	I (in/hr)	Q (cfs)
DA 1*	65.00	0.28	4.8	87.36
DA 2**	100.00	-	-	529.90
DA 3*	32.6	0.28	2.8	25.56
DA OFFSITE 1**	162.0	-	-	330.00
DA OFFSITE 2**	81.7	-	-	166.5
DA OFFSITE 3*	88.5	0.28	2.9	71.86
DA OFFSITE 4*	8.6	0.28	4.8	11.56



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Calculate Peak Runoff, Q

PROPOSED CONDITION

Drainage Area Name	Area (Acres)	C	I (in/hr)	Q (cfs)
DA 1*	65.00	0.34	4.8	106.08
DA 2**	100.00	-	-	566.10
DA 3*	35	0.8	4	112.00
DA OFFSITE 1**	165.75	-	-	337.70
DA OFFSITE 2**	78.20	-	-	159.35
DA OFFSITE 3*	86.10	0.28	2.9	69.91
DA OFFSITE 4*	8.6	0.28	4.8	11.56

*Calculated using Rational Method

**Calculated using SCS Method

Drainage Area Name	Existing Q	Proposed Q	Increase in Q
DA 1*	87.36	106.08	18.72
DA 2**	529.90	566.10	36.20
DA 3*	25.56	112.00	86.44



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Purpose: Determine the runoff from project site.

Assumptions

Drain Area 1 Calculate Runoff Coefficient

Drainage Area Name	Land Use Type	C	Area (ac)	Weighted C
DA 1	Impervious	0.9	0.07	0.34
	Gravel	0.8	5.67	
	Rangeland	0.3	59.26	
Total			65	

Drain Area 2 Calculate CN

Area (Acres)	CN	Description
0.02	98	Impervious, HSG B
0.04	98	Impervious, HSG C
0.18	49	Coarse Gravel, HSG A
1.61	69	Coarse Gravel, HSG B
2.73	79	Coarse Gravel, HSG C
1.87	65	Brush—brush-weed-grass mixture with brush HSG C
16.85	65	
28.53	65	
13.50	91	Industrial, HSG C
33.98	91	
1.30	91	
100.60	78	Weighted Average

Hydrograph Report

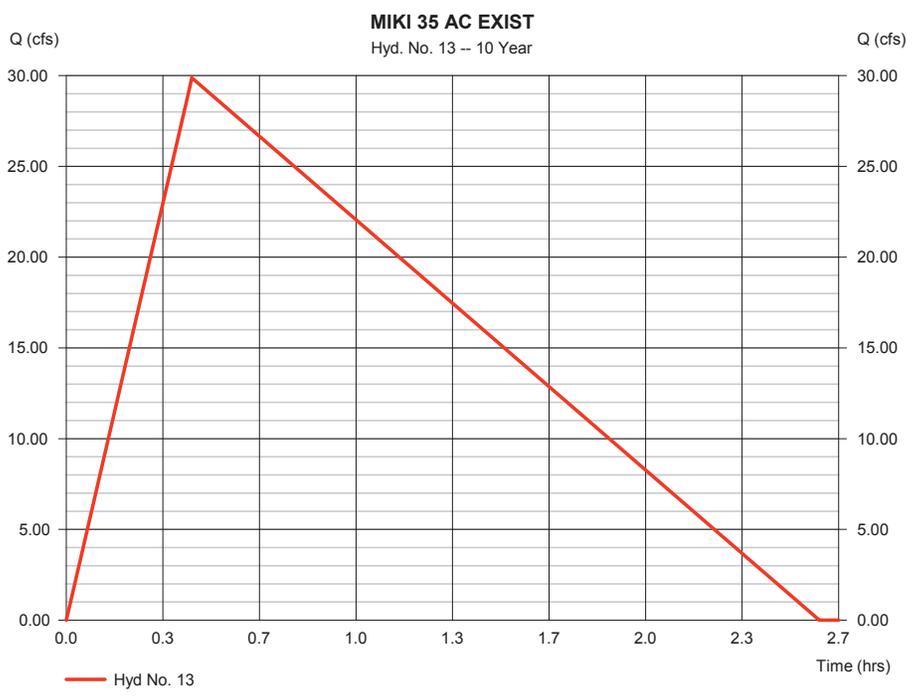
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 11 / 5 / 2018

Hyd. No. 13

MIKI 35 AC EXIST

Hydrograph type	= Rational	Peak discharge	= 29.87 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.43 hrs
Time interval	= 1 min	Hyd. volume	= 139,813 cuft
Drainage area	= 35.000 ac	Runoff coeff.	= 0.28
Intensity	= 3.048 in/hr	Tc by User	= 26.00 min
IDF Curve	= MIKI NOAA DATA.IDF	Asc/Rec limb fact	= 1/5



MIKI Basin
Miami County Drainage Standards - Rational Method
13-05-20

	TRIBUTARY SUBAREAS	AREA (acres)	WEIGHTED RUNOFF COEFFICIENT "C"	MAXIMUM LENGTH OF TRAVEL (feet)	DIFFERENCE IN ELEVATION (feet)	Slope %	k-value	TIME OF CONCENTRATION "Tc" (minutes)	10-YEAR "I" (in/hr)
EXISTING	DA 1 (Utppl industrial)	65.00	0.28	1140	56.0	4.91%	5143.6	5.6	4.80
	DA 3 (Utppl industrial)	32.60	0.28	1600	100.0	6.25%	6400.0	26.0	2.80
	DA OFFSITE 3	88.50	0.28	7570	272.0	3.59%	39935.5	27.2	2.90
	DA OFFSITE 4	6.60	0.28	1330	85.0	6.39%	5261.0	5.7	4.8
PROPOSED	DA 1 (Utppl industrial)	65.00	0.38	-	-	-	-	10.0	4.8
	DA 3 (Utppl industrial)	35.00	0.80	7570.00	272.00	3.59%	39935.52	27.24	4
	DA OFFSITE 3	86.10	0.28	1330	85.0	6.39%	5261.0	6.7	2.90
	DA OFFSITE 4	8.6	0.28	-	-	-	-	-	4.8

Hydrograph Report

1

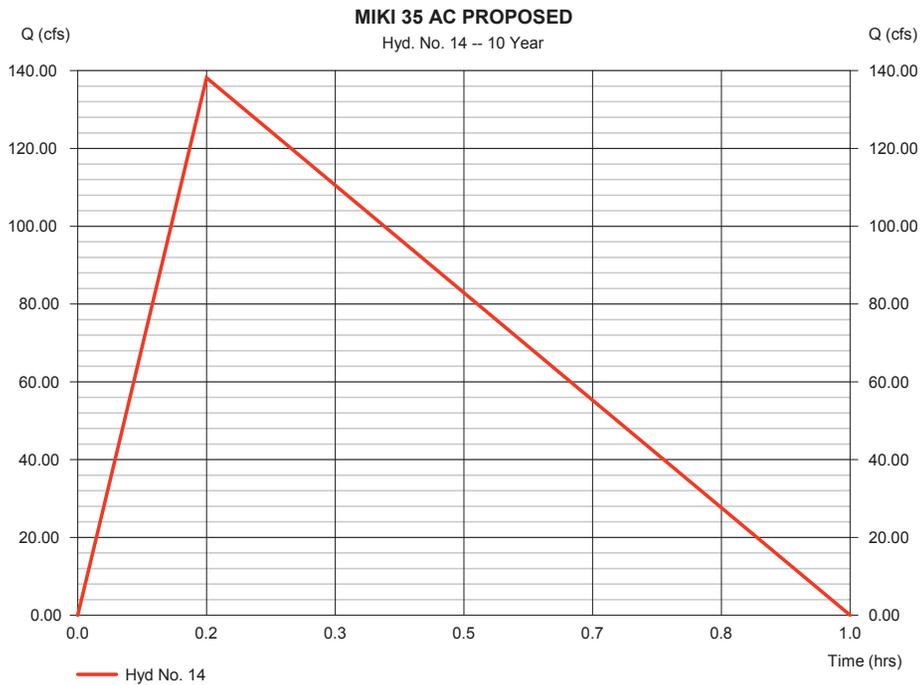
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Monday, 11 / 5 / 2018

Hyd. No. 14

MIKI 35 AC PROPOSED

Hydrograph type	= Rational	Peak discharge	= 138.15 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 248,674 cuft
Drainage area	= 35.000 ac	Runoff coeff.	= 0.8
Intensity	= 4.934 in/hr	Tc by User	= 10.00 min
IDF Curve	= MIKI NOAA DATA.IDF	Asc/Rec limb fact	= 1/5



Hydrograph Report

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

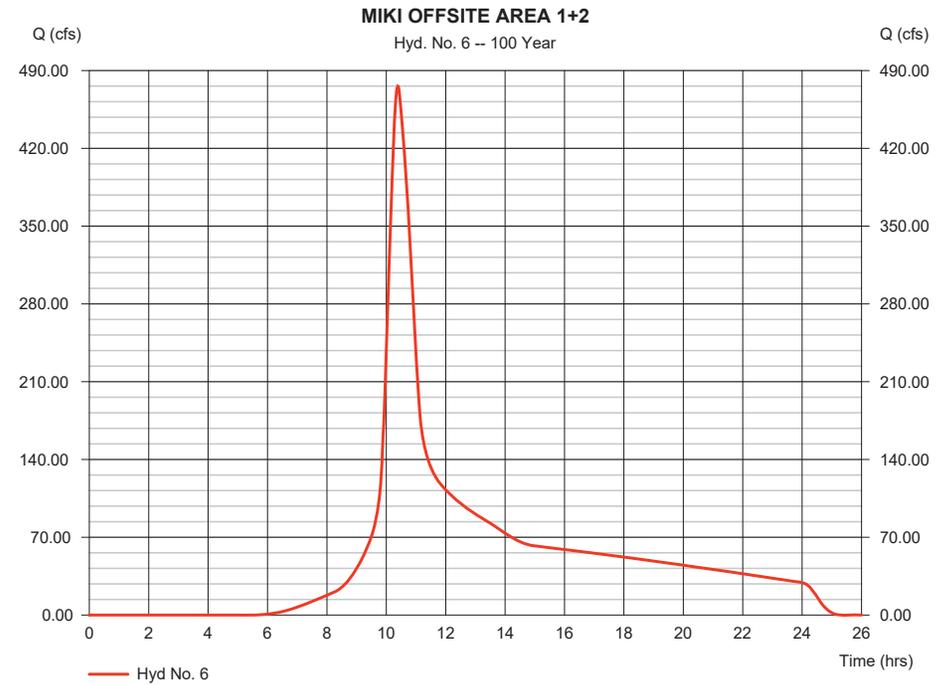
Thursday, 05 / 13 / 2021

Hyd. No. 6

MIKI OFFSITE AREA 1+2

Hydrograph type	= SCS Runoff	Peak discharge	= 475.96 cfs
Storm frequency	= 100 yrs	Time to peak	= 10.38 hrs
Time interval	= 1 min	Hyd. volume	= 4,800,937 cuft
Drainage area	= 243.950 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 48.50 min
Total precip.	= 9.86 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(243.700 x 65)] / 243.950



Hydrograph Report

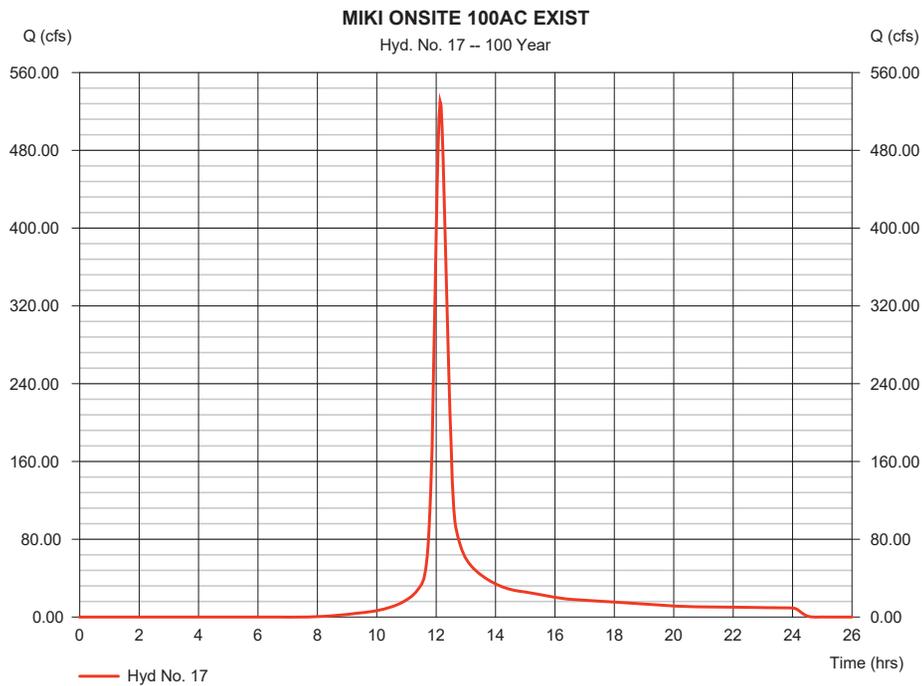
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Tuesday, 05 / 18 / 2021

Hyd. No. 17

MIKI ONSITE 100AC EXIST

Hydrograph type	= SCS Runoff	Peak discharge	= 529.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,945,636 cuft
Drainage area	= 100.000 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.60 min
Total precip.	= 9.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

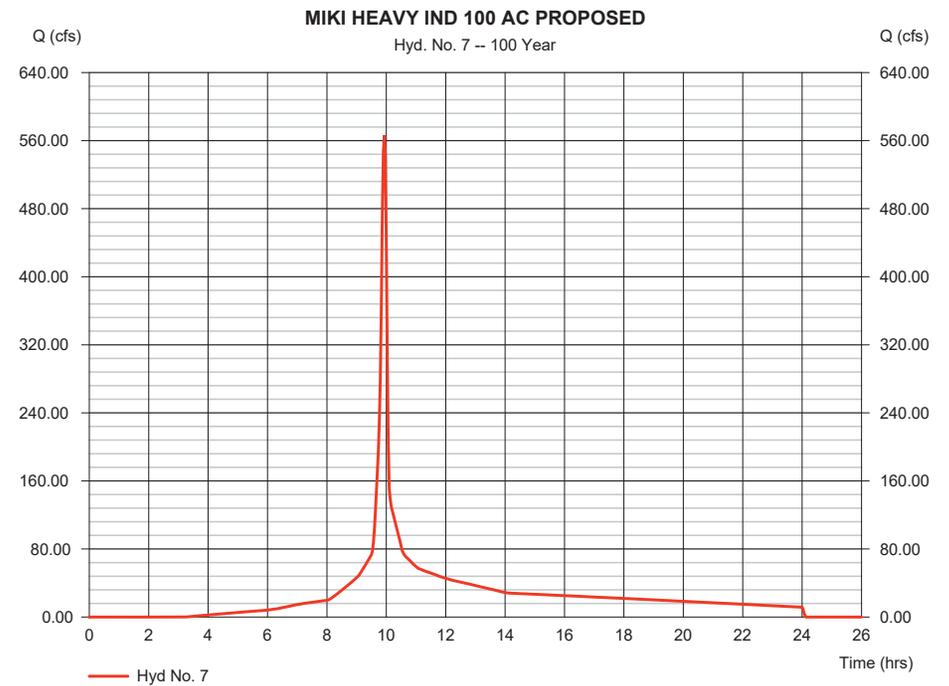
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Tuesday, 05 / 18 / 2021

Hyd. No. 7

MIKI HEAVY IND 100 AC PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 566.08 cfs
Storm frequency	= 100 yrs	Time to peak	= 9.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,427,091 cuft
Drainage area	= 100.000 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.20 min
Total precip.	= 9.86 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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

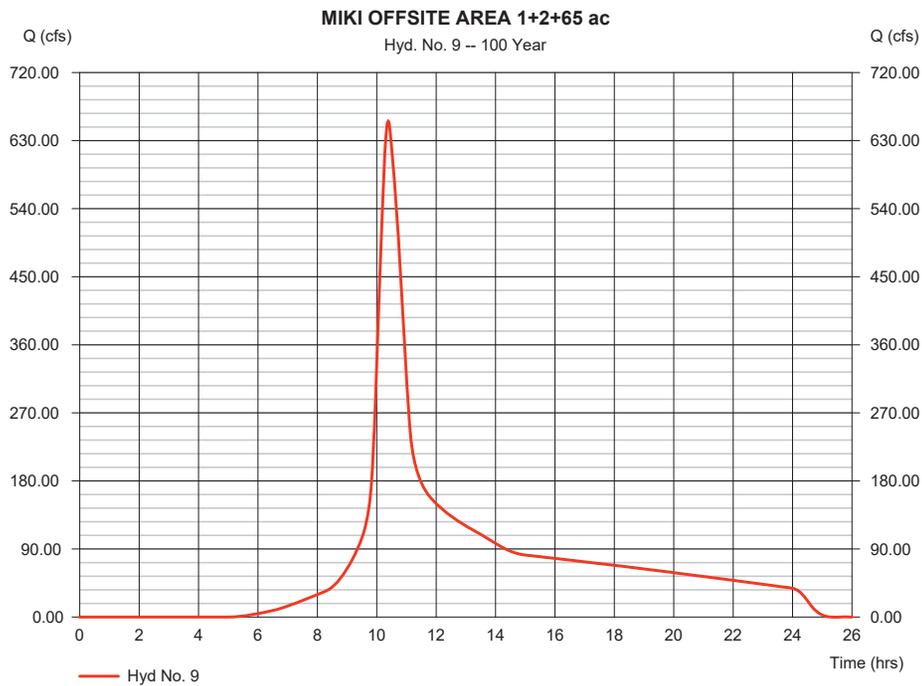
Thursday, 05 / 13 / 2021

Hyd. No. 9

MIKI OFFSITE AREA 1+2+65 ac

Hydrograph type	= SCS Runoff	Peak discharge	= 655.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 10.38 hrs
Time interval	= 1 min	Hyd. volume	= 6,519,391 cuft
Drainage area	= 308.950 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 48.50 min
Total precip.	= 9.86 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(243.950 x 65) + (65.000 x 78)] / 308.950



Hydrograph Report

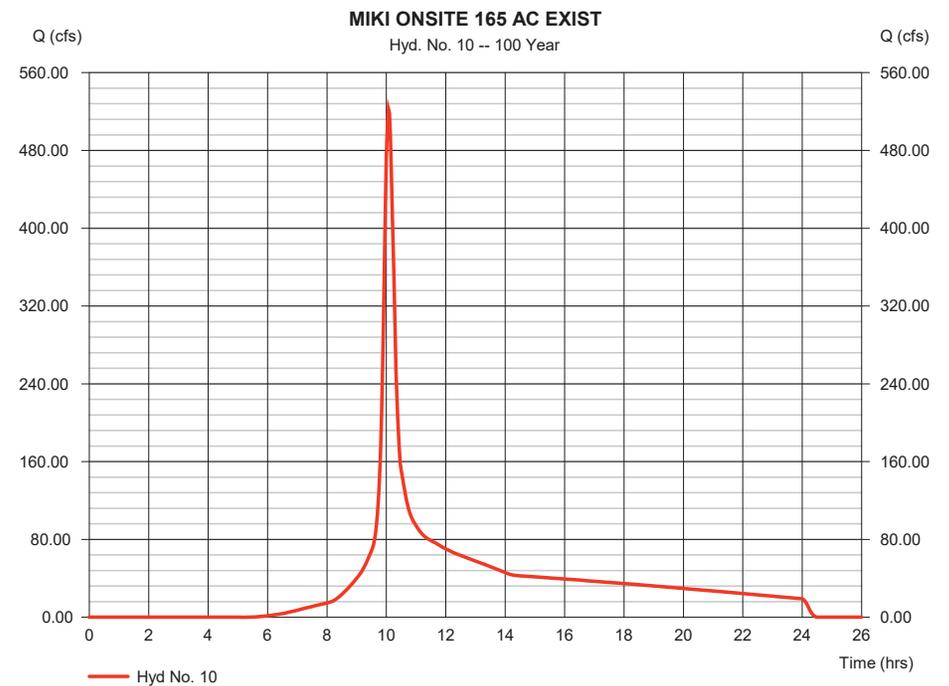
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Tuesday, 06 / 8 / 2021

Hyd. No. 10

MIKI ONSITE 165 AC EXIST

Hydrograph type	= SCS Runoff	Peak discharge	= 522.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 10.07 hrs
Time interval	= 2 min	Hyd. volume	= 3,261,255 cuft
Drainage area	= 165.000 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.00 min
Total precip.	= 9.86 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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

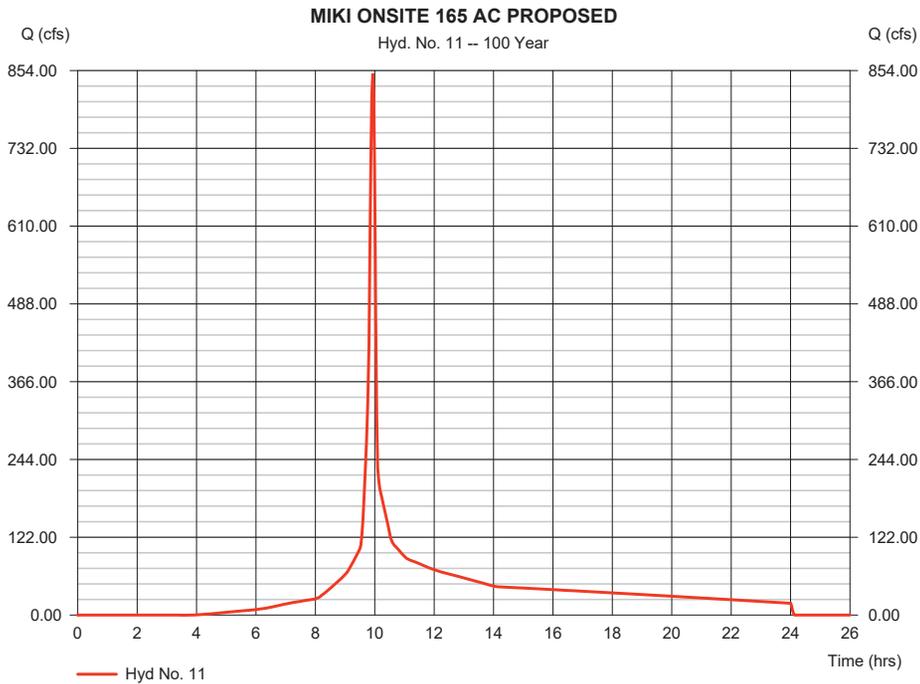
Tuesday, 05 / 18 / 2021

Hyd. No. 11

MIKI ONSITE 165 AC PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 849.46 cfs
Storm frequency	= 100 yrs	Time to peak	= 9.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,643,567 cuft
Drainage area	= 165.000 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 9.86 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(65.000 x 65) + (100.000 x 78)] / 165.000



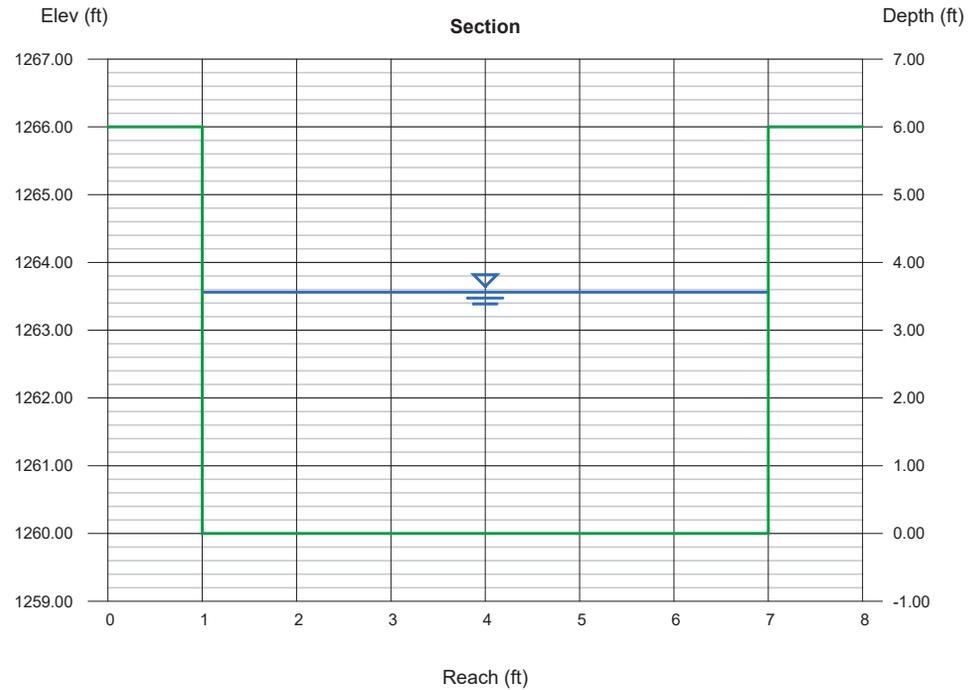
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, May 13 2021

6' X 6' Interceptor Ditch

Rectangular		Highlighted	
Bottom Width (ft)	= 6.00	Depth (ft)	= 3.56
Total Depth (ft)	= 6.00	Q (cfs)	= 337.70
Invert Elev (ft)	= 1260.00	Area (sqft)	= 21.36
Slope (%)	= 1.00	Velocity (ft/s)	= 15.81
N-Value	= 0.013	Wetted Perim (ft)	= 13.12
Calculations		Crit Depth, Yc (ft)	= 4.62
Compute by:	Known Q	Top Width (ft)	= 6.00
Known Q (cfs)	= 337.70	EGL (ft)	= 7.45



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, May 13 2021

6' X 7' Interceptor Ditch

Rectangular

Bottom Width (ft) = 6.00
Total Depth (ft) = 7.00

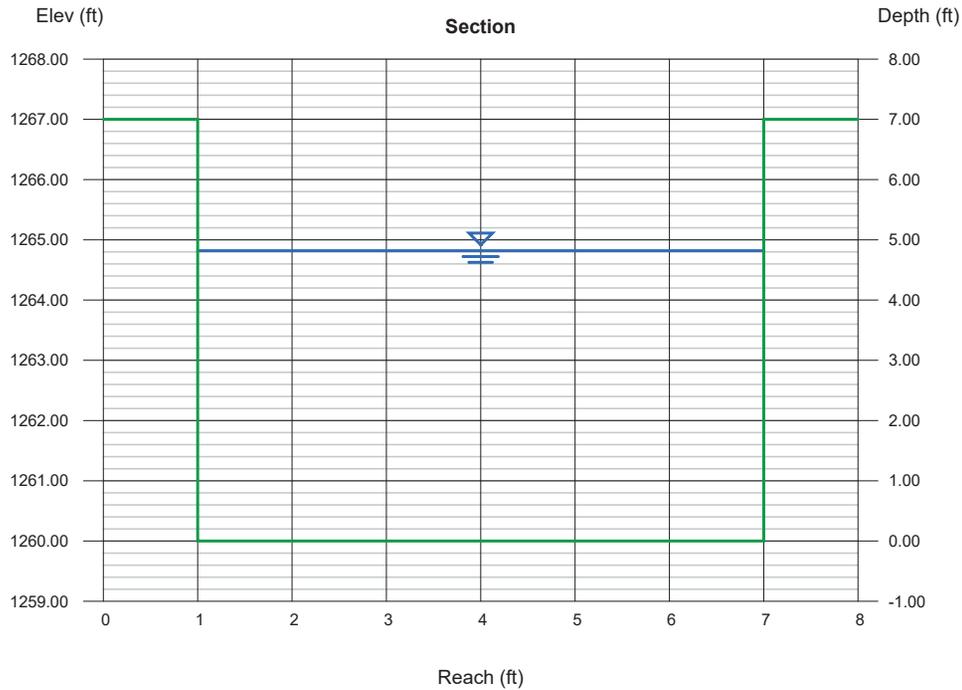
Invert Elev (ft) = 1260.00
Slope (%) = 1.00
N-Value = 0.013

Calculations

Compute by: Known Q
Known Q (cfs) = 497.05

Highlighted

Depth (ft) = 4.82
Q (cfs) = 497.05
Area (sqft) = 28.92
Velocity (ft/s) = 17.19
Wetted Perim (ft) = 15.64
Crit Depth, Yc (ft) = 5.98
Top Width (ft) = 6.00
EGL (ft) = 9.41



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, May 13 2021

8' X 8' Interceptor Ditch

Rectangular

Bottom Width (ft) = 8.00
Total Depth (ft) = 8.00

Invert Elev (ft) = 1210.00
Slope (%) = 1.00
N-Value = 0.013

Calculations

Compute by: Known Q
Known Q (cfs) = 603.13

Highlighted

Depth (ft) = 4.12
Q (cfs) = 603.13
Area (sqft) = 32.96
Velocity (ft/s) = 18.30
Wetted Perim (ft) = 16.24
Crit Depth, Yc (ft) = 5.62
Top Width (ft) = 8.00
EGL (ft) = 9.33

