## STORMWATER MANAGEMENT, GROUNDWATER RECHARGE AND WATER QUALITY ANALYSIS

For **RPM Development, LLC** 

## **Proposed Residential Development**

2495 Brunswick Pike (AKA Alt. Route 1) Block 2001, Lots 3, 60-66 & 68 Township of Lawrence Mercer County, New Jersey

Prepared by:



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### I. SITE DESCRIPTION

The project area is comprised of Block 2001, Lots 3, 60-66 & 68 in the Township of Lawrence, Mercer County, New Jersey. The property is located at 2495 Brunswick Pike (AKA Alt. Route 1). The proposed development consists of redeveloping the northern portion of the site which is currently mostly open space in order to construct a residential development consisting of three (3) multi-family three-story buildings and six (6) two-story duplexes for a total floor area of 87,283 SF with 102 parking spaces and associated driveways, landscaped areas, stormwater management facilities, and accompanying site amenities.

The southern portion of the lot is currently developed with the Lawrence Shopping Center and associated loading and parking areas. The northern portion of the lot was historically developed with a parking area and a man-made drainage ditch, and currently consists of mostly open space. There are wetlands along the northwestern property line, adjacent to Foch Avenue. Furthermore, the site is also located within a Flood Hazard Area and within the Delaware and Raritan Canal Review Zone B.

The property is bordered to the north by Texas Avenue with residential uses beyond, to the east and south by commercial uses with Brunswick Pike beyond, and to the west by wetlands with residential uses beyond.

The existing conditions of the tract have been verified by the Boundary and Partial Topographic Survey as prepared by Dynamic Survey, LLC, dated 06/06/2019.

### II. DESIGN OVERVIEW

This report has been prepared to define and analyze the stormwater drainage conditions that would occur as a result of the development of Block 2001, Lots 3, 60-66 & 68 in the Township of Lawrence, Mercer County, New Jersey.

The proposed development consists of redeveloping the northern portion of the site which is currently mostly open space in order to construct a residential development consisting of three (3) multi-family three-story buildings and six (6) two-story duplexes for a total floor area of 87,283 SF with 102 parking spaces with associated driveways, landscaped areas, stormwater management facilities, and accompanying site amenities.

Based upon the scope of the project, the development is classified as a major development as it increases the amount of impervious coverage onsite by more than ¼ acre; therefore, the project has been designed to meet the stormwater runoff quantity and quality standards set forth under N.J.A.C. 7:8. Accordingly, the following items are addressed within this report:

• Erosion control, groundwater recharge and runoff quantity standards (7:8-5.4)

- Stormwater runoff quality standards (7:8-5.5)
- Calculation of stormwater runoff and groundwater recharge (7:8-5.6)
- Standards for structural stormwater management measures (7:8-5.7)

The proposed development is exempt from the groundwater recharge requirements set forth by N.J.A.C. 7:8 due to the fact that the project is located within an "urban redevelopment area" as it is a previously developed portion of the Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM).

A hydrological evaluation is provided for the NJDEP Water Quality, 2, 10, and 100 year storm events utilizing the Urban Hydrology for Small Watershed TR55 method.

The Township of Lawrence and NJDEP peak flow reduction requirements are as follows:

2-year:	50% reduction
10-year:	25% reduction
100-year:	20% reduction

It is the intention of the design of this facility to comply with the Stormwater Management Best Management Practices.

### **III. EXISTING DRAINAGE CONDITIONS**

The tract has been evaluated with the following existing drainage sub-watershed areas as depicted on the Existing Drainage Area Map:

Existing Drainage Area South: This area of the tract consists of the southern portion of the development area. Runoff from the open space area and asphalt areas flow via overland flow and is ultimately tributary to the adjacent development on the southern side of the proposed development.

Existing Drainage Area Texas Avenue: This area of the tract consists of the northern portion of the development area adjacent to Texas Avenue, which includes an existing sidewalk. Runoff from the open space area and sidewalk areas flow via overland flow and is ultimately tributary to Texas Avenue.

Based on Mercer County soils survey information, the soil types native to the site include:

MERCI	ER COUNTY SOIL SURVEY INI	FORMATION
SOIL TYPE (SYMBOL)	SOIL TYPE (NAME)	HYDROLOGIC SOIL GROUP (HSG)
UdstB	Udorthents, stratified substratum, 0 to 8 percent slopes	D

### IV. PROPOSED DRAINAGE CONDITIONS

The tract has been evaluated with the following drainage sub-watershed areas as depicted on the Proposed Drainage Area Map:

Proposed Drainage Area South: This area of the tract consists of proposed parking and building areas. Runoff from this area is collected by the onsite stormwater conveyance system and is tributary to the underground detention basin located underneath the proposed parking area. Stormwater from the detention basin is routed through an outlet control structure and into a Contech Peak Diversion StormFilter Manufactured Treatment Device. Runoff from the Manufactured Treatment Device is tributary to the headwall and scour hole located to the east of the proposed retaining wall and is ultimately tributary to the existing man-made drainage ditch onsite, which flows off-site towards the adjacent existing development on the southern side of the proposed development.

<u>Proposed Drainage Area South Undetained</u>: This area of the tract consists of the southwestern and southern portions of the development area which are not collected by the proposed onsite stormwater conveyance system. Runoff from the open space area and sidewalk areas flows overland and is ultimately tributary to the adjacent existing development on the southern side of the proposed development, similar to existing conditions.

<u>Proposed Drainage Area Texas Avenue</u>: This area of the tract consists of open space and asphalt areas on the northern portion of the site. Runoff from this area is not collected by the onsite stormwater conveyance system and will sheet flow directly to the existing stormwater conveyance system located on Texas Avenue, similar to existing conditions.

### V. DESIGN METHODOLOGY

The intention of the proposed stormwater design is to provide measures as required to address applicable aspects of the Township of Lawrence Land Use Ordinance and N.J.A.C. 7:8. In order to prepare the stormwater calculations for the subject project, extensive initial investigation of the property and topography was performed.

On-site review of the tract was performed by Dynamic Engineering Consultants, PC to verify existing site conditions and land cover characteristics. Dynamic Survey, LLC, was contracted to prepare the Boundary and Partial Topographic Survey for the existing site. Furthermore, Dynamic Earth, LLC performed test pits within the site to establish the seasonal high water table.

Based on our review of the existing site conditions and the Boundary and Partial Topographic Survey, the Drainage Area Maps for the existing and proposed site conditions as defined within this report were established. A grading plan was developed for the proposed site improvements with the existing drainage patterns in mind. The plan was designed to ensure runoff from the proposed development could be directed to stormwater management facilities in order to address the applicable sections of the Township of Lawrence Land Use Ordinance and N.J.A.C. 7:8.

Under proposed conditions, the runoff from the proposed parking area will be collected via a series of inlets and is ultimately connected via an underground pipe network to the underground detention basin. The stormwater from the detention basin is routed through an outlet control structure and a Contech Peak Diversion StormFilter Manufactured Treatment Device. The Manufactured Treatment Device has been approved the by the NJDEP to remove 80% of the TSS generated by the water quality design storm for the study area, thereby satisfying the water quality aspect of N.J.A.C. 7:8.

All stormwater tributary to the proposed stormwater conveyance system is routed through an outlet control structure which discharges runoff at a controlled rate in order to satisfy the stormwater quantity requirements set forth by the Township Lawrence Land Use Ordinance and N.J.A.C. 7:8.

The proposed development is exempt from the groundwater recharge requirements set forth by N.J.A.C. 7:8 due to the fact that the project is located within and "urban redevelopment area" as it is a previously developed portion of the Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM).

The overall stormwater management report for the subject tract has been evaluated by Dynamic Engineering Consultants to ensure that the overall development satisfies the stormwater criteria set forth in the N.J.A.C. 7:8 and Township of Lawrence Land Use Ordinance.

### VI. RUNOFF RATE REDUCTION PERFORMANCE

Summary	for Point Of Analysis	s Northwest (Ex. Stu	dy Area South) PROPOSED
	EXISTING RUNOFF RATE (CFS)	PROPOSED RUNOFF RATE (CFS)	RUNOFF RATE REDUCTION (CFS)
2 Year	8.139	4.083	-4.056
10 Year	13.66	9.695	-3.965
100 Year	24.33	19.11	-5.110

### <u>Pre-Development and Post-Development Peak Runoff Results</u> Summary for Point Of Analysis Northwest (Ex. Study Area South

### <u>Pre-Development and Post-Development Peak Runoff Results</u> Summary for Point Of Analysis North (Ex. Study Area Texas Avenue)

<u>.</u>	EXISTING RUNOFF RATE (CFS)	PROPOSED RUNOFF RATE (CFS)	PROPOSED RUNOFF RATE REDUCTION (CFS)
2 Year	0.656	0.303	-0.353
10 Year	1.054	0.517	-0.537
100 Year	1.826	0.944	-0.882

### <u>Pre-development and Post Development Peak Runoff Results</u> <u>Summary for Total Site</u>

	EXISTING RUNOFF RATE (CFS)	REDUCTION REQUIREMENT	ALLOWABLE RUNOFF RATE (CFS)	PROPOSED RUNOFF RATE (CFS)
2 Year	8.795	50%	4.398	4.386
10 Year	14.71	25%	11.033	10.140
100 Year	26.15	20%	20.920	20.050

### VII. UNDERGROUND DETENTION BASIN SYSTEM DESIGN

As previously stated within this report, the stormwater management design utilizes one (1) underground stormwater detention basin and a proposed underground conveyance pipe system to satisfy the stormwater quantity regulations set forth by the Township of Lawrence Land Use Ordinance and N.J.A.C 7:8. Stormwater runoff from the proposed underground detention basin will be released at a controlled rate through an outlet control structure in order to satisfy the stormwater runoff quantity regulations set forth by the Township of

Lawrence Land Use Ordinance and N.J.A.C 7:8. Stormwater runoff from the basin will be discharged out of a headwall adjacent to the existing drainage ditch located on the northeastern portion of the site.

### VIII. WATER QUALITY

The TSS removal rate requirement set forth by the Township of Lawrence Ordinance and N.J.A.C. 7:8 is 80% for the newly proposed impervious coverage. The stormwater management design for the project satisfies this requirement by utilizing a Contech Peak Diversion StormFilter Manufactured Treatment Device certified by the NJDEP to provide a TSS removal rate of 80%. Therefore, the stormwater management facilities provide a TSS removal rate of 80% for the subject project, thereby, satisfying the water quality aspect of the Township of Lawrence Land Use Ordinance and N.J.A.C. 7:8.

### IX. GROUNDWATER RECHARGE

As was mentioned previously, the proposed development is exempt from the groundwater recharge requirements set forth by N.J.A.C 7:8 due to the fact that the project is located within and "urban redevelopment area" as it is a previously developed portion of the Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM). Therefore, no groundwater recharge measures are required as part of the proposed development.

### X. CONCLUSION

The proposed development has been designed with provisions for the safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns, adjacent roadways, or adjacent parcels.

The proposed stormwater management design incorporates a StormFilter Manufactured Treatment Device capable of 80% total suspended solid (TSS) removal as stated within the New Jersey Stormwater Best Management Practices Manual thereby satisfying NJAC 7:8 Water Quality Standards.

The proposed development is exempt from the groundwater recharge requirements set forth by N.J.A.C 7:8 due to the fact that the project is located within and "urban redevelopment area" as it is a previously developed portion of the Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM).

Furthermore, the stormwater management design shall reduce peak flow rates for the proposed development area and meets the minimum peak flow reduction for the 2, 10 and 100-year storm as dictated by N.J.A.C. 7:8. With this stated, it is evident that the proposed development will not have a negative impact on the existing

stormwater management system, water quality or groundwater recharge on site or within the vicinity of the subject parcel.

APPENDIX

# RUNOFF COEFFICIENT (CN) CALCULATIONS – EXISTING



# EXISTING DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER (CN) CALCULATIONS

	1C (Min.) 10	
	Total         Total Area         Total Area         TC (Mm.)           Pervious         (acres)         (sf)         (acres)         (	0004000
	Total Area (acres) 3.95	000
	Total Pervious Area (acres) 367	
	Curve Avg. Perv. Number Curve (CN) Used Number	
	Curve Number (CN) Used	
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	HSG D - Wooded Area (acre)	00'0
	Curve Number (CN) Used	20
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By: by:	Curve HSG D - Number Open CN) Used Space Area (acre)	20.02
Computed By: Checked By: Date:	Curve Number (CN) Used	50
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# RUNOFF COEFFICIENT (CN) CALCULATIONS – PROPOSED



# PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project:       Proposed Residential Development       Computed By:       TAZ         Job #:       1279-99-010       1279-99-010       Checked By:       LPG         Location:       Lawrence, NJ       Date:       9/29/2020         Tainage Area       Impervious       Curve       HSG D-       Open         Pron DA South (Basin)       172       74.822       98       0.25       10,886       80       80       00       10       10			
Proposed Residential Development     Computed By:       1279-99-010     1279-99-010     Checked By:       n:     Lawrence, NJ     Date:       rainage Area     Impervious Impervious     Curve     HSG D -     Proceed By:       Rainage Area     Impervious Impervious     Number     Open     Open     Avg. Perv.       Rainage Area     Impervious     Number     Open     Open     Number       Routh (Basin)     1.72     74.822     98     0.25     10,886     80     80		TC (Min.) 10	
Proposed Residential Development     Computed By:       1279-99-010     1279-99-010     Checked By:       n:     Lawrence, NJ     Date:       rainage Area     Impervious Impervious     Curve     HSG D -     Proceed By:       Rainage Area     Impervious Impervious     Number     Open     Open     Avg. Perv.       Rainage Area     Impervious     Number     Open     Open     Number       Routh (Basin)     1.72     74.822     98     0.25     10,886     80     80		Total Area (sf) 85,708.00	
Proposed Residential Development     Computed By:       1279-99-010     1279-99-010       n:     Lawrence, NJ       n:     Lawrence, NJ       rainage Area     Impervious Impervious       Area (st)     Number       Area (st)     Number       (CN) Used     Space Area       (Space Area     Space Area       (Space Area     (Space Area       (St)     (Sf)       (Sf)     (Sf)		Total Area (acres) 1.97	
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HYDROGRAPH SUMMARY REPORTS – EXISTING AND PROPOSED CONDITIONS 2 YR. 10 YR. & 100 YR.

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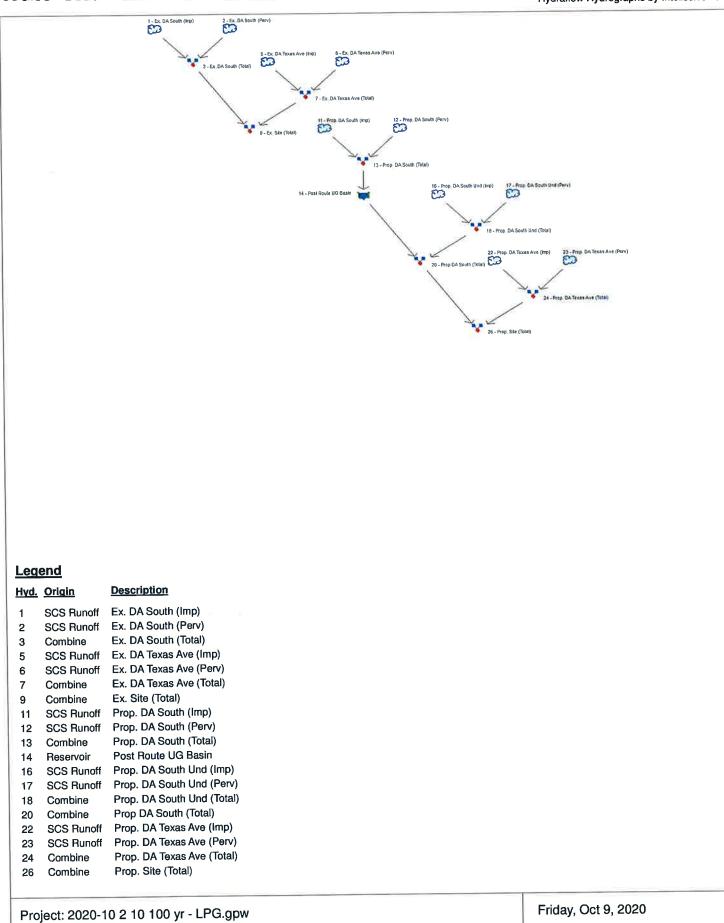
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# Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.1



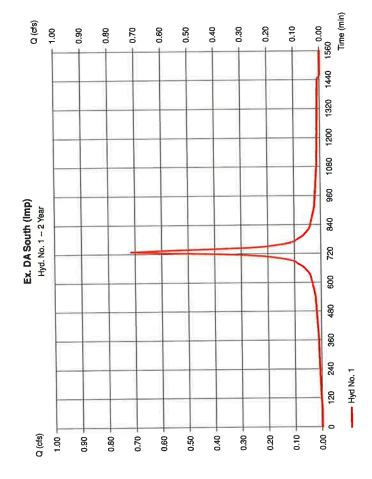
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Hydrograph description	Ex. DA South (Imp)	Ex. DA South (Perv)	Ex. DA South (Total)	Ex. DA Texas Ave (Imp)	Ex. DA Texas Ave (Perv)	Ex DA Texas Ave (Total)	Ex. Site (Total)	Prop. DA South (Imp)	Prop. DA South (Perv)	Prop. DA South (Total)	Post Route UG Basin	Prop. DA South Und (Imp)	Prop. DA South Und (Perv)	Prop. DA South Und (Total)	Prop DA South (Total)	Prop. DA Texas Ave (Imp)	Prop. DA Taxas Ave (Perv)	Prop. DA Texas Ave (Total)	Prop. Site (Total)	
Total strge used (cuft)	I	1	l	1	I	l	1	1	1	Į	6,486	1	Ĭ	I	1	1	1	I	I	
Maximum elevation (ft)	l	1	ļ			I	1	l	1000	1	60.46	l	I	l	1	1	1	I		
Irrflow hyd(s)	ŧ	I	1,2	Ľ	1	5,6	3, 7,	I)	4	11, 12	ŧ	Ĩ	I	16, 17	14, 18,	<u>)</u>	I	ន នាំ	20, 24,	
Hyd. volume (cuft)	2,932	27,255	30,187	1,361	1,188	2,550	32,736	18,011	1,265	19,276	19,268	3,875	8,805	12,680	31,948	733	455	1,188	33,137	
Time to peak (min)	730	062	730	230	230	730	062	730	730	730	750	730	730	730	730	730	067	730	730	
Time Interval (min)	w	ŝ	ŝ	9	6	v	ŝ	ŝ	ŝ	6	ыл. С	ŝ	ND.	ND.	2	ŝ	ŝ	ŝ	- 50	
Peelk flow (cfs)	0.715	7.424	8.139	0.332	0.324	0.656	8.795	4.392	0.346	4.738	1.577	0.945	2.407	3.352	4.083	0.179	0.124	0.303	4.386	
Hydrograph type (ortgin)	SCS Runoff	SCS Runoff	Combine	SCS Runoff	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runoff	Combine	Reservoir	SCS Runoff	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runott	Combine	Combine	
₽. ₽.2	-	N		ŝ		۲	o,	÷	면	ų	4	16	17	18	8	ន	ន	54	8	_

e v9.1																						
2 Hydraflow Hydrographs by Intelisotive v9.1	Hydrograph	uondusseo	Ex. DA South (Imp)	Ex. DA South (Perv)	Ex. DA South (Total)	Ex. DA Texas Ave (Imp)	Ex. DA Texas Ave (Perv)	Ex. DA Texas Ave (Total)	Ex Sille (Total)	Prop. DA South (Imp)	Prop. DA South (Perv)	Prop. DA South (Total)	Post Route UG Basin	Prop. DA South Und (Imp)	Prop. DA South Und (Perv)	Prop. DA South Und (Total)	Prop DA South (Total)	Prop. DA Texas Ave (Imp)	Prop. DA Texas Ave (Perv)	Prop. DA Texas Ave (Total)	Prop. Site (Total)	
1		100-Yr	1.818	22.51	24.33	0.844	0.981	1.826	26.15	11.17	1.360	12.53	0.731	2.403	9.467	11.87	19.11	0.455	0.490	0.944	20.05	
		50-Yr		ł	ļ	ł	Į				l	1	l			1	ł	1		l	1	-
		가	1				1			1				ļ		1	I			ļ	1	
٩	owr (cfla)	10-Yr	1.090	12.57	13.66	0.506	0.548	1.054	14.71	6.633	0.679	7.372	4.670	1.440	4.723	6.163	3,695	0.272	0244	0.517	10,14	
leca	Peak Outflow (cfs)	5.41	1	1					1	!				I			l		İ			
od F		3-Yr	1				1		l		l	1		ļ		1	I	1		1	Ĩ	
Peri		2-Yr	0.715	7.424	8.139	0.332	0.324	0.656	8.795	4.392	0.346	4.738	1.577	0.945	2.407	3.352	4.083	0.179	0.124	0.303	4.386	
turn		1-Yr	1		1				ļ		1	ļ	1	1				l	ł		ł	
h Re	Inflow	Hyd(s)	1	1	1,2		1	5,6	3, 7,		1	11, 12	13			16, 17	14, 18,	1	I	ន ដ	20, 24,	
Hydrograph Return Period Recap	Hydrograph	type (origin)	SCS Runoff	SCS Runoff	Combine	SCS Runott	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runoff	Combine	Reservoir	SCS Runoff	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runoff	Combine	Combine	
Š	WH	ź	-	~	e	<b>س</b>	9	~	თ	ŧ	₽	5	4	ų	: 1	18	ន	8	8	25	28	

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Hydraflow Hydrographs by Intelisolve v9.1	isolve v9.1		Friday, Oct 9, 2020
Hyd. No. 1			
Ex. DA South (Imp)			
Hvdrograph type =	= SCS Runoff	Peak discharge	
	= 2 Vrs	Time to peak	
Time interval	= 5 min	Hyd. volume	= 2,932 cuft
Drainade area =	= 0.280 ac	Curve number	= 98
Basin Shine =	= 0.0 %	Hydraulic length	II
Tc method =	= USER	Time of conc. (Tc)	"
Total precip.	= 3.31 in	Distribution	= Custom
Storm duration =	NOAA Atlas 14 Type-C.cds	Shape factor	= 484



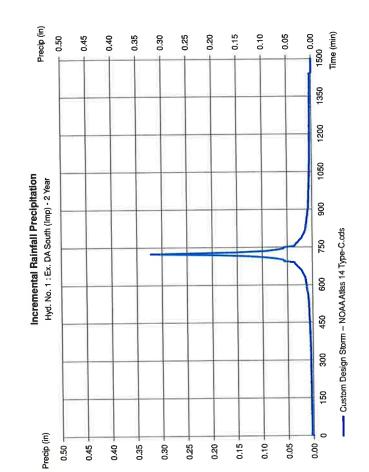
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Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 1

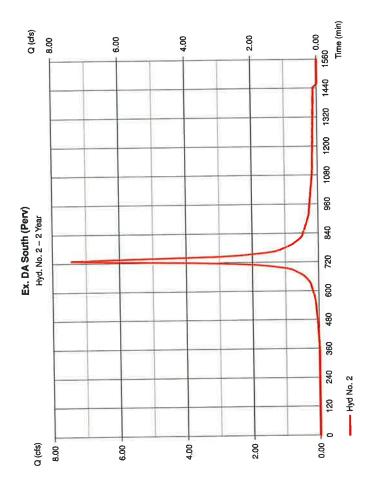
	F	
	= 5 min = Custom	
	Time interval Distribution	
	= 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds	
Ex. DA South (Imp)	Storm Frequency Total precip. Storm duration	



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Hydraftow Hydrographs by Intellsofve v9.1	telisofve v9.1		Friday, Oct 9, 2020
Hyd. No. 2			
Ex. DA South (Perv)	(		
Undroation time	- SCS Bunnff	Peak discharge	= 7.424 cfs
Chorm fragmancy	- 2 Vrs	Time to peak	= 730 min
Time interval	- 5 min	Hyd. volume	= 27,255 cuft
Drainada area	- 3.670.36	Curve number	= 89
Drainaye area	- 0.0%	Hydraulic length	= 0 ft
		Time of conc. (Tc)	= 10.00 min
		Distribution	= Custom
total precip.		Shane factor	- 484
Storm duration	= NOAA Atlas 14 Lype-C.cos	Oliape lacio	2

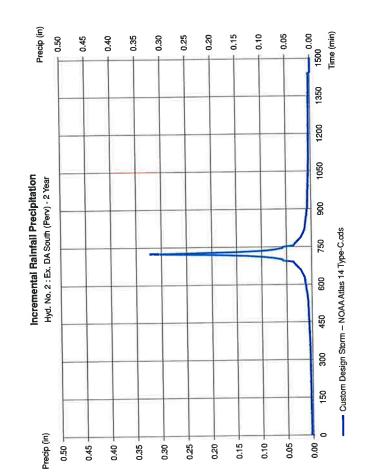


Precipitation Report	Hydraflow Hydrographs by Intelfsolve v9.1

Friday, Oct 9, 2020

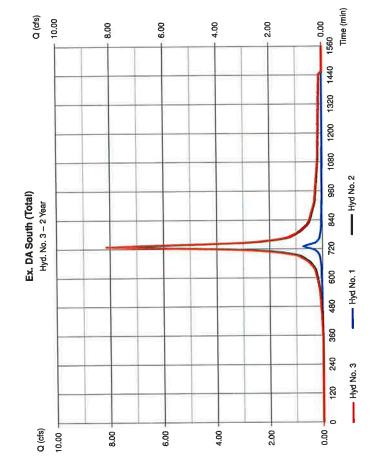
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		5 min Custom
		= 5 = Cus
		Time interval Distribution
		= 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds
Hyd. No. 2	Ex. DA South (Perv)	Storm Frequency Total precip. Storm duration



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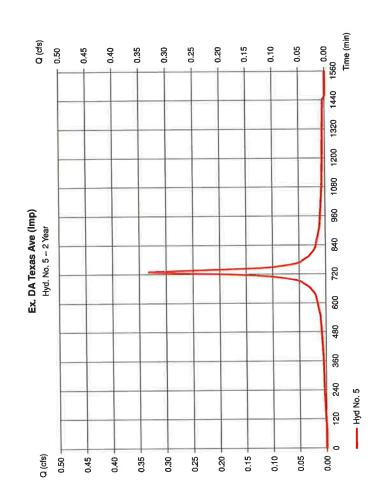
	Friday, Oct 9, 2020			Peak discharge = 8.139 cfs Time to peak = 730 min Hyd. volume = 30,187 cuft Contrib. drain. area = 3.950 ac
Hydrograph Report	Hydraflow Hydrographs by Intelisolve v9.1	Hyd. No. 3	Ex. DA South (Total)	Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 1, 2



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Hydraflow Hydrographs by Intellisolve v9.1 Hvvd No. 5

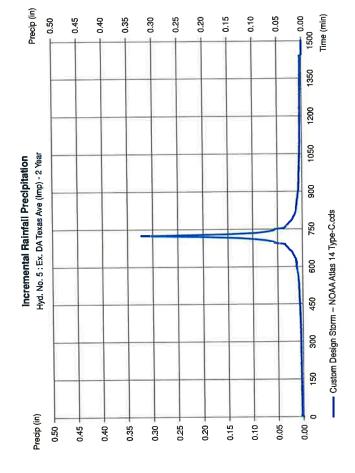
= 0.332 cfs = 730 min = 1,361 cuft = 98 0 = 01 c0 = 10.00 min = 484	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor
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Precipitation Report Hyda No. 5 Ex. DA Texas Ave (Imp) Storm Frequency = 2 yrs	Report solve v8.1 np) = 2 yrs	Time interval	5. min
Total precip. Storm duration	<ul> <li>= 3.3100 in</li> <li>= NOAA Atlas 14 Type-C.cds</li> </ul>	Distribution	= Custom



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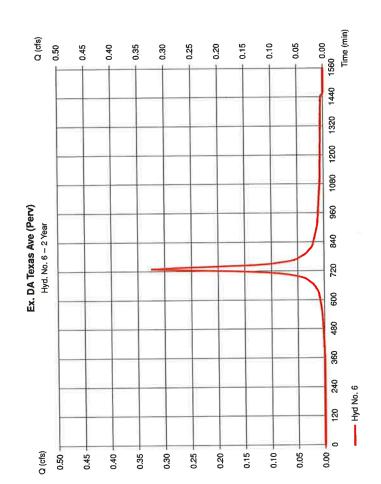
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Friday, Oct 9, 2020

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Hyd. No. 6			
Ex. DA Texas Ave (Perv)	(Perv)		
Hydrograph type Storm frequency Time interval Drainage area Basin Slope Basin Slope Total precip. Storm duration	<ul> <li>= SCS Runoff</li> <li>= 2 yrs</li> <li>= 5 min</li> <li>= 0.160 ac</li> <li>= 0.0 %</li> <li>= USER</li> <li>= 3.31 in</li> <li>= NOAA Attas 14 Type-C.cds</li> </ul>	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	<ul> <li>0.324 cfs</li> <li>7.30 min</li> <li>1,188 cuft</li> <li>1,188 cuft</li> <li>89</li> <li>0 ft</li> <li>10.00 min</li> <li>484</li> </ul>



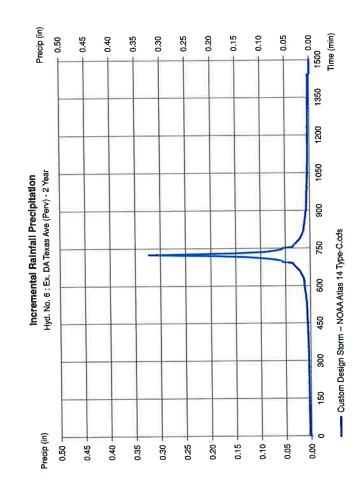
Precipitation Report

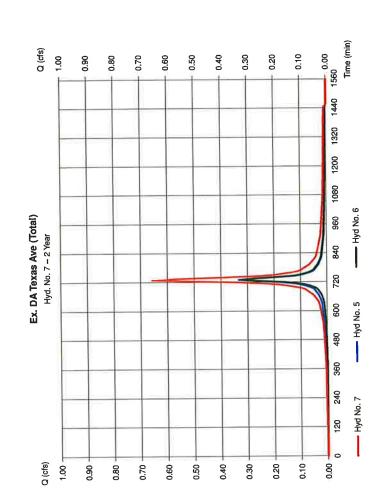
Hydraftow Hydrographs by Intellsolve v9.1		Friday, Oct 9, 2020
Hyd. No. 6		
Ex. DA Texas Ave (Perv)		
Storm Frequency = 2 yrs Total precip. = 3.3100 in Storm duration = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom

Hydrograph Report

12

Friday, Oct 8, 2020			Peak discharge = $0.656$ cfs Time to peak = 730 min Hyd. volume = $2.550$ cuft Contrib. drain. area = $0.290$ ac
Hydraflow Hydrographs by Intelfsoive v9.1	Hyd. No. 7	Ex. DA Texas Ave (Total)	Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 5, 6

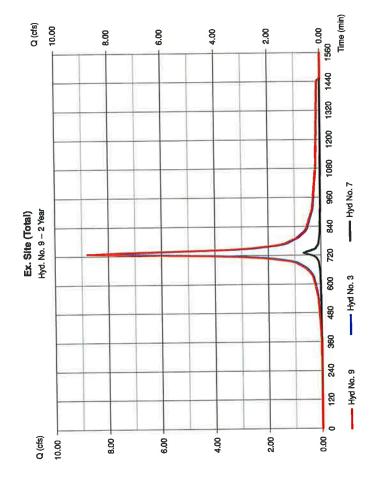




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	Peak discharge = 8.795 cfs Time to peak = 730 min Hyd, volume = 32.736 cuft Contrib. drain. area = 0.000 ac
Ex. Site (Total)	Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 3, 7



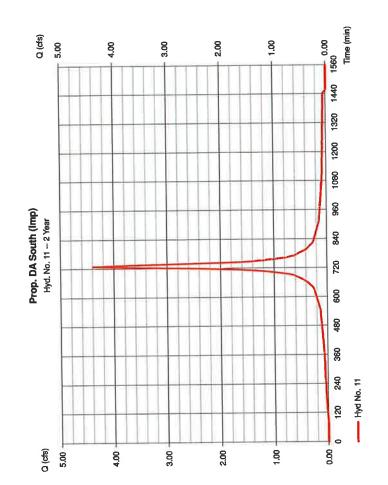
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Friday, Oct 9, 2020

# ograph Report Hydraflow Hydrographs by Intellsolve v9.1

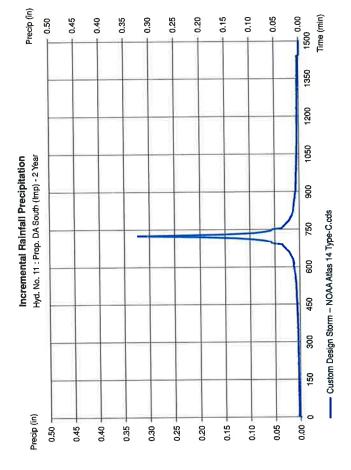
	Peak discharge = 4.392 cfs Time to peak = 730 min Hyd. volume = 18,011 cuft Curve number = 98 Hydraulic length = 0 ft Time of conc. (To) = 10.00 min Distribution = 6.0stom Shape factor = 484
	Part Hydrogen Him Sister Hydrogen Hydrogen Hydrogen Hydrogen Hydrogen Hydrogen Hydrogen Hydrogen Hydrogen Hydro
(dı	<ul> <li>SCS Runoff</li> <li>2 yrs</li> <li>5 min</li> <li>1.720 ac</li> <li>0.0 %</li> <li>USER</li> <li>3.31 in</li> <li>NOAA Attas 14 Type-C.cds</li> </ul>
<b>Hyd. No. 11</b> Prop. DA South (Imp)	Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration



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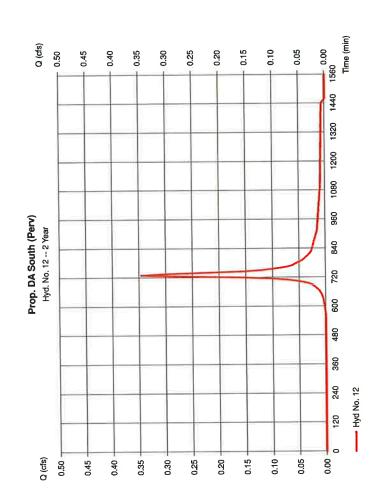
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<b>Precipitation Report</b>	n Report		
Hydraflow Hydrographs by Intellsolve v9.1	italisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 11			
Prop. DA South (Imp)	(dı		
Storm Frequency Total precip. Storm duration	= 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom



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Hydrograph Report	ort		:
Hydraflow Hydrographs by Intelisolve v9.1	5		Friday, Oct 9, 2020
Hyd. No. 12			
Prop. DA South (Perv)			
	= SCS Bunoff	Peak discharge	= 0.346 cfs
Shim fragmency = 2 VIS		Time to peak	= 730 min
		Hyd. volume	= 1,265 cuft
"	Q	Curve number	1
Basin Slope = 0.0 %		Hydraulic length	= 0 ft
"		Time of conc. (Tc)	-
Total precip. = 3.31 in		Distribution	= Custom
u =	VOAA Atlas 14 Type-C.cds	Shape factor	= 484



**Precipitation Report** 

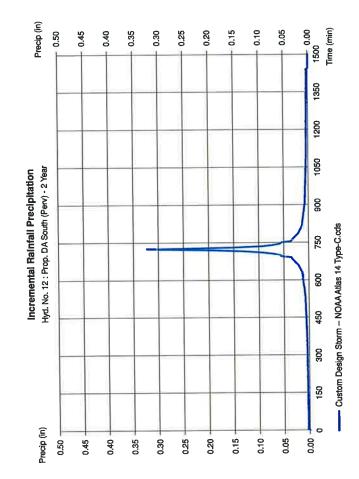
Hydraflow Hydrographs by Intellsolve v9.1	fisoiva v9.1		Friday, Oct 9, 2020
Hyd. No. 12			
Prop. DA South (Perv)	v)		
Storm Frequency Total precip. Storm duration	= 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom

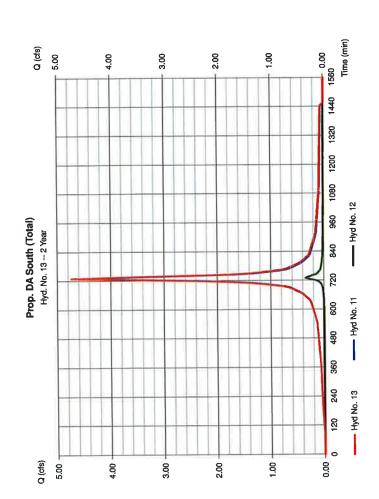
Hydrograph Report Hydrafiow Hydrographs by Intelisoive v9.1

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Hyd. No. 13

	Peak discharge = 4.738 cfs Time to peak = 730 min Hyd. volume = 19,276 cuft Contrib. drain. area = 1.970 ac
Prop. DA South (Total)	Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 11, 12

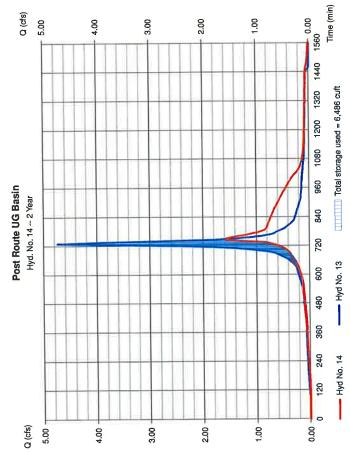




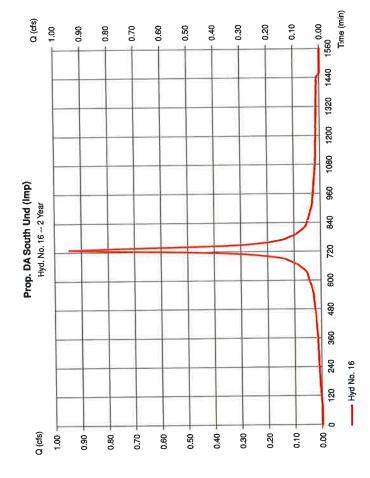
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20	Pond	Pond Report	t											3
Friday, Oct 9, 2020	Hydraflow Hyd Pond No. <sup>-</sup> Pond Data Ug Chembers	Hydraflow Hydrographs by Intelisione v3.1 Pond No. 1 - UG Det Basin Pond Data Ug Chembers - Inven elev. = 58.00 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 230.00 ft, No. Barrels = 6, Stope = 0.00%, Headers = Yes	et Basin : = 59.00 ft,	9.1 Pise x Span	= 3.00 × 3.00	ft, Barre	4 Len = 230.0	0 Å, No.	Barreis = 8,	Stope = 0	× %00.	Frida	Friday, Oct 9, 2020 ders = Yes	2020
1.577 cfs	Stage / S Stage (ft)	Stage / Storage Table Stage (tt) Elevati	Table Elevation (ft)	Contour	Contour area (sqft)	Incr. 9	Incr. Storage (cutt)		Total storage (cuft)	(cuft)				
750 min 19,268 cuft 30,466 cuft 3,486 cuft	0.00 0.90 0.90 0.90 0.90 2.40 2.40 2.40 2.40 2.40 2.40 2.40 2.4	88888888888888888888888888888888888888	200 200 200 200 200 200 200 200 200 200	555555555555555555555555555555555555555	년 년 년 년 11년 11년 11년 11년 11년 11년 11년 11년		0 7022 1,484 1,708 1,535 1,708 1,219 1,219 701		0 702 5,042 5,042 8,750 8,750 8,750 11,576 11,576 11,576 13,497					
	Culvert /	Culvert / Orifice Structures	uctures			S	Weir Structures	ures						Ê
		[A]		[c] [a]	[PrfRsr]	-			[A]	[8]	ច	ē		
G (cfs)	Rise (m) Span (m) No. Barnet Inwert EI. (ft) Langth (ft) Slope (%) N-Value Ortflos Coeff. Muth:Stage	8 8 8 8 8 8 8 8 8 8 00 - 00 0 - 0 - 0 - 0	40-00040>	4.00 5.00 6.00 44.00 1 1 1 55.00 50.30 0.00 0.00 0.013 0.013 0.66 0.00 0.66 2.60 Yes Yes	0.00 0.00 0.00 0.00 0.00 0.00 N/r N/r N/r N/r	00323 01	Creat Len (ft) Veir Coeff. Weir Type Muth-Stage Luth-Stage Exfil.((in/hr) TW Elev. (ft)	# 0.50 # 60.80 # 3.33 # Rect # Rect # Yes # 0.000 # 0.000	= 0.50 0.00 = 60.80 0.00 = Rect = Yes No = 0.00 (by Contour) = 0.00	0.00 0 0.00 0 3.333 3 3.333 3 3.333 3 3.333 3 3.33 0.00 0 No No No	0000 8000 8000 8000 8000 8000 8000 800	0000 E   2		P
4.00	Stage / S Stage	News: Cu/ Stage / Storage / Discharge Table Stage Storage Elevation Ch. ft cuft ft disc	scharge Elevation ft	Nens: Chiver Confinera unativanse arran a una lorade (oco) control. Meni franca a franca do data a automorporca fro 1780-16 Cav A Civ B Civ C P-1781sar Wir A Wir B Wir C Wir D Exami Usener Todal Cas A cis		relyzed unde CCN C cfs	⊭intet(ic)andou Priffar ¥ cfs c	whet (oc) com Wr A cfs	Werman Werman	wr C V ds cis	Wr D I		Clarer Cfs	cha l
3.00	0.00 0.30 0.30 0.80 0.80 1.50 1.50 2.21 2.21 2.21 3.00	0 702 3,407 5,442 6,750 6,750 6,750 11,5092 11,5092 11,5092 11,5092 11,5092 13,497	59.00 59.30 59.30 59.30 59.30 60.20 60.20 61.40 61.40 61.70 61.70	0.00 0.29 ic 0.51 ic 0.51 ic 0.67 ic 2.02 ic 6.98 cc 6.98 cc 6.98 cc 10.46 cc	0.28 0.28 0.28 0.28 0.28 0.28 0.28 0.28	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	1	21427			1111111111			0.00 0.51 0.53 0.65 0.73 0.65 10.38 0.73 12.11 10.38

Hydraflow Hydrographs by Intellsofve v9.1	Intelisorve v9.1		Friday,
Hyd. No. 14			
Post Route UG Basin	asin		
Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name	<ul> <li>Reservoir</li> <li>2 yrs</li> <li>5 min</li> <li>13 - Prop. DA South (Total)</li> <li>UG Det Basin</li> </ul>	Peak discharge Time to peak Hyd, volume Max, Elevation Max, Storage	= 1.577 c = 750 mi = 19,268 = 60.46 f = 6,486 c
Storage Indication method used.	l used.		



Hydrograph Report		
Hydratiow Hydrographs by Intellective v9.1		Friday, Oct 9, 2020
Hyd. No. 16		
Prop. DA South Und (Imp)		
Hvdrooraph type = SCS Runoff	Peak discharge	= 0.945 cfs
Storm fragments = 2 vrs	Time to peak	
	Hyd. volume	= 3,875 cuft
11 CC	Curve number	ш
Basin Slope = $0.0\%$	Hydraulic length	= 0 11
Tc method = USER	Time of conc. (Tc)	ш
Total precip. = 3.31 in	Distribution	= Custom
Storm duration = NOAA Atlas 14 Type-C.cds	Shape factor	= 484



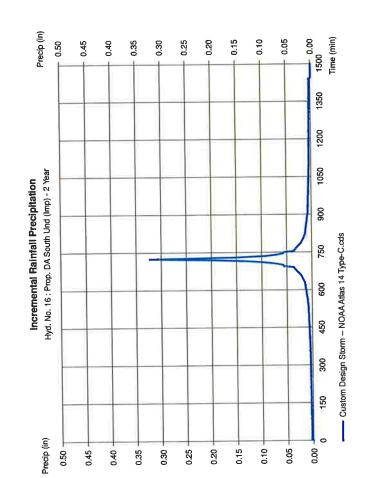
n Report	elisotve v9.1
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Precipi	Hydraflow Hydro

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	Time interval Distribution
(dul) pi	= 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds
Prop. DA South Und (Imp)	Storm Frequency Total precip. Storm duration

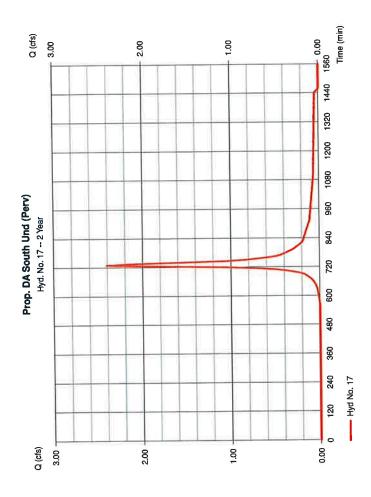
= 5 min = Custom



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Hyd. No. 17 Prop. DA South Und (Perv)

	fs	_	Ľ,			nin	_		
	= 2.407 cfs	= 730 min	= 8,805 c	= 80	= 0 ft	= 10.00 min	= Custom	= 484	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor	
d (Perv)	- SCS Bunoff	= 2 Vrs	= 5 min	= 1.740 ac	- 00%	= USER	= 3.31 in	= NOAA Atlas 14 Type-C.cds	
Prop. DA South Und (Perv)	Hudrograph time	Storm frequency	Time interval	Drainane area	Bacin Slone	Tc method	Total nrecin	Storm duration	



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Friday, Oct 9, 2020

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 Precipitation Report

 Friday, Cot 9, 2020

 Time interval

 = 5 min

 Friday, Cot 9, 2020

 Time interval

 = 5 min

 Friday, Cot 9, 2020

 Time interval

 = 5 min

 Friday, Cot 9, 2020

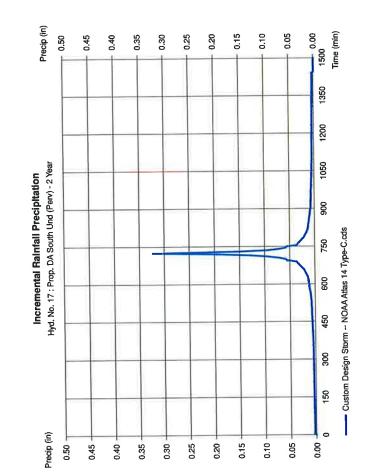
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 Friday, Cot 9, 2020

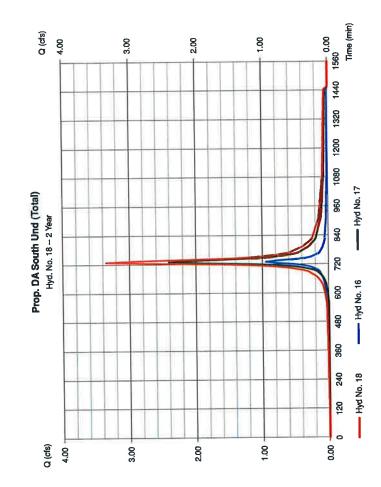
 Time interval

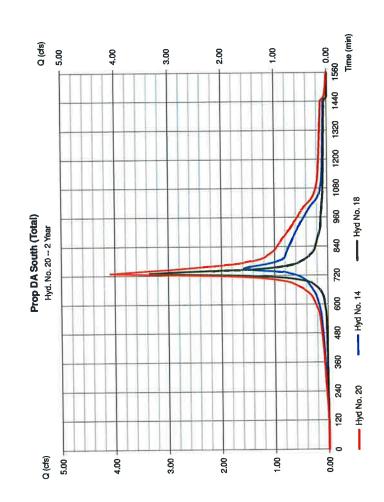
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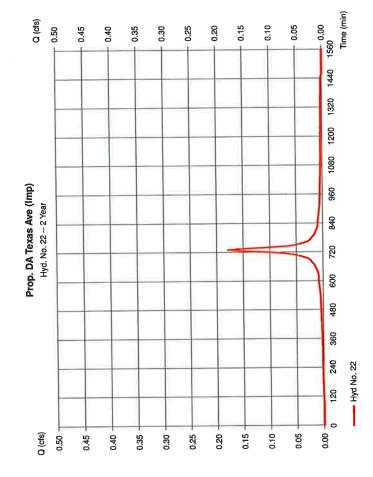
Hydraftow Hydrographs by Intellacive v8.1	Friday, Oct 9, 2020
Hyd. No. 18	
Prop. DA South Und (Total)	
Hvdrowanh two = Combine	Peak discharge = 3.352 cfs
	Time to peak = 730 min
	Hyd. volume = 12,680 cuft
) <del>-</del>	Contrib. drain. area = 2.110 ac

Hydrograph Report	
lydratiow Hydrographs by Intelfsolve v9.1	Friday, Oct 9, 2020
Hyd. No. 20	
Prop DA South (Total)	
Hydrograph type = Combine	Peak discharge = 4.083 cfs Time to peak = 730 min
Time interval = 5 min Time interval = 5 min Inflow hyds. = 14, 18	Hyd. volume = 31,948 cuft Contrib. drain. area = 0.000 ac



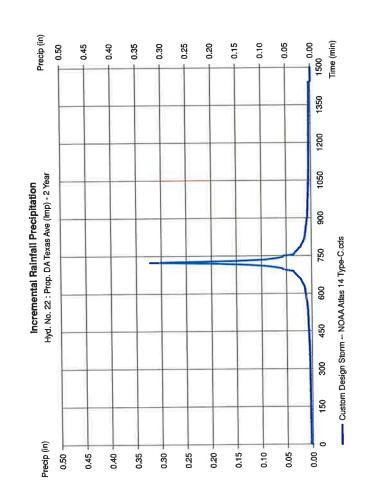


	-		
Hydraflow Hydrographs by Intellsolve v9.1	Intelisoive v9.1		Friday, Oct 9, 2020
Hyd. No. 22			
Prop. DA Texas Ave (Imp)	vе (Ітр)		
Hvdrooranh tvne	= SCS Bunoff	Peak discharge	= 0.179 cfs
Storm frequency	= 2 VIS	Time to peak	= 730 min
Time interval	= 5 min	Hyd. volume	= 733 cuft
Drainade area	= 0.070 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Te method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.31 in	Distribution	= Custom
Storm duration	= NOAA Atlas 14 Type-C.cds	Shape factor	= 484



1	Friday, Oct 9, 2020			2 yrs Time interval = 5 min 3.3100 in Distribution = Custom NOAA Atlas 14 Tyne-C.cds
Repor	elisolve v9.1		(lmp)	= 2 yrs = 3.3100 in = NOAA Atla
<b>Precipitation Report</b>	lydraflow Hydrographs by Intellisolve v9.1	Hyd. No. 22	Prop. DA Texas Ave (Imp)	Storm Frequency Total precip.

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Hvdrodraph Report

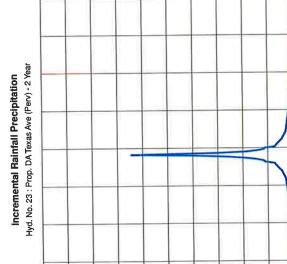
Hydraflow Hydrographs by Intelisolve v9.1	Intelisoive v9.1		
Hyd. No. 23			
Prop. DA Texas Ave (Perv)	/e (Perv)		
Hvdrooraph type	= SCS Runoff	Peak discharge	6
Storm frequency	= 2 yrs	Time to peak	Ш
Time interval	= 5 min	Hyd. volume	H
Drainade area	= 0.090 ac	Curve number	II
Basin Slope	= 0.0 %	Hydraulic length	U
Tc method	= USER	Time of conc. (Tc)	Ц
Total precip.	= 3.31 in	Distribution	11
	NOAA Atlact A Trace Code	Shane factor	11

1	Q (cfs) 0.50	0.45	0.40	0.35	0.30	0.25
= 0.124 cfs = 730 min = 455 cuft = 80 = 0.1t = 10.00 min = 484	-					
Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	ve (Perv) 'Year					
	Prop. DA Texas Ave (Perv) Hyd. No. 23 2 Year					
Hydrograph type = SCS Storm frequency = 2 yrs Time interval = 5 m Drainage area = 0.05 Basin Slope = 0.0 To method = 0.0 Total predp. = 3.31 Storm duration = NO/	Q (cfs)	0.45	0.40	0.35	0:30	0.25

Precip (in)

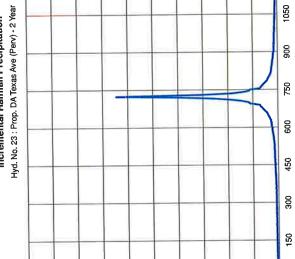
0.50

0.45 0.40 0.35 0.30 0.25 0.20 0.15



Precip (in)

0.50 0.45 0.40 0.35 0.30 0.25 0.20



1500

1350

1200

Custom Design Storm -- NOAA Atlas 14 Type-C.cds

0

Time (min) → 0.00 1560

1320 1440

1200

1080

096

840

720

600

480

360

240

0

0.00

0.05

0.10

Hyd No. 23 120

0.00

0.10 0.05

0.05

0.15 0.10

0.15

0.20

0.20

0.15 0.10 0.05 Time (min)

**Precipitation Report** 

Hydrafiow Hydrographs by Intelisolve v9.1 Hyd. No. 23

Friday, Oct 9, 2020

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Prop. DA Texas Ave (Perv)

Time interval Distribution = 2 yrs = 3.3100 in = NOAA Atlas 14 Type-C.cds Storm Frequency Total precip. Storm duration

= 5 min = Custom

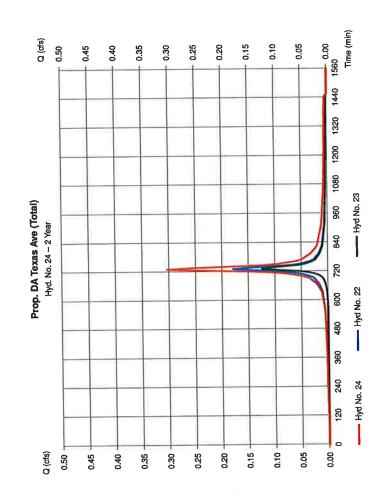
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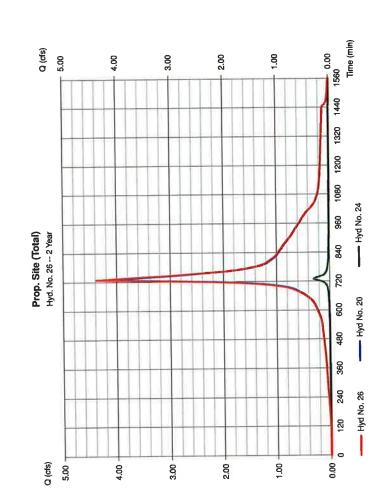
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				Peak dischar Time to peak Hyd. volume Contrib. drair
Hydrograph Report	Hychaflow Hychographs by Imalisolve v9.1	Hyd. No. 24	Prop. DA Texas Ave (Total)	Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 22, 23

	Peak discharge = 0.303 cfs Time to peak = 730 min Hyd. volume = 1,188 cuft Contrib. drain. area = 0.160 ac
Texas Ave (Total)	ph type = Combine quency = 2 yrs rval = 5 min ds. = 22, 23

6	Friday, Oct 9, 207		Peak discharge = 4.386 cfs Time to peak = 730 min Hyd. volume = 33,137 cuft Contrib. drain. area = 0.000 ac
Hydrograph Report	tycicatiow Hychographs by Intellisofve v9.1	26 <sup>drail</sup>	= Combine = 2 yrs = 5 min = 20, 24
Hydrogr	Hydrafiow Hydrogra	Hyd. No. 26 Prop Site (Total)	Hydrograph type Storm frequency Time interval Inflow hyds.





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Friday, Oct 9, 2020

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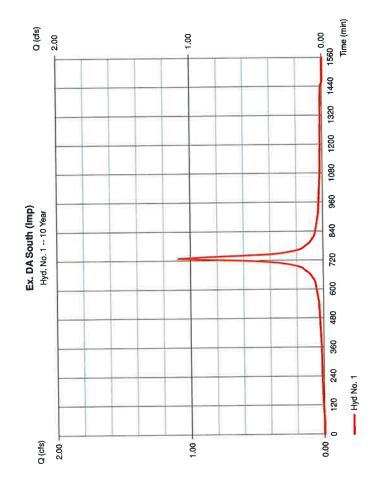
Hydratiow Hydrographs by Intelisoive v9.1	num Total Hydrograph Bon strye used description (suff)	Ex. DA South (imp)	Ex. DA South (Perv)	Ex. DA South (Total)	Ex DA Texas Ave (Imp)	Ex. DA Texas Ave (Perv)	Ex DA Texas Ave (Total)	- Ex Stite (Total)	Prop. DA South (Imp)	1	Prop. DA South (Total)	rg B,370 Post Route UG Basin	Prop. DA South Und (Imp)	Prop. DA South Und (Perv)	Prop. DA South Und (Total)	Prop DA South (Total)	Prop. DA Texas Ave (Imp)	Prop. DA Texas Ave (Perv)	Prop. DA Texas Ave (Total)	Prop. Site (Total)	
	Inflow Meximum hyd(s) elevetion (ft)	1	1	1,2	1	1	5,6	3, 7,	1	1	11, 12	13 60.79	1	1	16, 17	14, 18,	1	1	 ន ន	20, 24,	
eport	Hyd. volume (cuft)	4,548	47,229	51,777	2,112	2,059	4,171	55,948	27,939	2,469	30,408	30,400	6,010	17,182	23,192	53,591	1,137	888	2,026	55,617	
ary R	Time to peak to (min)	730	730	730	0624	730	230	230	06.7	730	06/	740	730	730	730	735	730	062	06./	735	
imm.	Time Interval (min)	so.		9	ŝ	S	ŝ	ŝ	ŝ	40	-0	və	ŝ	ŝ	ŝ	ŝ	s	5	S	2	
h Su	Peak fictre (cfis)	1.090	12.57	13.66	0.506	0.548	1.054	14.71	6.693	0.679	7.372	4.670	1.440	4.723	6.163	9.695	0.272	0.244	0.517	10.14	
Hydrograph Summary Report	Hydrograph type (origin)	SCS Runoff	SCS Runot	Combine	SCS Runoff	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runoff	Combine	Reservoir	SCS Runoff	SCS Runoff	Combine	Combine	SCS Runoff	SCS Runoff	Combine	Combine	
ž	PF 9	-	~		5		2	თ	÷	12	13	4	16	17	18	8	ន	ន	24	8	

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Hydraflow Hydrographs by Intellsolve v9.1

Hyd. No. 1

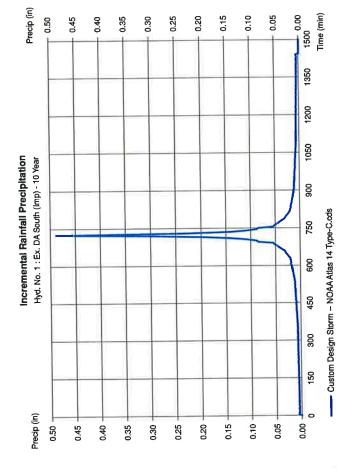
	Ex. DA South (Imp) Ex. DA South (Imp) Hydrograph type = SCS Runoff Storm frequency = 10 yrs Time interval = 5, min Drainage area = 0.0 % Tc method = USER Tc method = USER Tc method = 501 interval Storm duration = NOAA Attas 14 Type-C.cds		Peak discharge = 1.090 cfs Time to peak = 730 min Hyd. volume = 4,548 cuft Curve number = 98 Hydraulic length = 0 ft Time of conc. (Tc) = 10.00 min Distribution = Custom Distribution = 484
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	Friday, Oct 9, 2020		Time interval = 5 min Distribution = Custom
Report	sisolve v9.1		= 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds
Precipitation Report	Hydraflow Hydrographs by Intelisoive v9.1	Hyd. No. 1 Ex. DA South (Imp)	

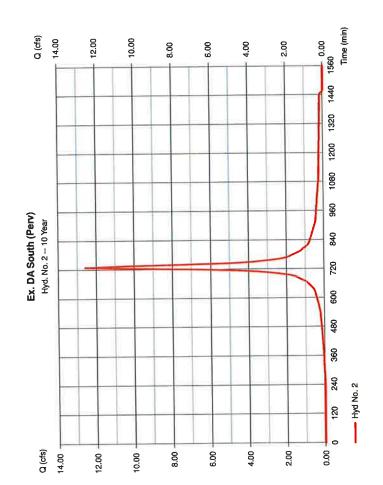


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Hydraflow Hydrographs by Intelisolve v9.1 Hyd. No. 2

	4 Time to peak       = 12.57 cfs         Time to peak       = 730 min         Hyd. volume       = 47,229 cutf         Cutome       = 47,229 cutf         Hydraulic length       = 0 ft         Time of conc. (Tc)       = 10.00 min         Distribution       = custom         A Type-C.ods       Shape factor       = 484
<u>د</u>	<ul> <li>= SCS Runoff</li> <li>= 10 yrs</li> <li>= 5 min</li> <li>= 3.670 ac</li> <li>= 0.0 %</li> <li>= USER</li> <li>= 5.01 in</li> <li>= NOAA Atlas 14 Type-C.cds</li> </ul>
Ex. DA South (Perv)	Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration

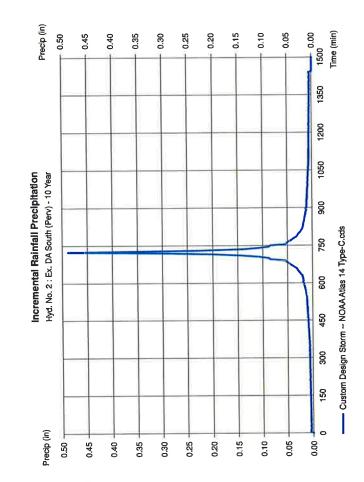


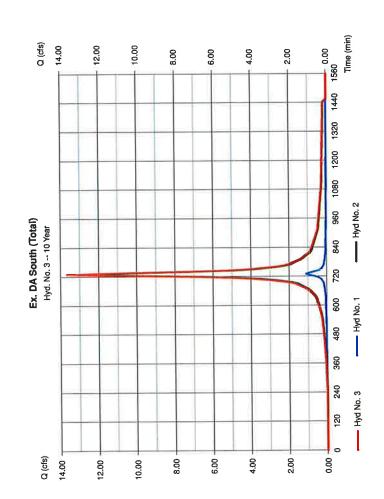
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**Precipitation Report** 

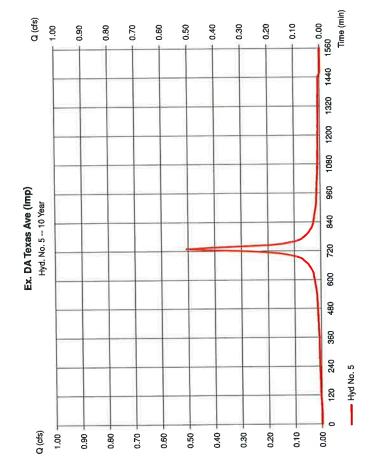
Hydraflow Hydrographs by Intellsolve v9.1	itsolve v9.1		Friday, Oct 9, 2020
Hyd. No. 2			
Ex. DA South (Perv)			
Storm Frequency Total precip. Storm duration	= 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom

Hydrograph Report	3
Hydraflow Hydrographs by Intelsolve v9.1	Friday, Oct 9, 2020
Hyd. No. 3	
Ex. DA South (Total)	
Hydrograph type = Combine Storm frequency = 10 yrs Time interval = 5 min Inflow hyds. = 1, 2	Peak discharge = 13.66 cfs Time to peak = 730 min Hyd. volume = 51,777 cuft Contrib. drain. area = 3.950 ac





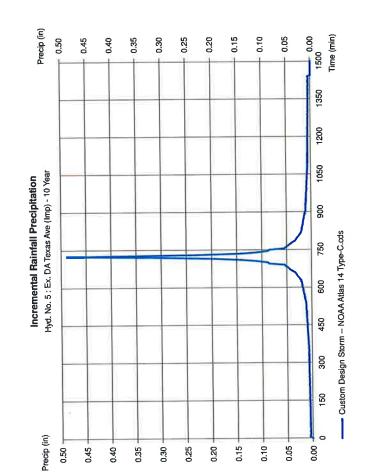
Hydraflow Hydrographs by Intellsolve v9.1	Isolve v9.1		Friday, Oct 9, 2020
Hyd. No. 5			
Ex. DA Texas Ave (Imp)	(du		
	= SCS Runoff	Peak discharge	- 11
	- 10 vrs	Time to peak	- U
Time interval	= 5 min	Hyd. volume	= 2,112 cuft
Drainade area	= 0.130 ac	Curve number	11
Basin Slone	0.0%	Hydraulic length	ī
	LISER	Time of conc. (Tc)	'n
Total precip.	= 5.01 in	Distribution	= Custom
Storm duration =	NOAA Atlas 14 Type-C.cds	Shape factor	= 484



recipitation Report	draftow Hydrographs by Intelisolve v9.1
Precipi	Hydraflow Hydroc

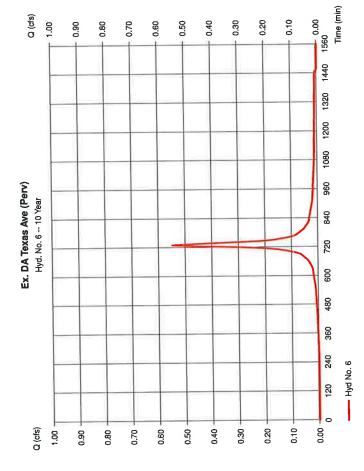
Hyd. No. 5

Ex. DA Texas Ave (Imp) Storm Frequency = 10 yrs Total precip. = 5.0100 in Storm duration = NOAA Atlas 14 Type-C.cds



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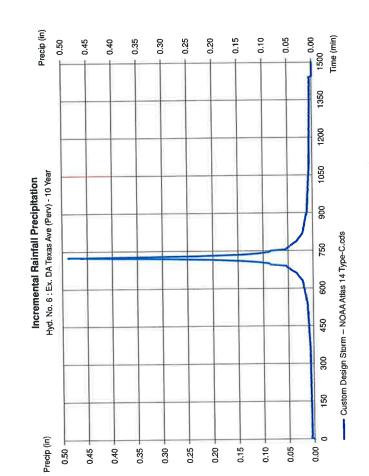


**Precipitation Report** 

Friday, Oct 9, 2020

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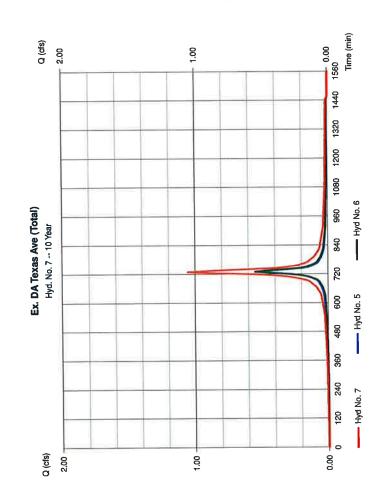
= 5 min = Custom Time interval Distribution = 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds Hydraflow Hydrographs by Intelisolve v9.1 Ex. DA Texas Ave (Perv) Storm Frequency Total precip. Storm duration Hyd. No. 6

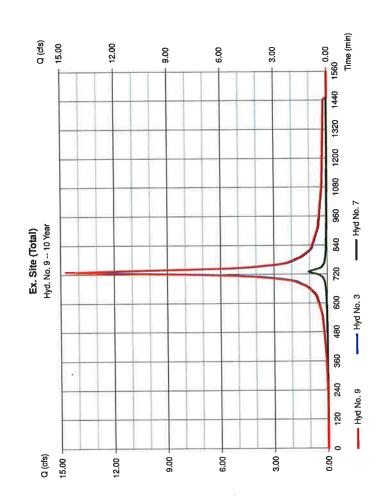


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	Friday, Oct 9, 2020			Peak discharge = $1.054$ cfs Time to peak = 730 min Hyd. volume = $4,171$ cuft Contrib. drain. area = $0.290$ ac
nepoir	halisolve v9.1		(Total)	= Combine = 10 yrs = 5, 6
nyurugrapin mepun	Hydraflow Hydrographs by Intellsolve v9.1	Hyd. No. 7	Ex. DA Texas Ave (Total)	Hydrograph type Storm frequency Time interval Inflow hyds.

Hydraffow Hydrographs by Intelecove v6.1 Friday, Oct.9, 2020 Hydr. No. 9 E.v. Site (Total) Hydrograph type = Combine Storm frequency = 10 yrs Time interval = 5 min Inflow hyds. = 3, 7 Contrib. drain. area = 0.000 ac

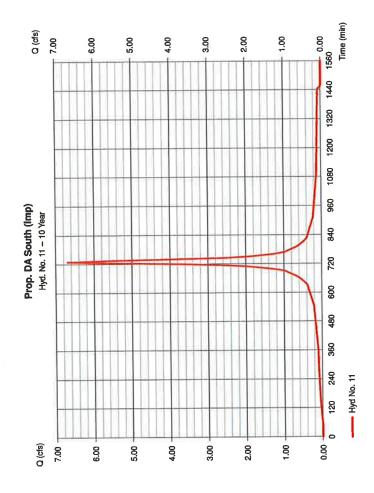




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Hydrograph Report

Hydrograph Report	n Report		2
Hydraflow Hydrographs by Intellsolve v9.1	Intelisoive v9.1		Friday, Oct 9, 2020
Hyd. No. 11			
Prop. DA South (Imp)	(du		
Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip.	= SCS Runoff = 10 yrs = 5 min = 1.720 ac = 0.0 % = 0.0 Stas 14 Twne-C.cds = 0.01 in	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	= 6.693 cfs = 730 min = 27,939 cuft = 9.1 = 0.1 = 10.00 min = 484
		-	



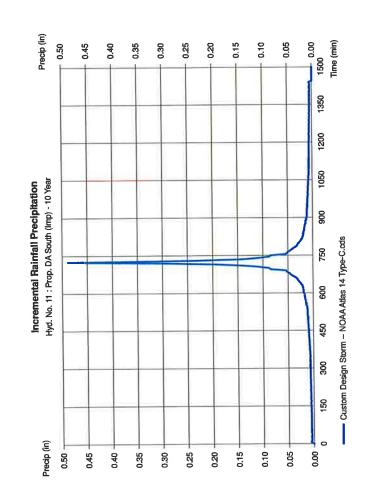
Precipitation Report	Hydraflow Hydrographs by Intelisolve v9.1	Hyd. No. 11

Friday, Oct 9, 2020

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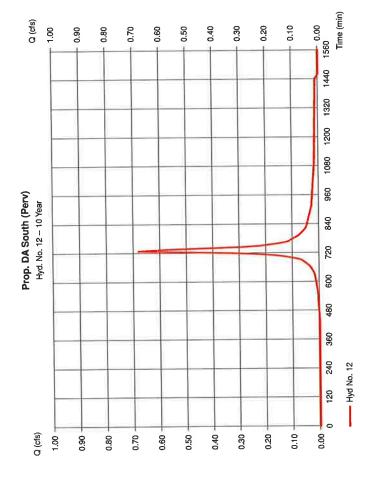
	Time interval Distribution
	10 yrs 5.0100 in NOAA Atlas 14 Type-C.cds
~	0 0 0
Prop. DA South (Imp)	Storm Frequency Total precip. Storm duration

= 5 min = Custom

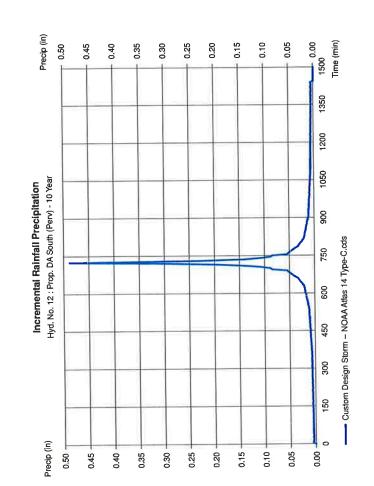


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Hydraflow Hydrographs by Intelisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 12		
Prop. DA South (Perv)		
Hvdrograph type = SCS Runoff	Peak discharge	= 0.679 cfs
Storm tradition = 10 vrs	Time to peak	= 730 min
Time interval = 5 min	Hyd. volume	= 2,469 cuft
"	Curve number	= 80
"	Hydraulic length	= 0 ft
	Time of conc. (Tc)	= 10.00 min
1	Distribution	= Custom
= Lo	Shape factor	= 484



er heit		Friday, Oct 9, 2020
Storm Frequency = 10 yrs Total precip. = 5.0100 in Storm duration = NOAA Atlas 14 Type-C.cds	Lime interval Distribution	= 5 min = Custom

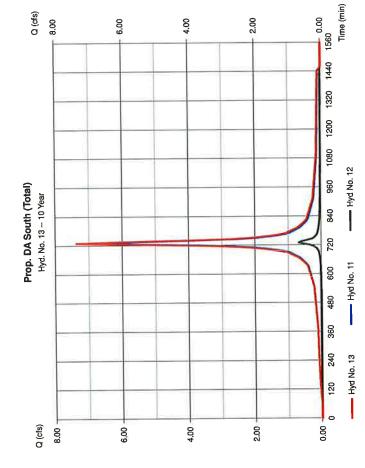


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Hydraflow Hydrographs by Intelisolve v9.1	Friday, Oct 9, 202
Hyd. No. 13	
Prop. DA South (Total)	
Hydrograph type = Combine	je =
Storm frequency = 10 yrs	II
II	Hyd. volume = $30,408$ cutt
nflow hyds. = 11, 12	Contrib. drain. area = 1.970 ac



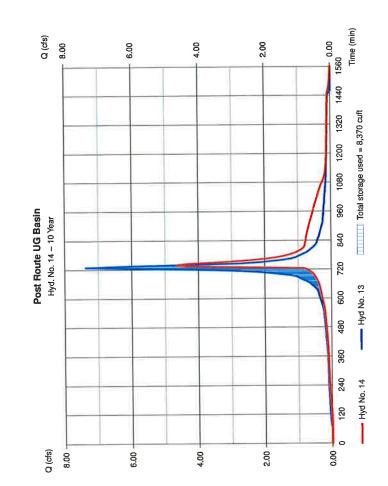
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Friday, Oct 9, 2020

				Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage
Hydrograph Report	Hydraflow Hydrographs by Intelisotve v9.1	Hyd. No. 14	Post Route UG Basin	Hydrograph type = Reservoir Storm frequency = 10 yrs Trme interval = 5 min Inflow hyd. No. = 13 - Prop. DA South (Total) Reservoir name = UG Det Basin

Storage Indication method used.



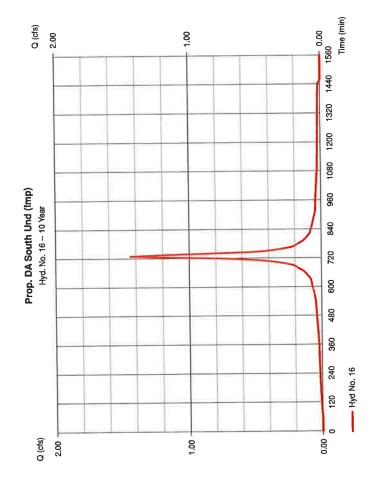
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Friday, Oct 9, 2020

= 4.670 cfs = 740 min = 30,400 cuft = 60.79 ft = 8,370 cuft

Hydraflow Hydrographs by Intelisolve v9.1	
Hyd. No. 16	
Prop. DA South Und (Imp)	
Hydrograph type = SCS Runoff Storm fremiency = 10 vrs	Peak disch Time to pe

	= 1.440 cfs	30 min	6,010 cuft	80	H I	10.00 min	Custom	184	
	"		"	11	II	u.	"	1	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor	
	= SCS Runoff		= 5 min	IJ	I	= USER	I	= NOAA Atlas 14 Type-C.cds	
ללווווי) הווה וווחהה עה ילהון	Hvdrograph type	Storm fredulency	Time interval	Drainade area	Basin Slope		Total nrecin	Storm duration	



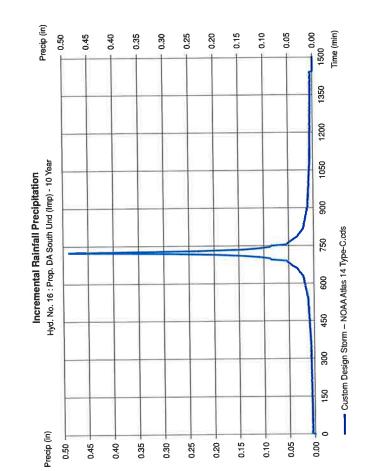
Precipitation Report	Hydraflow Hydrographs by Intelisolve v9.1

Friday, Oct 9, 2020

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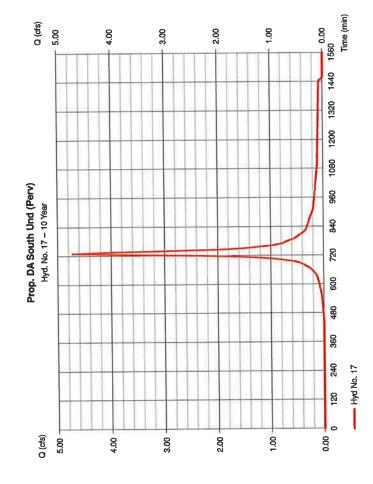
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	= 5 min = Custom
	Time interval Distribution
d (Imp)	= 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds
Prop. DA South Und (Imp)	Storm Frequency Total precip. Storm duration



23

Hydratiow Hydrographs by Intellisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 17		
Prop. DA South Und (Perv)		
Hydrograph type = SCS Runoff Storm frequency = 10 yrs Time interval = 5 min	Peak discharge Time to peak Hyd. volume	= 4.723 cfs = 730 min = 17,182 cuft
e a l	Curve number Hydraulic length	= 80 = 0 ft 10 00 min
Tc method = USER Total precip. = 5.01 in Storm duration = NOAA Atlas 14 Type-C.cds	Type-C.cds Shape factor	= 10.00 mm = Custom = 484

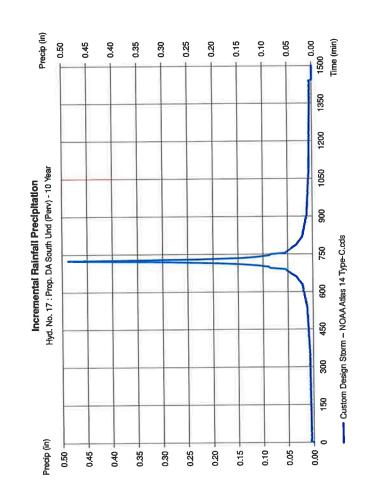


Precipitation Report		1
Hydratiow Hydrographs by Intelisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 17		
Prop. DA South Und (Perv)		
Storm Frequency = 10 yrs Total precip. = 5.0100 in	Time interval Distribution	= 5 min = Custom

= 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds

Storm Frequency Total precip. Storm duration

55



Hydraftow Hydrographs by Imailsolve v9.1	Friday, Oct 9, 2020
Hyd. No. 18	
Prop. DA South Und (Total)	
Hydrograph type = Combine Storm frequency = 10 yrs Time interval = 5 min Inflow hyds. = 16, 17	Peak discharge = 6.163 cfs Time to peak = 730 min Hyd. volume = 23,192 cuft Contrib. drain. area = 2.110 ac

 Hydrograph Refort

 Hydrafow Hydrographs by Intelsolve V6:1

 Friedw. Oct. 9, 2000

 Hydrograph Kop DA South (Total)

 Prop DA South (Total)

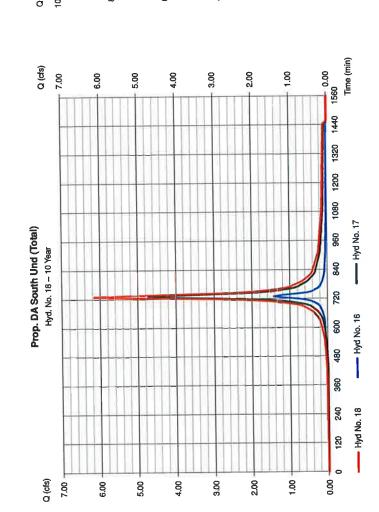
 Hydrograph type
 = Combine

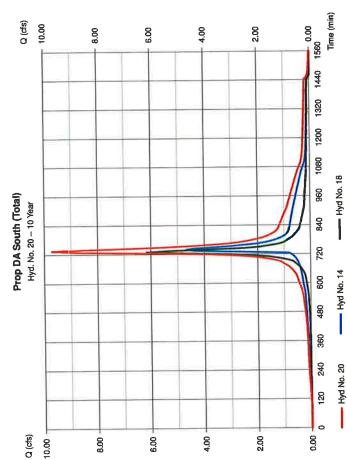
 Hydrograph type
 = Combine

 Storm frequency
 = 10 yrs

 Time interval
 = 53,591 cuft

 Inflow hyds.
 = 14, 18

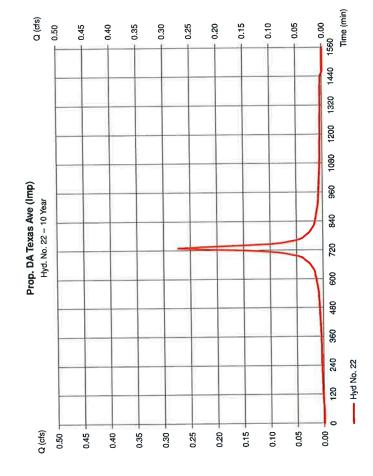




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Friday, Oct 9, 202			= 0.272 cfs = 730 min = 1,137 cuft = 98 = 0 ft = 0 ft = 10.00 min = 484
			Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor
Intellsolve v9.1		ve (Imp)	<ul> <li>SCS Runoff</li> <li>10 yrs</li> <li>5 min</li> <li>5 min</li> <li>0.070 ac</li> <li>0.0%</li> <li>USER</li> <li>5.01 in</li> <li>5.01 in</li> <li>NOAA Atlas 14 Type-C.cds</li> </ul>
Hydraflow Hydrographs by Intellsolve v9.1	Hyd. No. 22	Prop. DA Texas Ave (Imp)	Hydrograph type Storm frequency Time interval Drainage area Basin Stope Tc method Total precip. Storm duration



Precipitation Report	
Hydraficw Hydrographs by Intelisoive v9.1	Friday, Oct 9, 2020
Hyd. No. 22	
Prop. DA Texas Ave (Imp)	

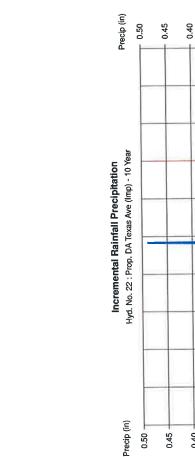
= 5 min = Custom

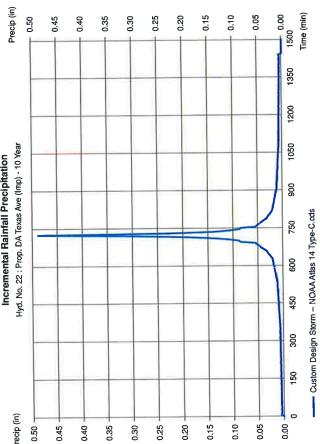
Time interval Distribution

= 10 yrs
 = 5.0100 in
 = NOAA Atlas 14 Type-C.cds

Storm Frequency Total precip. Storm duration

20

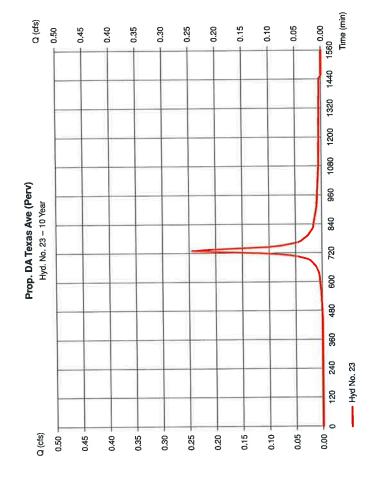




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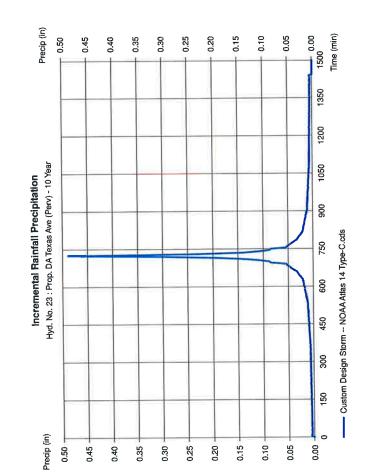
Hydrograph Report	Report		
Hydraflow Hydrographs by Intellsolve v9.1	ntelisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 23			
Prop. DA Texas Ave (Perv)	e (Perv)		
Hvdrooraph type	= SCS Runoff	Peak discharge	= 0.244 cfs
Storm frequency	= 10 vrs	Time to peak	
Time interval	= 5 min	Hyd. volume	= 889 cuft
Drainage area	= 0.090 ac	Curve number	Ű.
Basin Slone	= 0.0%	Hydraulic length	= 0 ft
Te method	_	Time of conc. (Tc)	= 10.00 min
Total nrecin	= 5.01 in	Distribution	= Custom
Storm duration	= NOAA Atlas 14 Type-C.cds	Shape factor	= 484



<b>Precipitation Report</b>	Hydraflow Hydrographs by Intellsolve v9.1

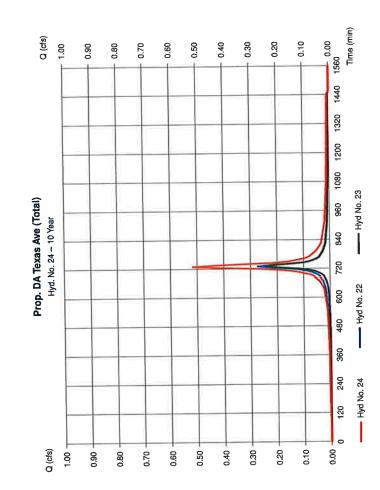
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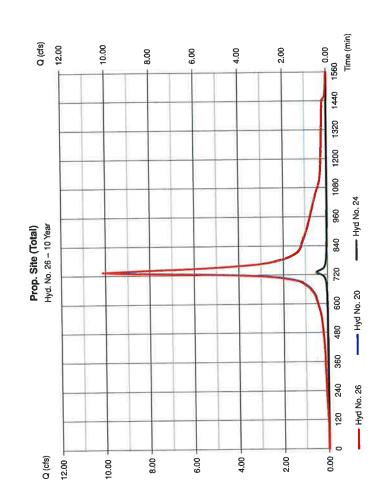
11 Jan 190. 20			
Prop. DA Texas Ave (Perv)	(Perv)		
Storm Frequency Total precip. Storm duration	= 10 yrs = 5.0100 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom



bine Peak discharge = 0. Time to peak = 73 Hyd. volume = 2, 3 Contrib. drain. area = 0.	-	Friday, Oct 9, 2020
Ave (Total) = Combine = 0 yrs = 5 min = 22, 23 Ave (Total) - Contrib. drain. area =	Hydraflow Hydrographs by Intelfsolve v9.1	
bine Peak discharge = Time to peak = Hyd. volume = 3 Contrib. drain. area =	Hyd. No. 24	
<ul> <li>Combine</li> <li>Combine</li> <li>Time to peak</li> <li>Time to peak<td>Prop. DA Texas Ave (Total)</td><td></td></li></ul>	Prop. DA Texas Ave (Total)	
= 10 yrs Time to peak = 5 min = 22, 23 Contrib. drain. area =		
= 5 min = 22, 23 = 22, 23		Time to peak =
= 22, 23		Hyd. volume = 2,026 cuft
	1 11	Contrib. drain. area = 0.160 ac

Hydraftow Hydrographs by Intelestore vs. 1 Hydr. No. 26 Prop. Site (Total) Hydrograph type = Combine Friday, oct. 9, 26 Prop. Site (Total) Hydrograph type = 10,14 cfs Time to peak discharge = 10,14 cfs Time to peak = 735 min Hydr. volume = 55,617 cuft Inflow hyds. = 20, 24 Contrib. drain. area = 0.000 ac





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Hydrograph Report

Friday, Oct 9, 2020

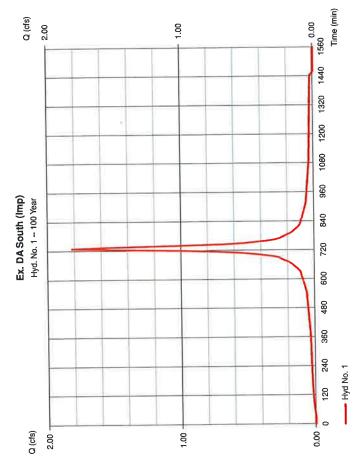
No. (6	Hydrograph type (origh)	Peak flow (cfs)	Time Interval (min)	Time to peak (min)	Hyd. volume (cuft)	lmflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Mydrograph description
-	SCS Runoff	1.618	0	062	7,709	1	1	I	Ex. DA South (Imp)
-	SCS Runoff	22.51	ŝ	730	87,561	I	ļ	I	Ex. DA South (Perv)
	Combine	24.33	S	06.2	95,270	1, 2	I	]	Ex. DA South (Total)
500	SCS Runot	0.644	S	082	3,579	I	Ĵ	Î	Ex DA Texas Ave (Imp)
	SCS Runoff	0.981	ŝ	230	3,817	1	I	I	Ex. DA Texas Ave (Perv)
	Combine	1.826	ŝ	730	7,396	5, 6	I	I	Ex. DA Texas Ave (Total)
5 6	Combine	26.15	ŝ	230	102,666	3, 7,	l	I	Ex. Site (Total)
11	SCS Rumoff	11.17	6	730	47,354	1	l	l	Prop. DA South (Imp)
	SCS Runoff	1.360	ധ	730	5,049	Ì	I	I	Prop. DA South (Perv)
-	Combine	12.53	ŝ	730	52,403	11, 12	l	1	Prop. DA South (Total)
14 Res	Reservoir	8.731	s	740	52,395	13	61.47	11,660	Post Route UG Basin
16 SC	SCS Runoff	2.403	10	230	10,187	I	I	1	Prop. DA South Und (Imp)
_	SCS Runoff	9.467	ŝ	230	35,144	١	1	1	Prop. DA South Und (Perv)
	Combine	11.87	ю	230	45,330	16, 17	I	I	Prop. DA South Und (Total)
S S	Combine	19.11	10	730	97,726	14, 18,	I	I	Prop DA South (Total)
sc sc	SCS Runoff	0.455	ŝ	730	1,927	I	I	l	Prop. DA Texas Ave (Imp)
-		0.490	10	062	1.818	I	1	ļ	Prop. DA Texas Ave (Perv)
_		1044	, u	06/2	3.745	8 8	1	I	Prop. DA Texas Ave (Total)
5	Compline		,	3	ł	[			
26 26	Combine	20.05	10	730	101,471	20, 24,	l	I	Prop. Site (Total)
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Hydrograph Report

Hydraflow Hydrographs by Intelisofve v9.1 Hyd. No. 1

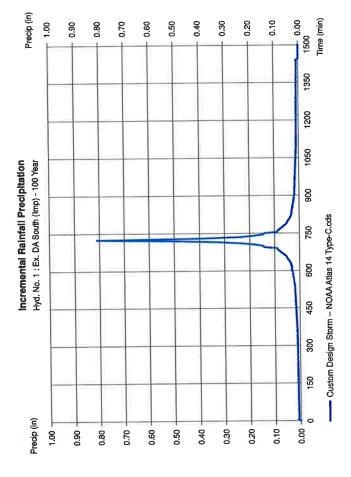
	Peak discharge= 1.818 cfsTime to peak= 7:30 minHyd. volume= 7,709 cuftCurve number= 9Hydraulic length= 0 ftTime of conc. (Tc)= 10.00 minDistribution= 2 customShape factor= 484
(	<ul> <li>= SCS Runoff</li> <li>= 100 yrs</li> <li>= 5 min</li> <li>= 0.280 ac</li> <li>= 0.0 %</li> <li>= USER</li> <li>= 8.33 in</li> <li>= NOAA Atlas 14 Type-C.cds</li> </ul>
Ex. DA South (Imp)	Hydrograph type Storm frequency Time interval Drainage area Basin Slope Tc method Total precip. Storm duration



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Hydrallow Hydrographs by Intelisotve v9.1	alisotve v9.1		Friday, Oct 9, 2020
Hyd. No. 1			
Ex. DA South (Imp)			
Storm Frequency Total precip. Storm duration	= 100 yrs = 8.3300 in = NOAA Atlas 14 Typ <del>e</del> -C.cds	Time interval Distribution	= 5 min = Custom



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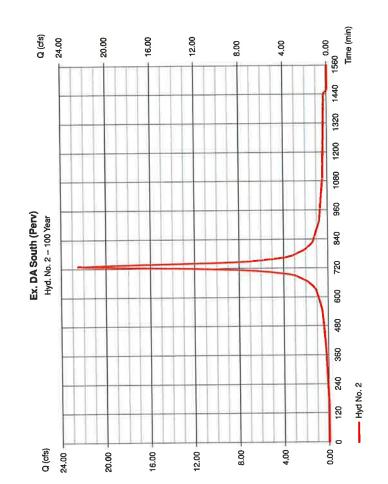
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Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 2

	II	П	11	11	11	11	II	II
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor
(Vie	= SCS Runoff		= 5 min	= 3.670 ac	= 0.0 %	= USER	= 8.33 in	= NOAA Atlas 14 Type-C.cds
Ex. DA South (Perv)	Hvdrodraph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration

= 22.51 cfs = 730 min = 87,561 cuft = 89 = 0 ft = 10.00 min = 484



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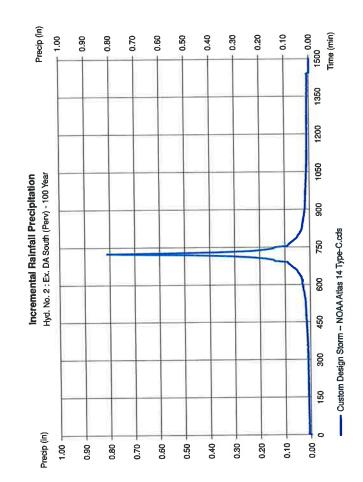
**Precipitation Report** 

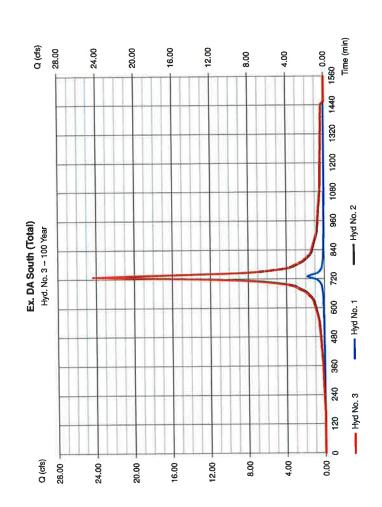
Hydraflow Hydrographs by Intellsolve v9.1	bitschre v9.1		Fridey, Oct 9, 2020
Hyd. No. 2			
Ex. DA South (Perv)			
Storm Frequency Total precip. Storm duration	= 100 yrs = 8.3300 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom

Hydraflow Hydrographs by Intellsolve v9.1	Friday, Oct 8, 2020
Hyd. No. 3	
Ex. DA South (Total)	
Hydrograph type = Combine Storm frequency = 100 yrs Time interval = 5 min Inflow hyds. = 1, 2	Peak discharge = 24.33 cfs Time to peak = 730 min Hyd. volume = 95,270 cuft Contrib. drain. area = 3.950 ac

Hydrograph Report

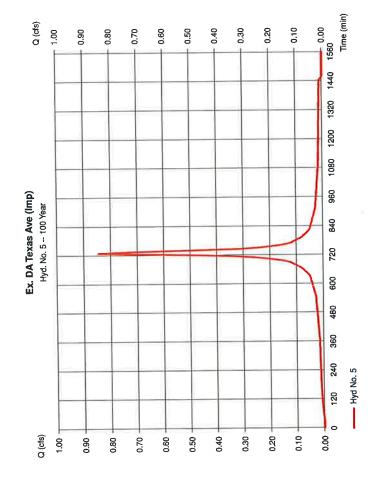
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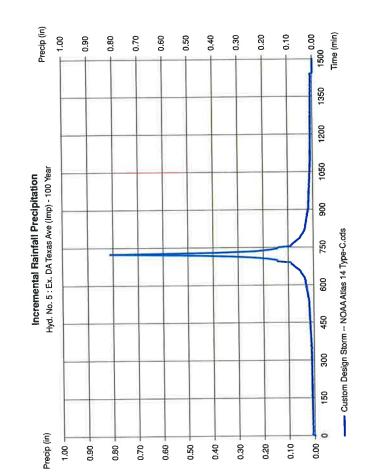
	Friday, Oct 9, 2020			Peak discharge = 0.844 cfs	11	Hyd. volume = $3,579$ cuft	Curve number = 98	Hydraulic length = 0 ft		u	Shape factor = 484
Hydrograph Report	Hydraftow Hydrographs by Intellsolve v9.1	Hyd. No. 5	Ex. DA Texas Ave (Imp)	vdrodraph type = SCS Runoff	Storm frequency = 100 vrs	Time interval = 5 min	1	Basin Slope = 0.0 %	Tc method = USER	Total precip. = 8.33 in	Storm duration = NOAA Atlas 14 Type-C.cds



pitation Report	lydrographs by Intellsolve v9.1
Precipitat	Hydraflow Hydrographs

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		Time interval = 5 min Distribution = Custom
Hyd. No. 5	Ex. DA Texas Ave (Imp)	Storm Frequency = 100 yrs Total precip. = 8.3300 in Storm duration = NOAA Atlas 14 Type-C.cds



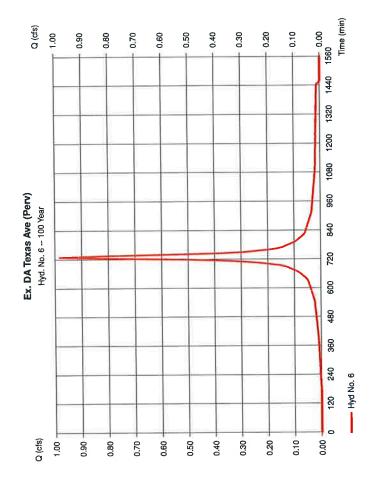
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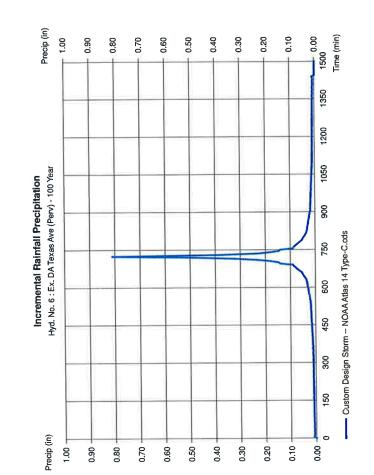
Hydrograph Report	n Report	
Hydraflow Hydrographs by Intellsolve v9.1	inteliscive v9.1	
Hyd. No. 6		
Ex. DA Texas Ave (Perv)	(Perv)	
Hydrograph type Storm frequency	<ul> <li>SCS Runoff</li> <li>100 yrs</li> </ul>	Peak dischary Time to peak
Time interval	= 5 min - 0160 ac	Hyd. volume Curve numbe
Basin Slope	= 0.0%	Hydraulic len
Tc method	= USER	Time of conc.
Total precip.	= 8.33 in	Distribution
Storm duration	= NOAA Atlas 14 Type-C.cds	Shape factor

Time to a second	
	= 730 min
Hyd. volume	= 3,817 cuft
Curve number	= 89
Hvdraulic length	= 0 ft
Time of conc. (Tc)	= 10.00 min
Distribution	= Custom
NOAA Atlas 14 Type-C.cds Shape factor	= 484
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Hydraflow Hydrographs by Intellsolve v9.1	elisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 6			
Ex. DA Texas Ave (Perv)	oev)		
Storm Frequency Total precip. Storm duration	= 100 yrs = 8.3300 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom



Friday, Oct 9, 2020

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Friday, Oct 9, 2020			Peak discharge = $1.826$ cfs Time to peak = 730 min Hyd. volume = 7,396 cuft Contrib. drain. area = 0.290 ac
Hydraflow Hydrographs by Intellsolve v9.1	Hyd. No. 7	Ex. DA Texas Ave (Total)	Hydrograph type = Combine Storm frequency = 100 yrs Time interval = 5 min Inflow hyds. = 5, 6

 Hydrograph Report

 Hydraflow vs.1

 Friday, Oct 9, 2020

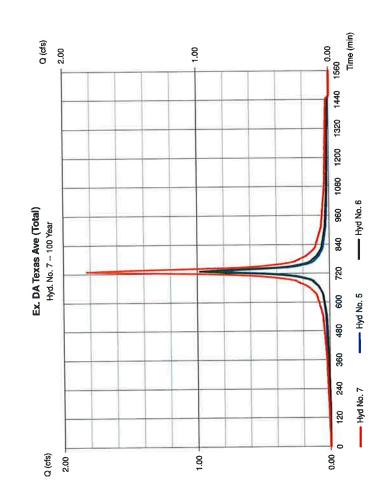
 Friday, Oct 9, 2020

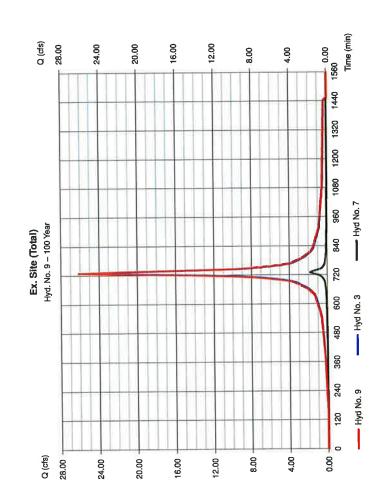
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 Hydraflow vs.1

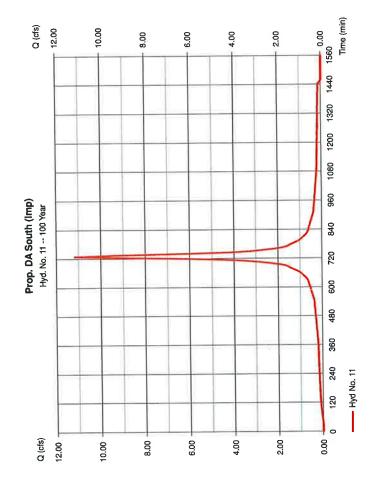
 Friday, Oct 9, 2020

 Friday, Oct 9,



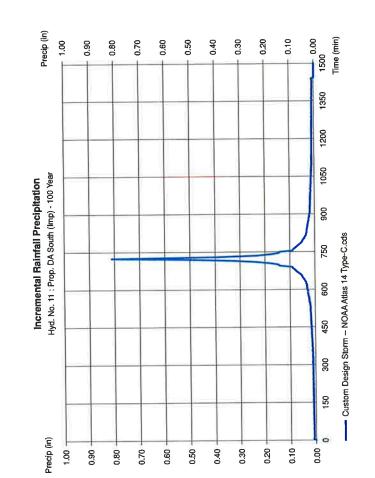


Friday, Oct 9, 2020			= 11.17 cfs = 730 min = 47,354 cuft = 0 ft = 10.00 min = 484
			Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor
maisolva v9.1		(du	= SCS Runoff = 100 yrs = 5 min = 1.720 ac = 0.0 % = USER = 8.33 in = NOAA Atlas 14 Type-C.cds
Hydraflow Hydrographs by Intelisolve v9.1	Hyd. No. 11	Prop. DA South (Imp)	Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration

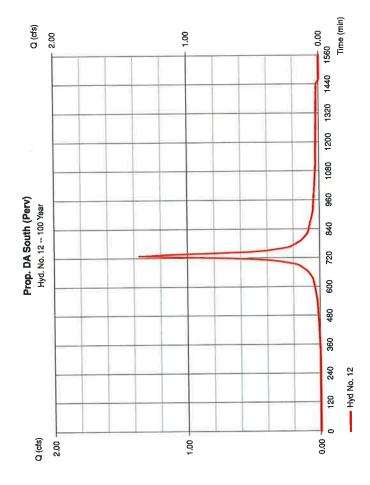


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Precipitation Report			
Hydraflow Hydrographs by Intelsolve v9.1			Friday, Oct 9, 20
Hyd. No. 11			
Prop. DA South (Imp)			
Storm Frequency = 100 yrs Total precip. = 8.3300 in Storm duration = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom	

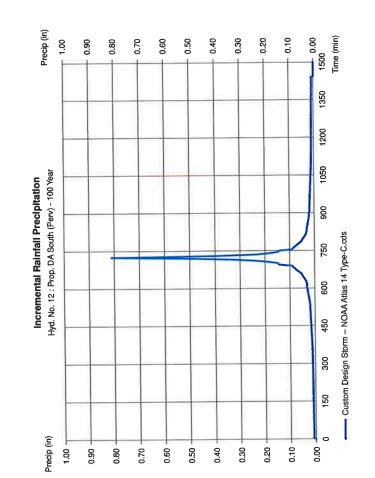


Hydraflow Hydrographs by Intelfsolve v9.1	Intelfsolve v9.1		Friday, Oct 9, 2020
Hyd. No. 12			
Prop. DA South (Perv)	Perv)		
Hydrograph type	= SCS Runoff	Peak discharge	li.
Storm frequency	= 100 yrs	lime to peak	 
Time interval	= 5 min	Hyd. volume	= 5,049 cuft
Drainage area	= 0.250 ac	Curve number	00 
Basin Slope	= 0.0%	Hydraulic length	1
Tc method	= USER	Time of conc. (Tc)	
Total precip.	= 8.33 in	Distribution	= Custom
Storm duration	= NOAA Atlas 14 Type-C.cds	Shape factor	= 484



Precipitation Report

Hydratiow Hydrographs by Intelisolve v9.1	isolve v9.1		Friday, Oct 9, 2020
Hyd. No. 12			
Prop. DA South (Perv)	(		
Storm Frequency Total precip. Storm duration	= 100 yrs = 8.3300 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom

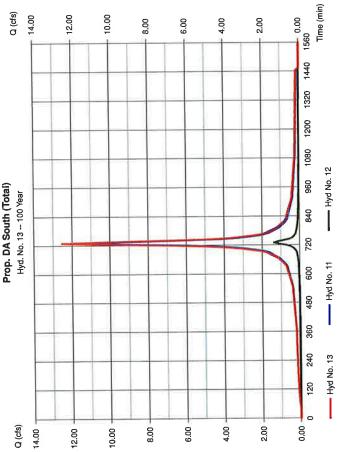


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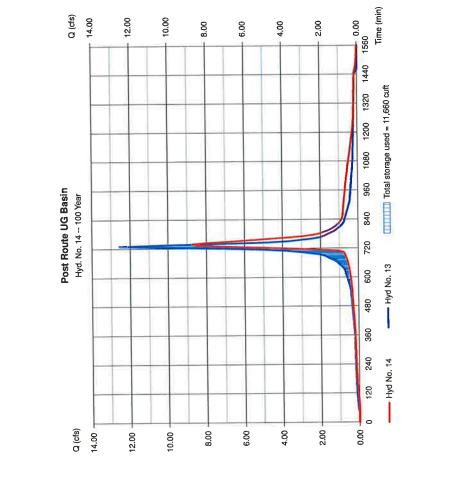
Hydraflow Hydrographs by Intelisolve v9.1	Friday, Oct 9, 202
Hyd. No. 13	
Prop. DA South (Total)	
Hvdroaraph type = Combine	e e
	Time to peak = $730 \text{ min}$
Time interval = 5 min	Hyd. volume = $52,403$ curt
Inflow hvds. = 11, 12	Contrib. drain. area = 1.9/0 ac

Hyd. volume = 52,403 cuf Contrib. drain. area = 1.970 ac	otal)
	Prop. DA South (Total)
= 5 min = 11, 12	
Time interval Inflow hyds.	(Jaie)

Storage Indication method used.



Hydrograph Report Hydrafow Hydrographs by Intelective v9.1 Hydr. No. 14 Post Route UG Basin Hydrograph type = Reservoi Storm frequency = 100 yrs	Report lelisone v9.1 sin = Reservoir = 100 yrs	Peak discharge Time to peak	Friday, Oct 9, 2020 Friday, Oct 9, 2020 = 8.731 cfs = 7.00 min
Time interval	= 5 min	Hyd. volume	= 52,395 cuit
Inflow hyd. No.	= 13 - Prop. DA South (Total)	Max. Elevation	= 61,47 ft
Reservoir name	= UG Det Basin	Max. Storage	= 11,660 cuft



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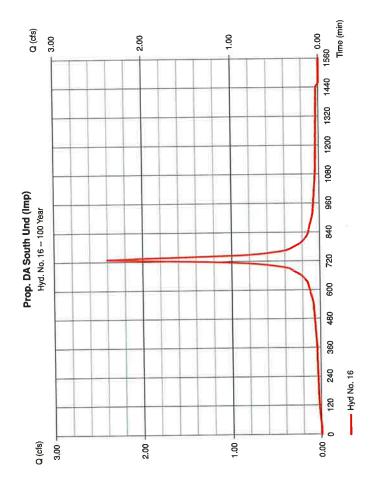
Friday, Oct 9, 2020

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Hyd. No. 16

	Peak discharge = 2.403 cfs Time to peak = 730 min Hyd. volume = 10,187 cuft Curve number = 98 Hydraulic length = 0 ft Time of conc. (Tc) = 10.00 min Distribution = Custom Shape factor = 484
(dml) pur	= SCS Runoff = 100 yrs = 5 min = 0.370 ac = 0.0 % = USER = 8.33 in = 8.33 in = NOAA Atlas 14 Type-C.cds
Prop. DA South Und (Imp)	Hydrograph type Storm frequency Time interval Drainage area Basin Slope Tc method Total precip. Storm duration

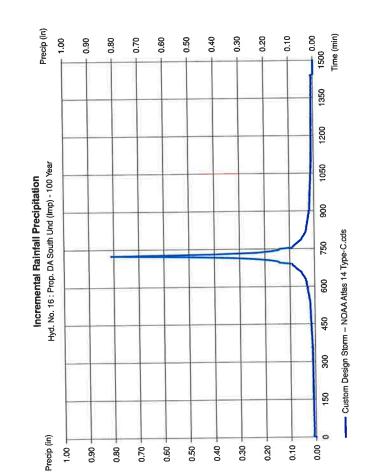


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Friday, Oct 9, 2020

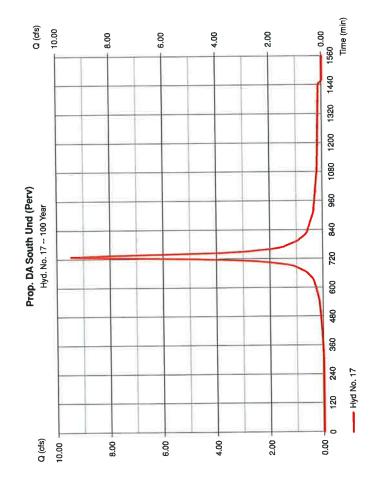
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Hydraflow Hydrographs by Intelisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 16		
Prop. DA South Und (Imp)		
Storm Frequency = 100 yrs Total precip. = 8.3300 in Storm duration = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom



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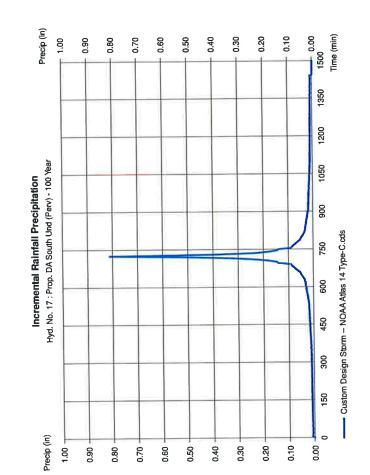
Hydraflow Hydrographs by Intellsolve v9.1	Intelisolve v9.1		Friday, Oct 9, 2020
Hyd. No. 17			
Prop. DA South Und (Perv)	nd (Perv)		
Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration	<ul> <li>SCS Runoff</li> <li>100 yrs</li> <li>5 min</li> <li>1.740 ac</li> <li>1.740 ac</li> <li>USER</li> <li>8.33 in</li> <li>NOAA Atlas 14 Type-C.cds</li> </ul>	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	= 9.467 cfs = 730 min = 35,144 cuft = 80 = 014 = 10.00 min = 484



Precipitation Report
Hydrafiow Hydrographs by Intellsolve v9.1
Hyd. No. 17
Dron DA South   [nd (Pen/)

	Time interval Distribution pe-C.cds
Perv)	= 100 yrs = 8.3300 in = NOAA Atlas 14 Type-C.cds
Prop. DA South Und (Perv)	Storm Frequency Total precip. Storm duration

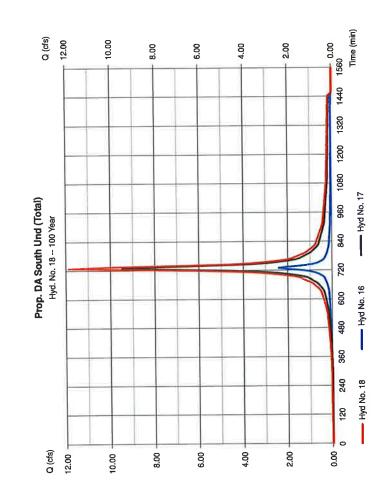
= 5 min ≂ Custom

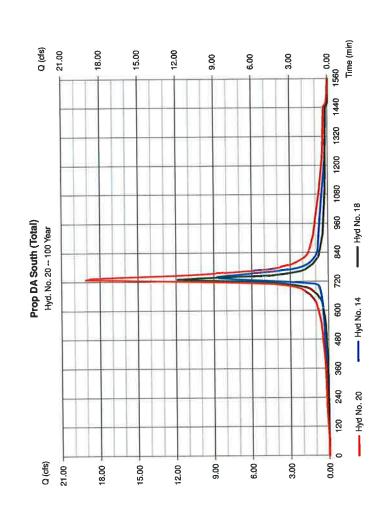


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Hydratiow Hydrographs by Intelsolve v9.1	Friday, Oct 9, 2020
Hyd. No. 18	
Prop. DA South Und (Total)	
Hydrograph type = Combine Storm frequency = 100 yrs Time interval = 5 min Inflow hyds. = 16, 17	Peak discharge = 11.87 cfs Time to peak = 730 min Hyd. volume = 45,330 cuft Contrib. drain. area = 2.110 ac

Hydrafter tłychographs by Intelsolve v6.1 Hydr. No. 20 Prop DA South (Total) Hydrograph type = Combine Storm frequency = 19.11 cfs Time to peak discharge = 19.11 cfs Storm frequency = 100 yrs Time interval = 5 min Hydr. Volume = 97,726 cuft Inflow hyds. = 14, 18





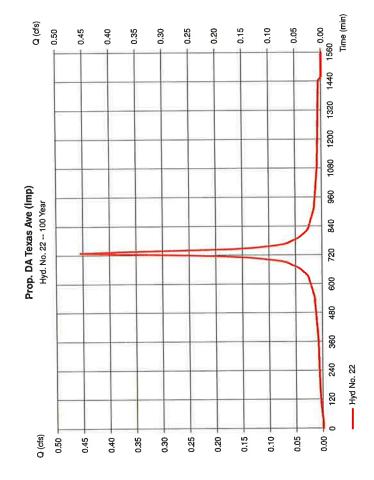
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Hydrograph Report

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Hydrograph Report			8
Hydraflow Hydrographs by Intellsolve v9.1			Friday, Oct 9, 2020
Hyd. No. 22			
Prop. DA Texas Ave (Imp)			
Hvdrooraph type = SCS Bunoff		Peak discharge	= 0.455 cfs
Storm frequency = 100 vrs		o peak	= 730 min
Time interval = 5 min	Hyd. vo	Hyd. volume	= 1,927 cuft
11		number	= 98
Basin Slope = 0.0 %	Hydrau	ulic length	= 0 ft
Tc method = USER	Time o	Time of conc. (Tc)	= 10.00 min
Total precip. = 8.33 in	Distribution	ution	= Custom
= uo	NOAA Atlas 14 Type-C.cds Shape	shape factor	= 484



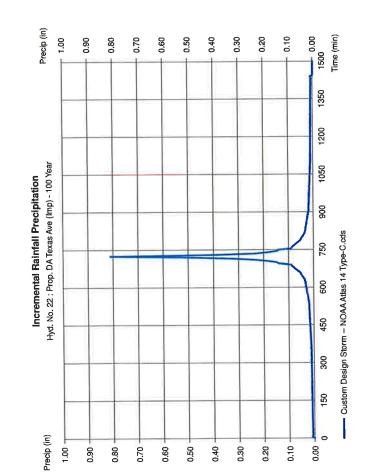
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Preci	Hydraflow F

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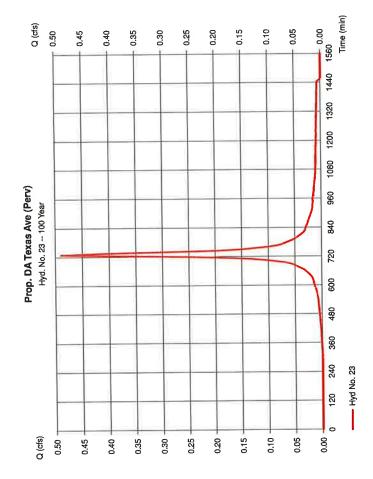
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Prop. DA Texas Ave (Imp)	(lmp)			
Storm Frequency Total precip. Storm duration	= 100 yrs = 8.3300 in = NOAA Atlas 14 Type-C.cds	Time interval Distribution	= 5 min = Custom	
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Hydratiow Hydrographs by Intelisolve v9.1	olve v9.1		Friday, Oct 9, 2020
Hyd. No. 23			
Prop. DA Texas Ave (Perv)	erv)		
	= SCS Runoff	Peak discharge	= 0.490 cfs
Storm frequency =	100 vrs	Time to peak	= 730 min
II	5 min	Hyd. volume	= 1,818 cuft
Drainade area =	0.090 ac	Curve number	= 80
Basin Slone =	0.0%	Hydraulic length	= 0.11
To method =	USER	Time of conc. (Tc)	= 10.00 min
Total precip	8.33 in	Distribution	= Custom
Storm duration =	NOAA Atlas 14 Type-C.cds	Shape factor	= 484

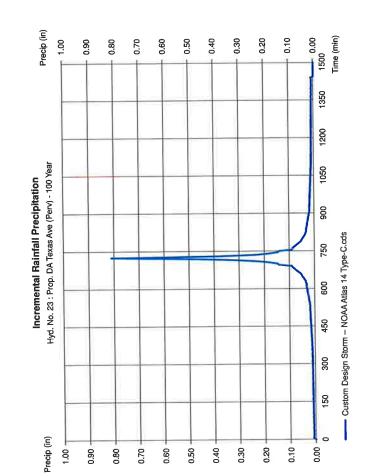


Precipitation Report

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Hydraflow Hydrographs by Intelisoive v9.1 Hyd. No. 23

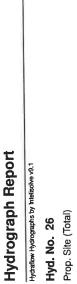
	5 min Custom
	Time interval = Distribution =
Prop. DA Texas Ave (Perv)	Storm Frequency = 100 yrs Total precip. = 8.3300 in Storm duration = NOAA Atlas 14 Type-C.cds



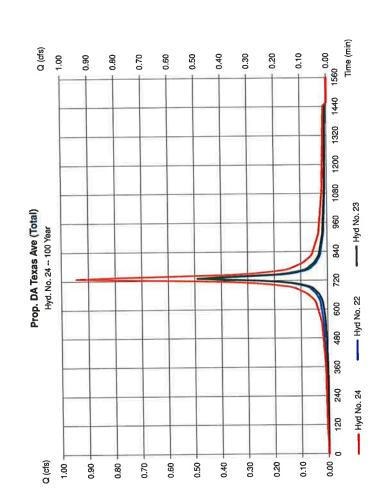
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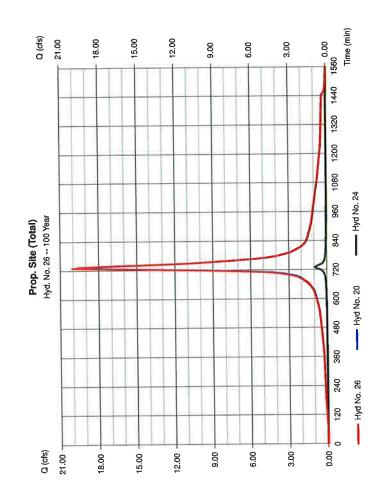
Hydraflow Hydrographs by Intelisolve v9.1	Friday, Oct 9, 2020
Hyd. No. 24	
Prop. DA Texas Ave (Total)	
Hvdrograph type = Combine	н ө
'n	Time to peak = 730 min
Time interval = 5 min	Hyd. volume = $3,725$ cult
inflow hyds. = 22, 23	Contrib. drain. area = 0.100 ac

Peak discharge = 0.944 cts Time to peak = 730 min Hyd. volume = 3,745 cuft Contrib. drain. area = 0.160 ac	
= Combine = 100 yrs = 5 min = 22, 23	
Irograph type m frequency ie interval w hyds.	



Hyd. No. 26		
Prop. Site (Total)		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 100 yrs = 5 min = 20, 24	Peak discharge = 20.05 cfs Time to peak = 730 min Hyd, volume = 101,471 cuft Contrib. drain. area = 0.000 ac





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# Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisoive v9.1

Friday, Oct 9, 2020

8

	Intensity-L	intensity-pursuon-risequery equation openions in the		
Do Las	8	٥	ш	(N/A)
-	39.0824	9.5000	0.8528	
N	45.6943	10.7000	0.8185	
	0.000	0.0000	0:000	
ŝ	99.7061	14.8000	0.9304	1
<b>P</b>	249.7597	21.8001	1.0961	
8	115.7547	14.9000	0.8980	1
50	7.3699	0.1000	0.2544	
õ	403.8513	25.1001	1.1108	1

Intensity = B / (Tc + D)^E

Return					SUBUI	(mensky values (man)	(man)					
(erv)	s P	ę	15	ล	53	8	36	40	\$	8	18	8
	4.00	3.10	2.55	2.18	1.91	1.70	1.54	1.40	1.29	1.20	1.12	1.05
01	4.80	3.83	3.21	2.77	2.45	2.20	2.00	1.84	1.70	1.59	1.49	1.40
	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ŝ	6.20	5.03	4.24	3.67	3.24	2.90	283	2.40	ន្ត	2.06	1.92	1.80
10	6.80	5.63	4.80	4.17	3.69	3.30	2.98	2.72	2.50	2.31	214	200
32	7.89	6.45	5.47	4.76	4.23	3.80	3.46	3.17	2.93	2.73	2.55	240
23	4.87	4.09	3.69	3.44	3.25	3.10	2.98	2.88	2.80	2.72	2.66	2.60
ē	9.20	7.76	6.69	5.87	522	4.70	4.27	3.91	3.60	3.33	3.10	2.90

		œ	ainfall F	Rainfall Precipitation Table (in)	tion Tabl	e (in)		
Storm Distribution	1-94	2-yr	3-Jrt	5-yr	10-yr	25-yr	50-ÅL	100-31
SCS 24-hour	0.00	3.31	00.0	0.00	5.01	6.19	0.00	8.33
SCS 6-H-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huffi-1st	0.00	0.00	0:00	0.00	0.0	0:00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.0	00'0	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	125	3,31	0.00	0.00	5.01	6.19	0.00	8.33

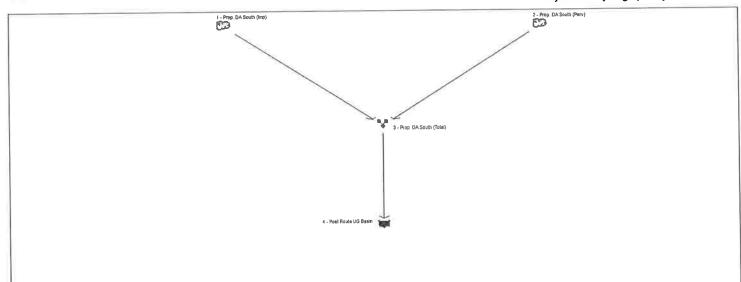
# HYDROGRAPH SUMMARY REPORTS – WATER QUALITY STORM

# **Hydraflow Table of Contents**

Hydraflow Hydrographs by Intelisolve v9.1 Friday, Oct 9, 20	20
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Summary Report Hydrograph Reports	3
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Hydraflow Hydrographs by Intelisolve v9.1



### <u>Legend</u> <u>Hyd.</u> Origin

### Description

1	SCS Runoff	Prop. DA South (Imp)
2	SCS Runoff	Prop. DA South (Perv)
3	Combine	Prop. DA South (Total)
4	Reservoir	Post Route UG Basin

Project: 2020-10 WQ - LPG.gpw

5 F						
Hydratiow Hydrographs by Intellsolve v9.1	Hydrograph description	Prop. DA South (Imp)	Prop. DA South (Perv)	Prop. DA South (Total)	Rode Basis	± 9, 2020
	Total strge used (cuft)	Ī	I	1	4 XX4	Friday, Oct 9, 2020
	Maximum elevation (11)	l		l	90 G	ear
	hriflow hyd(s)	I	ľ	1, 2	۳	Return Period: 1 Year
leport	Hyd. volume (cuft)	6,053	142	6,196	89 -	Return
ary R	Time to peak (min)	02	75	۴	8	
mm	Time Interval (min)	ŝ	ŝ	ю	ν <b>ο</b>	
oh Si	Peak flow (cfs)	3.813	0.078	3.882	0.701	PG.gpw
Hydrograph Summary Report	Hydrograph type (origin)	SCS Runoff	SCS Runoff	Combine	Reservoir	2020-10 WQ - LPG.gpw
Нý	Řý	-	6	e	*	50

solve v9.1							
Hvdraffow Hvdrographs by Intellsolve v9.1	Hydrograph	description	Prop. DA South (Imp)	Prop. DA South (Perv)	Prop. DA South (Total)	Post Route UG Basin Triday. Oct 9, 2020	
		100-Yr	I	I			
		S0-Yr	l		ļ		-
		25-Yr		I	I		
đ	low (cfs)	10-Yr		I	I		
Reca	Peak Outflow (cfs)	5-Yr	I	l			
iod F		3-Yr	1	I	I	1	
Per		2-Yr	1	I	ſ		
iturn		1-Yr	3.813	0.078	3.882	0.701 PG crow	
oh Re	Inflow	(s)p/H	ļ	1	1,2	m	"
Hydrograph Return Period Recap	Hydrograph	type (origin)	SCS Runoff	SCS Runoff	Combine	Reservoir 3 0.701	). IIIU. EVEN
ž	Ŷ	ź	-	N	e	*	Í

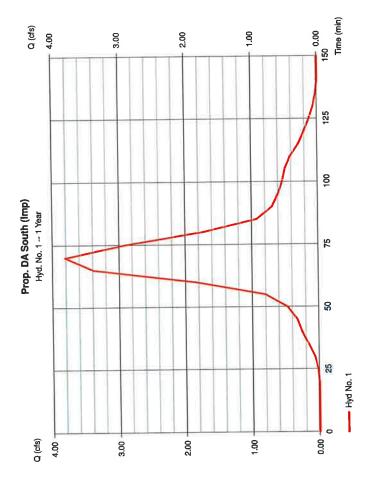
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	/a v9.1	
	tellsolve	
	rdrographs by Intr	
1	Graph	T
	Hydro	Ň
	ydraflow Hy	L.
	₽	Í

Hyd. No. 1 Prop. DA South (Imp)

	= 3.813 cfs	= 70 min	153 cuft		+	10.00 min	Custom	4	
	= 3.6	= 70	= 6,0		-	<b>`</b>	<u> </u>	= 484	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc	Distribution	Shape factor	
14	= SCS Runoff	= 1 Vrs	= 5 min	= 1.720 ac	- 00%	= USER	= 1.25 in	Water Quality Storm.cds	
רוטף. בל טטטטוון וווויף/	Hvdrooraph type	Storm frequency	Time interval	Drainage area	Bacin Slone	Te method	Total precip.	Storm duration	



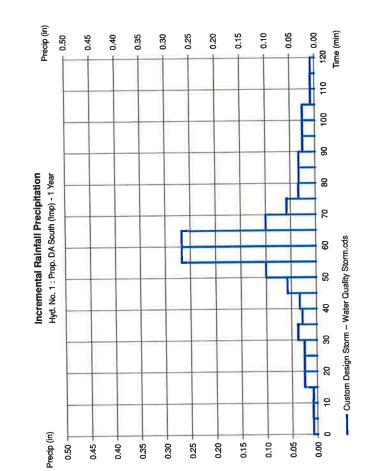
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Friday, Oct 9, 2020

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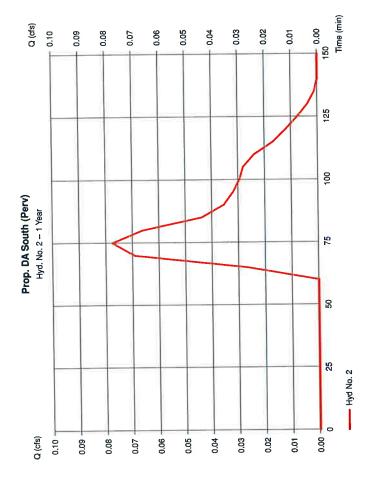
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	Friday, Oct 9, 2020			Time interval = 5 min Distribution = Custom m.cds
Precipitation Report	Hydraflow Hydrographs by Intelisolve v9.1	Hyd. No. 1	Prop. DA South (Imp)	Storm Frequency = 1 yrs Total precip. = 1.2500 in Storm duration = Water Quality Storm.cds



Hydraflow Hydrographs by Intellsolve v9.1	
Hyd. No. 2	
Prop. DA South (Perv)	
Hydrograph type = SCS Runoff	Peak

0.078 cfs 75 min 142 cuft 80 0 ft 10.00 min Custom 484	
Peak discharge = Time to peak = Hyd. volume = Curve number Hydraulic length = Time conc. (Tc) = Distribution = Shape factor =	
= SCS Runoff = 1 yrs = 5 min = 0.250 ac = 0.0 % = USER = 1.25 in = Water Quality Storm.cds	
Hydrograph type Storm frequency Time interval Drainage area Basin Slope Tc method Total precip. Storm duration	



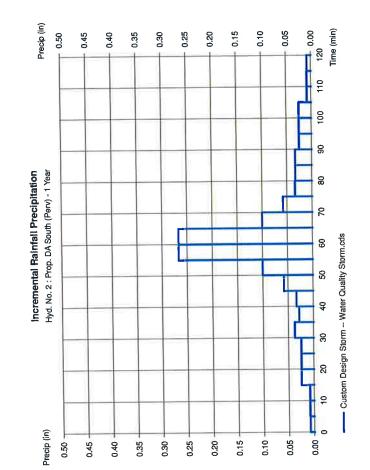
Report	
Precipitation	

Hydraflow Hydrographs by Intelisolve v9.1 c

Friday, Oct 9, 2020

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Hyd. No. 2				
Prop. DA South (Perv)				
Storm Frequency = 1 yrs Total precip. = 1.2500 ir Storm duration = Water Qi	1 yrs 1.2500 in Water Quality Storm.cds	Time interval Distribution	= 5 min = Custom	



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Intellisative v9.1	
Hydraflow Hydrographs by	Hyd. No. 3

Prop. DA South (Total)

Peak discharge = 3.882 cfs Time to peak = 70 min Hyd. volume = 6,196 cuft Contrib. drain. area = 1.970 ac	
Hydrograph type = Combine Storm frequency = 1 yrs Time interval = 5 min Inflow hyds. = 1, 2	

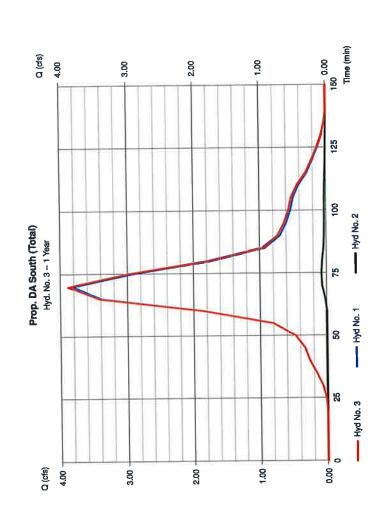
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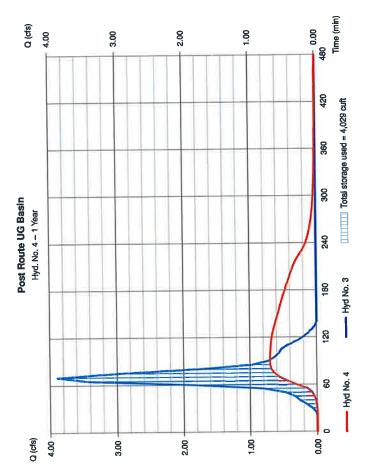
Friday, Oct 9, 2020

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Hydrafow Hydrograph by Intellective vis.1     Friday, cot 8, 2020       Hydr. No. 4     Post Route UG Basin       Post Route UG Basin     Peak discharge       Hydrograph type     = Reservoir       Time interval     = 5 min       Inflow hyd. No.     = 3 - Prop. DA South (Total)       Reservoir name     = UG Det Basin	a by metaotwevs.1 3 Basin De = Reservoir cy = 1 yrs . = 3 - Prop. DA South (Total)	Hydrograph Report	port		
<ul> <li>Basin</li> <li>Beak discharge = (</li> <li>Peak discharge = (</li> <li>e = Heservoir</li> <li>e = Heservoir</li> <li>Time to peak</li> <li>Time to peak</li> <li>= 1</li> <li>Max. Elevation</li> <li>= 1</li> <li>G Det Basin</li> </ul>	à Basin pe = Reservoir cy = 1 yrs = 3 - Prop. DA South (Total)	rdraftow Hydrographs by Intellsofve	V9.1		Fridey, Oct 9, 2020
Reservoir Peak discharge = ( 1 yrs Time to peak = 1 5 min Hyd. volume = 6 3 - Prop. DA South (Total) Max. Elevation = 1 UG Det Basin = 1	Reservoir 1 yrs 3 - Prop. DA South (Total)	lyd. No. 4			
= Reservoir       Peak discharge       =         = 1 yrs       Time to peak       =         = 5 min       Hyd. volume       =         = 3 - Prop. DA South (Total)       Max. Elevation       =         = UG Det Basin       Max. Storage       =	= Reservoir = 1 yrs = 5 min = 3 - Prop. DA South (Total)	ost Route UG Basin			
= 1 yrs = 5 min = 3 - Prop. DA South (Total) Max. Elevation = 1 = 0.G Det Basin = 0.	= 1 yrs = 5 min = 3 - Prop. DA South (Total)	u	servoir	Peak discharge Time to peak	= 0.701 cfs = 90 min
= 3 - Prop. DA South (Total) Max. Elevation = 0 = UG Det Basin	= 3 - Prop. DA South (Total)	uc; 11 11	min	Hyd. volume	= 6,188 cuft
= UG Det Basin Max. Storage =		11	- Prop. DA South (Total)	Max. Elevation	= 60.01 ft
		II	G Det Basin	Max. Storage	= 4,029 cuft







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Friday, Oct 9, 2020

Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisolve v9.1

Montain         B         D         E         (MA)           11         38.0824         9.5000         0.8528            2         45.6843         10.7000         0.8528            3         0.0000         0.0000         0.8528            3         45.6843         10.7000         0.8528            3         0.0000         0.0000         0.89394            5         98.7061         14.8000         0.3904            10         248.7587         21.8001         1.09611            26         7.3899         0.1000         0.29904            50         7.3893         0.1100         0.29800            60         7.3893         0.11000         0.2944	Return	Intensity-E	Intensity-Duration-Frequency Equation Coefficients (FHA)	Equation Coefficien	(FHA)
39,0824 9,5000 45,8949 10,7000 0,0000 0,0000 99,7061 14,8000 249,7597 14,8000 115,7547 14,9000 7,3899 0,1000 7,3899 0,1000	Ê	8	٥	ш	(N/A)
45.6843 10.7000 0.0000 0.0000 98.7061 14.6000 249.7597 21.6001 115.7547 14.9000 7.3859 0.1000 4.03.8513 25.1001	-	39.0824	9.5000	0.8528	
0,0000 0,0000 99,7061 14,8000 249,7597 21,8001 115,7547 14,9000 7,3899 0,1000 403,8513 25,1001	N	45.6943	10.7000	0.8185	ļ
99.7061 14.8000 243.7597 21.8001 115.7547 14.9000 7.3899 0.1000 403.8513 25.1001	0	00000	0.0000	0.0000	
243.7567 21.8001 115.7547 14.9000 7.3899 0.1000 403.8513 25.1001	5	99.7061	14.8000	0.9304	
115.7547 14.9000 7.3699 0.1000 403.8513 25.1001	₽	249.7597	21.8001	1.0961	
7.3699 0.1000 403.8513 2.5.1001	52	115.7547	14.9000	0.8980	1
403.8513 25.1001	20	7.3699	0.1000	0.2544	
	100	403.8513	25.1001	1.1108	

Intensity = B / (Tc + D)^E

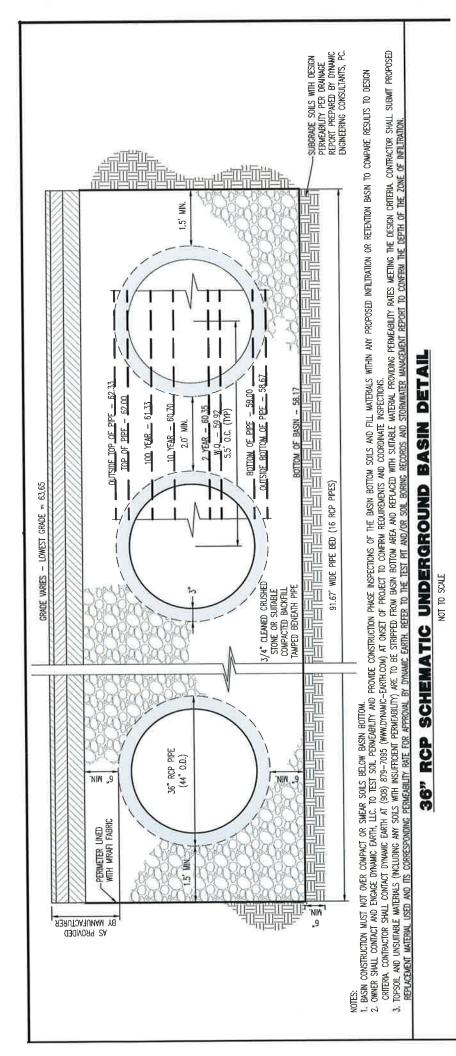
Return					Intens	Intensity Values (In/hr)	(In/hr)					
(SIV)	S mb	9	15	ន	52	8	8	40	45	8	5	8
-	4.00	3.10	2.55	2.18	1.91	1.70	1.54	1.40	1.29	1.20	1.12	1.05
N	4.80	3.83	3.21	277	2.45	2.20	2.00	1.84	1.70	1.59	1.49	1.40
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	6.20	5.03	4.24	3.67	3.24	2.90	2.63	2.40	222	2.06	1.92	1.80
10	6.80	5.63	4.80	4.17	3.69	3.30	2.98	2.72	2.50	2.31	2.14	2.00
۶	7.89	6.45	5.47	4.76	4.23	3.80	3.46	3.17	2.93	2.73	2.55	2.40
22	4.87	4.09	3,69	3.44	3.25	3.10	2.98	288	2.80	2.72	2.66	2.60
<u>1</u> 0	9.20	7.76	6.69	5.87	22	4.70	4.27	3.91	3.60	3.33	3.10	2.90

Tc = time in minutes. Values may exceed 60.

	_	œ	ainfall F	recipita	Rainfall Precipitation Table (in)	e (in)		
Storm Distribution	1-yr	2-yr	З-уг	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.31	0.00	0.00	5.01	6.19	0.00	8.33
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	00'0	0.00
Huft-1st	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
Huff-2nd	00.0	0.00	0.00	0.00	0,00	0.00	0.00	0.00
Huff-3rd	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Custom	1.25	3.31	0.00	0.0	5.01	6.19	0.00	8.33

w Hydrographs by Im w Hydrographs by Im bata - Irvert elev. / Storage Table () () () () () () () () () () () () ()	Hydragflow Hydrographs by Intellective (S.)       Pond No. 1 - UG Det Basin Ud Chembers - Invert elev 59.00 ft, Stage / Storage Table       Stage / Storage Stage       Stage / Storage       Stage / Storage (S)       Stage (In)       Stage (In)       Stage (In)       Stage (S)       Pointer (In)       Stage (S)       No. Barrels       No. Ba										01
	Pond No. 1 - UG Det Basin           Pond Data         Lug Chembers - Invert elev 59.00 ft, 1           Stage (1)         Elevertion (11)           Stage (1)         Elevertion (11)           Stage (1)         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 1         Elevertion (11)           Stage (1)         Elevertion (11)         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 128         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 128         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 128         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 128         Elevertion (11)           Dud Chembers - Inveit elev 59.00 ft, 10         Elevertion (11)           Dud Chembers - Inveit Elevertion (11)         = 36.00 ft, 10           Dud Chembers - Inveit Elevertion (11)         = 36.00 ft, 10           Reserveit Elevertion (11)         = 36.00 ft, 10         10           Reserveit Elevertion (11)         = 0.50 ft, 10         10           Reserveit Elevertion (11)         = 0.00 ft, 10         10           Reserveit Elevertion (11)         = 0.50 ft, 10         10           Reserveit Elevertion (11)         = 0.50 ft, 10         10           Reserveit Elevertion (11)         = 0.50 ft,	/e v9.1							PH-	ay, Oct 9,	2020
	Pond Data         Lug Chembers - Invert elev 59.00 ft, 1           Ug Chembers - Invert elev 59.00 ft, 1         Stage / Storage Table           Stage (f)         Elevertion (ft)           Stage (f)         Elevertion (ft)           D00         59.00 ft, 1           D00         59.00 ft, 1           D00         59.00 ft, 10           D00         51.70           240         60.20           240         60.20           240         60.00 ft, 10	E									
	Stage / Storage Table         Eventon (tr)           5300         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.00         59.00           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.01         21.0           0.02         21.0           0.03         21.0           0.04         0.01           0.05         0.01           0.05         0.01	0 ft, Rise x Span =	3.00 × 3.00 ft	Barrel Len =	230.00 ft,	No. Barrels	= 8, Slope	= 0.00%,	Headen	3 <b>=</b> Y86	
Envolution (i)         Contour area (equ)         Inc. storage (cur)         One accurate (equ)         Inc. storage (cur)         Inc. stora	Elevention (1) 59.00 59.00 59.00 59.00 59.00 50.00 51.10 51.10 51.10 50.00 50.00 50.00 50.00 50.00 50.00 50.00 50.00 66.6 6.6 6.6 6.6 6.6 6.6 6.6		:	1	1		(a)				
Ma         TO         TO           MA         1,200         1,200         1,200           MA         1,200         1,200         1,200           MA         1,200         1,200         1,200           MA         1,200         1,200         1,200           MA         1,200         5,247         1,275           MA         1,275         5,247         1,005           MA         1,000         1,000         1,000           MA         0         0         0,00         0,00           MA         0         0         0,00         0,00         0,00           MA         0         0         0,00         0,00         0,00         0,00           MA         0         0         0,00         0,00         0,00         0,00           MA         0         0         0         0,00         0,00         0,00           MA         MA         0         0         0         0,00         0,00           MA         MA         0         0         0         0         0         0           MA         MA         MA         0         0         0			(ubs) 84	incr. storege	(und)						
1702         702         702         702           1444         1708         5,750         5,407           1708         5,750         5,407         5,407           1708         5,750         5,407         5,407           1708         5,750         5,407         5,407           1708         5,750         5,407         5,407           1708         1,708         6,750         5,407           1709         1,709         6,750         5,407           1,709         1,709         6,750         5,407           1,709         1,709         6,750         0,000           1,709         5,700         0,000         0,000           1,709         5,700         0,000         0,000           1,709         5,700         0,000         0,000           1,709         1,709         1,709         1,709           1,709         1,709         1,709         1,709           1,700         0,000         0,000         0,000         0,000           1,709         1,709         1,709         1,709         1,709           1,709         0,100         0,100         0,000         0,000	□ □ 4 @ ← 0 0 0 4 0 > 0 <sup>2</sup>	n/a		0			0				
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[A]         [D]         [C]         [C] <td>Lay         Lay         Lay           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         -         0.50         0           -         0.50         0.00         0           -         0.50         0.00         0           -         -         0.50         0           -         0.50         0         0           -         -         0.50         0         0           -         -         0.50         0         0           -         -         1.03         1.04         Y           -         -         0.50         0         0           -         -         -         1.03         1.04           -         -         -         -         1.03           -         -         -         0.50         0.05           -         -         -         -         0.50           -         -</td> <td>-</td> <td>[Dullow]</td> <td></td> <td></td> <td>LAI</td> <td>[B]</td> <td>2</td> <td>0</td> <td></td> <td></td>	Lay         Lay         Lay           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         36.00         6           -         -         0.50         0           -         0.50         0.00         0           -         0.50         0.00         0           -         -         0.50         0           -         0.50         0         0           -         -         0.50         0         0           -         -         0.50         0         0           -         -         1.03         1.04         Y           -         -         0.50         0         0           -         -         -         1.03         1.04           -         -         -         -         1.03           -         -         -         0.50         0.05           -         -         -         -         0.50           -         -	-	[Dullow]			LAI	[B]	2	0		
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(%)         =         0.50         0.00         0.00         0.00         10.8           e.e.m         2.013         0.13         0.13         0.13         0.13         0.13         0.13         0.13         0.14           e.m         2.05         0.60         0.80         EmfLight/htth         =         0.00         (%)         Control           ispace         interval         Yes         Yes         No.         TW Elev. (h)         =         0.00         (%)         Control           /*         Kex Culturation antimum antimantimum antimum antimantimum antimum antimantimum a	(%) = 0.50 0 Coeft. = 0.13 0 Coeft. = 0.60 0 ingo 1 = 0.60 - 103 10 0 - 103 10 0 - 103 10 - 103 10		0.00	N-1-1-W	90	= Yes	N	2	2		
e.         103         013	<ul> <li>Coeff. = .013</li> <li>Coeff. = .0.50</li> <li>Storage / Discharge</li> <li>/ Storage / Discharge</li> <li>/ Storage / Discharge</li> <li>/ 1,922</li> <li>3,407</li> <li>55,002</li> <li>50,020</li> /ul>		n/a								
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UNDERGROUND DETENTION BASIN DETAIL



# STORMFILTER SIZING SUMMARY & NJDEP CERTIFICATION



# **StormFilter Design Summary**

**RPM** 

Lawrence, NJ 2/27/20

#### Information Provided by Engineer (Dynamic Engineering):

- Required TSS removal rate = 80%
- Water quality flow rate = 1.048 cfs
- 100-YR peak flow rate = 15.34 cfs
- Impervious drainage area = 1.69 acres
- Presiding agency = NJDEP

#### StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter<sup>®</sup> is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge surface area = 10.61 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- Hydraulic head required: 3.05 feet (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

#### **Design Summary:**

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **21 cartridges** in order to meet the hydraulic load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends an 8' x 16' precast Peak Diversion StormFilter.

$$N_{cartridges \ hyd.load} = \frac{Q_{treat} \ X \ 449 \ gpm/_{cfs}}{Q_{cartridge}} = \frac{1.048 \ cfs \ X \ 449 \ gpm/_{cfs}}{22.5 \ gpm/_{cartridge}} = 20.91 \Rightarrow (21) \ 27" \ Cartridges$$

$$N_{cartridges \ mass \ load} = \frac{Area_{site}}{Max \ Area_{cartridge}} = \frac{1.69 \ acre}{0.136 \ acres/_{cartridge}} = 12.42 \Rightarrow (13) \ 27" \ Cartridges$$



# **StormFilter Design Summary**

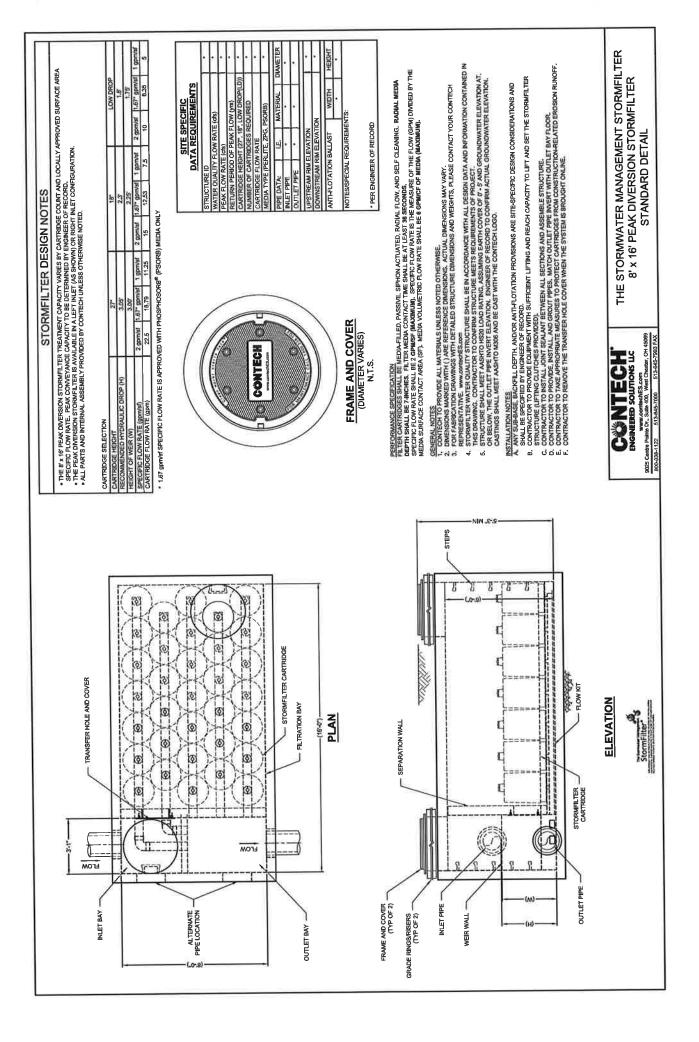
#### Maintenance:

Maintenance of Stormwater best management practices is required per the New Jersey Administrative Code 7:8-5.8. Recommendations for maintenance are included in chapters 8 & 9 of the New Jersey Stormwater Best Management Practices Manual. To comply with requirements, CONTECH offers a network of Preferred Service Providers that have the capability to perform all necessary inspections, compliance reporting and cleaning services. CONTECH recommends inspecting the system annually and maintaining the system at the recommendation of the annual inspection. Full maintenance is typically required every 24-36 months. Disposal of material should be handled in accordance with local regulations. Please contact CONTECH's Maintenance Department for all questions regarding maintenance at (503) 258-3157 or visit our website at www.conteches.com/maintenance.

Thank you for the opportunity to present this information to you and your client. If you have any questions, please call me at (443-457-1529).

Sincerely,

Taylor Murdock Contech Engineered Solutions LLC





# State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION Bureau of Nonpoint Pollution Control Division of Water Quality Mail Code 401-02B Post Office Box 420 Trenton, New Jersey 08625-0420 609-633-7021 Fax: 609-777-0432 http://www.state.nj.us/dep/dwq/bnpc\_home.htm

BOB MARTIN Commissioner

December 14, 2016

Derek M. Berg Director - Stormwater Regulatory Management - East Contech Engineered Solutions LLC 71 US Route 1, Suite F Scarborough, ME 04074

Re: MTD Laboratory Certification Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC Off-line Installation

### TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at <u>http://www.njcat.org/verificationprocess/technology-verification-database.html</u>.

CHRIS CHRISTIE Governor

KIM GUADAGNO Lt. Governor The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

- The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.
- 2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.
- 3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7;8-5.5.
- 4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.
- 5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at <a href="http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813">http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813</a> &PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.
- 6. Sizing Requirements:

The example below demonstrates the sizing procedure for a StormFilter System.

Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

- 1. Five (5) 12" cartridges,
- 2. Three (3) 18" cartridges, or
- 3. Two (2) 27" cartridges

### Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual) c=0.99 (runoff coefficient for impervious) Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

- 1. Thirty-six (36) 12" cartridges,
- 2. Twenty-four (24) 18" cartridges, or
- 3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter C	Cartridge Hei	ghts and New Je	ersey Treatme	nt Capacities
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR <sup>1</sup> (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area <sup>2</sup> (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.

 Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File Richard Magee, NJCAT Vince Mazzei, NJDEP - DLUR Ravi Patraju, NJDEP - BES Gabriel Mahon, NJDEP - BNPC Shashi Nayak, NJDEP - BNPC



# StormFilter Inspection and Maintenance Procedures





# **Maintenance Guidelines**

The primary purpose of the Stormwater Management StormFilter<sup>®</sup> is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

# **Maintenance Procedures**

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

#### 1. Inspection

• Inspection of the vault interior to determine the need for maintenance.

#### 2. Maintenance

- Cartridge replacement
- Sediment removal

# **Inspection and Maintenance Timing**

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.



In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

## **Maintenance Frequency**

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..



## **Inspection Procedures**

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning**: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

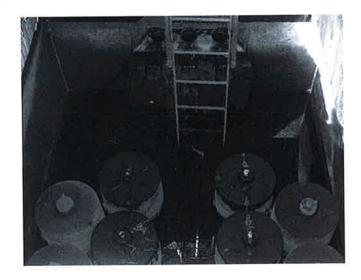
**Important:** Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

- 1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
- 2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
- 3. Open the access portals to the vault and allow the system vent.
- 4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
- 5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
- 6. Close and fasten the access portals.
- 7. Remove safety equipment.
- 8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
- 9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

# **Maintenance Decision Tree**

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

- 1. Sediment loading on the vault floor.
  - a. If >4" of accumulated sediment, maintenance is required.
- 2. Sediment loading on top of the cartridge.
  - a. If > 1/4" of accumulation, maintenance is required.
- 3. Submerged cartridges.
  - a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
- 4. Plugged media.
  - a. If pore space between media granules is absent, maintenance is required.
- 5. Bypass condition.
  - a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
- 6. Hazardous material release.
  - a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
- 7. Pronounced scum line.
  - a. If pronounced scum line (say  $\geq 1/4"$  thick) is present above top cap, maintenance is required.



# Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

**Important**: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

**Warning**: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

- 1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
- 2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
- 3. Open the doors (access portals) to the vault and allow the system to vent.
- 4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
- Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
- 6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
- 7. Remove used cartridges from the vault using one of the following methods:

# Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.



**Important:** Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

- C. Set the used cartridge aside or load onto the hauling truck.
- D. Continue steps a through c until all cartridges have been removed.

# Method 2:

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.
- B. Unscrew the cartridge cap.
- C. Remove the cartridge hood and float.
- D. At location under structure access, tip the cartridge on its side.
- E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.
- F. Set the empty, used cartridge aside or load onto the hauling truck.
- G. Continue steps a through e until all cartridges have been removed.

- 8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
- 9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
- Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
- 11. Close and fasten the door.
- 12. Remove safety equipment.
- 13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used <u>empty</u> cartridges to Contech Engineered Solutions.

# Related Maintenance Activities -Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

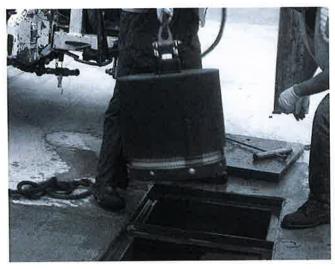


# **Material Disposal**

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.





# **Inspection Report**

Date: Personnel:
Location:System Size:
System Type: Vault Cast-In-Place Linear Catch Basin Manhole Date:
Sediment Thickness in Forebay:
Sediment Depth on Vault Floor:
Structural Damage:
Estimated Flow from Drainage Pipes (if available):
Cartridges Submerged: Yes No Depth of Standing Water:
StormFilter Maintenance Activities (check off if done and give description)
Trash and Debris Removal:
Minor Structural Repairs:
Drainage Area Report
Excessive Oil Loading: Yes No Source:
Sediment Accumulation on Pavement: Yes No Source:
Erosion of Landscaped Areas: Yes No Source:
Items Needing Further Work:
Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.
Other Comments:

Review the condition reports from the previous inspection visits.

# StormFilter Maintenance Report

Date:		Personnel:			
ocation:		System Size:			
system Type:	Vault	Cast-In-Place	Linear Catch Basin	Manhole 🗌	Other 🔲
ist Safety Proce	edures and Equip	oment Used:			

# System Observations

Months in Service:				
Oil in Forebay (if present):	Yes	No		
Sediment Depth in Forebay (if present): _			 	
Sediment Depth on Vault Floor:			 _	
Structural Damage:				
Drainage Area Report				
Excessive Oil Loading:	Yes	No	Source:	
Sediment Accumulation on Pavement:	Yes	No	Source:	
Erosion of Landscaped Areas:	Yes	No	Source:	

# StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris:	Yes	No	Details:	
Replace Cartridges:	Yes	No	Details:	
Sediment Removed:	Yes	No	Details:	
Quantity of Sediment Removed (estimate	?):			
Minor Structural Repairs:	Yes	No	Details:	•
Residuals (debris, sediment) Disposal Met	thods:			
Notes:				
2				



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# STORMWATER COLLECTION SYSTEM CALCULATIONS (PIPE SIZING)

# DYNAMIC ENGINEERING

# Inlet Area Summary and Average Coefficient (C) Calculations

Proposed Residential Development Project: Job #:

1279-99-010

Location: Township of Lawrence Computed By: LPG Checked By: RMD Date: 10/9/2020

Drainage Area		Coefficient (C) Used			Average Coefficient (C) Used	Total Area (SF)	Total Area (acres)
		0.95	<u> </u>	· /		7957	0.18
IA 1 IA 2	6547			0.35		7879	
IA 11	4955			0.35		4955	0.11
IA 12	2026		888	0.35	0.77	2914	
IA 31	3947	0.95	2918	0.35	0.69	6865	0.16
IA 41	4577	0.95	1130	0.35	0.83	5707	0.13
IA 51	12726	0.95	2197	0.35	0.86	14923	0.34



# Stormwater Collection System Calculations Project: Proposed Residential Development Computed By: LPG Job #: 1279-99-010 Checked By: RMD Location: Township of Lawrence Date: 10/9/2020

Project: Proposed Residential Development Job #: 1279-99-010 Location: Township of Lawrence Design Storm: 25 Yr

NOTES: 1) Design method used is Rational Method, unless otherwise noted 2) Refer to Weighted Runoff Coefficient table for calculation of incremental areas and C values

PIPE \$	ECTION	SUBCATCHMENT AREA	INCR	EMENTAL	CUMULATIVE		TIME OF CENTRA		I	PEAK R	UNOFF	PIP	'ING INF	TUT	Р	IPING DA'	ГА
FROM	то	Area (Acres)	*C*	AxC Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum for Pipe (CFS)	Dia. (In)	Length (Ft)	Man "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Pipe Velocity (fps)
Infet I	Inlet 2	0.18	0.84	0.15	0,15	10.00	0.58	10.00	6.80	1.02	1.02	15	126.0	0.013	0.0047	4.43	3.61
Inlet 2	MH 3	0.18	0.91	0.16	0.31	10.00	0.23	10.58	6.68	1.07	2.07	15	- 51.0	0.013	0.0050	4.57	3.73
Inlet 11	Inlet 12	0.11	0.95	0.10	0.10	10.00	0.23	10.00	6.80	0.68	0.68	15	51.0	0.013	0.0050	4.57	3.73
Inlet 12	MH 13	0.07	0.77	0.05	0.15	10.00	0.41	10.23	6.80	0.34	1.02	15	91.0	0.013	0.0050	4_57	3.73
Inlet 31	MH 32	0.16	0.69	0.11	0.11	10.00	0.15	10.00	6.80	0.75	0.75	15	95.0	0.013	0.0393	12.80	10.44
Inlet 41	MH 42	0.13	0.83	0.11	0.11	10.00	0.27	10.00	6.80	0.75	0.75	15	60.0	0.013	0.0050	4.57	3.73
Inlet 51	MH 52	0,34	0.86	0.29	0.29	10.00	0.11	10.00	6.80	1.97	1.97	15	24.0	0.013	0.0050	4_57	3.73
OCS 61	Headwall	0.93	0.92	0.86	0.86	10.00	0.16	10.00	6.80	5,85	5,85	36	63.0	0.013	0.0050	47_16	6 68

**RIP RAP CALCULATIONS** 



245 Main Street, Suite 110, Chester, NJ 07930 (908) 879-9229

Date:	10/9/2020
Project:	PM Developme
<b>Project No:</b>	1279-99-010

Calculated By: TAZ Checked By: LPG

# Conduit Outlet Protection Calculations

Rip Rap Pad # <u>1</u>	- F	κір	кар	Pad	Ŧ	1	
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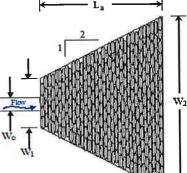
Design Parameters:		
Design Storm Flow for 25 Year, Q	6.20	cfs
Vertical Dimension of Outlet Pipe, D。	36	in
Horizontal Dimension of Outlet Pipe, W	36	in
Tailwater Depth, $TW^1$	1.46	ft

#### Apron Dimension Calculations:

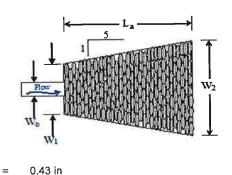
Unit Dicharge,  $q = Q/D_o = 2.07$  cfs per foot

• Case I: TW < 1/2 D,

Apron Length, $L_a = \frac{1.8q}{D_a^{1/2}} +$	$7D_o = 23.15  \text{ft}$	or	L . =	24 ft
Width, $W_1 = 3W_o = 9$ . ft			W 1 =	
Width, $W_2 = 3W_o + L_a =$	32.15 ft	or	$W_2 =$	33 ft



•	Case II: TW ≥ 1/2 D ₀
	Apron Length, $L_a = \frac{3q}{D_a^{1/2}} =$
	Width, $W_1 = 3W_0 =$
	Width, $W_2 = 3W_o + 0.4L_a$ =



# Rip Rap Stone Size Calculations:

Median	Stone	dea	=	0.02 <i>q</i> '''
Modian	otono,	G 50		TW

d 50 = 6 in

W<sub>1</sub> = W<sub>2</sub> =

#### Notes:

- Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
   The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d<sub>50</sub>. The largest stone size in the mixture shall be 1.5 times the d<sub>50</sub> size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

#### Footnote:

- 1. Tailwater depth shall be the 2-year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use TW = 0.2D o.
- 2. For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to  $1/4W_o$ .

# STORMWATER BASIN AREA INVESTIGATION REPORT, PREPARED BY DYNAMIC EARTH, LLC

# STORMWATER BASIN AREA INVESTIGATION REPORT

PROPOSED SITE DEVELOPMENT 2495 Brunswick Pike Block 2001, Lots 2, 3, 4, 5 & 68 Lawrence Township, Mercer County, New Jersey

Prepared for:

RPM DEVELOPMENT GROUP 77 Park Street Montclair, New Jersey 07042

Prepared by:



245 Main Street, Suite 110 Chester, New Jersey 07930

/Peter H. Howell, P.E. Principal NJ PE License No. 24GE04728700

Patrick J. Granitzki, PE Principal NJ PE License No. 24GE05355900

Project #1279-99-010E March 6, 2020

# STORMWATER BASIN AREA INVESTIGATION REPORT Proposed Site Development 2495 Brunswick Pike Block 2001, Lots 2, 3, 4, 5 & 68 Lawrence Township, Mercer County, New Jersey

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2.0	SCOPE OF SERVICES	1
3.0	UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) SOIL SURVEY	2
4.0	RESULTS	, <b>2</b>
4.1		~
4.1	Subsurface Soil Profile Seasonal High Groundwater and Permeability Testing	

#### **APPENDICES**

Test Location Plan Records of Subsurface Exploration

### 1.0 LOCATION AND DESCRIPTION

Dynamic Earth, LLC (Dynamic Earth) has completed an exploration and evaluation for the proposed stormwater management facility for the site development to be located at 2495 Brunswick Pike in Lawrence Township, Mercer County, New Jersey. The site is identified as Block 2001, Lots 2, 3, 4, 5 and 68. The subject site is shown on the *Test Location Plan* attached within the appendix of this report.

At the time of Dynamic Earth's investigation, the area of the proposed stormwater management facility was grass covered. The subject site is bound to the north by Texas Avenue and residential property beyond; to the east by the existing shopping center with Brunswick Pike beyond; to the south by the existing shopping center; and to the west by the residential property.

At the time of Dynamic Earth's investigation conceptual site plans were not developed; however, we understand that the proposed site development will be located within the northern portion of the site near Texas Avenue. Proposed site development plans are expected to include the construction of a Multi-Family Development with associated stormwater management facilities.

Topographic information was provided on a June 6, 2019 *Topographic Survey* prepared by Dynamic Survey, LLC. Existing site grades range between approximately 69 feet within the norther portion of the site and 57 feet within the southern portion of the site.

### 2.0 SCOPE OF SERVICES

Dynamic Earth's scope of services pertaining to this report included evaluating the subsurface conditions at soil profile pit locations to estimate the apparent seasonal high groundwater level and collecting samples for laboratory permeability testing. Eight soil profile pits (identified as SPP-1 through SPP-8) were performed as part of our investigation.

The test locations were excavated with a rubber-tire backhoe within the area of anticipated stormwater management facilities. The test locations were backfilled to the surface with excavated soils at. The test locations are shown on the attached *Supplemental Soil Profile Pit Location Plan*.

The soils encountered were classified in general conformance with the Field Book for Describing and Sampling Soils (Version 3), published by the National Soil Survey Center, Natural Resources Conservation Service, U.S. Department of Agriculture (USDA). Observations were made for groundwater and/or redoximorphic features indicative of zones of saturation or seasonal high groundwater. Soil logs are included in the Appendix of this report.

Undisturbed tube permeability tests were collected in general accordance with New Jersey Department of Environmental Protection (N.J.D.E.P.) Stormwater Best Practices Manual – Appendix E test methods on representative samples obtained from anticipated stormwater management facility infiltration depths.

### 3.0 UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) SOIL SURVEY

Based on a review of the United States Department of Agriculture – Natural Resources Conservation Services (USDA-NRCS) soil survey the following soil resources are mapped underlying the site within the area of the proposed site improvements and are described below:

**Udorthents, stratified substratum, zero to eight percent slopes (UdstB):** Udorthents stratified substratum with zero to eight percent slopes is mapped within the majority of the proposed stormwater management facility. The typical soil profile of this series soil (as reported in the soil survey) consists of sand to a depth of 10 inches underlain by gravelly coarse sand to a depth of 72 inches below the natural ground surface (limit of report). The depth to the water table is reported to be more than 80 inches below the natural ground surface.

Othello silt loams, zero to two percent slopes, northern coastal plain (OthA): Orthello silt loams with zero to two percent slopes is mapped within the southwestern portion of the proposed stormwater management facility. The typical soil profile of this series soil (as reported in the soil survey) consists of silt loam to a depth of 29 inches, with a sandy loam to a depth of 34 inches, underlain by loamy sand to a depth of 80 inches below the natural ground surface (limit of report). The depth to the water table is reported to be more between 10 and 20 inches below the natural ground surface.

### 4.0 RESULTS

Detailed descriptions of the subsurface conditions encountered are presented on the *Records of Subsurface Investigation* included herein. The subsurface conditions encountered in the soil profile pits consisted of the following generalized strata in order of increasing depth and were generally consistent with the USDA soil series detailed above.

### 4.1 Subsurface Soil Profile

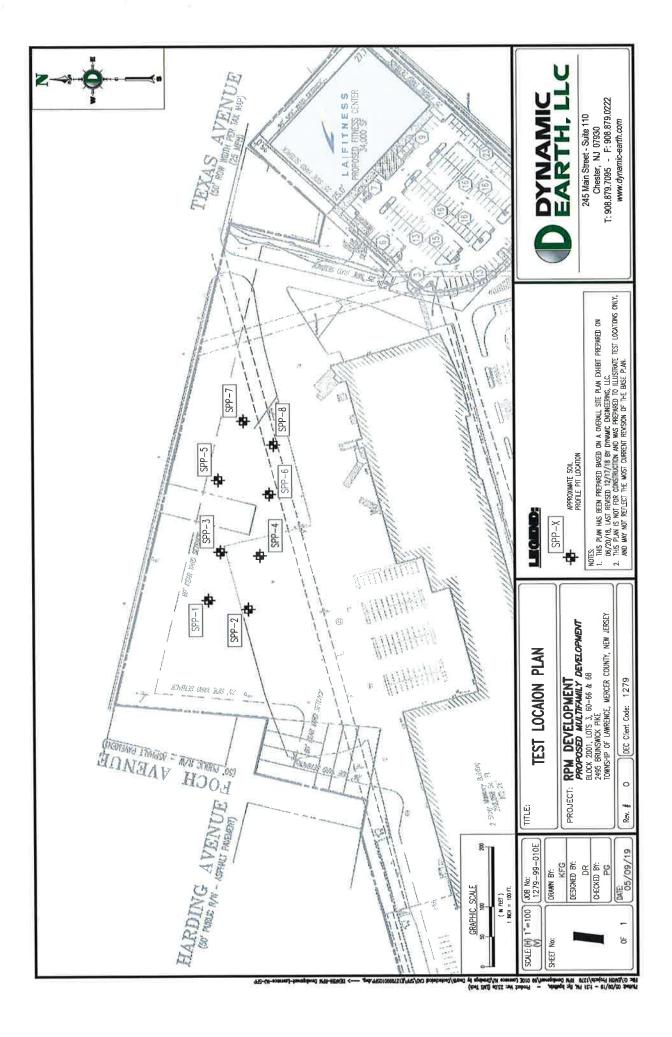
The soil profile pits were performed within existing grass areas and encountered between approximately three inches and 24 inches of topsoil fill at the surface. Debris encountered within the topsoil layer included porcelain tile fragments. Beneath the surficial cover, natural residual soils were encountered that consisted of sand, sandy loam, loamy sand, silt loam, silt, silty clay, and silty clay loam with variable amounts of gravel. The natural soils were encountered to termination/refusal depths ranging between approximately four feet and 11.3 feet below the ground surface; corresponding to elevations ranging between 53.4 feet and 57.9 feet.

#### 4.2 Seasonal High Groundwater and Permeability Testing

Groundwater or evidence of seasonal high groundwater was encountered within planned stormwater management locations at depths ranging from 0.4 feet and five feet below the ground surface; corresponding to elevations ranging between 58.1 feet and 54.6 feet. Groundwater levels are expected to fluctuate seasonally and following significant periods of precipitation. Permeability testing was not requested as part of this investigation. A summary of the seasonal high groundwater levels and permeability test results is presented in the following table:

SEA	SONAL HIGH GRO	UNDWATER AND PERMEABI	LITY TEST SUMMARY
		Estimated Seasonal	l High Groundwater
Location	Surface Elevation (mse)	Depth (Feet)	Elevation (Feet)
SPP-1	60.1	5.0	55.1
SPP-2	60.1	2.9	57.2
SPP-3	59.2	3.3	55.9
SPP-4	58.4	3.2	55.2
SPP-5	58.5	0.4	58.1
SPP-6	56.6	2.0	54.6
SPP-7	57.1	0.8	56.3
SPP-8	57.4	2.7	54.7

**Test Location Plan** 



**Records of Subsurface Exploration** 

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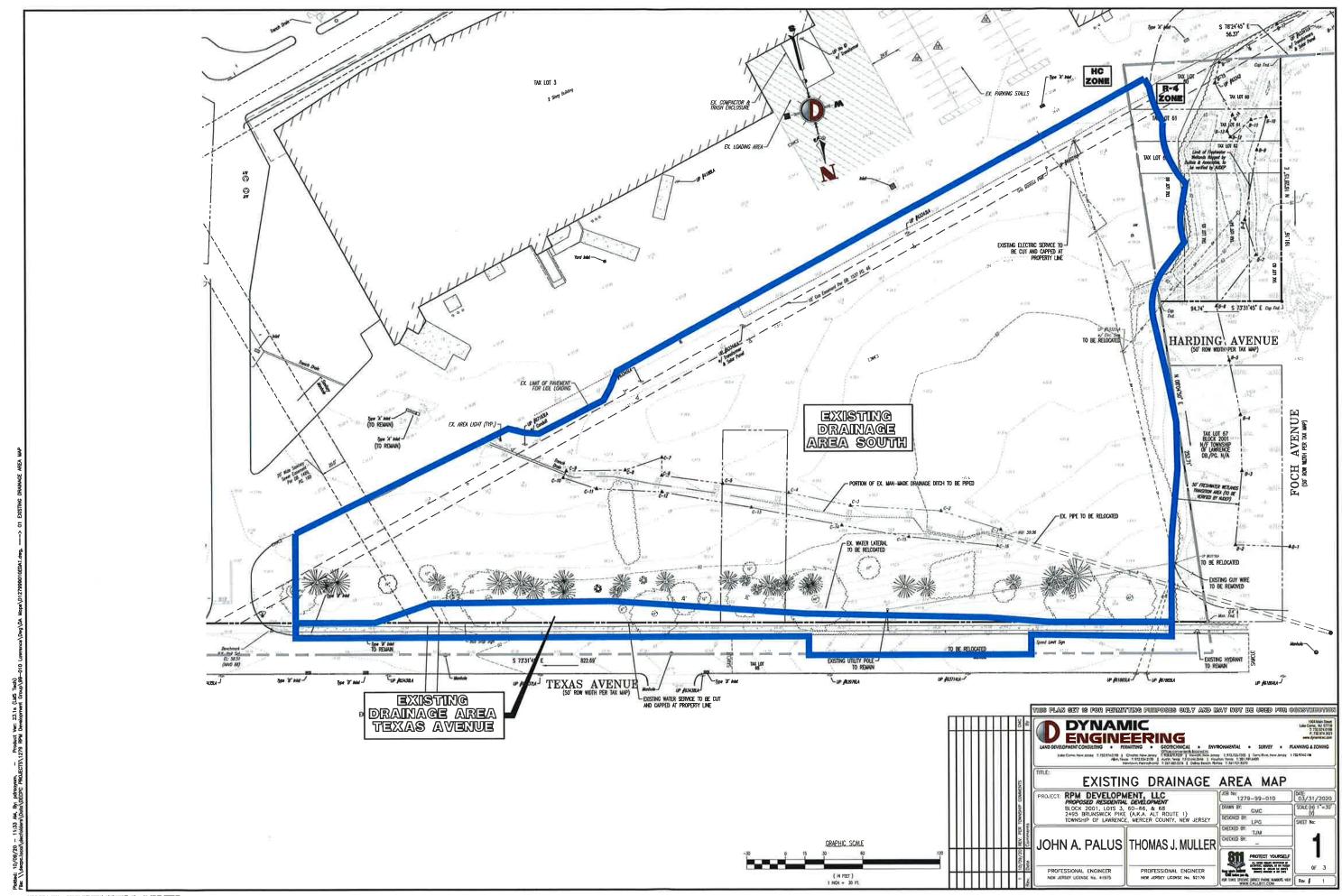
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Ž		A liter draw	- Church	Combactor	No Trpe	3	<b>GRAVEL</b>	ŧ	GRAVEL.		GRAVEL			-		Γ								t four feet bek
>		e. Neces Creek	conciented.			¥		BLT LOAN		93		OWNE				Γ								proximately a
<b>A</b> W	Project Processed Maintening Devicement	Dete 1	40		-	SOL TEXTUNE																		Additoral Ramarta: SPP-1 was terminated approximately at bur feet below the ground surface.
	it ber	Has. Ter		ः ।	$\left  \right $	_	-	.Ee	-		+	.6	+		e	-	 -		_	+				 C SPP-1 war
	A Matter	Cite in the local division of the local divi				NOLOR		TOPBOIL Dark Brown (7.8YR 3/3)		Brown (7.8YR 8/3)		(7.6VR 6/3)			(* 8YR 8/3)									18

# DRAINAGE AREA MAPS



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