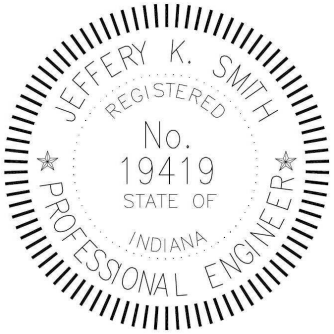
Final Drainage Report for

Commerce Business Park – Building #2 Expansion

City of Franklin, Johnson County, Indiana

Dated: September 28, 2023



Calculations Prepared By:

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LAND PLANNING · ENGINEERING · SURVEYING · PROJECT MANAGEMENT

Certified By:

9/28/23

Jeffery K. Smith, P.E. 19419

REPORT INDEX:

TECHNICAL INFORMATION DATA

Summary of Pre-Developed Drainage Conditions:

The project, "Commerce Business Park" is located at 1424 Commerce Parkway, in the City of Franklin, Johnson County, Indiana. The site is located within the 'C' soil classifications per the Soil Survey Maps for Johnson County. The undeveloped site was planted in comprised of row crops and used for agriculture purposes. Building #1 was constructed in 2013. Building #2 was constructed in 2018.

Onsite Pre-Basin '1' drains to the south to an existing swale along Arvin Road. The swale then drains east to an existing 36" RCP under Commerce Parkway. The drainage runoff ultimately releases to Hurricane Creek. A summary of the drainage release runoff:

Onsite Pre-Basin '1'		
A = 5.72 acres	CN = 78	T/C=27.4 min.
Q_{10} = 1.11 cfs, Q_{10} = 3.51 cfs, Q_{100} = 7.98 cfs		

Allowable Release Rates:

The allowable runoff release rates per Section 6.19 of the Subdivision Control Ordinance of the City of Franklin are as follows:

- The peak discharge from the 100-yr. post-developed storm event shall not exceed the peak discharge from the 10-yr. pre-developed storm event.
- The peak discharge from the 10-yr. post-developed storm event shall not exceed the peak discharge from the 2-yr. pre-developed storm event.

The allowable post-developed release rates for the site were calculated per the above requirements and a summary of the release rates are as follows:

Q_{10} = 1.11 cfs, Q_{100} = 3.51 cfs

Summary of Post-Developed Drainage Conditions:

The proposed site improvements for the "Commerce Business Park" will consist of two 24,000 sq. ft. buildings, including asphalt parking, concrete aprons, concrete curbs and sidewalks. Additional improvements consist of the installation of public and private utilities. The runoff from the site will be routed through a proposed dry detention pond with the outlet controlled by a pond control box, which will outlet to the existing 36" RCP pipe under Commerce Parkway. The drainage design for the site is designed to meet the General Drainage Standards, Chapter 6.19 of the City of Franklin Subdivision Control Ordinance. A summary of the drainage runoff and the dry detention pond are as followed:

Onsite Post-Basin '1':

A = 5.72 acres CN = 89 T/C=25.4 min.
Q_2 = 3.56 cfs, Q_{10} = 8.14 cfs, Q_{100} = 15.00 cfs
Detention:
N.P. = 735.00, T.O.B. = 740.00, Storage = 77,458 Cu. Ft.
100-yr elev. = 737.86
Outflow:
Q_2 = 0.72 cfs, Q_{10} = 0.91 cfs, Q_{100} = 3.35 cfs

The "Commerce Business Park – Building #2 Expansion" has a 5,000 sq. ft. building expansion to the main 15,000 sq. ft. building and the site construction will include asphalt parking, and concrete apron. See the Post-Developed Watershed Map in Section VI of this report.

Water Quality:

The dry detention pond and pond control box are designed to meet the City of Franklin Subdivision Control Ordinance, Section 6.19, for water quality design. The water quality detention pond is designed for option #1; detain 20% of the 0.5" direct runoff for 24 hours past the peak. However, the required storage for this runoff and 24 hour detention time required an orifice less than the 2" diameter, which is the minimum allowable orifice. Using a 2"diameter orifice the pond will detain 20% of the 0.5" direct runoff for a period of at least 6 hours past the peak, at 24 hours past the peak the dry detention basin will drain down to normal pool.

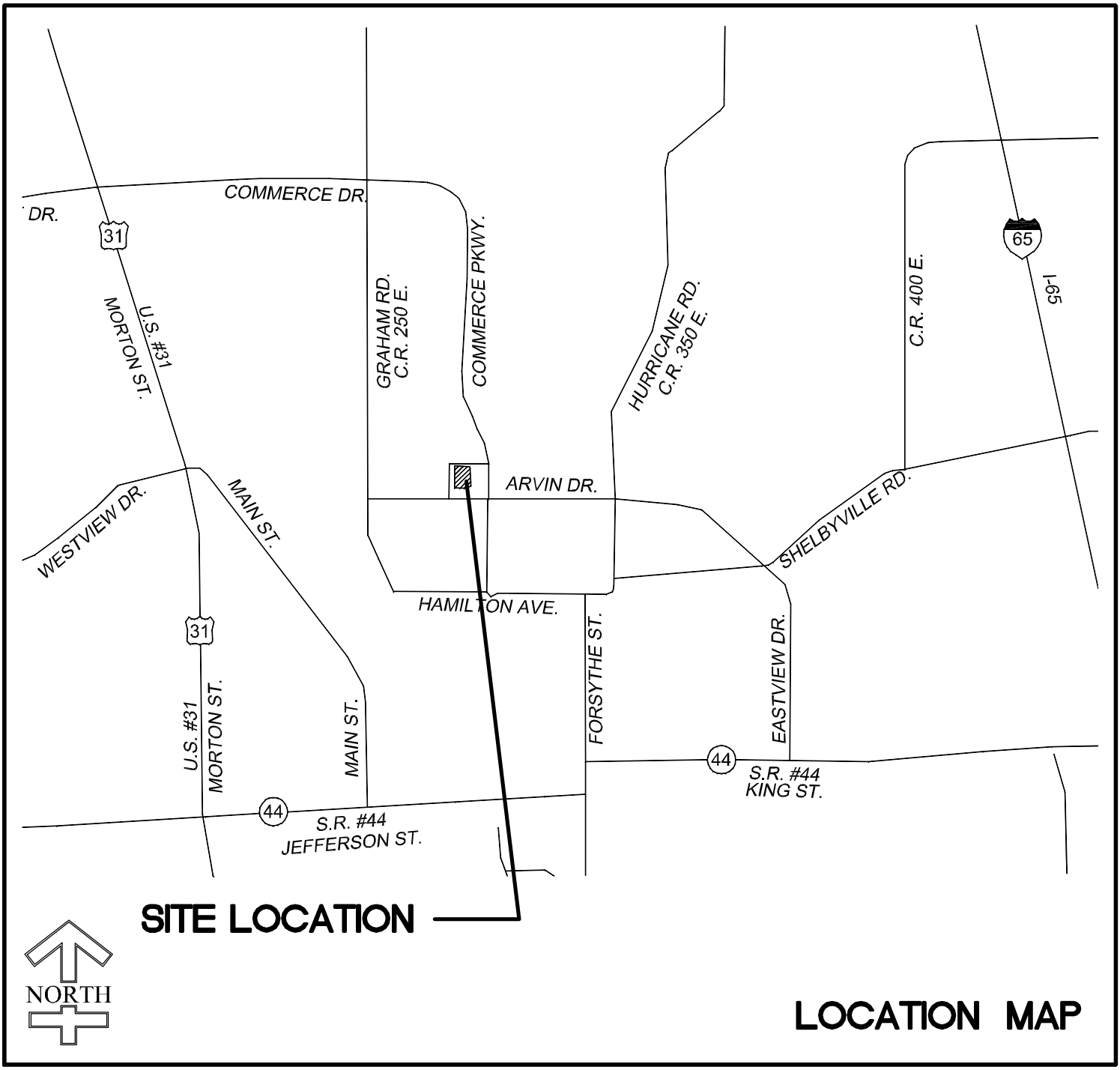
Engineering Methodology:

The calculations contained herein have been prepared in compliance with the City of Franklin Subdivision Control Ordinance. The detention facilities were designed using HYDRAFLOW Hydrograph Routing Module. A storm hydrograph is developed using the "SCS Curve Number Method" for each watershed and routed through a user defined detention basin and outlet structure configuration. Water surface elevations and outlet rates are determined by the storage indication method which uses a stage/storage/discharge relationship and inflow hydrograph to set the inflow minus the outflow equal to the change in storage. The post-developed drainage basins and basin characteristics for each pond are shown on the "Post-Development Drainage Map".

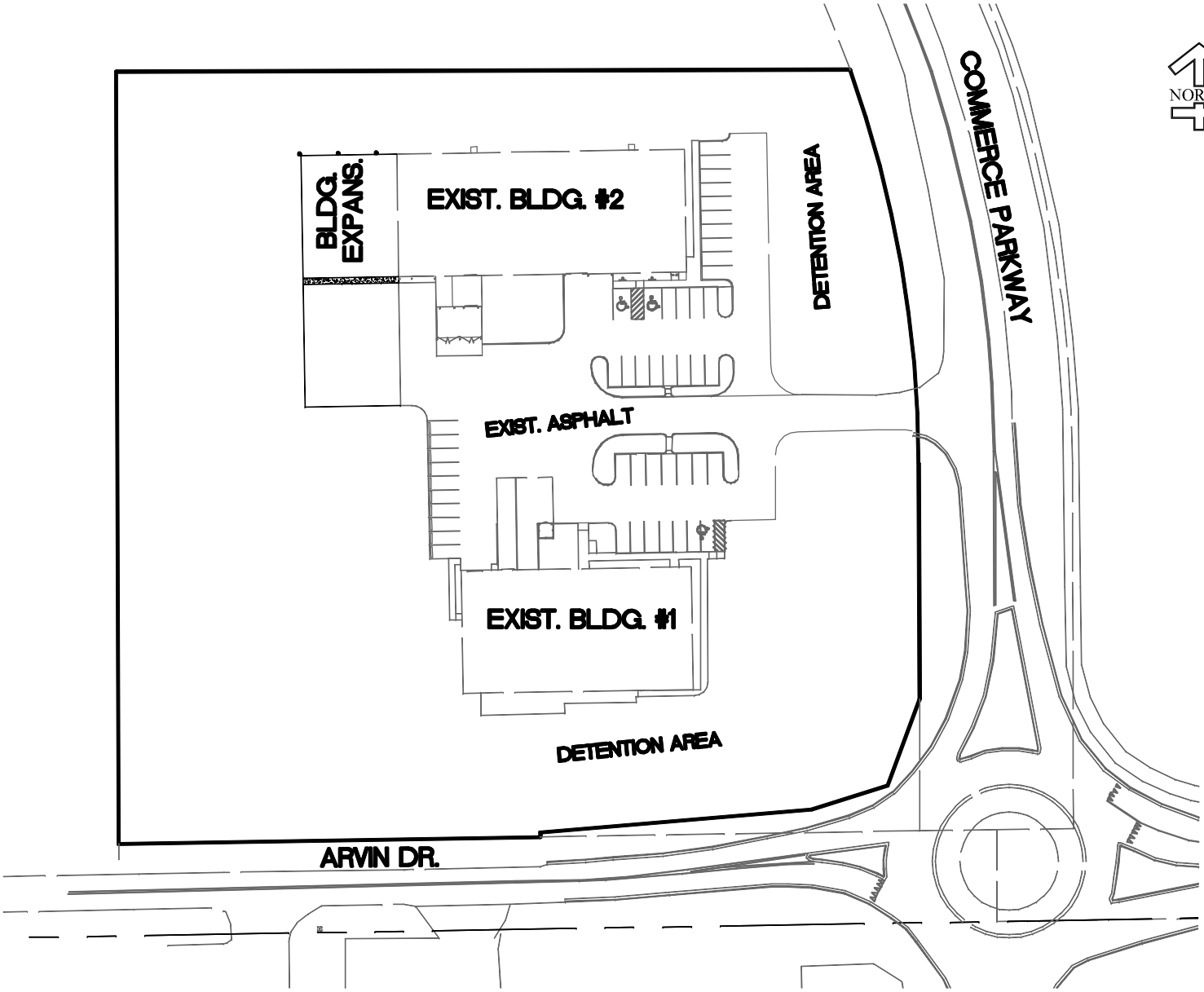
The storm sewer system was designed using the HYDRAFLOW Storm Sewer Module. Discharge rates for each inlet were calculated using the "SCS Curve Number Method" and input into the HYDRAFLOW Storm Sewer Module to calculate the capacity and hydraulic grade line for each pipe. Storm sewer systems are sized for a 10-year event with no surcharging.

Erosion Control:

The land disturbing activities will be less than 1 acre, so an IDEM Construction Stormwater General Permit (CSGP) submittal is not required. A Stormwater Pollution Prevention Plan (SWPPP) with an activities schedule will be submitted as part of the construction plans. Standard maintenance schedules and details will be included. All swales and pond banks will be mulch-seeded and have an erosion control blanket installed. All drainage easements will be mulch-seeded and the rights-of-way will be temporary seeded. A perimeter filter fence will be installed where needed as well as at all ditch inlets.



LOCATION MAP


NORTH
COMMERCE PARKWAY
BLDG. EXPANS.
EXIST. BLDG. #2
DETENTION AREA
EXIST. ASPHALT
EXIST. BLDG. #1
DETENTION AREA
ARVIN DR.

National Flood Hazard Layer FIRMette

FEMA

86°3'20"W 39°29'54"N

86°2'42"W 39°29'26"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/28/2023 at 8:49 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hours	Minutes	Return Period - Rainfall Intensity (in/hr)					
		2	5	10	25	50	100
0.08	5	4.75	6.14	6.99	8.08	8.83	9.69
0.17	10	3.63	4.75	5.48	6.40	7.07	7.77
0.25	15	2.97	3.92	4.55	5.34	5.94	6.53
0.5	30	1.98	2.64	3.09	3.65	4.10	4.50
1	60	1.25	1.67	1.96	2.31	2.62	2.88
2	120	0.76	1.02	1.20	1.40	1.59	1.75
3	180	0.56	0.75	0.88	1.03	1.17	1.29
6	360	0.33	0.44	0.52	0.60	0.68	0.75
12	720	0.20	0.26	0.30	0.35	0.39	0.43
24	1440	0.11	0.15	0.17	0.20	0.22	0.25

Hours	Minutes	Return Period - Rainfall Depth (in)					
		2	5	10	25	50	100
0.08	5	0.40	0.51	0.58	0.67	0.74	0.81
0.17	10	0.61	0.79	0.91	1.07	1.18	1.30
0.25	15	0.74	0.98	1.14	1.34	1.49	1.63
0.5	30	0.99	1.32	1.55	1.83	2.05	2.25
1	60	1.25	1.67	1.96	2.31	2.62	2.88
2	120	1.52	2.04	2.40	2.80	3.18	3.50
3	180	1.68	2.25	2.64	3.09	3.51	3.87
6	360	1.98	2.64	3.12	3.60	4.08	4.50
12	720	2.40	3.12	3.60	4.20	4.68	5.16
24	1440	2.64	3.60	4.08	4.80	5.28	6.00

TABLE 202-02: IDF and IDD Tables for Indianapolis, IN

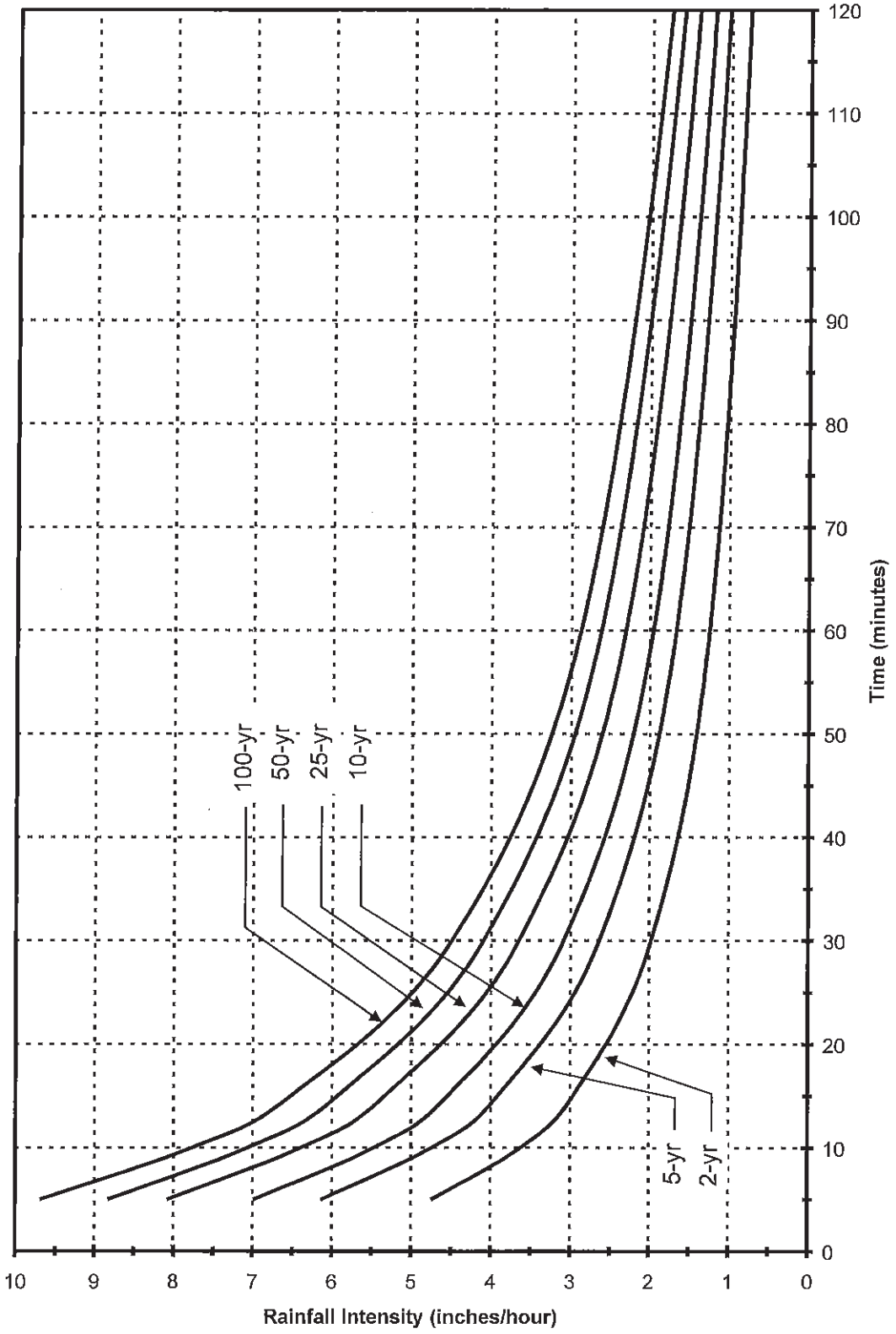


FIGURE 202-01: Indianapolis IDF Curve

Surface Description	n
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils: Residue cover </= 20% Residue cover > 20%	 0.06 0.17
Grass: Short grass prairie Dense grasses Bermuda grass	 0.15 0.24 0.41
Range (natural)	0.13
Woods: Light underbrush Dense underbrush	 0.40 0.80

TABLE 203-01: Roughness coefficients (Manning's n) for sheet flow

TYPE OF SURFACE	RUNOFF COEFFICIENT ©
Non-Urban Areas	
Bare earth	0.55
Steep grassed areas (slope 2:1)	0.60
Turf meadows	0.25
Forested areas	0.20
Cultivated fields	0.30
Urban Areas	
All watertight roof surfaces	0.90
Pavement	0.85
Gravel	0.85
Impervious soils (heavy)	0.55
Impervious soils (with turf)	0.45
Slightly pervious soil	0.25
Slightly pervious soil (with turf)	0.20
Moderately pervious soil	0.15
Moderately pervious soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 SF	0.45
Lots < 12,000 SF	0.45
Lots < 17,000 SF	0.40
Lots > ½ acre	0.35
Park, Cemetery or Unimproved Area	0.30

TABLE 204-01: Runoff Coefficients© for Use in the Rational Method

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Brookston: Br	B/D	Frequent	Brief	Dec–May	0–1.0	Apparent	Dec–May	High.
Crosby: CrA	C	None			1.0–3.0	Apparent	Jan–Apr	High.
[1] CsB2:								
Crosby part	C	None			1.0–3.0	Apparent	Jan–Apr	High.
Miami part	B	None			>6.0			Moderate.
Eel: Ee	C	Frequent	Brief	Oct–Jun	3.0–6.0	Apparent	Jan–Apr	High.
Fox: FoA, FoB2, [1] FxC2	B	None			>6.0			Moderate.
Genesee: Ge	B	Frequent	Brief	Oct–Jun	>6.0			Moderate.
Hennepin: HeF	B	None			>6.0			Moderate.
Martinsville: MgA, MgB2	B	None			>6.0			Moderate.
Miami: MmA, MmB2, MmC2, [1] MxD2, MxE2.	B	None			>6.0			Moderate.
Ockley: OcA, OcB2	B	None			>6.0			Moderate.
Rensselaer: Re	B/D	None			0–1.0	Apparent	Dec–May	High.
Shoals: Sh	C	Frequent	Brief	Oct–Jun	1.0–3.0	Apparent	Jan–Apr	High.
Sleeth: Sk	C	None			1.0–3.0	Apparent	Jan–Apr	High.
Sloan: So	B/D	Frequent	Long	Oct–Jun	0–0.5	Apparent	Nov–Jun	High.
Urban land:								
[1] Ub:								
Brookston part	B/D	Frequent	Brief	Dec–May	0–1.0	Apparent	Dec–May	High.
[1] Uc:								
Crosby part	C	None			1.0–3.0	Apparent	Jan–Apr	High.
[1] UfA:								
Fox part	B	None			>6.0			Moderate.
[1] UfC:								
Fox part	B	None			>6.0			Moderate.
[1] Ug:								
Genesee part	B	Frequent	Brief	Oct–Jun	>6.0			Moderate.
[1] UmB:								
Miami part	B	None			>6.0			Moderate.
[1] UmC:								
Miami part	B	None			>6.0			Moderate.
[1] Uw:								
Westland part	B/D	Frequent	Brief	Dec–May	0–1.0	Apparent	Dec–May	High.
Westland: We	B/D	Frequent	Brief	Dec–May	0–1.0	Apparent	Dec–May	High.
Whitaker: Wh	C	None			1.0–3.0	Apparent	Jan–Apr	High.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 205-01: Soil and Water Features for Marion County, Indiana
(SOURCE: NRCS, Soil Survey of Marion county, Indiana, 1991)

Cover Description	Curve Numbers for Hydrologic Soil Groups				
Cover Type and Hydrologic Condition	Average Percent Impervious Area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [2]		68	79	86	89
Poor condition (grass cover < 50%)		49	69	79	84
Fair condition (grass cover 50% to 75%)		39	61	74	80
Good condition (grass cover > 75%)					
Impervious Areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and Roads:					
Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban Districts:					
Commercial and Business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential Districts by Average Lot Size:					
0.125 acre or less (townhouses)	65	77	85	90	92
0.25 acre	38	61	75	83	87
0.33 acre	30	57	72	81	86
0.50 acre	25	54	70	80	85
1.00 acre	20	51	68	79	84
2.00 acre	12	46	65	77	82
Developing Urban Areas					
Newly graded areas (pervious area only, no vegetation)		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in *Table 205-04*).					

[1] *Average runoff condition, and $I_a = 0.2S$*

[2] *The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: Impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. If the impervious area is not connected, the NRCS method has an adjustment to reduce the effect.*

[3] *CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.*

TABLE 205-02: Runoff Curve Numbers for Urban Areas
(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Cover Description	Curve Numbers for Hydrologic Soil Groups			
Cover Type and Hydrologic Condition	A	B	C	D
Cultivated Land (Row Crops) With conservation treatment Without conservation treatment	72 62	81 71	88 78	91 81
Pasture or Range Land Poor condition Good condition	68 39	79 61	86 74	89 80
Meadow Good condition	30	58	71	78
Wood or Forest Land Thin stand, poor cover, no mulch Good cover	45 25	66 55	77 70	83 77

TABLE 205-03: Runoff Curve Numbers for Undeveloped Areas
(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Cover Description	Curve Numbers for Hydrologic Soil Groups			
Cover Type and Hydrologic Condition	A	B	C	D
Pasture, grassland or range with continuous forage for grazing.				
Poor	68	79	86	89
Fair	49	69	79	84
Good	39	61	74	80
Meadow with continuous grass, protected from grazing and generally mowed for hay.	30	58	71	78
Brush/brush-weed-grass mixture with brush being the major element.				
Poor	48	67	77	83
Fair	35	56	70	77
Good	30	48	65	73
Woods and grass combination (orchard or tree farm).				
Poor	57	73	82	86
Fair	43	65	76	82
Good	32	58	72	79
Woods				
Poor	45	66	77	83
Fair	36	60	73	79
Good	30	55	70	77
Farmsteads	59	74	82	86

TABLE 205-04: Runoff Curve Numbers for Agricultural Lands
(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Pre-Developed Drainage Conditions

Project: COMMERCE BUSINESS PARK | By: JPH | Date: 7/19/13

Location: | Checked: | Date:

Circle one: [Present] Developed

Onsite Basin '1'

1. Runoff curve number (CN)

Soil Name and Hydrologic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN 1/	Area (in acres)	Product of CN x area	
'C'	Cultivated Land (Row Crops)	78	5.72	446.2	
				0.0	
				0.0	
				0.0	
				0.0	
		Totals=	5.72	446.2	

CN (weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{446.2}{5.72} = 78.00$

TR55 Tc Worksheet

Hyd. No. 1

Pre Dev - 1 hr.

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.64	2.64	0.00	
Land slope (%)	= 0.80	0.00	0.00	
Travel Time (min)	**= 15.56** +	**0.00** +	**0.00** =	**15.56**
Shallow Concentrated Flow				
Flow length (ft)	= 267.00	377.00	0.00	
Watercourse slope (%)	= 0.80	0.20	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 1.44	0.72	0.00	
Travel Time (min)	**= 3.08** +	**8.71** +	**0.00** =	**11.79**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.012	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00** +	**0.00** +	**0.00** =	**0.00**

Total Travel Time, Tc ..... **27.35 min**

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.97	1	49	2,765	----	------	------	Pre Dev - 1 hr.
2	SCS Runoff	1.11	1	60	4,986	----	------	------	Pre Dev - 2 hr.
3	SCS Runoff	1.06	1	66	6,568	----	------	------	Pre Dev - 3 hr.
4	SCS Runoff	0.86	1	102	9,753	----	------	------	Pre Dev - 6 hr.
5	SCS Runoff	0.99	1	331	14,919	----	------	------	Pre Dev - 12 hr.
6	SCS Runoff	0.83	1	938	18,140	----	------	------	Pre Dev - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:23 AM

Hyd. No. 2

Pre Dev - 2 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 1.11 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 78
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.4 min
Total precip.	= 1.52 in	Distribution	= Huff-1st
Storm duration	= 2 hrs	Shape factor	= 484

Hydrograph Volume = 4,986 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.63	0.56	1.20	0.97	1.77	0.68
0.65	0.61	1.22	0.95	1.78	0.68
0.67	0.65	1.23	0.93	1.80	0.68
0.68	0.70	1.25	0.91	1.82	0.67
0.70	0.74	1.27	0.89	1.83	0.67
0.72	0.78	1.28	0.87	1.85	0.66
0.73	0.82	1.30	0.85	1.87	0.65
0.75	0.86	1.32	0.83	1.88	0.65
0.77	0.89	1.33	0.82	1.90	0.64
0.78	0.92	1.35	0.80	1.92	0.63
0.80	0.95	1.37	0.79	1.93	0.62
0.82	0.97	1.38	0.77	1.95	0.61
0.83	1.00	1.40	0.76	1.97	0.60
0.85	1.02	1.42	0.75	1.98	0.59
0.87	1.04	1.43	0.74	2.00	0.58
0.88	1.06	1.45	0.73	2.02	0.57
0.90	1.07	1.47	0.72	2.03	0.57
0.92	1.08	1.48	0.71	2.05	0.56
0.93	1.09	1.50	0.71		
0.95	1.10	1.52	0.70		
0.97	1.11	1.53	0.69	*...End*	
0.98	1.11	1.55	0.69		
1.00	1.11 <<	1.57	0.69		
1.02	1.11	1.58	0.68		
1.03	1.10	1.60	0.68		
1.05	1.10	1.62	0.68		
1.07	1.09	1.63	0.68		
1.08	1.08	1.65	0.68		
1.10	1.07	1.67	0.68		
1.12	1.05	1.68	0.68		
1.13	1.04	1.70	0.68		
1.15	1.02	1.72	0.68		
1.17	1.00	1.73	0.68		
1.18	0.98	1.75	0.68		

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.43	1	40	9,519	----	------	------	Pre Dev - 1 hr.
2	SCS Runoff	3.51	1	51	14,915	----	------	------	Pre Dev - 2 hr.
3	SCS Runoff	3.21	1	56	18,274	----	------	------	Pre Dev - 3 hr.
4	SCS Runoff	2.35	1	95	25,043	----	------	------	Pre Dev - 6 hr.
5	SCS Runoff	2.14	1	328	32,437	----	------	------	Pre Dev - 12 hr.
6	SCS Runoff	1.71	1	937	40,209	----	------	------	Pre Dev - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Tuesday, Jul 23 2013, 10:23 AM

Hyd. No. 2

Pre Dev - 2 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 3.51 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 78
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.4 min
Total precip.	= 2.40 in	Distribution	= Huff-1st
Storm duration	= 2 hrs	Shape factor	= 484

Hydrograph Volume = 14,915 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.52	1.84	1.08	2.98
0.53	1.99	1.10	2.92
0.55	2.14	1.12	2.86
0.57	2.28	1.13	2.80
0.58	2.42	1.15	2.74
0.60	2.55	1.17	2.67
0.62	2.68	1.18	2.60
0.63	2.80	1.20	2.54
0.65	2.91	1.22	2.47
0.67	3.01	1.23	2.41
0.68	3.10	1.25	2.35
0.70	3.19	1.27	2.29
0.72	3.27	1.28	2.23
0.73	3.33	1.30	2.17
0.75	3.39	1.32	2.12
0.77	3.43	1.33	2.07
0.78	3.46	1.35	2.02
0.80	3.48	1.37	1.98
0.82	3.50	1.38	1.94
0.83	3.51	1.40	1.90
0.85	3.51 <<	1.42	1.86
0.87	3.50	1.43	1.83
0.88	3.49	1.45	1.80
0.90	3.47	1.47	1.78
0.92	3.44		
0.93	3.41		
0.95	3.38	*...End*	
0.97	3.34		
0.98	3.29		
1.00	3.25		
1.02	3.20		
1.03	3.15		
1.05	3.10		
1.07	3.04		

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	7.98	1	37	21,496	----	------	------	Pre Dev - 1 hr.
2	SCS Runoff	7.64	1	46	30,862	----	------	------	Pre Dev - 2 hr.
3	SCS Runoff	6.85	1	50	37,039	----	------	------	Pre Dev - 3 hr.
4	SCS Runoff	4.51	1	87	47,257	----	------	------	Pre Dev - 6 hr.
5	SCS Runoff	3.80	1	326	58,701	----	------	------	Pre Dev - 12 hr.
6	SCS Runoff	2.96	1	937	73,765	----	------	------	Pre Dev - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:24 AM

Hyd. No. 1

Pre Dev - 1 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 7.98 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.4 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 21,496 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.35	4.03	0.92	5.37
0.37	4.48	0.93	5.21
0.38	4.91	0.95	5.05
0.40	5.33	0.97	4.90
0.42	5.73	0.98	4.77
0.43	6.10	1.00	4.65
0.45	6.45	1.02	4.53
0.47	6.76	1.03	4.40
0.48	7.04	1.05	4.28
0.50	7.28	1.07	4.15
0.52	7.49	1.08	4.01
0.53	7.65		
0.55	7.78		
0.57	7.87	*...End*	
0.58	7.94		
0.60	7.97		
0.62	7.98 <<		
0.63	7.96		
0.65	7.93		
0.67	7.87		
0.68	7.78		
0.70	7.68		
0.72	7.56		
0.73	7.41		
0.75	7.25		
0.77	7.07		
0.78	6.88		
0.80	6.69		
0.82	6.49		
0.83	6.29		
0.85	6.10		
0.87	5.91		
0.88	5.73		
0.90	5.55		

Post-Developed Drainage Conditions

Project: COMMERCE BUSINESS PARK By: JPH Date: 7/19/13
Location: Checked: Date:

Circle one: Present **Developed** Onsite Basin '1'

1. Runoff curve number (CN)

Soil Name and Hydrologic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN 1/	Area (in acres)	Product of CN x area	
'C'	Urban Disticts (Industrial) (60% impervious coverage)	89	5.72	509.1	
				0.0	
				0.0	
				0.0	
				0.0	
		Totals=	5.72	509.1	

CN (weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{509.1}{5.72} = 89.00$

TR55 Tc Worksheet

Hyd. No. 1

Post Dev - 1 hr.

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.64	2.64	0.00	
Land slope (%)	= 0.80	0.00	0.00	
Travel Time (min)	**= 15.56**	**+ 0.00**	**+ 0.00**	**= 15.56**
Shallow Concentrated Flow				
Flow length (ft)	= 850.00	0.00	0.00	
Watercourse slope (%)	= 0.50	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 1.44	0.00	0.00	
Travel Time (min)	**= 9.86**	**+ 0.00**	**+ 0.00**	**= 9.86**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.012	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 25.42 min

Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:27 AM

Pond No. 1 - Dry Detention

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	735.00	00	0	0
1.00	736.00	2,480	1,240	1,240
2.00	737.00	20,925	11,703	12,943
3.00	738.00	33,400	27,163	40,105
4.00	739.00	41,305	37,353	77,458

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 12.00	2.00	5.00	0.00
Span (in)	= 12.00	2.00	5.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 735.00	735.00	736.00	0.00
Length (ft)	= 40.00	0.50	0.50	0.00
Slope (%)	= 0.30	0.50	0.50	0.00
N-Value	= .011	.011	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 11.70	0.00	0.00	0.00
Crest El. (ft)	= 737.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

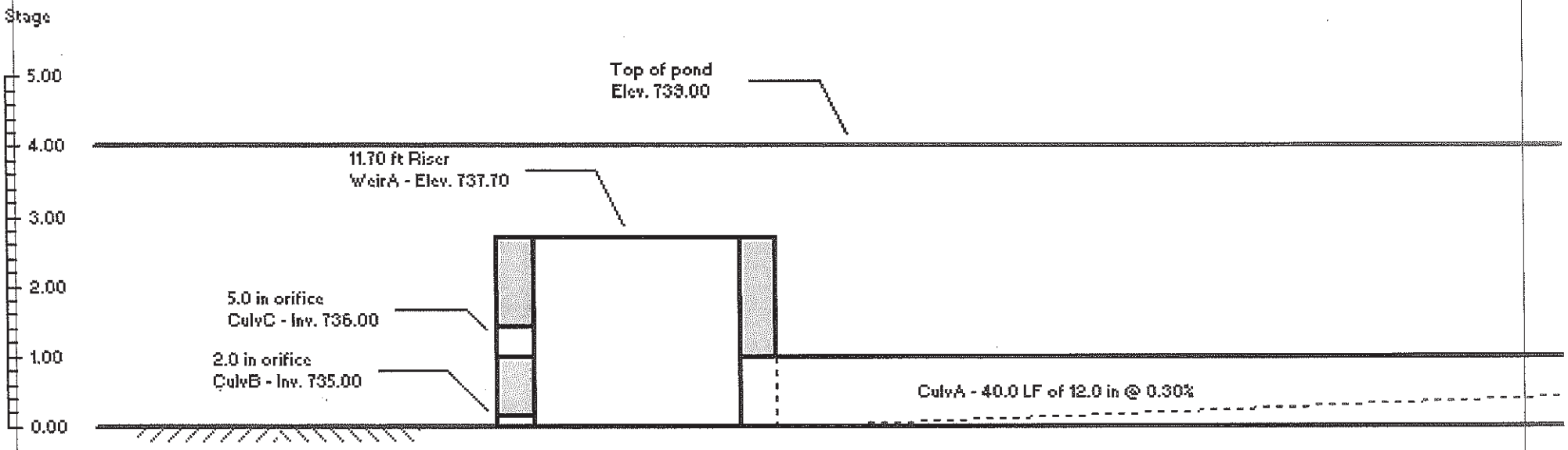
Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	735.00	0.00	0.00	0.00	---	0.00	---	---	---	---	0.00
1.00	1,240	736.00	0.10	0.10	0.00	---	0.00	---	---	---	---	0.10
2.00	12,943	737.00	0.72	0.13	0.58	---	0.00	---	---	---	---	0.71
3.00	40,105	738.00	5.72	0.04	0.26	---	5.43	---	---	---	---	5.72
4.00	77,458	739.00	7.07	0.01	0.04	---	7.00	---	---	---	---	7.04

Dry Detention



Section

NTS

* Side slope estimated average from contours

Schematic only. Not for construction.

PROJECT NAME: Commerce Business Park
Emergency spillway calculation Pond

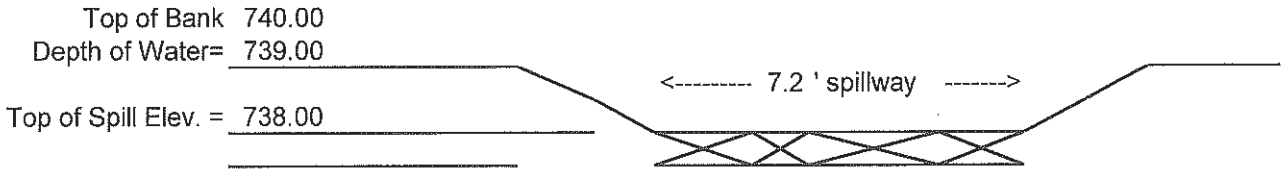
Peak 100 Yr. Inflow = 15 c.f.s.

1.25 x 15 c.f.s. = 18.8

Weir Equation: Q = C L H(3/2)

Where Q = outflow
L = length of weir
C = discharge coefficient
H = hydraulic head over weir

18.75 c.f.s. = 2.6 (L) 1
L = 7.212 '



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.56	1	36	9,390	----	------	------	Post Dev - 1 hr.
2	SCS Runoff	3.38	1	45	13,513	----	------	------	Post Dev - 2 hr.
3	SCS Runoff	2.95	1	52	16,096	----	------	------	Post Dev - 3 hr.
4	SCS Runoff	2.02	1	86	21,164	----	------	------	Post Dev - 6 hr.
5	SCS Runoff	1.85	1	326	28,619	----	------	------	Post Dev - 12 hr.
6	SCS Runoff	1.33	1	936	33,017	----	------	------	Post Dev - 24 hr.
7	Reservoir	0.51	1	83	9,382	1	736.57	7,904	Thru Pond - 1 hr.
8	Reservoir	0.61	1	136	13,504	2	736.77	10,207	Thru Pond - 2 hr.
9	Reservoir	0.64	1	189	16,087	3	736.82	10,876	Thru Pond - 3 hr.
10	Reservoir	0.64	1	210	21,156	4	736.83	10,916	Thru Pond - 6 hr.
11	Reservoir	0.72	1	481	28,610	5	737.02	13,387	Thru Pond - 12 hr.
12	Reservoir	0.69	1	1038	33,008	6	736.94	12,238	Thru Pond - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:25 AM

Hyd. No. 1

Post Dev - 1 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 3.56 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 1.25 in	Distribution	= Huff-1st
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 9,390 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.35	1.93	0.92	2.26
0.37	2.13	0.93	2.20
0.38	2.33	0.95	2.13
0.40	2.51	0.97	2.07
0.42	2.68	0.98	2.02
0.43	2.84	1.00	1.97
0.45	2.99	1.02	1.92
0.47	3.12	1.03	1.87
0.48	3.23	1.05	1.82
0.50	3.33		
0.52	3.40		
0.53	3.47	*...End*	
0.55	3.51		
0.57	3.54		
0.58	3.56		
0.60	3.56 <<		
0.62	3.55		
0.63	3.53		
0.65	3.50		
0.67	3.46		
0.68	3.41		
0.70	3.34		
0.72	3.27		
0.73	3.19		
0.75	3.11		
0.77	3.01		
0.78	2.92		
0.80	2.82		
0.82	2.73		
0.83	2.65		
0.85	2.57		
0.87	2.49		
0.88	2.41		
0.90	2.33		

Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 5

Post Dev - 12 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 1.85 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 2.40 in	Distribution	= Huff-2nd
Storm duration	= 12 hrs	Shape factor	= 484

Hydrograph Volume = 28,619 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)	
3.92	0.93	4.48	1.48	5.05	1.83	5.62	1.75
3.93	0.96	4.50	1.50	5.07	1.83	5.63	1.74
3.95	0.97	4.52	1.52	5.08	1.83	5.65	1.72
3.97	0.99	4.53	1.53	5.10	1.83	5.67	1.70
3.98	1.01	4.55	1.55	5.12	1.83	5.68	1.68
4.00	1.03	4.57	1.57	5.13	1.83	5.70	1.66
4.02	1.05	4.58	1.59	5.15	1.83	5.72	1.64
4.03	1.07	4.60	1.61	5.17	1.83	5.73	1.62
4.05	1.08	4.62	1.62	5.18	1.83	5.75	1.60
4.07	1.10	4.63	1.64	5.20	1.83	5.77	1.59
4.08	1.11	4.65	1.65	5.22	1.83	5.78	1.57
4.10	1.13	4.67	1.67	5.23	1.83	5.80	1.56
4.12	1.14	4.68	1.68	5.25	1.83	5.82	1.54
4.13	1.16	4.70	1.70	5.27	1.83	5.83	1.53
4.15	1.17	4.72	1.71	5.28	1.83	5.85	1.52
4.17	1.19	4.73	1.72	5.30	1.83	5.87	1.51
4.18	1.20	4.75	1.74	5.32	1.83	5.88	1.50
4.20	1.21	4.77	1.75	5.33	1.84	5.90	1.49
4.22	1.22	4.78	1.76	5.35	1.84	5.92	1.48
4.23	1.23	4.80	1.77	5.37	1.84	5.93	1.47
4.25	1.25	4.82	1.78	5.38	1.84	5.95	1.46
4.27	1.26	4.83	1.79	5.40	1.85	5.97	1.46
4.28	1.27	4.85	1.80	5.42	1.85	5.98	1.45
4.30	1.29	4.87	1.81	5.43	1.85 <<	6.00	1.45
4.32	1.30	4.88	1.81	5.45	1.85	6.02	1.44
4.33	1.31	4.90	1.82	5.47	1.84	6.03	1.44
4.35	1.33	4.92	1.82	5.48	1.84	6.05	1.43
4.37	1.34	4.93	1.82	5.50	1.83	6.07	1.43
4.38	1.36	4.95	1.83	5.52	1.83	6.08	1.42
4.40	1.38	4.97	1.83	5.53	1.82	6.10	1.42
4.42	1.40	4.98	1.83	5.55	1.81	6.12	1.41
4.43	1.42	5.00	1.83	5.57	1.80	6.13	1.40
4.45	1.44	5.02	1.83	5.58	1.79	6.15	1.40
4.47	1.46	5.03	1.83	5.60	1.77	6.17	1.39

Continues on next page...

Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 11

Thru Pond - 12 hr.

Hydrograph type	= Reservoir	Peak discharge	= 0.72 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Reservoir name	= Dry Detention
Max. Elevation	= 737.02 ft	Max. Storage	= 13,387 cuft

Storage Indication method used. | Outflow hydrograph volume = 28,610 cuft

(Printed values >= 75% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
7.72	0.79	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.73	0.79	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.75	0.78	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.77	0.78	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.78	0.78	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.80	0.78	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.82	0.77	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.83	0.77	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.85	0.77	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.87	0.77	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.88	0.76	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.90	0.76	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.92	0.76	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.93	0.75	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.95	0.75	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.97	0.74	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
7.98	0.74	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.00	0.73	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.02	0.72	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72 <<
8.03	0.71	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.05	0.71	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.07	0.70	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.08	0.69	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.10	0.68	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.12	0.67	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.13	0.67	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.15	0.66	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.17	0.65	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.18	0.65	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.20	0.64	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.22	0.63	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.23	0.63	737.02	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.25	0.62	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.27	0.62	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.28	0.61	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.30	0.61	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.32	0.61	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.33	0.60	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.35	0.60	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.37	0.60	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.38	0.59	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72
8.40	0.59	737.01	0.73	0.13	0.59	-----	-----	-----	-----	-----	-----	0.72

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	8.14	1	33	20,794	----	------	------	Post Dev - 1 hr.
2	SCS Runoff	7.54	1	42	28,618	----	------	------	Post Dev - 2 hr.
3	SCS Runoff	6.42	1	48	33,014	----	------	------	Post Dev - 3 hr.
4	SCS Runoff	4.60	1	53	42,032	----	------	------	Post Dev - 6 hr.
5	SCS Runoff	3.27	1	297	51,263	----	------	------	Post Dev - 12 hr.
6	SCS Runoff	2.28	1	936	60,648	----	------	------	Post Dev - 24 hr.
7	Reservoir	0.78	1	85	20,785	1	737.19	18,049	Thru Pond - 1 hr.
8	Reservoir	0.85	1	139	28,609	2	737.38	23,251	Thru Pond - 2 hr.
9	Reservoir	0.87	1	196	33,006	3	737.44	24,957	Thru Pond - 3 hr.
10	Reservoir	0.89	1	322	42,024	4	737.48	26,089	Thru Pond - 6 hr.
11	Reservoir	0.91	1	549	51,254	5	737.56	28,214	Thru Pond - 12 hr.
12	Reservoir	0.89	1	1100	60,631	6	737.48	26,064	Thru Pond - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:25 AM

Hyd. No. 1

Post Dev - 1 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 8.14 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 1.96 in	Distribution	= Huff-1st
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 20,794 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.32	4.43	0.88	4.73
0.33	4.93	0.90	4.57
0.35	5.40	0.92	4.41
0.37	5.82	0.93	4.26
0.38	6.21	0.95	4.12
0.40	6.57		
0.42	6.90		
0.43	7.19	*...End*	
0.45	7.44		
0.47	7.66		
0.48	7.83		
0.50	7.97		
0.52	8.06		
0.53	8.12		
0.55	8.14 <<		
0.57	8.13		
0.58	8.09		
0.60	8.03		
0.62	7.93		
0.63	7.82		
0.65	7.69		
0.67	7.53		
0.68	7.36		
0.70	7.16		
0.72	6.94		
0.73	6.71		
0.75	6.46		
0.77	6.20		
0.78	5.95		
0.80	5.71		
0.82	5.49		
0.83	5.28		
0.85	5.09		
0.87	4.91		

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 5

Post Dev - 12 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 3.27 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 3.60 in	Distribution	= Huff-2nd
Storm duration	= 12 hrs	Shape factor	= 484

Hydrograph Volume = 51,263 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs	Time (hrs)	Outflow cfs	Time (hrs)	Outflow cfs	Time (hrs)	Outflow cfs
3.80	1.65	4.37	2.56	4.93	3.27	5.50	3.16
3.82	1.68	4.38	2.59	4.95	3.27 <<	5.52	3.15
3.83	1.71	4.40	2.61	4.97	3.27	5.53	3.13
3.85	1.75	4.42	2.64	4.98	3.27	5.55	3.11
3.87	1.79	4.43	2.67	5.00	3.26	5.57	3.09
3.88	1.83	4.45	2.70	5.02	3.26	5.58	3.06
3.90	1.87	4.47	2.74	5.03	3.26	5.60	3.04
3.92	1.90	4.48	2.77	5.05	3.25	5.62	3.01
3.93	1.94	4.50	2.80	5.07	3.24	5.63	2.97
3.95	1.97	4.52	2.83	5.08	3.24	5.65	2.94
3.97	2.01	4.53	2.86	5.10	3.23	5.67	2.90
3.98	2.04	4.55	2.89	5.12	3.23	5.68	2.86
4.00	2.07	4.57	2.92	5.13	3.22	5.70	2.83
4.02	2.10	4.58	2.94	5.15	3.22	5.72	2.80
4.03	2.13	4.60	2.97	5.17	3.21	5.73	2.76
4.05	2.16	4.62	3.00	5.18	3.21	5.75	2.73
4.07	2.18	4.63	3.02	5.20	3.21	5.77	2.70
4.08	2.21	4.65	3.04	5.22	3.20	5.78	2.67
4.10	2.23	4.67	3.07	5.23	3.20	5.80	2.65
4.12	2.26	4.68	3.09	5.25	3.20	5.82	2.62
4.13	2.28	4.70	3.11	5.27	3.20	5.83	2.60
4.15	2.30	4.72	3.13	5.28	3.20	5.85	2.58
4.17	2.32	4.73	3.15	5.30	3.20	5.87	2.56
4.18	2.34	4.75	3.16	5.32	3.19	5.88	2.54
4.20	2.36	4.77	3.18	5.33	3.19	5.90	2.52
4.22	2.38	4.78	3.20	5.35	3.19	5.92	2.50
4.23	2.40	4.80	3.21	5.37	3.20	5.93	2.49
4.25	2.41	4.82	3.23	5.38	3.20	5.95	2.47
4.27	2.43	4.83	3.24	5.40	3.20	5.97	2.46
4.28	2.45	4.85	3.25	5.42	3.20	5.98	2.45
4.30	2.47	4.87	3.25	5.43	3.19	6.00	2.44
4.32	2.49	4.88	3.26	5.45	3.19	6.02	2.43
4.33	2.51	4.90	3.26	5.47	3.18	6.03	2.42
4.35	2.54	4.92	3.27	5.48	3.17	6.05	2.41

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Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 11

Thru Pond - 12 hr.

Hydrograph type	= Reservoir	Peak discharge	= 0.91 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Reservoir name	= Dry Detention
Max. Elevation	= 737.56 ft	Max. Storage	= 28,214 cuft

Storage Indication method used.

Outflow hydrograph volume = 51,254 cuft

(Printed values >= 75% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
8.83	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.85	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.87	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.88	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.90	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.92	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.93	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.95	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.97	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
8.98	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.00	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.02	0.96	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.03	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.05	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.07	0.95	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.08	0.94	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.10	0.94	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.12	0.93	737.56 <<	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.13	0.92	737.56 <<	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.15	0.92	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91 <<
9.17	0.91	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.18	0.90	737.56 <<	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.20	0.89	737.56 <<	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.22	0.87	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.23	0.86	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.25	0.85	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.27	0.83	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.28	0.82	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.30	0.80	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.32	0.79	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.33	0.78	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.35	0.77	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.37	0.75	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.38	0.74	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.40	0.73	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.42	0.72	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.43	0.71	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.45	0.71	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.47	0.70	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91
9.48	0.69	737.56	0.91	0.15	0.76	-----	-----	-----	-----	-----	-----	0.91

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Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	15.00	1	32	37,435	----	------	------	Post Dev - 1 hr.
2	SCS Runoff	13.44	1	39	49,308	----	------	------	Post Dev - 2 hr.
3	SCS Runoff	11.48	1	44	56,513	----	------	------	Post Dev - 3 hr.
4	SCS Runoff	8.40	1	50	68,953	----	------	------	Post Dev - 6 hr.
5	SCS Runoff	5.17	1	294	82,140	----	------	------	Post Dev - 12 hr.
6	SCS Runoff	3.55	1	936	99,093	----	------	------	Post Dev - 24 hr.
7	Reservoir	1.58	1	83	37,426	1	737.75	33,321	Thru Pond - 1 hr.
8	Reservoir	3.30	1	114	49,299	2	737.85	36,149	Thru Pond - 2 hr.
9	Reservoir	3.34	1	113	56,504	3	737.86	36,207	Thru Pond - 3 hr.
10	Reservoir	3.19	1	166	68,944	4	737.85	36,006	Thru Pond - 6 hr.
11	Reservoir	3.35	1	376	82,131	5	737.86	36,229	Thru Pond - 12 hr.
12	Reservoir	3.00	1	955	99,033	6	737.84	35,753	Thru Pond - 24 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:25 AM

Hyd. No. 1

Post Dev - 1 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 15.00 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 37,435 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.30	8.37	0.87	8.13
0.32	9.33	0.88	7.81
0.33	10.22	0.90	7.52
0.35	11.04		
0.37	11.74		
0.38	12.38	*...End*	
0.40	12.96		
0.42	13.46		
0.43	13.89		
0.45	14.26		
0.47	14.55		
0.48	14.77		
0.50	14.92		
0.52	14.98		
0.53	15.00 <<		
0.55	14.95		
0.57	14.84		
0.58	14.69		
0.60	14.49		
0.62	14.24		
0.63	13.96		
0.65	13.65		
0.67	13.29		
0.68	12.91		
0.70	12.48		
0.72	12.02		
0.73	11.54		
0.75	11.04		
0.77	10.53		
0.78	10.04		
0.80	9.59		
0.82	9.19		
0.83	8.81		
0.85	8.46		

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 5

Post Dev - 12 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 5.17 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 5.16 in	Distribution	= Huff-2nd
Storm duration	= 12 hrs	Shape factor	= 484

Hydrograph Volume = 82,140 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)	
3.70	2.60	4.27	4.03	4.83	5.15	5.40	4.96
3.72	2.63	4.28	4.05	4.85	5.16	5.42	4.95
3.73	2.67	4.30	4.08	4.87	5.16	5.43	4.94
3.75	2.70	4.32	4.11	4.88	5.17	5.45	4.93
3.77	2.75	4.33	4.13	4.90	5.17 <<	5.47	4.92
3.78	2.79	4.35	4.17	4.92	5.17	5.48	4.90
3.80	2.84	4.37	4.20	4.93	5.17	5.50	4.88
3.82	2.89	4.38	4.24	4.95	5.16	5.52	4.86
3.83	2.95	4.40	4.28	4.97	5.16	5.53	4.83
3.85	3.01	4.42	4.32	4.98	5.15	5.55	4.80
3.87	3.07	4.43	4.36	5.00	5.14	5.57	4.76
3.88	3.13	4.45	4.41	5.02	5.13	5.58	4.72
3.90	3.19	4.47	4.46	5.03	5.12	5.60	4.68
3.92	3.24	4.48	4.50	5.05	5.11	5.62	4.63
3.93	3.30	4.50	4.55	5.07	5.10	5.63	4.58
3.95	3.35	4.52	4.59	5.08	5.08	5.65	4.52
3.97	3.40	4.53	4.63	5.10	5.07	5.67	4.46
3.98	3.45	4.55	4.68	5.12	5.06	5.68	4.40
4.00	3.50	4.57	4.72	5.13	5.05	5.70	4.35
4.02	3.55	4.58	4.75	5.15	5.04	5.72	4.29
4.03	3.59	4.60	4.79	5.17	5.03	5.73	4.24
4.05	3.63	4.62	4.83	5.18	5.02	5.75	4.19
4.07	3.67	4.63	4.86	5.20	5.01	5.77	4.15
4.08	3.71	4.65	4.89	5.22	5.00	5.78	4.10
4.10	3.75	4.67	4.92	5.23	4.99	5.80	4.06
4.12	3.78	4.68	4.95	5.25	4.99	5.82	4.02
4.13	3.82	4.70	4.98	5.27	4.98	5.83	3.98
4.15	3.85	4.72	5.01	5.28	4.98	5.85	3.95
4.17	3.87	4.73	5.03	5.30	4.97	5.87	3.91
4.18	3.90	4.75	5.06	5.32	4.97	5.88	3.88
4.20	3.92	4.77	5.08	5.33	4.96	5.90	3.85
4.22	3.95	4.78	5.10	5.35	4.96	5.92	3.83
4.23	3.97	4.80	5.12	5.37	4.96	5.93	3.80
4.25	4.00	4.82	5.13	5.38	4.96	5.95	3.78

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Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:26 AM

Hyd. No. 11

Thru Pond - 12 hr.

Hydrograph type	= Reservoir	Peak discharge	= 3.35 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Reservoir name	= Dry Detention
Max. Elevation	= 737.86 ft	Max. Storage	= 36,229 cuft

Storage Indication method used.

Outflow hydrograph volume = 82,131 cuft

(Printed values >= 75% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
5.78	4.10	737.82	2.58	0.13	0.79	-----	1.66	-----	-----	-----	-----	2.58
5.80	4.06	737.82	2.65	0.13	0.79	-----	1.73	-----	-----	-----	-----	2.65
5.82	4.02	737.83	2.71	0.13	0.78	-----	1.80	-----	-----	-----	-----	2.71
5.83	3.98	737.83	2.76	0.13	0.77	-----	1.86	-----	-----	-----	-----	2.76
5.85	3.95	737.83	2.82	0.12	0.77	-----	1.92	-----	-----	-----	-----	2.82
5.87	3.91	737.83	2.87	0.12	0.77	-----	1.98	-----	-----	-----	-----	2.87
5.88	3.88	737.84	2.91	0.12	0.76	-----	2.03	-----	-----	-----	-----	2.91
5.90	3.85	737.84	2.95	0.12	0.76	-----	2.07	-----	-----	-----	-----	2.95
5.92	3.83	737.84	2.99	0.12	0.75	-----	2.12	-----	-----	-----	-----	2.99
5.93	3.80	737.84	3.03	0.12	0.75	-----	2.16	-----	-----	-----	-----	3.03
5.95	3.78	737.84	3.06	0.12	0.75	-----	2.19	-----	-----	-----	-----	3.06
5.97	3.76	737.84	3.09	0.12	0.74	-----	2.23	-----	-----	-----	-----	3.09
5.98	3.74	737.85	3.12	0.12	0.74	-----	2.26	-----	-----	-----	-----	3.12
6.00	3.73	737.85	3.15	0.12	0.74	-----	2.29	-----	-----	-----	-----	3.15
6.02	3.71	737.85	3.17	0.12	0.74	-----	2.32	-----	-----	-----	-----	3.17
6.03	3.70	737.85	3.20	0.12	0.73	-----	2.34	-----	-----	-----	-----	3.20
6.05	3.68	737.85	3.22	0.12	0.73	-----	2.37	-----	-----	-----	-----	3.22
6.07	3.67	737.85	3.24	0.12	0.73	-----	2.39	-----	-----	-----	-----	3.24
6.08	3.65	737.85	3.26	0.12	0.73	-----	2.41	-----	-----	-----	-----	3.26
6.10	3.63	737.85	3.27	0.12	0.73	-----	2.43	-----	-----	-----	-----	3.27
6.12	3.62	737.85	3.29	0.12	0.73	-----	2.45	-----	-----	-----	-----	3.29
6.13	3.60	737.85	3.30	0.12	0.72	-----	2.46	-----	-----	-----	-----	3.30
6.15	3.57	737.86	3.32	0.12	0.72	-----	2.48	-----	-----	-----	-----	3.32
6.17	3.55	737.86	3.33	0.12	0.72	-----	2.49	-----	-----	-----	-----	3.33
6.18	3.52	737.86	3.34	0.12	0.72	-----	2.50	-----	-----	-----	-----	3.34
6.20	3.49	737.86	3.34	0.12	0.72	-----	2.51	-----	-----	-----	-----	3.34
6.22	3.45	737.86	3.35	0.12	0.72	-----	2.51	-----	-----	-----	-----	3.35
6.23	3.42	737.86	3.35	0.12	0.72	-----	2.52	-----	-----	-----	-----	3.35
6.25	3.38	737.86	3.35	0.12	0.72	-----	2.52	-----	-----	-----	-----	3.35
6.27	3.34	737.86	3.35	0.12	0.72	-----	2.52	-----	-----	-----	-----	3.35 <<
6.28	3.30	737.86	3.35	0.12	0.72	-----	2.52	-----	-----	-----	-----	3.35
6.30	3.26	737.86	3.35	0.12	0.72	-----	2.51	-----	-----	-----	-----	3.35
6.32	3.22	737.86	3.35	0.12	0.72	-----	2.51	-----	-----	-----	-----	3.34
6.33	3.19	737.86	3.34	0.12	0.72	-----	2.50	-----	-----	-----	-----	3.34
6.35	3.15	737.86	3.33	0.12	0.72	-----	2.49	-----	-----	-----	-----	3.33
6.37	3.12	737.86	3.32	0.12	0.72	-----	2.48	-----	-----	-----	-----	3.32
6.38	3.09	737.86	3.31	0.12	0.72	-----	2.47	-----	-----	-----	-----	3.31
6.40	3.06	737.85	3.30	0.12	0.72	-----	2.46	-----	-----	-----	-----	3.30

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Water Quality Calculations

Project Name: COMMERCE BUSINESS PARK Project # 13011

Water Quality - Dry Detention Pond

Option #1

20% of Runoff from a 1.25" storm event

Volume= 9,400 c.f. X 0.20 = 1,880 c.f.

Option #2

20% of a 0.50" direct runoff

$$\text{Volume} = 5.72 \text{ ac.} \times \frac{43560 \text{ s.f.}}{1 \text{ ac.}} \times \frac{144 \text{ s.-in.}}{1 \text{ s.f.}} \times 0.50\text{-in}$$

= 17,939,750 c.in = 10,382 c.f.

= 10,382 c.f. X 0.20 = **2,076 c.f. <== USE**

Peak storm event happens at 1.32 inch storm event

Storm event that provides 2,076 c.f. is a 1.32 inch storm event
Peak occurs at 14.65 hrs for the 1.32 inch storm event

14.65 hrs + 6.0 hrs = 20.65 hrs

Pond Elevation at 20.65 hrs = 736.10 n.p. 735.00

Pond Storage Volume at 20.65 hrs = 4,576 c.f. < 2,076 c.f.

$$\frac{1.5}{6{,}240} = \frac{1.10}{4{,}576}$$

14.65 hrs + 12.0 hrs = 26.65 hrs

Pond Elevation at 26.65 hrs = 735.79 n.p. 735.00

Pond Storage Volume at 26.65 hrs = 980 c.f. < 2,076 c.f.

$$\frac{1}{1{,}240} = \frac{0.79}{980}$$

14.65 hrs + 24.0 hrs = 38.65 hrs

Pond Elevation at 38.65 hrs = 735.00 n.p. 735.00

Pond Storage Volume at 38.65 hrs = 0 c.f. < 0 c.f.

$$\frac{1}{1{,}240} = \frac{0.00}{0}$$

Minimum 2" wq orifice used

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.33	1	650	9,400	----	------	------	WQ 1.25IN EVENT
2	SCS Runoff	0.36	3	651	10,351	----	------	------	WQ 0.5IN EVENT
3	Reservoir	0.19	3	879	10,342	2	736.18	3,355	Thru Pond - 1 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 11:16 AM

Hyd. No. 2

WQ 0.5IN EVENT

Hydrograph type	= SCS Runoff	Peak discharge	= 0.36 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Drainage area	= 5.72 ac	Curve number	= 89
Basin Slope	= 0.8 %	Hydraulic length	= 870 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.4 min
Total precip.	= 1.32 in	Distribution	= Huff-2nd
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 10,351 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
8.35	0.18	10.05	0.32	11.75	0.28	13.45	0.22
8.40	0.18	10.10	0.33	11.80	0.28	13.50	0.22
8.45	0.19	10.15	0.33	11.85	0.29	13.55	0.21
8.50	0.19	10.20	0.33	11.90	0.29	13.60	0.21
8.55	0.20	10.25	0.33	11.95	0.29	13.65	0.21
8.60	0.21	10.30	0.33	12.00	0.29	13.70	0.20
8.65	0.21	10.35	0.33	12.05	0.29	13.75	0.20
8.70	0.22	10.40	0.34	12.10	0.29	13.80	0.20
8.75	0.23	10.45	0.34	12.15	0.28	13.85	0.20
8.80	0.24	10.50	0.34	12.20	0.28	13.90	0.20
8.85	0.25	10.55	0.34	12.25	0.27	13.95	0.20
8.90	0.25	10.60	0.35	12.30	0.26	14.00	0.20
8.95	0.26	10.65	0.35	12.35	0.25	14.05	0.20
9.00	0.27	10.70	0.35	12.40	0.25	14.10	0.20
9.05	0.27	10.75	0.35	12.45	0.24	14.15	0.20
9.10	0.28	10.80	0.36	12.50	0.24	14.20	0.20
9.15	0.28	10.85	0.36 <<	12.55	0.23	14.25	0.20
9.20	0.29	10.90	0.35	12.60	0.23	14.30	0.20
9.25	0.29	10.95	0.35	12.65	0.23	14.35	0.20
9.30	0.29	11.00	0.34	12.70	0.23	14.40	0.20
9.35	0.30	11.05	0.34	12.75	0.23	14.45	0.20
9.40	0.30	11.10	0.32	12.80	0.23	14.50	0.20
9.45	0.31	11.15	0.31	12.85	0.23	14.55	0.20
9.50	0.31	11.20	0.31	12.90	0.23	14.60	0.19
9.55	0.31	11.25	0.30	12.95	0.23	14.65	0.19
9.60	0.32	11.30	0.29	13.00	0.23	14.70	0.18
9.65	0.32	11.35	0.29	13.05	0.23	14.75	0.18
9.70	0.32	11.40	0.28	13.10	0.23		
9.75	0.32	11.45	0.28	13.15	0.23		
9.80	0.32	11.50	0.28	13.20	0.23	*...End*	
9.85	0.32	11.55	0.28	13.25	0.23		
9.90	0.32	11.60	0.28	13.30	0.23		
9.95	0.32	11.65	0.28	13.35	0.23		
10.00	0.32	11.70	0.28	13.40	0.22		

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 11:14 AM

Hyd. No. 3

Thru Pond - 1 hr.

Hydrograph type	= Reservoir	Peak discharge	= 0.19 cfs
Storm frequency	= 2 yrs	Time interval	= 3 min
Inflow hyd. No.	= 2	Reservoir name	= Dry Detention
Max. Elevation	= 736.18 ft	Max. Storage	= 3,355 cuft

Storage Indication method used.

Outflow hydrograph volume = 10,342 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
6.20	0.02	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.25	0.02	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.30	0.03	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.35	0.03	735.03	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.40	0.03	735.03	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.45	0.03	735.03	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
6.50	0.04	735.04	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.55	0.04	735.04	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.60	0.04	735.05	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.65	0.04	735.05	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.70	0.05	735.06	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.75	0.05	735.06	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.80	0.05	735.07	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.85	0.05	735.08	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.90	0.06	735.08	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
6.95	0.06	735.09	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
7.00	0.06	735.10	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
7.05	0.06	735.10	0.01	0.01	-----	-----	-----	-----	-----	-----	-----	0.01
7.10	0.06	735.11	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.15	0.07	735.12	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.20	0.07	735.12	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.25	0.07	735.13	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.30	0.08	735.14	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.35	0.08	735.15	0.02	0.02	-----	-----	-----	-----	-----	-----	-----	0.02
7.40	0.09	735.16	0.03	0.03	-----	-----	-----	-----	-----	-----	-----	0.03
7.45	0.09	735.16	0.03	0.03	-----	-----	-----	-----	-----	-----	-----	0.03
7.50	0.10	735.17	0.03	0.03	-----	-----	-----	-----	-----	-----	-----	0.03
7.55	0.11	735.18	0.03	0.03	-----	-----	-----	-----	-----	-----	-----	0.03
7.60	0.11	735.20	0.03	0.03	-----	-----	-----	-----	-----	-----	-----	0.03
7.65	0.12	735.21	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.70	0.13	735.22	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.75	0.13	735.23	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.80	0.14	735.25	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.85	0.14	735.26	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.90	0.15	735.28	0.04	0.04	-----	-----	-----	-----	-----	-----	-----	0.04
7.95	0.15	735.29	0.05	0.05	-----	-----	-----	-----	-----	-----	-----	0.05
8.00	0.15	735.31	0.05	0.05	-----	-----	-----	-----	-----	-----	-----	0.05
8.05	0.16	735.32	0.05	0.05	-----	-----	-----	-----	-----	-----	-----	0.05

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
18.30	0.11	736.14	0.16	0.10	0.06	-----	-----	-----	-----	-----	-----	0.16
18.35	0.11	736.14	0.16	0.10	0.06	-----	-----	-----	-----	-----	-----	0.16
18.40	0.10	736.14	0.16	0.10	0.06	-----	-----	-----	-----	-----	-----	0.16
18.45	0.10	736.14	0.16	0.10	0.06	-----	-----	-----	-----	-----	-----	0.16
18.50	0.09	736.14	0.16	0.10	0.06	-----	-----	-----	-----	-----	-----	0.16
18.55	0.09	736.14	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.16
18.60	0.09	736.14	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.16
18.65	0.09	736.13	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.70	0.09	736.13	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.75	0.09	736.13	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.80	0.09	736.13	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.85	0.09	736.13	0.16	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.90	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
18.95	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.00	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.05	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.10	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.15	0.09	736.13	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.20	0.09	736.12	0.15	0.10	0.05	-----	-----	-----	-----	-----	-----	0.15
19.25	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.15
19.30	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.15
19.35	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.40	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.45	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.50	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.55	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.60	0.09	736.12	0.15	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.65	0.09	736.12	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.70	0.09	736.12	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.75	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.80	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.85	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.90	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
19.95	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
20.00	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
20.05	0.09	736.11	0.14	0.10	0.04	-----	-----	-----	-----	-----	-----	0.14
20.10	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.14
20.15	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.14
20.20	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.25	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.30	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.35	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.40	0.09	736.11	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.45	0.09	736.10	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.50	0.09	736.10	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.55	0.09	736.10	0.14	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.60	0.09	736.10	0.13	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.65	0.09	736.10	0.13	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.70	0.09	736.10	0.13	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.75	0.09	736.10	0.13	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13
20.80	0.09	736.10	0.13	0.10	0.03	-----	-----	-----	-----	-----	-----	0.13

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Thru Pond - 1 hr.

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
25.95	0.00	735.98	0.10	0.10	-----	-----	-----	-----	-----	-----	-----	0.10
26.00	0.00	735.97	0.10	0.10	-----	-----	-----	-----	-----	-----	-----	0.10
26.05	0.00	735.96	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.10	0.00	735.94	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.15	0.00	735.93	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.20	0.00	735.92	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.25	0.00	735.90	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.30	0.00	735.89	0.10	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.35	0.00	735.88	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.40	0.00	735.86	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.45	0.00	735.85	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.50	0.00	735.84	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.55	0.00	735.82	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.60	0.00	735.81	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.65	0.00	735.80	0.09	0.09	-----	-----	-----	-----	-----	-----	-----	0.09
26.70	0.00	735.79	0.09	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
26.75	0.00	735.78	0.09	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
26.80	0.00	735.76	0.09	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
26.85	0.00	735.75	0.09	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
26.90	0.00	735.74	0.09	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
26.95	0.00	735.73	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.00	0.00	735.72	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.05	0.00	735.70	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.10	0.00	735.69	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.15	0.00	735.68	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.20	0.00	735.67	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.25	0.00	735.66	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.30	0.00	735.65	0.08	0.08	-----	-----	-----	-----	-----	-----	-----	0.08
27.35	0.00	735.64	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.40	0.00	735.63	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.45	0.00	735.62	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.50	0.00	735.61	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.55	0.00	735.59	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.60	0.00	735.58	0.08	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.65	0.00	735.57	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.70	0.00	735.56	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.75	0.00	735.55	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.80	0.00	735.54	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.85	0.00	735.53	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.90	0.00	735.52	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
27.95	0.00	735.52	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
28.00	0.00	735.51	0.07	0.07	-----	-----	-----	-----	-----	-----	-----	0.07
28.05	0.00	735.50	0.07	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.10	0.00	735.49	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.15	0.00	735.48	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.20	0.00	735.47	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.25	0.00	735.46	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.30	0.00	735.45	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.35	0.00	735.44	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.40	0.00	735.43	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06
28.45	0.00	735.42	0.06	0.06	-----	-----	-----	-----	-----	-----	-----	0.06

Continues on next page...

Thru Pond - 1 hr.

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
36.15	0.00	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.20	0.00	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.25	0.00	735.02	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.30	0.00	735.01	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.35	0.00	735.01	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.40	0.00	735.01	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.45	0.00	735.01	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00
36.50	0.00	735.01	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	0.00

...End

Ø OUTFLOW

Storm Sewer Calculations
Building #2

Commerce Business Park - Building #1 — Storm Sewer Calculations

		Desc.	Soil	Ac.		CN		CNxAc.	
STR. #	Runoff curve number (CN)	Imp.	(PR.)	0.09	x	98	=	9	
604		Imp.	(fut)	0.91	x	98	=	89	
		Lawn	'C'	0.67	x	79	=	53	
Area =				0.00	x	0	=	0	
1.67			Total	1.67		/		151	= CN- 90
Acres	"T/c" =								

1. Sheet Flow T.C.= $\dfrac{0.007 \times (0.15 \times 40)^{0.80}}{2.64^{0.50} \times 0.01^{0.40}}$ = 7 Minutes

2. Shallow Concentrated

Unpaved: T.C.= 16.135 x $0.0075^{0.5}$ = 1.40 ft/sec

= 0 feet / 1.40 ft/sec = 0 Minutes

Paved: T.C.= 20.328 x $0.005^{0.5}$ = 1.44 ft/sec

= 490 feet / 1.44 ft/sec = 6 Minutes

T/c Total= 13 Minutes

		Desc.	Soil	Ac.		CN		CNxAc.	
STR. #	Runoff curve number (CN)	Imp.	(PR.)	0.29	x	98	=	28	
606		Imp.	(fut)	0.00	x	98	=	0	
		Lawn	'C'	0.11	x	79	=	9	
Area =				0.00	x	0	=	0	
0.40			Total	0.40		/		37	= CN- 93
Acres	"T/c" =								

1. Sheet Flow T.C.= $\dfrac{0.007 \times (0.15 \times 30)^{0.80}}{2.64^{0.50} \times 0.02^{0.40}}$ = 4 Minutes

2. Shallow Concentrated

Unpaved: T.C.= 16.135 x $0.015^{0.5}$ = 1.98 ft/sec

= 45 feet / 1.98 ft/sec = 0 Minutes

Paved: T.C.= 20.328 x $0.01^{0.5}$ = 2.03 ft/sec

= 56 feet / 2.03 ft/sec = 0 Minutes

T/c Total= 5 Minutes

Commerce Business Park - Building #2

Storm Sewer Calculations

STR. #	Runoff curve number (CN)	Desc.	Soil	Ac.		CN		CNxAc.		
610		Imp.	(PR.)	0.47	x	98	=	46		
		Imp.	(fut)	0.00	x	98	=	0		
		Lawn	'C'	0.08	x	79	=	6		
Area =				0.00	x	0	=	0		
0.55			Total	0.55		/		52	= CN-	95
Acres	"T/c" =									

1. Sheet Flow T.C.= $\frac{0.007 \times (0.15 \times 123)^{0.80}}{292^{0.50} \quad 0.01^{0.40}}$ = 2 Minutes

2. Shallow Concentrated

Unpaved: T.C.= 16.135 x $0.0075^{0.5}$ = 1.40 ft/sec

= 0 feet / 1.40 ft/sec = 0 Minutes

Paved: T.C.= 20.328 x $0.015^{0.5}$ = 2.49 ft/sec

= 48 feet / 2.49 ft/sec = 0 Minutes

T/c Total= 2 Minutes

5 Minutes Minumum

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	4.42	1	23	4,751	----	------	------	Str. 604 - 0.5 hr.
2	SCS Runoff	4.36	1	34	6,968	----	------	------	Str. 604 - 1 hr.
3	SCS Runoff	3.45	1	58	9,481	----	------	------	Str. 604 - 2 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:28 AM

Hyd. No. 1

Str. 604 - 0.5 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 4.42 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.84 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.0 min
Total precip.	= 1.55 in	Distribution	= Huff-2nd
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 4,751 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	
0.27	2.34	
0.28	2.86	
0.30	3.35	
0.32	3.77	
0.33	4.09	
0.35	4.30	
0.37	4.41	
0.38	4.42	<<
0.40	4.37	
0.42	4.26	
0.43	4.08	
0.45	3.86	
0.47	3.60	
0.48	3.32	
0.50	3.03	
0.52	2.72	
0.53	2.42	

...End

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	1.67	1	17	1,362	----	------	------	Str. 606 - 0.5 hr.
2	SCS Runoff	1.37	1	29	1,913	----	------	------	Str. 606 - 1 hr.
3	SCS Runoff	0.95	1	52	2,524	----	------	------	Str. 606 - 2 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Jul 23 2013, 10:28 AM

Hyd. No. 1

Str. 606 - 0.5 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 1.67 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.40 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 5.0 min
Total precip.	= 1.55 in	Distribution	= Huff-2nd
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 1,362 cuft

(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow (cfs)
0.22	1.04
0.23	1.30
0.25	1.52
0.27	1.64
0.28	1.67 <<
0.30	1.63
0.32	1.53
0.33	1.39
0.35	1.23
0.37	1.08
0.38	0.94

...End

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	2.64	1	17	2,179	----	-------	-------	Str. 610 - 0.5 hr.
2	SCS Runoff	2.11	1	28	2,974	----	-------	-------	Str. 610 - 1 hr.
3	SCS Runoff	1.42	1	51	3,843	----	-------	-------	Str. 610 - 2 hr.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Thursday, Feb 8 2018, 8:24 AM

Hyd. No. 1

Str. 610 - 0.5 hr.

Hydrograph type	= SCS Runoff	Peak discharge	= 2.64 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.55 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 5.0 min
Total precip.	= 1.55 in	Distribution	= Huff-2nd
Storm duration	= 1 hrs	Shape factor	= 484

Hydrograph Volume = 2,179 cuft

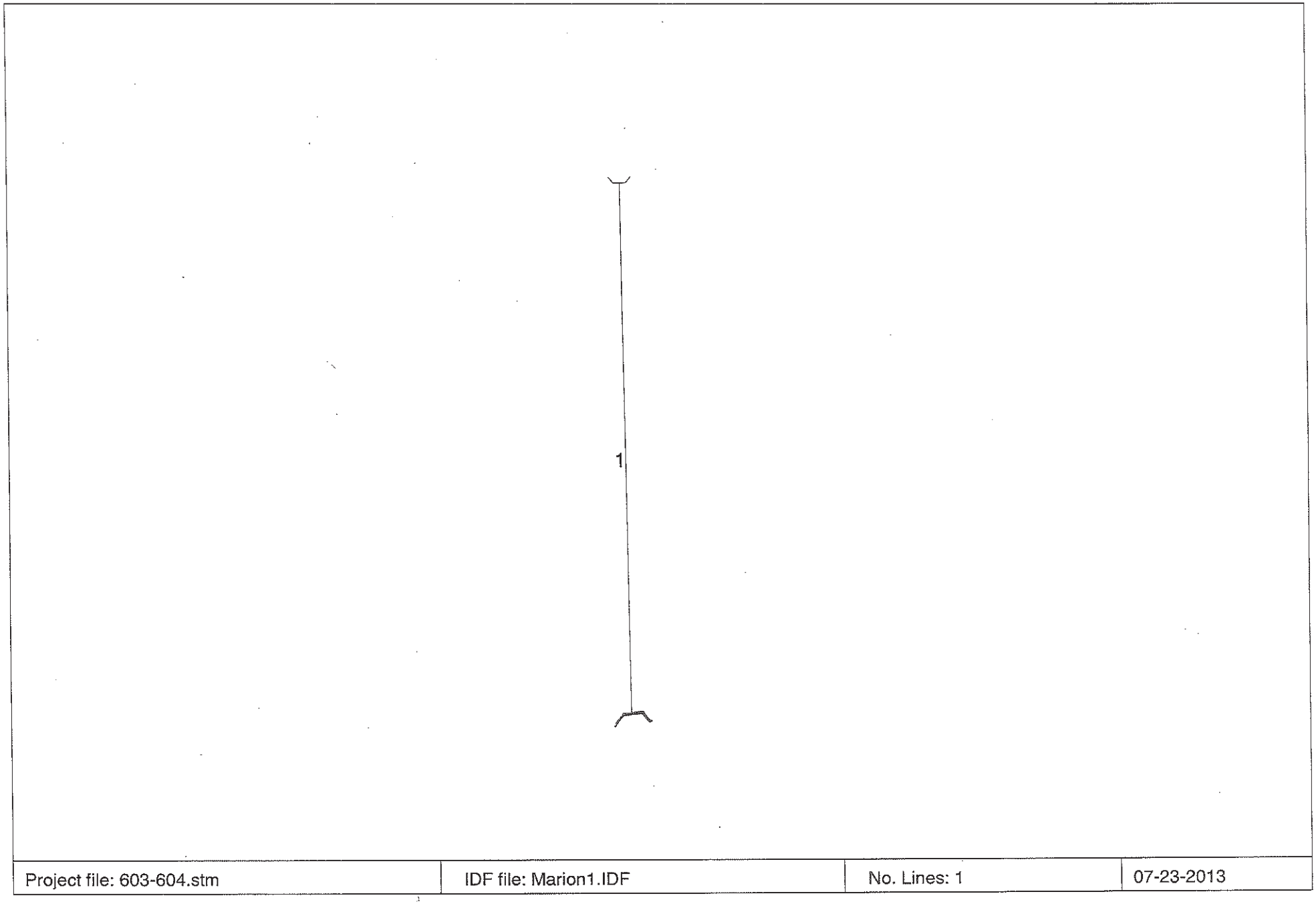
(Printed values >= 50% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow (cfs)
0.20	1.41
0.22	1.83
0.23	2.20
0.25	2.49
0.27	2.64
0.28	2.64 <<
0.30	2.54
0.32	2.35
0.33	2.11
0.35	1.86
0.37	1.61
0.38	1.40

...End

Hydraflow Plan View



Project file: 603-604.stm	IDF file: Marion1.IDF	No. Lines: 1	07-23-2013

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	603	4.36	18 c	45.0	736.05	736.20	0.333	736.85	737.16	0.00	End

Project File: 603-604.stm	IDF File: Marion1.IDF	Total No. Lines: 1	Run Date: 07-23-2013

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

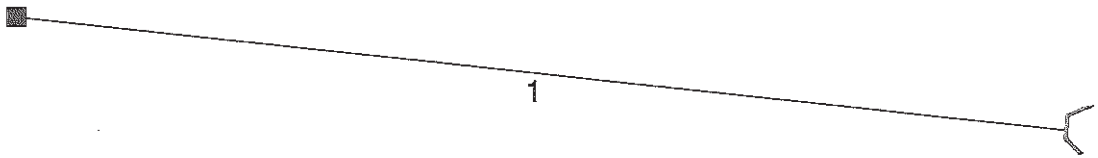
Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	45.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.36	6.06	4.10	18	0.33	736.20	736.05	737.16	736.85	740.35	0.00	603

Project File: 603-604.stm | IDF File: Marion1.IDF | Total number of lines: 1 | Run Date: 07-23-2013

NOTES: Intensity = 0.00 / (Inlet time + 0.00) ^ 0.00; Return period = 10 Yrs. ; Initial tailwater elevation = 736.85 (ft)

Hydraflow Plan View



Project file: 605-606.stm	IDF file: Marion1.IDF	No. Lines: 1	07-23-2013

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	606	3.35	15 c	84.0	736.15	736.40	0.295	736.88	737.43	0.00	End

Project File: 605-606.stm	IDF File: Marion1.IDF	Total No. Lines: 1	Run Date: 07-23-2013

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

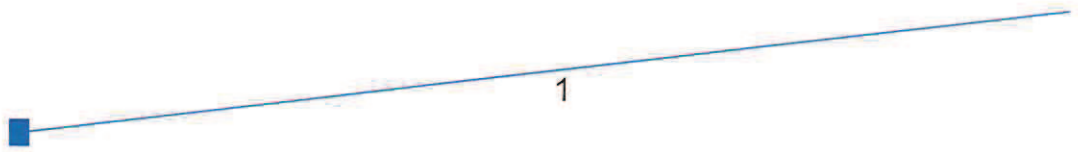
Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	84.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.35	3.51	3.79	15	0.30	736.40	736.15	737.43	736.88	738.75	0.00	606

Project File: 605-606.stm | IDF File: Marion1.IDF | Total number of lines: 1 | Run Date: 07-23-2013

NOTES: Intensity = 0.00 / (Inlet time + 0.00) ^ 0.00; Return period = 10 Yrs. ; Initial tailwater elevation = 736.88 (ft)

Hydraflow Plan View



Project file: 609-610.stm	IDF file: Marion1.IDF	No. Lines: 1	02-08-2018

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	606	2.64	15 c	82.0	736.45	736.70	0.305	737.10	737.57	0.00	End

Project File: 609-610.stm	IDF File: Marion1.IDF	Total No. Lines: 1	Run Date: 02-08-2018

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	82.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.64	3.57	3.50	15	0.30	736.70	736.45	737.57	737.10	740.75	0.00	606

Project File: 609-610.stm | IDF File: Marion1.IDF | Total number of lines: 1 | Run Date: 02-08-2018

NOTES: Intensity = 0.00 / (Inlet time + 0.00) ^ 0.00; Return period = 10 Yrs. ; Initial tailwater elevation = 737.10 (ft)

COMMERCE BUSINESS PARK - BUILDING #1
INLET DEPTH CALCULATION

INLET # 606	Neenah 3405	Casting (50% Clogged)
Discharge Rate (Qi) =	1.67 c.f.s.	
Perimeter of Grate Opening (P) =	3.95 ft.	
Area of Grate Opening (Ai) =	0.75 sq. ft.	

Grate acting as weir (depths less than 0.3 ft.):
Qi = 3.0P[(d)^1.5]
Grate acting as orifice (depths greater than 0.4 ft.):
Qi = 4.89(Ai)[(d)^0.8]

Weir flow depth =	0.27 ft.
Orifice flow depth =	0.21 ft.
Allowable Depth =	0.50 ft.

COMMERCE BUSINESS PARK - BUILDING #2
INLET DEPTH CALCULATION

INLET # 610 **Neenah 3405** **Casting (50% Clogged)**

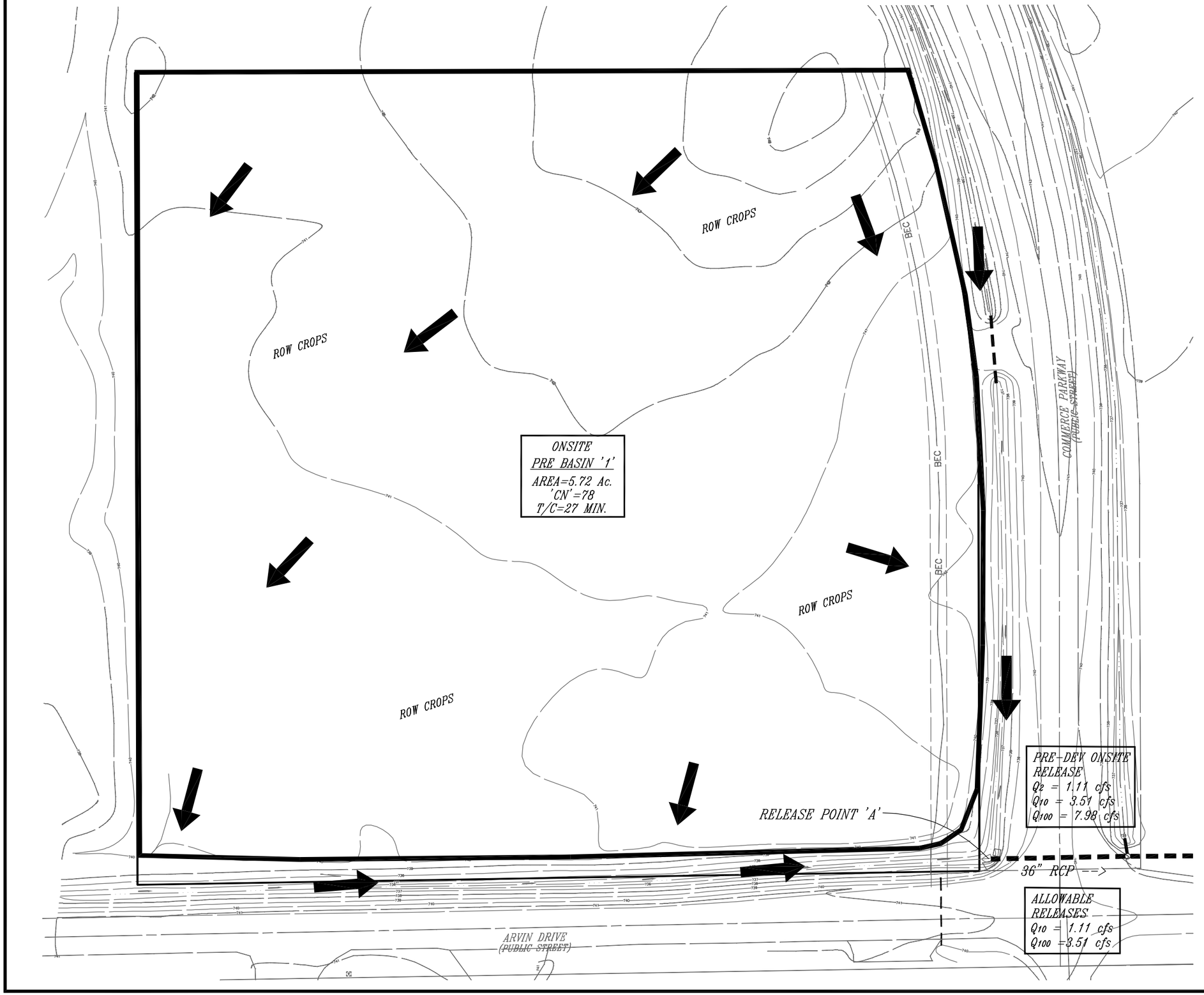
Discharge Rate (Qi) =	1.98	c.f.s.
Perimeter of Grate Opening (P) =	3.95	ft.
Area of Grate Opening (Ai) =	0.75	sq. ft.

Grate acting as weir (depths less than 0.3 ft.):
$Qi = 3.0P[(d)^{1.5}]$
Grate acting as orifice (depths greater than 0.4 ft.):
$Qi = 4.89(Ai)[(d)^{0.8}]$

Weir flow depth =	0.30	ft.
Orifice flow depth =	0.29	ft.

Allowable Depth =	0.50	ft.

Watershed Basin Maps



DATE | REVISION | SYMBOL

SCALE 1"=60'
DRAWN JPH
CHECKED JKS
CERTIFIED _ _

PROJECT
COMMERCE BUSINESS PARK
CITY OF FRANKLIN, JOHNSON COUNTY, INDIANA

TITLE
PRE-DEVELOPMENT DRAINAGE MAP

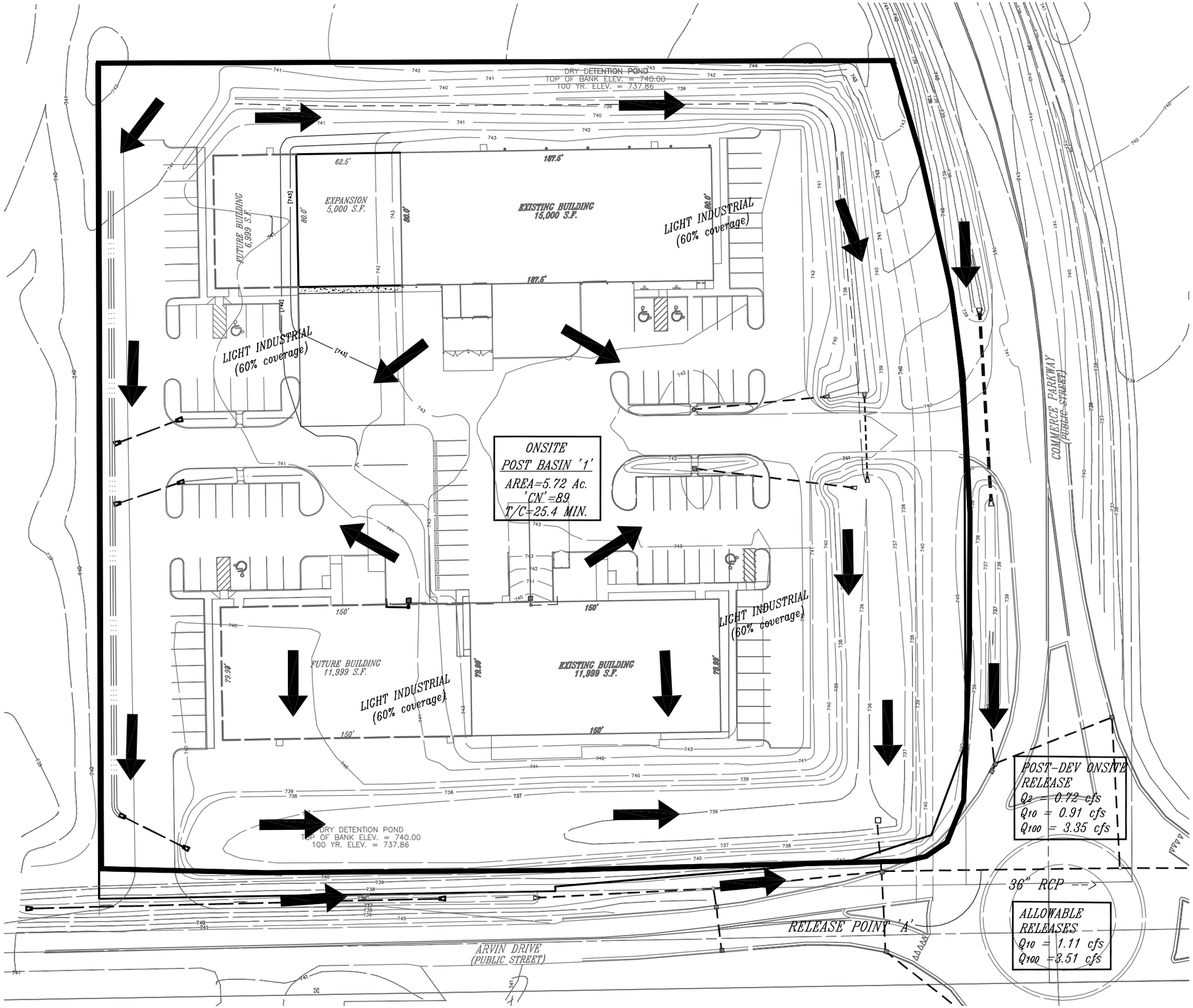
PROJECTS plus
GREENWOOD SURVEYING COMPANY
CIVIL ENGINEERING – LAND SURVEYING
LAND PLANNING – CONSTRUCTION MANAGEMENT
2555 Fairview Place Suite A - Greenwood, Indiana 46142
(317)-882-5003

JOB NUMBER
13011

SHEET
1

OF 1 SHEETS

DATE
JULY 19, 2013



DATE	REVISION	SYMBOL

SCALE 1"=60'
DRAWN JPH
CHECKED JKS
CERTIFIED _/_/_

PROJECT
COMMERCE BUSINESS PARK
CITY OF FRANKLIN, JOHNSON COUNTY, INDIANA

TITLE
OVERALL
POST-DEVELOPMENT DRAINAGE MAP

PROJECTS *plus*

GREENWOOD SURVEYING COMPANY

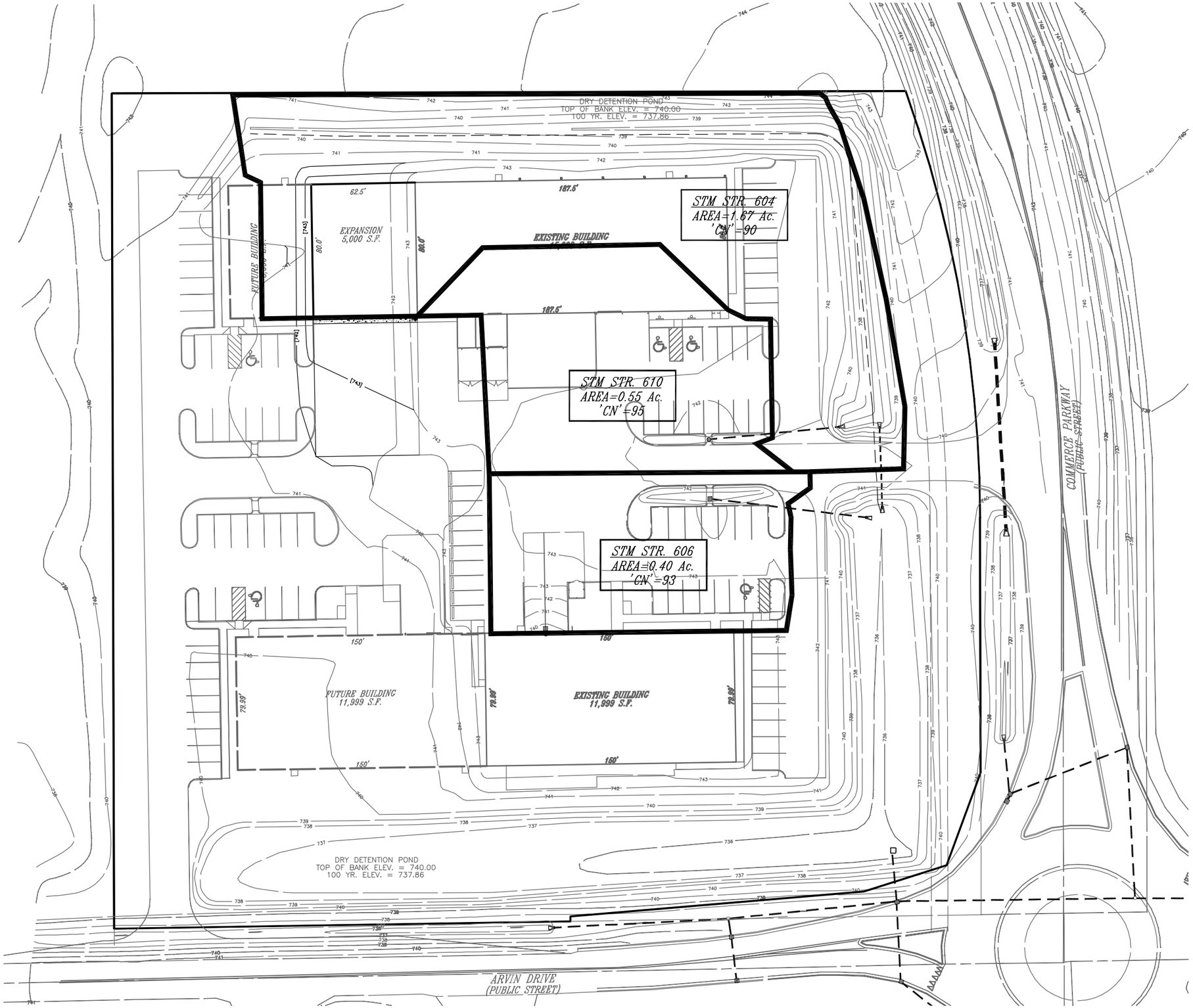
CIVIL ENGINEERING – LAND SURVEYING
LAND PLANNING – CONSTRUCTION MANAGEMENT
2355 Fairview Place Suite A - Greenwood, Indiana 46142
(317)-882-5003

JOB NUMBER
13011.03

SHEET
1

OF **1** SHEETS

DATE
SEPTEMBER 28, 2023



DATE

REVISION

SYMBOL

SCALE 1"=60'

DRAWN JPH

CHECKED JKS

CERTIFIED

PROJECT

COMMERCE BUSINESS PARK

CITY OF FRANKLIN, JOHNSON COUNTY, INDIANA

TITLE

BUILDING #2 – STORM SEWER DRAINAGE MAP

PROJECTS *plus*

GREENWOOD SURVEYING COMPANY

CIVIL ENGINEERING – LAND SURVEYING
LAND PLANNING – CONSTRUCTION MANAGEMENT 46142
2555 Fairview Place Suite A Greenwood, Indiana
(317) 882-5005

JOB NUMBER
13011.03

SHEET
1

OF **1** SHEETS

DATE
SEPTEMBER 28, 2023