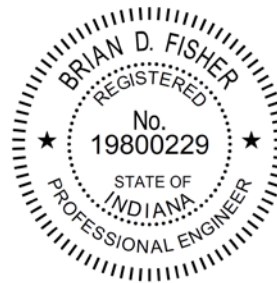


# PRELIMINARY DRAINAGE REPORT

**PROJECT:**  
**Heritage Section 10**  
**Franklin, Indiana**



**DESIGN ENGINEER:**

**Brian D. Fisher, P.E.**  
**The Schneider Corporation**  
**8901 Otis Avenue**  
**Indianapolis, IN 46216-1037**  
**317-826-7145**

**October 10, 2018**



Historic Fort Harrison, 8901 Otis Avenue, Indianapolis, Indiana 46216  
Phone - 317.826.7100 Fax - 317.826.7200  
[www.schneidercorp.com](http://www.schneidercorp.com) [contact@schneidercorp.com](mailto:contact@schneidercorp.com)

## **TABLE OF CONTENTS**

A. Drainage Narrative	1-2
B. Site Maps	
Area Map	4
Soils Map	5-18
C. Existing Conditions	
Predeveloped Basins Exhibit	20
D. Developed Conditions	
Post Developed Basin Exhibit	22
Franklin Precipitation Data	23-25
HydroCAD Report	26-37
E. Storm Sewer	
Drainage Basins Exhibit	39
Storm Sewer Calculations	40

## **DRAINAGE NARRATIVE**

### **Project Background:**

This is a preliminary drainage study for Heritage Section 10 Subdivision consisting of approximately 14.95 acres west of Hurricane Road and directly south of Heritage Section 2. The purpose of the study is to identify the existing and proposed drainage basins and provide preliminary sizing of the detention basin to serve the subdivision.

### **Terrain and existing ground condition:**

The project area is agricultural and consists of four (4) predeveloped watersheds ranging from 1.57 acres to 6.94 acres in size and varying in elevation from 741 in the southwest corner to 750 near the center of the parcel along the east edge. One (1) predeveloped watershed outlets to the northeast. The remaining three (3) predeveloped watersheds outlet to the south. Two (2) small offsite drainage areas drain unto the site from the south. Offsite area 1 consists of 0.21 acres and offsite area 2 consists of 0.09 acres. A Drainage Basins – Predeveloped Exhibit is included in the Existing Conditions section of this report.

### **Adjoining land conditions:**

North Parcel:

North:	Heritage Subdivision previous sections.
South:	Industrial Park
East:	Hurricane Road and Golf Course
West:	Agricultural

### **Soil types:**

Soils maps from the United States Department of Agriculture, Soil Conservation Service identify Brookston, Miami, and Crosby soils on the subject site. Brookston soils (Br), are a part of hydrologic group B/D, while Crosby soil (CrA) is a part of hydrologic group C/D and Crosby-Miami (CsB2) and Miami soils (MmB2), (MsC3) are part of hydrologic groups C. To be conservative the site was modeled with all soil being group D.

### **Overall Drainage Design:**

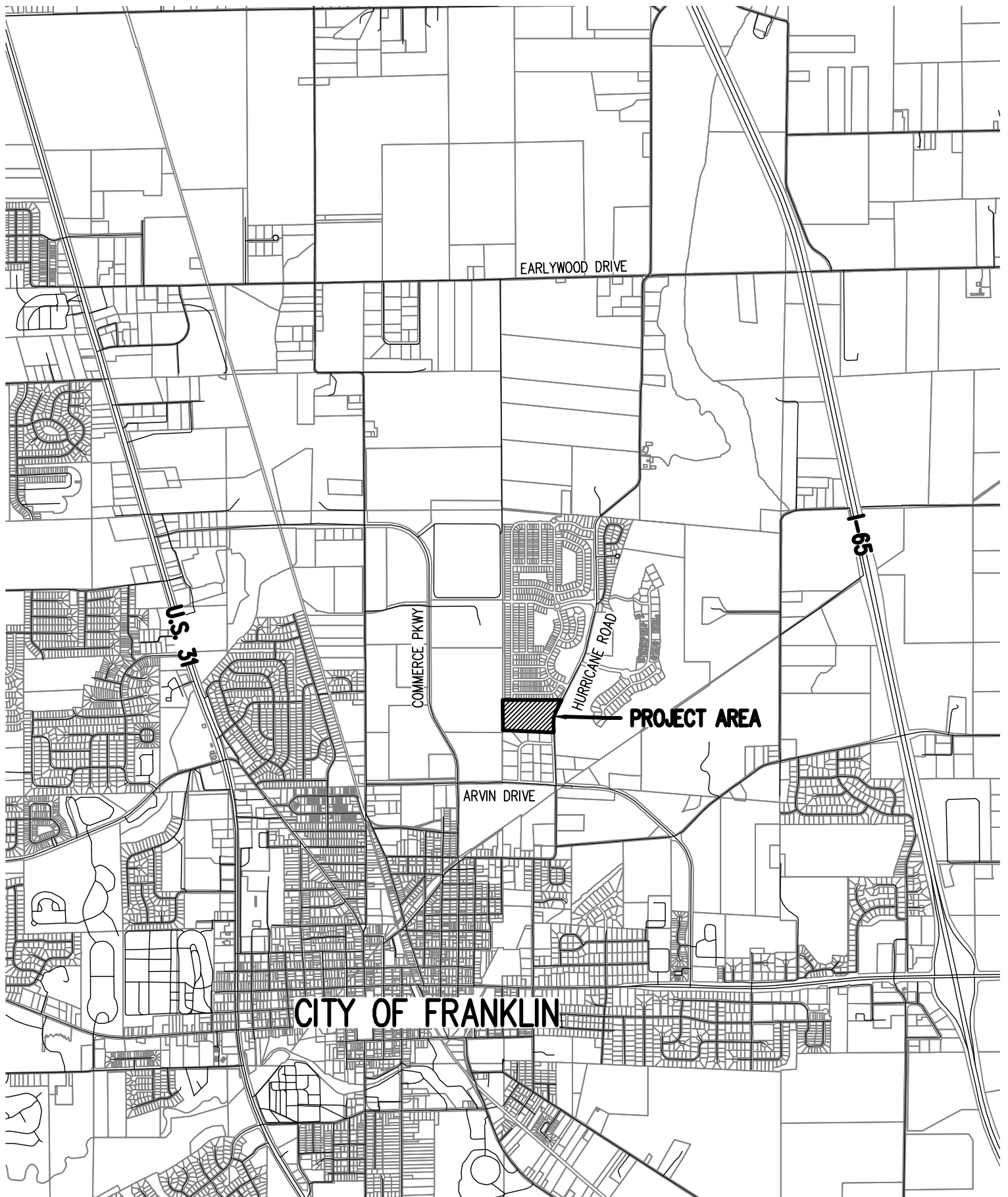
The City of Franklin design standards for development require that the post development release rate for up to and including the 10-year return period storm will not exceed 0.1 cfs per acre of development. The post development release rate for the 11-100-year return period storm will not exceed 0.3 cfs per acre of development. Since this is a preliminary design, the modeling for this report was completed using only the 100-year return period storm event.

The release rate for the pond is calculated as follows:

Post Development Watershed Acreage =	14.95 acres
11-100 year return period storm release rate =	0.3 cfs/acre
11-100 year return period storm calculated release rate =	4.49 cfs

The preliminary detention basin is designed with a normal pool elevation of 739.0. The preliminary outlet is an 8.5" orifice. The 100-year return period storm results in a release rate of 4.24 cfs with a 100 year HWL elevation of 744.34 feet.

## **SITE MAPS**



# **AREA MAP**


**SCALE: 1"=2500'**

Soil Map—Johnson County, Indiana  
(Heritage Section 10)





## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Indiana

Survey Area Data: Version 26, Sep 7, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 24, 2014—Mar 20, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Br	Brookston silty clay loam, 0 to 2 percent slopes	3.4	23.8%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	8.0	55.3%
CsB2	Crosby-Miami silt loams, 2 to 4 percent slopes, eroded	1.2	8.1%
MnB2	Miami silt loam, 2 to 6 percent slopes, eroded	0.4	2.6%
MtC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	1.5	10.2%
<b>Totals for Area of Interest</b>		<b>14.4</b>	<b>100.0%</b>

## Johnson County, Indiana

### Br—Brookston silty clay loam, 0 to 2 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2t98n

*Elevation:* 600 to 1,260 feet

*Mean annual precipitation:* 37 to 46 inches

*Mean annual air temperature:* 48 to 55 degrees F

*Frost-free period:* 145 to 180 days

*Farmland classification:* Prime farmland if drained

#### Map Unit Composition

*Brookston and similar soils:* 95 percent

*Minor components:* 5 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Brookston

##### Setting

*Landform:* Till plains, depressions

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Dip

*Down-slope shape:* Linear, concave

*Across-slope shape:* Concave

*Parent material:* Loess over loamy till

##### Typical profile

*Ap - 0 to 16 inches:* silty clay loam

*Btg1 - 16 to 32 inches:* silty clay loam

*Btg2 - 32 to 44 inches:* loam

*C - 44 to 60 inches:* loam

##### Properties and qualities

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Poorly drained

*Runoff class:* Negligible

*Capacity of the most limiting layer to transmit water (Ksat):*

Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* About 0 to 12 inches

*Frequency of flooding:* None

*Frequency of ponding:* Frequent

*Calcium carbonate, maximum in profile:* 40 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Moderate (about 8.9 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2w

*Hydrologic Soil Group:* B/D

*Hydric soil rating:* Yes

### **Minor Components**

#### **Crosby**

*Percent of map unit:* 5 percent

*Landform:* Till plains

*Landform position (two-dimensional):* Footslope, summit

*Landform position (three-dimensional):* Talf

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Johnson County, Indiana

Survey Area Data: Version 26, Sep 7, 2018

## Johnson County, Indiana

### CrA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2thy4

*Elevation:* 600 to 1,000 feet

*Mean annual precipitation:* 36 to 44 inches

*Mean annual air temperature:* 49 to 54 degrees F

*Frost-free period:* 145 to 180 days

*Farmland classification:* Prime farmland if drained

#### Map Unit Composition

*Crosby and similar soils:* 93 percent

*Minor components:* 7 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Crosby

##### Setting

*Landform:* Recessional moraines, water-lain moraines, ground moraines

*Landform position (two-dimensional):* Summit, backslope, footslope

*Landform position (three-dimensional):* Interfluvium, rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear, convex

*Parent material:* Silty material or loess over loamy till

##### Typical profile

*Ap - 0 to 10 inches:* silt loam

*Btg - 10 to 17 inches:* silty clay loam

*2Bt - 17 to 29 inches:* clay loam

*2BCt - 29 to 36 inches:* loam

*2Cd - 36 to 79 inches:* loam

##### Properties and qualities

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* 24 to 40 inches to densic material

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)

*Depth to water table:* About 6 to 24 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 55 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Moderate (about 6.5 inches)

### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2w

*Hydrologic Soil Group:* C/D

*Hydric soil rating:* No

### **Minor Components**

#### **Williamstown, eroded**

*Percent of map unit:* 5 percent

*Landform:* Water-lain moraines, ground moraines, recessional moraines

*Landform position (two-dimensional):* Backslope, shoulder, summit

*Landform position (three-dimensional):* Side slope, crest, head slope, nose slope, rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear, convex

*Hydric soil rating:* No

#### **Treaty, drained**

*Percent of map unit:* 2 percent

*Landform:* Depressions, water-lain moraines, swales

*Landform position (two-dimensional):* Toeslope, footslope

*Landform position (three-dimensional):* Base slope, dip

*Down-slope shape:* Linear

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: Johnson County, Indiana

Survey Area Data: Version 26, Sep 7, 2018

## Johnson County, Indiana

### CsB2—Crosby-Miami silt loams, 2 to 4 percent slopes, eroded

#### Map Unit Setting

*National map unit symbol:* 2thyc

*Elevation:* 600 to 1,000 feet

*Mean annual precipitation:* 36 to 44 inches

*Mean annual air temperature:* 49 to 54 degrees F

*Frost-free period:* 145 to 180 days

*Farmland classification:* Prime farmland if drained

#### Map Unit Composition

*Crosby, eroded, and similar soils:* 64 percent

*Miami, eroded, and similar soils:* 33 percent

*Minor components:* 3 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Crosby, Eroded

##### Setting

*Landform:* Water-lain moraines, ground moraines, recessional moraines

*Landform position (two-dimensional):* Footslope, backslope, summit

*Landform position (three-dimensional):* Interfluvium, rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear, convex

*Parent material:* Silty material or loess over loamy till

##### Typical profile

*Ap - 0 to 10 inches:* silt loam

*Btg - 10 to 17 inches:* silty clay loam

*2Bt - 17 to 29 inches:* clay loam

*2BCt - 29 to 36 inches:* loam

*2Cd - 36 to 79 inches:* loam

##### Properties and qualities

*Slope:* 2 to 4 percent

*Depth to restrictive feature:* 24 to 40 inches to densic material

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)

*Depth to water table:* About 6 to 24 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 55 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Moderate (about 6.5 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C/D

*Hydric soil rating:* No

**Description of Miami, Eroded**

**Setting**

*Landform:* Water-lain moraines, ground moraines, recessional moraines

*Landform position (two-dimensional):* Summit, backslope, shoulder, footslope

*Landform position (three-dimensional):* Side slope, crest, head slope, nose slope, rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear, convex

*Parent material:* Silty material or loess over loamy till

**Typical profile**

*Ap - 0 to 8 inches:* silt loam

*Bt1 - 8 to 13 inches:* silty clay loam

*2Bt2 - 13 to 31 inches:* clay loam

*2BCt - 31 to 36 inches:* loam

*2Cd - 36 to 79 inches:* loam

**Properties and qualities**

*Slope:* 2 to 4 percent

*Depth to restrictive feature:* 24 to 40 inches to densic material

*Natural drainage class:* Moderately well drained

*Runoff class:* High

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)

*Depth to water table:* About 24 to 36 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 45 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Low (about 5.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C

*Other vegetative classification:* Trees/Timber (Woody Vegetation)

*Hydric soil rating:* No

**Minor Components**

**Treaty, drained**

*Percent of map unit:* 3 percent

*Landform:* Depressions, water-lain moraines, swales  
*Landform position (two-dimensional):* Toeslope, footslope  
*Landform position (three-dimensional):* Base slope, dip  
*Down-slope shape:* Linear  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: Johnson County, Indiana  
Survey Area Data: Version 26, Sep 7, 2018



## Johnson County, Indiana

### MnB2—Miami silt loam, 2 to 6 percent slopes, eroded

#### Map Unit Setting

*National map unit symbol:* 2rkb2

*Elevation:* 180 to 370 feet

*Mean annual precipitation:* 37 to 46 inches

*Mean annual air temperature:* 48 to 55 degrees F

*Frost-free period:* 145 to 180 days

*Farmland classification:* All areas are prime farmland

#### Map Unit Composition

*Miami, eroded, and similar soils:* 85 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Miami, Eroded

##### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Backslope, shoulder, footslope

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Parent material:* Loess over loamy till

##### Typical profile

*Ap - 0 to 8 inches:* silt loam

*Bt - 8 to 13 inches:* silty clay loam

*2Bt - 13 to 31 inches:* clay loam

*2BCt - 31 to 36 inches:* loam

*2Cd - 36 to 79 inches:* loam

##### Properties and qualities

*Slope:* 2 to 6 percent

*Depth to restrictive feature:* 24 to 40 inches to densic material

*Natural drainage class:* Moderately well drained

*Runoff class:* High

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)

*Depth to water table:* About 24 to 36 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 45 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Low (about 5.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C

*Other vegetative classification:* Trees/Timber (Woody Vegetation)

*Hydric soil rating:* No

**Minor Components****Williamstown**

*Percent of map unit:* 5 percent

*Landform:* Till plains

*Landform position (two-dimensional):* Backslope, shoulder

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Other vegetative classification:* Trees/Timber (Woody Vegetation)

*Hydric soil rating:* No

**Treaty**

*Percent of map unit:* 5 percent

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Dip

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Other vegetative classification:* Mixed/Transitional (Mixed Native Vegetation)

*Hydric soil rating:* Yes

**Crosby**

*Percent of map unit:* 5 percent

*Landform:* Till plains

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Interfluve

*Down-slope shape:* Linear

*Across-slope shape:* Convex

*Other vegetative classification:* Trees/Timber (Woody Vegetation)

*Hydric soil rating:* No

**Data Source Information**

Soil Survey Area: Johnson County, Indiana

Survey Area Data: Version 26, Sep 7, 2018

## Johnson County, Indiana

### MtC3—Miami clay loam, 6 to 12 percent slopes, severely eroded

#### Map Unit Setting

*National map unit symbol:* 2rk9y

*Elevation:* 600 to 1,200 feet

*Mean annual precipitation:* 36 to 43 inches

*Mean annual air temperature:* 48 to 54 degrees F

*Frost-free period:* 145 to 180 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Miami, severely eroded, and similar soils:* 97 percent

*Minor components:* 3 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Miami, Severely Eroded

##### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Backslope, shoulder

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Parent material:* Loamy till

##### Typical profile

*Ap - 0 to 6 inches:* clay loam

*Bt - 6 to 29 inches:* clay loam

*BCt - 29 to 34 inches:* loam

*Cd - 34 to 80 inches:* loam

##### Properties and qualities

*Slope:* 6 to 12 percent

*Depth to restrictive feature:* 24 to 40 inches to densic material

*Natural drainage class:* Moderately well drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)

*Depth to water table:* About 24 to 36 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 45 percent

*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water storage in profile:* Low (about 4.8 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* C  
*Other vegetative classification:* Trees/Timber (Woody Vegetation)  
*Hydric soil rating:* No

#### **Minor Components**

##### **Crosby**

*Percent of map unit:* 3 percent  
*Landform:* Till plains  
*Landform position (three-dimensional):* Interfluve  
*Other vegetative classification:* Trees/Timber (Woody Vegetation)  
*Hydric soil rating:* No

### **Data Source Information**

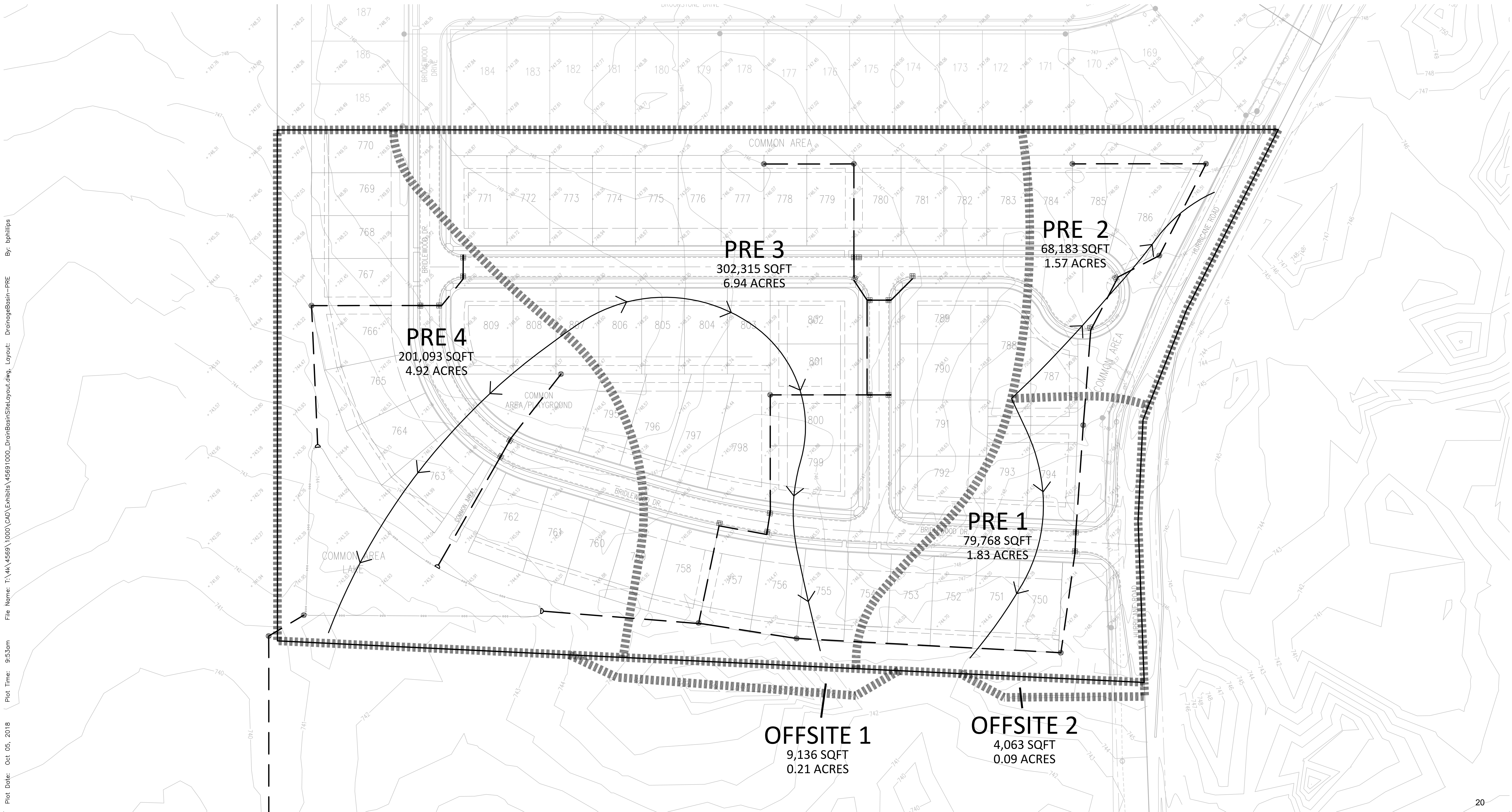
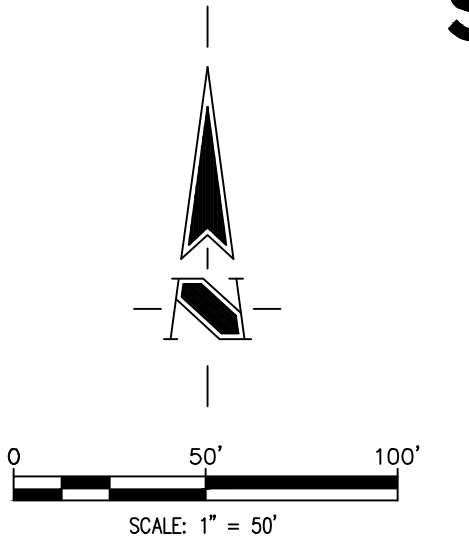
Soil Survey Area: Johnson County, Indiana  
Survey Area Data: Version 26, Sep 7, 2018

## **EXISTING CONDITIONS**

# HERITAGE SECTION 10

## JOHNSON COUNTY, INDIANA

### DRAINAGE BASINS – PREDEVELOPED EXHIBIT



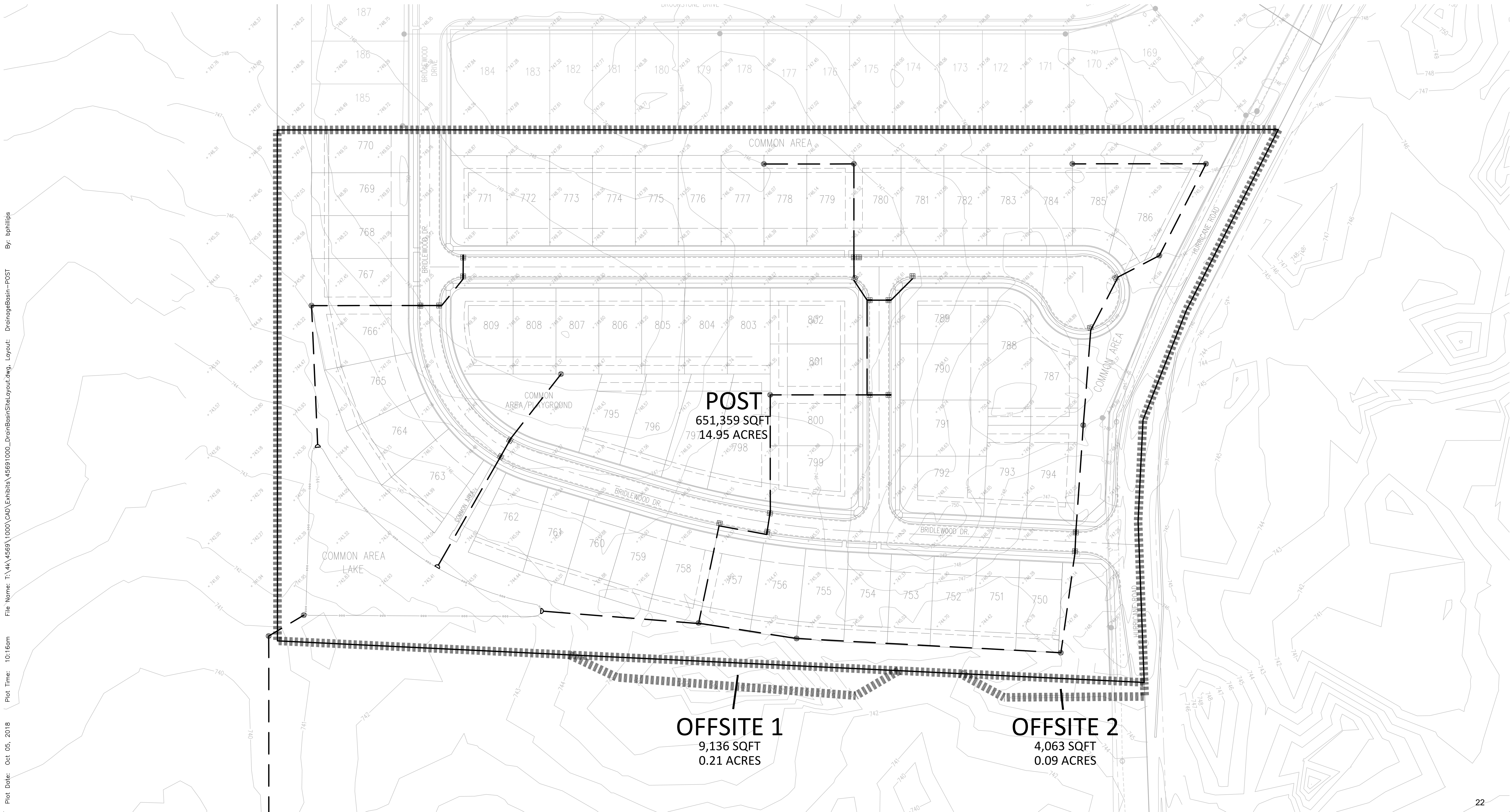
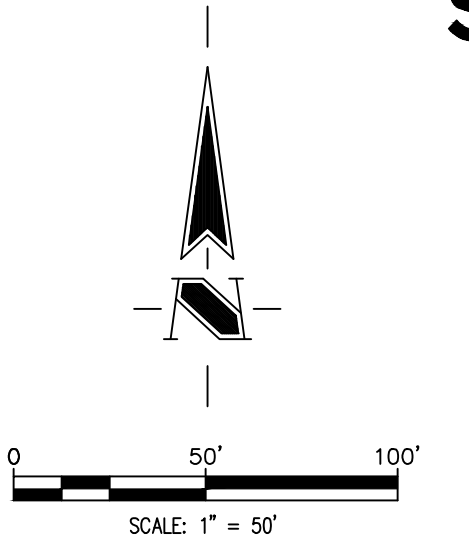
## **DEVELOPED CONDITIONS**



# HERITAGE SECTION 10

## JOHNSON COUNTY, INDIANA

### DRAINAGE BASINS – POST DEVELOPED EXHIBIT







NOAA Atlas 14, Volume 2, Version 3  
 Location name: Franklin, Indiana, USA\*  
 Latitude: 39.4838°, Longitude: -86.0642°  
 Elevation: 742.03 ft\*\*  
 \* source: ESRI Maps  
 \*\* source: USGS



## POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

## PF tabular

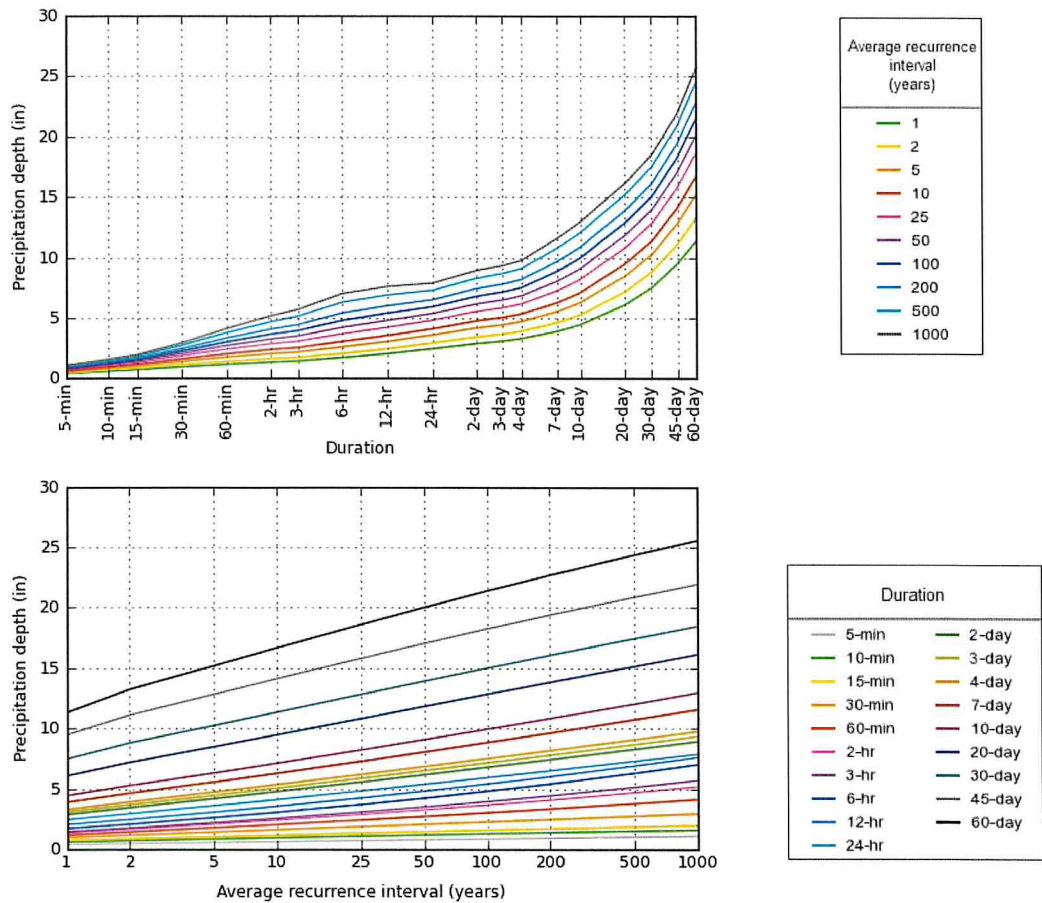
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.373 (0.332-0.422)	0.444 (0.395-0.501)	0.532 (0.472-0.600)	0.601 (0.532-0.678)	0.692 (0.608-0.781)	0.764 (0.666-0.863)	0.833 (0.720-0.944)	0.906 (0.775-1.03)	1.00 (0.844-1.15)	1.08 (0.892-1.24)
10-min	0.579 (0.517-0.655)	0.693 (0.617-0.782)	0.827 (0.734-0.933)	0.928 (0.822-1.05)	1.06 (0.930-1.20)	1.16 (1.01-1.31)	1.25 (1.08-1.42)	1.35 (1.16-1.54)	1.48 (1.24-1.69)	1.57 (1.30-1.81)
15-min	0.710 (0.633-0.803)	0.848 (0.755-0.957)	1.01 (0.902-1.15)	1.14 (1.01-1.29)	1.31 (1.15-1.48)	1.43 (1.25-1.62)	1.56 (1.35-1.77)	1.68 (1.44-1.92)	1.84 (1.55-2.11)	1.96 (1.62-2.26)
30-min	0.939 (0.838-1.06)	1.13 (1.01-1.28)	1.39 (1.24-1.57)	1.59 (1.40-1.79)	1.85 (1.62-2.09)	2.05 (1.79-2.31)	2.25 (1.94-2.55)	2.45 (2.10-2.80)	2.73 (2.30-3.13)	2.93 (2.43-3.39)
60-min	1.15 (1.02-1.30)	1.39 (1.24-1.57)	1.74 (1.55-1.97)	2.02 (1.79-2.28)	2.40 (2.11-2.70)	2.70 (2.35-3.05)	3.01 (2.60-3.41)	3.33 (2.85-3.79)	3.77 (3.17-4.32)	4.12 (3.42-4.76)
2-hr	1.34 (1.20-1.52)	1.62 (1.45-1.84)	2.04 (1.82-2.31)	2.38 (2.10-2.69)	2.85 (2.50-3.22)	3.24 (2.82-3.65)	3.65 (3.14-4.12)	4.08 (3.46-4.61)	4.68 (3.90-5.34)	5.18 (4.23-5.95)
3-hr	1.42 (1.27-1.62)	1.72 (1.53-1.95)	2.17 (1.93-2.46)	2.53 (2.24-2.87)	3.05 (2.67-3.45)	3.48 (3.01-3.93)	3.94 (3.37-4.46)	4.42 (3.73-5.03)	5.12 (4.22-5.86)	5.69 (4.59-6.55)
6-hr	1.70 (1.51-1.95)	2.05 (1.83-2.35)	2.60 (2.30-2.96)	3.04 (2.68-3.46)	3.67 (3.20-4.17)	4.20 (3.63-4.77)	4.78 (4.07-5.42)	5.39 (4.51-6.14)	6.28 (5.13-7.18)	7.01 (5.61-8.07)
12-hr	2.04 (1.82-2.30)	2.45 (2.19-2.77)	3.04 (2.72-3.45)	3.53 (3.14-3.99)	4.22 (3.72-4.74)	4.78 (4.18-5.37)	5.37 (4.64-6.04)	6.00 (5.10-6.77)	6.88 (5.74-7.82)	7.59 (6.23-8.68)
24-hr	2.44 (2.25-2.66)	2.92 (2.69-3.19)	3.58 (3.30-3.90)	4.10 (3.76-4.46)	4.79 (4.38-5.23)	5.35 (4.87-5.83)	5.91 (5.36-6.45)	6.48 (5.85-7.09)	7.26 (6.49-7.97)	7.87 (6.98-8.77)
2-day	2.86 (2.64-3.09)	3.42 (3.16-3.70)	4.17 (3.85-4.52)	4.76 (4.38-5.15)	5.54 (5.08-6.00)	6.16 (5.62-6.68)	6.78 (6.16-7.36)	7.41 (6.70-8.07)	8.26 (7.40-9.02)	8.92 (7.94-9.78)
3-day	3.06 (2.85-3.29)	3.66 (3.41-3.93)	4.44 (4.13-4.77)	5.04 (4.68-5.42)	5.86 (5.42-6.29)	6.49 (5.99-6.98)	7.14 (6.55-7.68)	7.79 (7.12-8.39)	8.66 (7.87-9.35)	9.34 (8.43-10.1)
4-day	3.27 (3.06-3.50)	3.90 (3.65-4.16)	4.70 (4.41-5.03)	5.33 (4.98-5.69)	6.17 (5.76-6.58)	6.83 (6.36-7.28)	7.50 (6.95-7.99)	8.17 (7.54-8.71)	9.07 (8.33-9.68)	9.75 (8.91-10.4)
7-day	3.88 (3.62-4.15)	4.61 (4.30-4.94)	5.53 (5.16-5.92)	6.26 (5.83-6.70)	7.25 (6.74-7.75)	8.04 (7.45-8.59)	8.83 (8.16-9.44)	9.64 (8.87-10.3)	10.7 (9.83-11.5)	11.6 (10.6-12.4)
10-day	4.42 (4.14-4.72)	5.25 (4.93-5.61)	6.28 (5.89-6.71)	7.10 (6.64-7.57)	8.20 (7.66-8.74)	9.07 (8.45-9.66)	9.95 (9.24-10.6)	10.8 (10.0-11.5)	12.0 (11.1-12.8)	13.0 (11.9-13.8)
20-day	6.07 (5.71-6.45)	7.18 (6.76-7.63)	8.46 (7.96-9.00)	9.46 (8.89-10.1)	10.8 (10.1-11.5)	11.8 (11.0-12.5)	12.8 (12.0-13.6)	13.8 (12.9-14.7)	15.1 (14.0-16.1)	16.1 (14.9-17.2)
30-day	7.47 (7.05-7.91)	8.79 (8.30-9.31)	10.2 (9.64-10.8)	11.3 (10.7-12.0)	12.8 (12.0-13.5)	13.9 (13.0-14.7)	15.0 (14.0-15.9)	16.0 (15.0-17.0)	17.4 (16.2-18.5)	18.5 (17.1-19.6)
45-day	9.47 (8.92-10.0)	11.1 (10.5-11.8)	12.8 (12.1-13.6)	14.1 (13.3-14.9)	15.8 (14.8-16.7)	17.0 (16.0-18.0)	18.3 (17.1-19.3)	19.4 (18.1-20.5)	20.9 (19.4-22.1)	21.9 (20.4-23.3)
60-day	11.3 (10.7-12.0)	13.2 (12.5-14.0)	15.2 (14.3-16.1)	16.7 (15.7-17.7)	18.6 (17.5-19.7)	20.0 (18.8-21.2)	21.4 (20.0-22.7)	22.7 (21.2-24.1)	24.4 (22.7-25.8)	25.6 (23.8-27.2)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

## PF graphical

PDS-based depth-duration-frequency (DDF) curves  
Latitude: 39.4838°, Longitude: -86.0642°

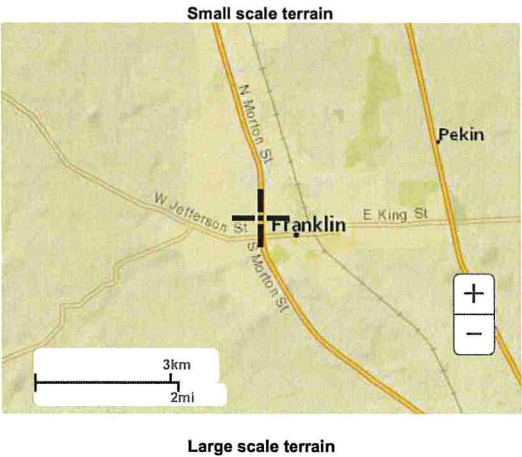


NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Mon Oct 8 18:56:25 2018

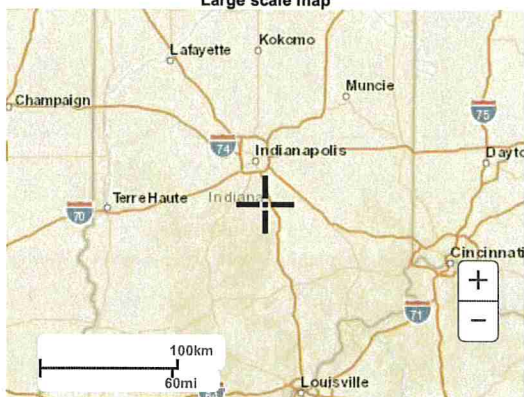
[Back to Top](#)

Maps & aerals





Large scale map



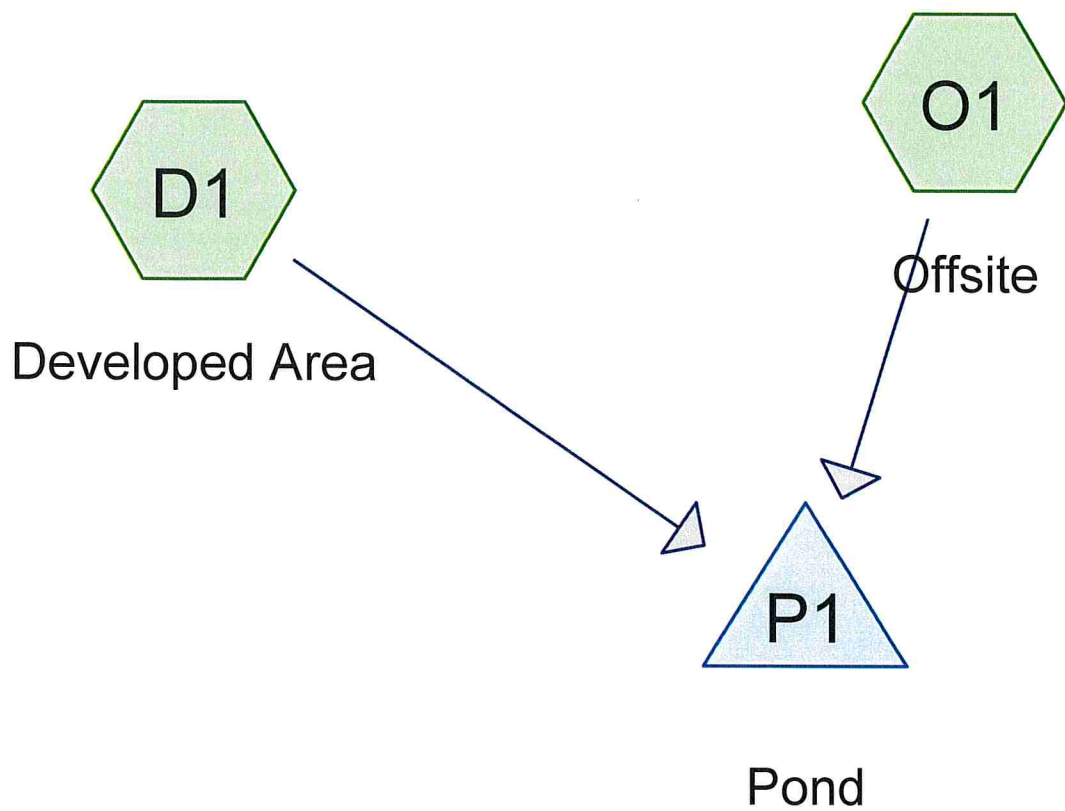
Large scale aerial

[Back to Top](#)

[US Department of Commerce](#)  
[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)





**Routing Diagram for Heritage Section 10 Subdivision**  
Prepared by {enter your company name here}, Printed 10/11/2018  
HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

## Heritage Section 10 Subdivision

Prepared by {enter your company name here}

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Printed 10/11/2018

Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.300	91	Cultivated Land (O1)
14.950	92	Residential, 1/8 acre lots (D1)
<b>15.250</b>	<b>92</b>	<b>TOTAL AREA</b>

## Heritage Section 10 Subdivision

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 3

### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
15.250	Other	D1, O1
<b>15.250</b>		<b>TOTAL AREA</b>

## Heritage Section 10 Subdivision

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 4

### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.300	0.300	Cultivated Land	O1
0.000	0.000	0.000	0.000	14.950	14.950	Residential, 1/8 acre lots	D1
<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>15.250</b>	<b>15.250</b>	<b>TOTAL AREA</b>	

**Heritage Section 10 Subdivision**

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 5

**Pipe Listing (all nodes)**

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D1	0.00	0.00	160.0	0.0030	0.012	12.0	0.0	1.0
2	D1	0.00	0.00	180.0	0.0300	0.012	15.0	0.0	0.0
3	D1	0.00	0.00	70.0	0.0050	0.012	15.0	0.0	0.0
4	D1	0.00	0.00	30.0	0.0030	0.012	18.0	0.0	0.0
5	D1	0.00	0.00	225.0	0.0060	0.012	18.0	0.0	0.0
6	D1	0.00	0.00	30.0	0.0040	0.012	21.0	0.0	0.0
7	D1	0.00	0.00	120.0	0.0030	0.012	24.0	0.0	0.0
8	D1	0.00	0.00	310.0	0.0035	0.012	24.0	0.0	0.0
9	D1	0.00	0.00	120.0	0.0040	0.012	24.0	0.0	0.0
10	D1	0.00	0.00	85.0	0.0030	0.012	36.0	0.0	0.0
11	O1	0.00	0.00	310.0	0.0035	0.012	24.0	0.0	0.0
12	O1	0.00	0.00	120.0	0.0040	0.012	24.0	0.0	0.0
13	O1	0.00	0.00	85.0	0.0030	0.012	36.0	0.0	0.0



**Heritage Section 10 Subdivision***Type II 24-hr 100 year Rainfall=5.91"*

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 6

Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment D1: Developed Area**Runoff Area=14.950 ac 0.00% Impervious Runoff Depth>4.96"  
Flow Length=1,630' Tc=37.5 min CN=92 Runoff=53.41 cfs 6.180 af**Subcatchment O1: Offsite**Runoff Area=0.300 ac 0.00% Impervious Runoff Depth>4.85"  
Flow Length=570' Tc=9.1 min CN=91 Runoff=2.12 cfs 0.121 af**Pond P1: Pond**Peak Elev=744.34' Storage=3.810 af Inflow=53.71 cfs 6.301 af  
Outflow=4.24 cfs 6.282 af**Total Runoff Area = 15.250 ac Runoff Volume = 6.301 af Average Runoff Depth = 4.96"**  
**100.00% Pervious = 15.250 ac 0.00% Impervious = 0.000 ac**

**Heritage Section 10 Subdivision**

Type II 24-hr 100 year Rainfall=5.91"

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 7

**Summary for Subcatchment D1: Developed Area**

Runoff = 53.41 cfs @ 12.32 hrs, Volume= 6.180 af, Depth&gt; 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100 year Rainfall=5.91"

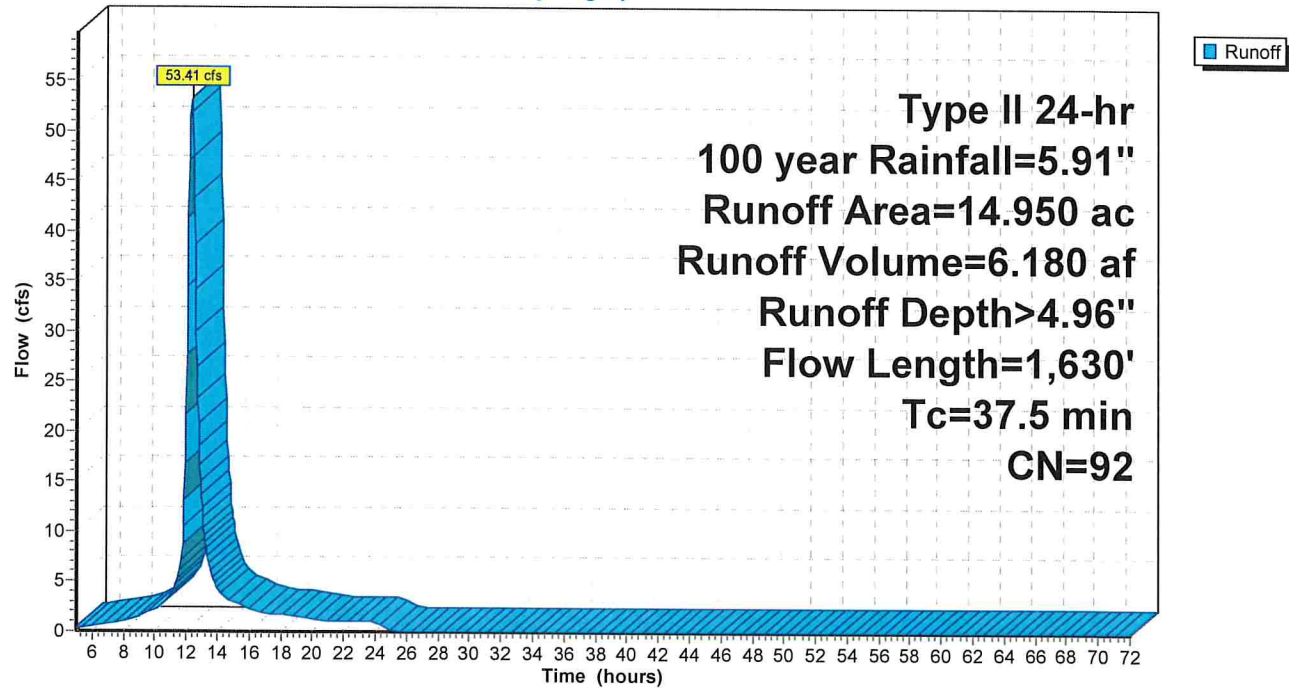
Area (ac)	CN	Description
* 14.950	92	Residential, 1/8 acre lots
14.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	300	0.0100	0.15		<b>Sheet Flow, Lawn</b> Grass: Short n= 0.150 P2= 2.92"
1.0	160	0.0030	2.64	1.99	<b>Pipe Channel, RCP_Round 12"</b> 12.0" Round w/ 1.0" inside fill Area= 0.8 sf Perim= 3.1' r= 0.24' n= 0.012 Concrete pipe, finished
0.3	180	0.0300	9.88	12.12	<b>Pipe Channel, RCP_Round 15"</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.3	70	0.0050	4.03	4.95	<b>Pipe Channel, RCP_Round 15"</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
0.1	30	0.0030	3.53	6.23	<b>Pipe Channel, RCP_Round 18"</b> 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
0.8	225	0.0060	4.99	8.81	<b>Pipe Channel, RCP_Round 18"</b> 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
0.1	30	0.0040	4.51	10.86	<b>Pipe Channel, RCP_Round 21"</b> 21.0" Round Area= 2.4 sf Perim= 5.5' r= 0.44' n= 0.012 Concrete pipe, finished
0.5	120	0.0030	4.27	13.42	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
1.1	310	0.0035	4.62	14.50	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
0.4	120	0.0040	4.93	15.50	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
0.3	85	0.0030	5.60	39.58	<b>Pipe Channel, RCP_Round 36"</b> 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
37.5	1,630	Total			

Subcatchment D1: Developed Area

Hydrograph



**Heritage Section 10 Subdivision**

Type II 24-hr 100 year Rainfall=5.91"

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 9

**Summary for Subcatchment O1: Offsite**

Runoff = 2.12 cfs @ 12.00 hrs, Volume= 0.121 af, Depth&gt; 4.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100 year Rainfall=5.91"

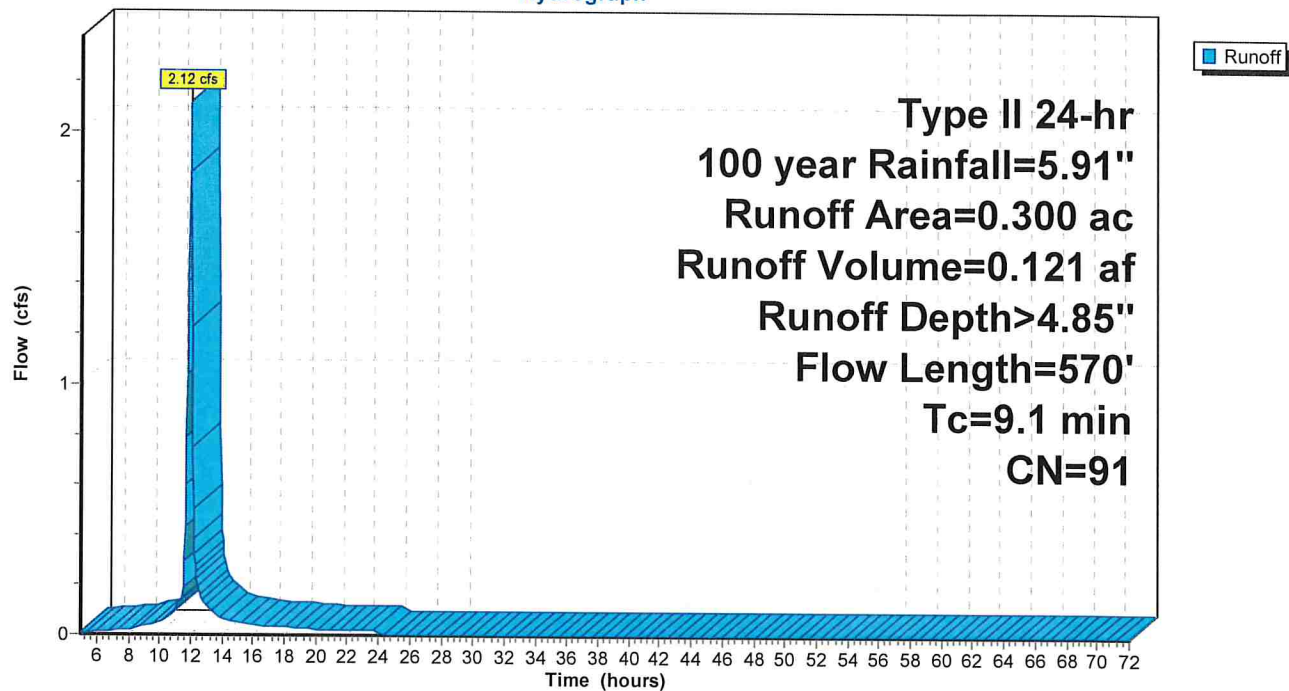
Area (ac)	CN	Description
* 0.300	91	Cultivated Land
0.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.0100	0.19		<b>Sheet Flow,</b> Cultivated: Residue<=20% n= 0.060 P2= 2.92"
5.2	30	0.0100	0.10		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.92"
1.1	310	0.0035	4.62	14.50	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
0.4	120	0.0040	4.93	15.50	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
0.3	85	0.0030	5.60	39.58	<b>Pipe Channel, RCP_Round 36"</b> 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
9.1	570	Total			

Subcatchment O1: Offsite

Hydrograph



**Heritage Section 10 Subdivision**

Type II 24-hr 100 year Rainfall=5.91"

Prepared by {enter your company name here}

Printed 10/11/2018

HydroCAD® 10.00-18 s/n 09455 © 2016 HydroCAD Software Solutions LLC

Page 11

**Summary for Pond P1: Pond**

[82] Warning: Early inflow requires earlier time span

Inflow Area = 15.250 ac, 0.00% Impervious, Inflow Depth > 4.96" for 100 year event  
 Inflow = 53.71 cfs @ 12.32 hrs, Volume= 6.301 af  
 Outflow = 4.24 cfs @ 14.09 hrs, Volume= 6.282 af, Atten= 92%, Lag= 106.6 min  
 Primary = 4.24 cfs @ 14.09 hrs, Volume= 6.282 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 744.34' @ 14.09 hrs Surf.Area= 0.930 ac Storage= 3.810 af

Plug-Flow detention time= 483.3 min calculated for 6.276 af (100% of inflow)  
 Center-of-Mass det. time= 482.7 min ( 1,287.9 - 805.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	739.00'	4.445 af	Custom Stage Data (Prismatic) Listed below (Recalc)

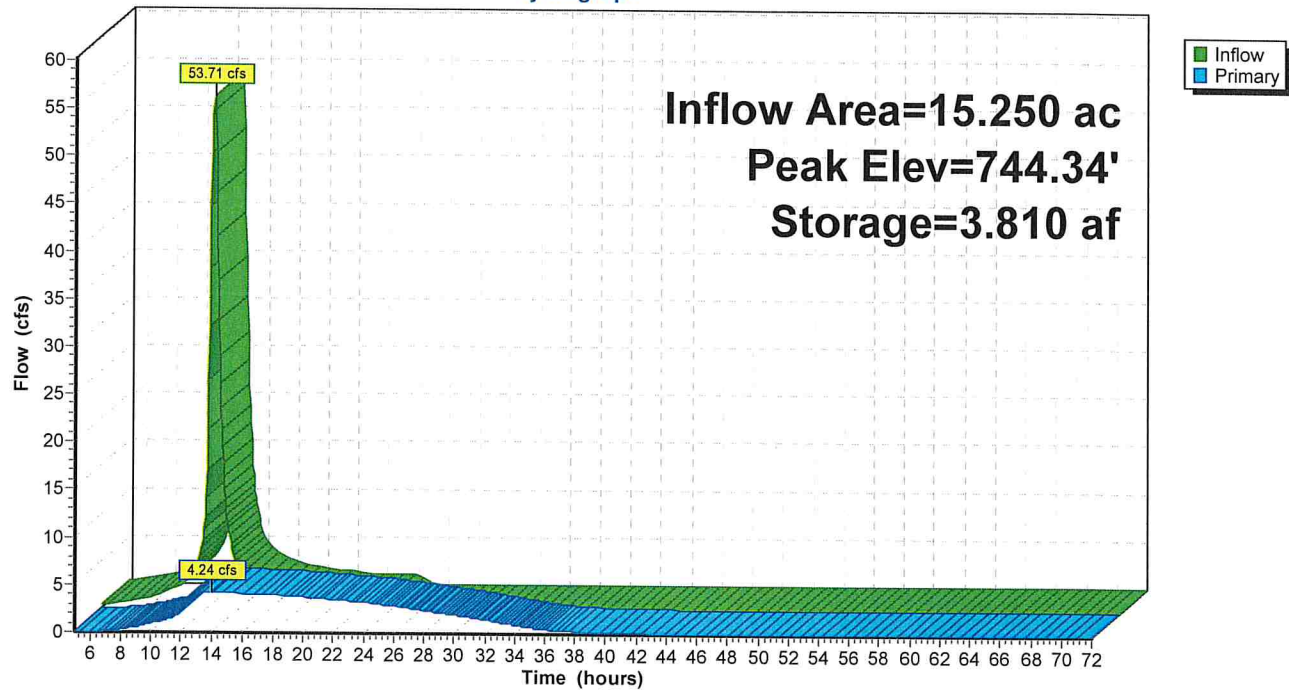
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
739.00	0.500	0.000	0.000
740.00	0.580	0.540	0.540
741.00	0.660	0.620	1.160
742.00	0.740	0.700	1.860
743.00	0.820	0.780	2.640
744.00	0.900	0.860	3.500
745.00	0.990	0.945	4.445

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	8.5" Vert. Orifice/Grate C= 0.600

**Primary OutFlow** Max=4.24 cfs @ 14.09 hrs HW=744.34' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 4.24 cfs @ 10.75 fps)

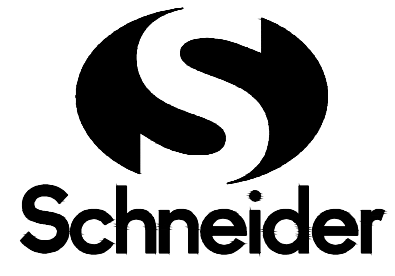
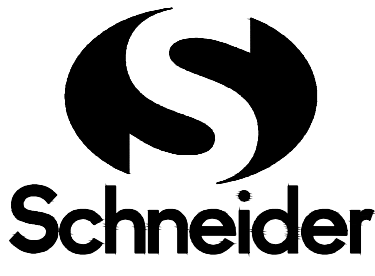
Pond P1: Pond

Hydrograph

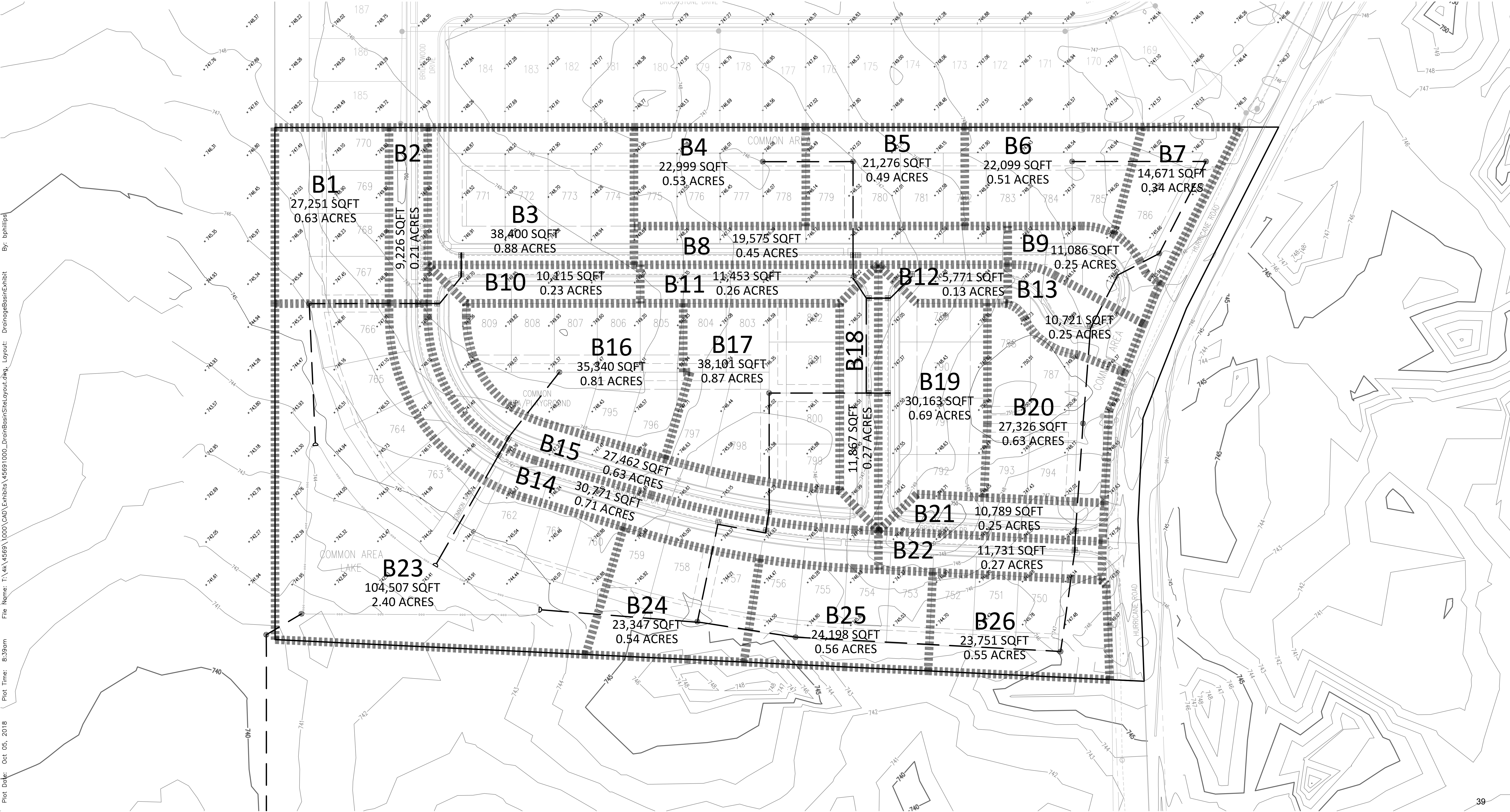
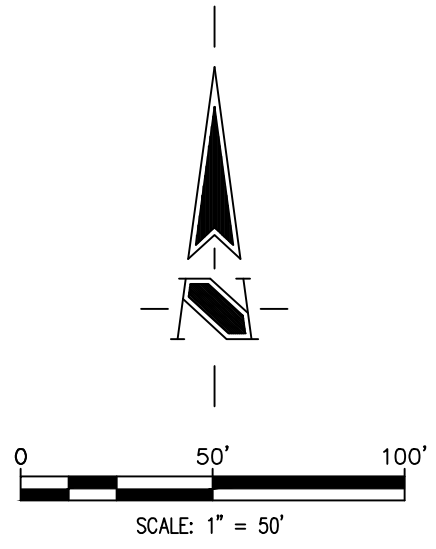


## **STORM SEWER**





HERITAGE SECTION 10  
JOHNSON COUNTY, INDIANA  
DRAINAGE BASINS EXHIBIT



By: bphilips

File Name: T:\4k 4569\1000\CAD\Exhibits\45691000\_DrainBasinSiteLayout.dwg Layout: DrainageBasinExhibit

Plot Time: 8:39am

Plot Date: Oct 05, 2018

Heritage Section 10  
DESIGN STORM: 10 YEAR  
MANNINGS n: 0.013

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16	17	18
Upstream Area	Downstream Area	Pipe Length (ft.)	Runoff Coefficient "C"	Area "A" (acres)	"CA"	Cumulative "CA"	Time of Conc. For Structure (min.)	Longest Time (min.)	Inlet Rainfall Intensity (in./hr.)	Design Rainfall Intensity (in./hr.)	Inlet Flow (cfs)	Design Flow (cfs)	Pipe Diameter (inches)	Pipe Slope (%)		Pipe Capacity (cfs)	Velocity (ft./sec)	Travel Time (min)
B3			0.50	0.88	0.440		5.0		6.99		3.08							
B10	B10	30	0.95	0.23	0.219	0.440	5.0	5.0	6.99	6.99	1.53	3.08	12	1.00		3.56	4.54	0.11
	B2	40				0.659		5.1		6.99		4.60	15	0.80		5.78	4.71	0.14
B2	B1	150	0.50	0.21	0.105	0.764	5.0	5.3	6.99	6.99	0.73	5.34	18	0.30		5.75	3.26	0.77
B1			0.50	0.63	0.315		5.0		6.99		2.20							
	Pond	165				1.079		6.0		6.69		7.21	18	0.50		7.43	4.20	0.65
B16			0.50	0.81	0.405		5.0		6.99		2.83							
	B15	100				0.405		5.0		6.99		2.83	12	1.00		3.56	4.54	0.37
B15			0.95	0.63	0.599		5.0		6.99		4.18							
	B14	30				1.004		5.4		6.99		7.01	18	0.50		7.43	4.20	0.12
B14			0.95	0.71	0.675		5.0		6.99		4.71							
	Pond	150				1.678		5.5		6.99		11.73	24	0.30		12.39	3.94	0.63
B4			0.50	0.53	0.265		5.0		6.99		1.85							
	B5	110				0.265		5.0		6.99		1.85	12	1.00		3.56	4.54	0.40
B5			0.95	0.49	0.466		5.0		6.99		3.25							
	B8	110				0.731		5.4		6.99		5.11	15	0.80		5.78	4.71	0.39
B8			0.95	0.45	0.428		5.0		6.99		2.99							
	B11	30				1.158		5.8		6.99		8.09	18	0.70		8.79	4.97	0.10
B11			0.95	0.26	0.247		5.0		6.99		1.73							
	B18	30				1.405		5.9		6.99		9.82	24	0.30		12.39	3.94	0.13
B12			0.95	0.13	0.124		5.0		6.99		0.86							
	B19	40				0.124		5.0		6.99		0.87	12	0.30		1.95	2.48	0.27
B19			0.50	0.69	0.345		5.0		6.99		2.41							
	B18	30				0.469		5.3		6.99		3.28	15	0.30		3.54	2.88	0.17
B18			0.50	0.27	0.135		5.0		6.99		0.94							
	B17	225				1.874		5.9		6.99		13.10	24	0.40		14.31	4.55	0.82
B17			0.50	0.87	0.435		5.0		6.99		3.04							
	B15	40				2.309		6.7		6.69		15.44	27	0.30		16.96	4.27	0.16
B15			0.95	0.00	0.000		5.0		6.99		0.00							
	B14	85				2.309		6.9		6.69		15.44	27	0.30		16.96	4.27	0.33
B14			0.95	0.71	0.000		5.0		6.99		0.00							
	B24	120				2.309		7.2		6.39		14.75	27	0.30		16.96	4.27	0.47
B6			0.50	0.51	0.255		5.0		6.99		1.78							
	B7	160				0.255		5.0		6.99		1.78	12	0.30		1.95	2.48	1.07
B7			0.50	0.34	0.170		5.0		6.99		1.19							
	B9	180				0.425		6.1		6.69		2.84	15	0.30		3.54	2.88	1.04
B9			0.95	0.25	0.238		5.0		6.99		1.66							
	B13	70				0.663		7.1		6.39		4.23	15	0.50		4.57	3.72	0.31
B13			0.95	0.25	0.238		5.0		6.99		1.66							
	B20	30				0.900		7.4		6.39		5.75	18	0.30		5.75	3.26	0.15
B20			0.50	0.63	0.315		5.0		6.99		2.20							
	B21	225				1.215		7.6		6.39		7.76	18	0.60		8.14	4.60	0.81
B21			0.95	0.25	0.238		5.0		6.99		1.66							
	B22	30				1.453		7.1		6.39		9.28	21	0.40		10.02	4.17	0.12
B22			0.95	0.27	0.257		5.0		6.99		1.79							
	B26	120				1.709		7.2		6.39		10.91	24	0.30		12.39	3.94	0.51
B26			0.50	0.55	0.275		5.0		6.99		1.92							
	B25	310				1.984		7.7		6.39		12.67	24	0.35		13.38	4.26	1.21
B25			0.50	0.56	0.280		5.0		6.99		1.96							
	B24	120				2.264		9.0		6.08		13.77	24	0.40		14.31	4.55	0.44
B24			0.50	0.54	0.270		5.0		6.99		1.89							
	Pond	85				4.843		7.2		6.39		30.93	36	0.30		36.53	5.17	0.27
Pond																		
	Outlet											4.49	18	0.30		5.75	3.26	0.00