



Project Description

Development Name Ironwood Drive Commercial Units

Address/Location 13960 Ironwood Drive, Grand Rapids, MI 49544

Developer/Owner Visser Brothers

Design Firm Feenstra & Associates

Engineer Dave Hanko

Date 7/10/2026

Run Preliminary Site Plan

Watershed Sand Creek

Subcatchment Connectivity and Area Summary

Number of Subcatchments 1

Subcatchment			Existing			Developed		
Name	D/S	Description	Area [ac]	% Impervious	Average CN	Area [ac]	% Impervious	Average CN
Sub1	none	Phase 2 Area	9.73	2%	82	9.73	64%	90
Total			9.73	2%	82	9.73	64%	90

Notes:

Subcatchment Discharge Summary - Developed

Rainfall

Source and Distribution NOAA Atlas 14 at West Olive, MI

Rainfall Frequency

Rainfall Depth [in]

1-year

2-year

10-year

25-year

100-year

2.25

2.59

3.91

4.95

6.90

Runoff

Sub	Area [ac]	Tc [hr]	Weighted CN	Peak Discharge [cfs]				
				1-year	2-year	10-year	25-year	100-year
1	9.73	0.25	90	13.80	16.61	27.13	35.73	50.66

Notes:

Channel Protection Volume Summary

Development Name

Pre-development Definition

BMP Volume Credited to Detention

← Normally set to "Vol. Retained"

Retention

Subcatchment		2-year Runoff Volume [cft]		Credited BMP Volume [cft]	Excess CPV [cft]	Extended Detention	
Name	Description	Pre-dev.	Developed			Release Rate [cfs]	ED Volume Provided [cft]
Sub1	Phase 2 Area	38,483	63,104	0	-24,621	0.190	24,621
Total		38,483	63,104	0	-24,621		24,621
Required Channel Protection Volume [cft]				24,621	Required Volume [cft]		24,621
Percent met by Retention				0	Required Volume met by ED?		Yes

Notes:

Water Quality Volume and TSS Removal Summary

Subcatchment		Water Quality Volume [cft]
Name	Description	
Sub1	Phase 2 Area	24,577
Total		24,577

TSS			
Generated	Upstream	Total	Removed
24,577	0	24,577	21,136
24,577			21,136

TSS Removal Efficiency [%]

86

80% TSS removal met?

Yes

Notes:

Ironwood Drive Commercial Units
Sub1: Phase 2 Area
Runoff
[Click here for documentation](#)

Existing Land Use	HSG	Area	Units	CN CN _{PRE}	Notes
Open spaces (grass cover) - fair	C	3.96	acre	79 71	
Open spaces (grass cover) - fair	D	5.60	acre	84 78	
Impervious (paved parking lot, roof, driveway, etc.)	D	0.17		98 78	
		9.73	acre	82 75	

Developed Land Use	HSG	Area	Units	Curve Number	Notes
DIST: Impervious (paved parking lot, roof, driveway, etc.)	D	4.44	acre	98	
DIST: Impervious (paved parking lot, roof, driveway, etc.)	C	1.78	acre	98	
DIST: Open spaces (grass cover) - good	D	1.33	acre	80	
DIST: Open spaces (grass cover) - good	C	2.18	acre	74	
		9.73	acre	90	

Notes:

Subcatchment Runoff Volume

Rainfall Frequency	1-year	2-year	10-year	25-year	100-year
Developed [cft]	52,885	63,104	104,595	138,569	203,913

Channel Protection Volume
[Click here for documentation](#)

Developed		Pre-developed	
2-year Runoff Volume [cft]	63,104	2-year Runoff Volume [cft]	38,483
2-year Runoff Volume from Upstream Subcatchments [cft]	0	Pre-development Definition	Existing
2-year Runoff available for Retention [cft]	63,104	Channel Protection required?	Yes
Required Channel Protection Volume for this Subcatchment [cft]		24,621	

Structural BMPs used to meet Channel Protection Volume

Structural BMP	A Infiltration Area [sqft]	V _s Storage Volume [cft]	i Design Infiltr. Rate [in/hr]	t _d Drain Time [hr]	Volume Provided [cft]
				N.A.	
				N.A.	
				N.A.	
				N.A.	
Totals					

Credited BMP Volume [cft]
0

Notes:

Volume Released [cft]

63,104

Water Quality Volume
[Click here for documentation](#)

Sum of Directly Connected Disturbed Impervious Area [ac]		6.22	Pitched Roofs/Paved [ac]	6.22	Flat Roofs [ac]	0.00	Unpaved [ac]	0.00
Sum of Directly Connected Disturbed Pervious Area [ac]		3.51						
Required Volume this Subcatchment [cft]		24,577						
Volume from Upstream Subcatchments [cft]		0						
Water Quality Volume to be Treated [cft]		24,577						

TSS Accounting

BMPs Used in Treatment Train	Treated Water Volume [cft]	TSS Removal Efficiency			TSS Removed
		Tabulated	Third-Party	Effective	
PASS: Sediment Forebay	24,577	50		50	12,288
PASS: Detention Basin (extended)	24,577	72		72	8,848
					0
					0
Released Water Volume [cft]	24,577	Total TSS Removed			21,136

Notes:



Time-of-Concentration

[Click here for documentation](#)

Development Name

Location 1

Existing Land Use

Sheet Flow

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Manning's n	Slope [ft/ft]		Travel Time [hr]
Short grass	724.00	714.53	300.00	0.150	0.0316		0.36
Subtotal							0.36

Shallow Concentrated Flow (after 300 feet of sheet flow)

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Slope [ft/ft]	Velocity [ft/s]		Travel Time [hr]
Unpaved	714.53	701.81	693.00	0.0184	2.19		0.09
Subtotal							0.09

Open Channels, Swales, and Pipes

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Area [sqft]	Wetted Perimeter [ft]	User Specified, n	Manning's n	Slope [ft/ft]	Velocity [ft/s]	Travel Time [hr]
Subtotal										0.00

Existing Time-of-concentration [hr] **0.45**

Developed Land Use

Sheet Flow

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Manning's n	Slope [ft/ft]		Travel Time [hr]
Paved	721.74	718.74	300.00	0.011	0.0100		0.07
Subtotal							0.07

Shallow Concentrated Flow (after 300 feet of sheet flow)

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Slope [ft/ft]	Velocity [ft/s]		Travel Time [hr]
Paved	718.74	716.74	200.00	0.0100	2.03		0.03
Unpaved	716.74	715.78	161.00	0.0060	1.25		0.04
Subtotal							0.06

Open Channels, Swales, and Pipes

Type	US Elevation [ft]	DS Elevation [ft]	Flow Distance [ft]	Area [sqft]	Wetted Perimeter [ft]	User Specified, n	Manning's n	Slope [ft/ft]	Velocity [ft/s]	Travel Time [hr]
Grass	715.78	710.32	547.00				0.025	0.0100		
Subtotal										0.00

Developed Total without Storage Device [hr] **0.13**

Storage Device

Storage Volume [cft]	10-year Design Discharge [cfs]	Description	Travel Time [hr]
Subtotal			0.00
Developed Time-of-Concentration [hr]			0.13



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Version 4.0



Flood Control Volume

[Click here for documentation](#)Development Name
Location 1 Subcatchment

Detention - Routing Method

Time-of-Concentration

Existing [hr]
Developed [hr]

Design Storm

Contributing Area [ac]
Developed Peak Discharge [cfs]

Allowable Discharge Worksheet

Standard Discharge [cfs] - 0.13 [cfs/ac] ☒ Select
Alternate Discharge [cfs] Detention Required? Allowable Discharge [cfs] Required Storage Volume [cft] Time to Drain [hrs]

Notes:

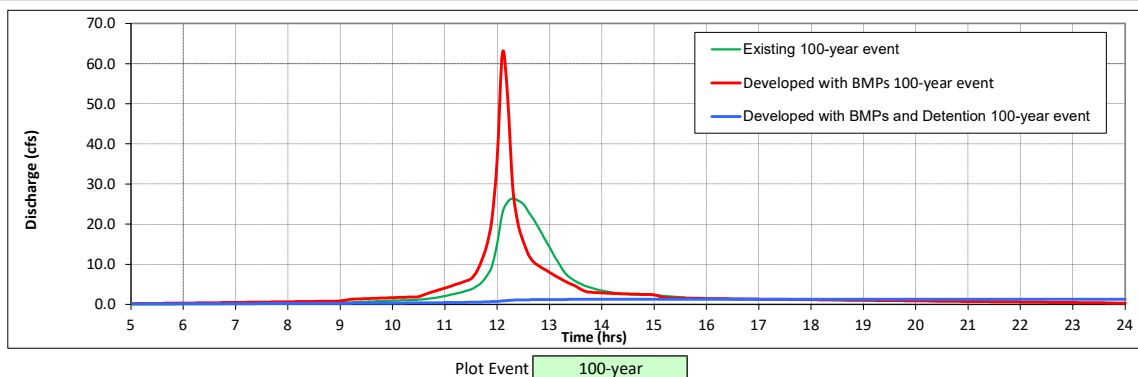
Calculated

Retention - Summary of Volumes

Design Storm

Runoff Volume [cft]
BMP Storage Volume [cft]
BMP Infiltrating Volume [cft]
Volume Provided by BMPs [cft]
Runoff Volume Retained by BMPs [cft]
Unretained Runoff Volume [cft]
Required Storage Volume [cft]
BMP Storage Volume when Volume Provided equals Runoff Volume

Hydrograph



Flood Control Summary

Rainfall	Source and Distribution	24-hour, NOAA Atlas 14 at West Olive, MI, NRCS MSE4				
	Rainfall Frequency	1-year	2-year	10-year	25-year	100-year
	Rainfall Depth [in]	2.25	2.59	3.91	4.95	6.90
Existing Land Use	Peak Discharge [cfs]	4.53	5.84	11.49	16.49	26.38
	Runoff Volume [cft]	29,763	38,483	76,038	108,116	171,250
Developed Land Use	Peak Discharge [cfs]	17.35	20.82	33.75	44.29	62.75
	Runoff Volume [cft]	52,885	63,104	104,595	138,569	203,913
	Runoff Volume Retained by BMPs [cft]	0	0	0	0	0
	BMP Volume Credited to Detention [cft]	0	0	0	0	0
	Volume Released [cft]	52,885	63,104	104,595	138,569	203,913
	Peak Discharge Released [cfs]	17.35	20.82	33.75	44.29	62.75
Developed with BMPs and Detention	Peak Discharge Released [cfs]	0.61	0.67	0.89	1.03	1.26
	Maximum Volume Detained [cft]	35,591	43,423	75,474	102,639	154,127



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Flood Control Volume

[Click here for documentation](#)Development Name
Location 2 Subcatchment [← Specify Sub](#)

Detention - Routing Method

Time-of-Concentration

Existing [hr]
Developed [hr]

Design Storm

Contributing Area [ac]
Developed Peak Discharge [cfs]

Allowable Discharge Worksheet

Standard Discharge [cfs] - 0.13 [cfs/ac] ☒ Select
Alternate Discharge [cfs] Detention Required? Allowable Discharge [cfs] Required Storage Volume [cft] Time to Drain [hrs]

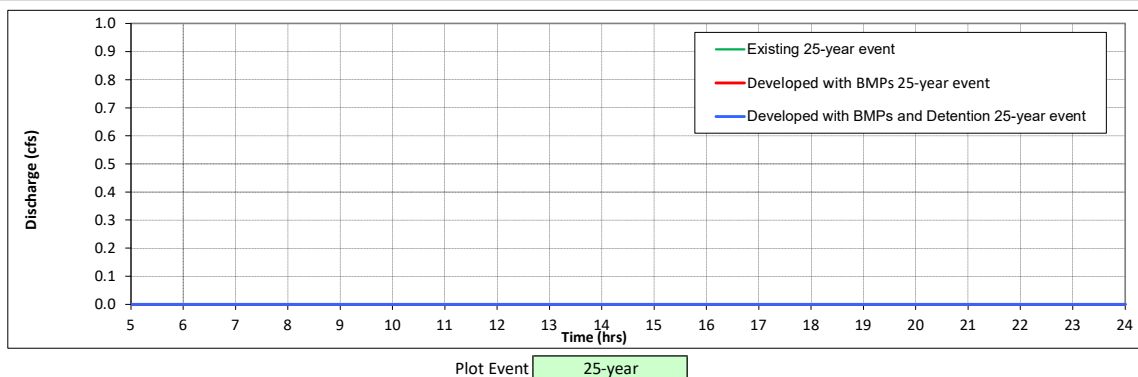
Notes:

Retention - Summary of Volumes

Design Storm

Runoff Volume [cft]
BMP Storage Volume [cft]
BMP Infiltrating Volume [cft]
Volume Provided by BMPs [cft]
Runoff Volume Retained by BMPs [cft]
Unretained Runoff Volume [cft]
Required Storage Volume [cft]
BMP Storage Volume when Volume Provided equals Runoff Volume

Hydrograph



Flood Control Summary

Rainfall	Source and Distribution	24-hour, NOAA Atlas 14 at West Olive, MI, NRCS MSE4				
	Rainfall Frequency	1-year	2-year	10-year	25-year	100-year
	Rainfall Depth [in]	2.25	2.59	3.91	4.95	6.90
Existing Land Use	Peak Discharge [cfs]	0.00	0.00	0.00	0.00	0.00
	Runoff Volume [cft]	0	0	0	0	0
Developed Land Use	Peak Discharge [cfs]	0.00	0.00	0.00	0.00	0.00
	Runoff Volume [cft]	0	0	0	0	0
	Runoff Volume Retained by BMPs [cft]	0	0	0	0	0
	BMP Volume Credited to Detention [cft]	0	0	0	0	0
	Volume Released [cft]	0	0	0	0	0
	Peak Discharge Released [cfs]	0.00	0.00	0.00	0.00	0.00
Developed with BMPs and Detention	Peak Discharge Released [cfs]	N.A.	N.A.	N.A.	N.A.	N.A.
	Maximum Volume Detained [cft]	N.A.	N.A.	N.A.	N.A.	N.A.