

Determination of Required Detention Basin Storage

Langlois PUD

Vergennes Township, MI

Developed C factor Calculations

Proposed Conditions

Drain Area	SF	Acre	C factor
Pervious	93288	2.14	0.25
Impervious	36132	0.83	0.90

$$\begin{aligned} \text{Total Proposed Site Area} &= 129,420 \text{ s.f.} \\ &= 2.97 \text{ acre} \end{aligned}$$

$$\begin{aligned} C_{\text{developed}} &= 0.43 \\ C * A_{\text{developed}} &= 1.28 \end{aligned}$$

$$Q_{\text{out}} = 0.13 \text{ cfs} * \text{Area} = 0.39 \text{ cfs}$$

$$\text{Volume of First 1/2" of runoff} = 5,393 \text{ c.f.}$$

Detention Basin Sizing

From NOAA Atlas 14, Volume 8, Version 2 - Lowell, MI 25-year storm,

T_d (min)	Duration T_d (hr)	Intensity i_{25} (in/hr)	Inflow Q_{in} (cfs)	Allow. Outflow Q_{out} (cfs)	$Q_{in}-Q_{out}$ (cfs)	Storage Vol V_{st} (cf)
5	0.08	7.70	9.86	0.39	9.47	2,841
10	0.17	5.64	7.22	0.39	6.83	4,100
15	0.25	4.60	5.89	0.39	5.50	4,952
30	0.50	3.40	4.35	0.39	3.97	7,138
60	1.00	2.23	2.85	0.39	2.47	8,885
120	2.00	1.39	1.78	0.39	1.39	10,029
180	3.00	1.02	1.31	0.39	0.92	9,929
360	6.00	0.60	0.77	0.39	0.38	8,246
720	12.00	0.34	0.44	0.39	0.05	2,115
1440	24.00	0.19	0.24	0.39	-0.14	-12,359

Required Basin Storage Volume **10,029 cf**

Detention Pond Sizing

Elevation ft	Area sf	Avg. Area sf	Height ft	Volume cf	Cumulative Volume cf
809	0			0	
810	1875	938	1.0	938	938
811	2730	2303	1.0	2303	3240
812	3686	3208	1.0	3208	6448
813	4742	4214	1.0	4214	10662
814	5899	5321	1.0	5321	15983

Volume (c.f.) = **15,983**
 Volume Required (c.f.) = **10,029**

Bottom of Pond elevation (X₀) = 809.00
 Water Quality Elevation (X_{wq}) = 811.67
 25-year Storm Elevation (X₂₅) = 812.85

Water Quality Control

Max Allowable Outflow, Q_{wq} = volume / 24 hr * 3600 sec

$$H = X_{wq} - X_0$$

$$A = Q_a / 0.62 * \sqrt{2 * 32.2 * h}$$

The Area of 0.50" Hole

Number of Orifice Holes

$$Q_{wq} = 0.06 \text{ cfs}$$

$$H = 2.67 \text{ ft.}$$

$$A = 0.008 \text{ s.f.}$$

$$= 0.001 \text{ s.f.}$$

$$= 5$$

$$Q_{wq} \text{ Design} = 0.06 \text{ cfs}$$

$$\text{Time To Discharge} = 27.0 \text{ hr.}$$

Flood Control

Orifice equation

$$A = Q_a / 0.62 * \sqrt{2 * 32.2 * h}$$

$$\text{where, } h = 1.18 \text{ ft. (25-yr. storm elevation - Water Quality Elev.)}$$

$$Q_a = 0.33 \text{ cfs (0.13 cfs/acre) - } Q_{wq}$$

$$A_{max} = 0.061 \text{ s.f.}$$

$$\text{Max Orifice Size} = 3.35 \text{ in.}$$

$$\text{Actual Orifice Size} = 3.00 \text{ in.}$$

$$\text{Actual } Q_{out} = 0.32 \text{ cfs}$$

Emergency Overflow

Provided by 15-inch storm sewer pipe. See pipe sizing spreadsheet for capacity calculation.