Project No. 16146
July 30, 2014

# STORMWATER MANAGEMENT SUMMARY

## INTRODUCTION:

The Clearwater Apartments project is located within the existing Rivers Crossing subdivision located on the north side of Clearwater Lane. Six total apartments are proposed, along with six additional detached garages. Additional paved parking areas are proposed to accommodate visitor parking. The adjacent existing Rivers Crossing development contains several storm water facilities and runoff from this development would be managed without increasing the load on these existing basins; as there are concerns over the capacity of the existing basins.

Previously created and archived base mapping from the Rivers Crossing design files were utilized to determine the various watersheds that were designed and built; existing basins were surveyed to accurately model existing conditions of both storm water facilities within Stillwater Circle. Existing watershed have been evaluated, and adjusted as necessary, to each facility based on what is currently draining there, versus what was originally proposed. The initial storm water basin, Basin A, is within Stillwater Circle in the rear yards of Lots 98-101 and Lots 177-182. This basin collects the runoff from 13.8 acres of the development and drains directly into the second basin, Basin B, which was recently revised by the City. Basin B collects water from a much larger drainage area of 42.9 acres and discharges westerly into a ditch system which ultimately drains to the Fox River. Our modeling indicates that Basin B can accommodate storm events through its principal outlet structure up to the 25 year reoccurrence interval, but overtops through its emergency spillway for storm events over the 50 year reoccurrence interval. It should be noted that only a portion of the Clearwater Apartment site drains directly into Clearwater Lane and is included in the Basin B watershed (please see the watershed map in the Appendix). Thus, with the existing basin not currently accommodating the entire spectrum of the design storms additional detention and management is being proposed. A summary of the existing basin hydrology and modeling is itemized below.

### Design Data

**Existing Basins A & B**

| **Site Assessment Data** | **Basin A** | **Basin B** | **rev. Basin B** |
|---|---|---|---|
| Contributing drainage area to basin | 13.8 acres | 42.9 acres | 42.5 acres |
| Runoff Curve Number (CN) | 75 | 75.6 | 75.5 |
| Time of Concentration | 28.7 min. | 56.4 min. | 56.4 min. |

### Basin A Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 5.7 cfs(1-yr/24 hr) | 2.6 cfs | 13.5' | 4,677 cu.ft. | #1 |
| 8.8 cfs (2yr/24hr) | 3.0 cfs | 14.1' | 9,477 cu.ft. | #1 |
| 20.4 cfs (10yr/24hr) | 3.8 cfs | 15.7' | 30,994 cu.ft. | #1 |
| 36.8 cfs (100yr/24hr) | 17.9 cfs | 16.9' | 51,831 cu.ft. | #1, #2 |

| | |
|---|---|
| Outlet #1 | 12" R.C.P. @ 10.89' |
| Outlet #2 | grass swale overflow @ 16.0' |

### Basin B Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 14.4 cfs (1-yr/24 hr) | 10.0 cfs | 11.8' | 26,112 cu.ft. | #1 |
| 20.9 cfs (2yr/24hr) | 13.1 cfs | 12.3' | 37,381 cu.ft. | #1, #2 &#3 |
| 45.5 cfs (10yr/24hr) | 25.5 cfs | 14.3' | 82,495 cu.ft. | #1, #2 &#3 |
| 92.6 cfs (100yr/24hr) | 79.4 cfs | 15.8' | 122,363 cu.ft. | #1 - #4 |

| | |
|---|---|
| Outlet #1 | 6" pipe @ 10.89' |
| Outlet #2 | concrete inlet @ 11.1' |
| Outlet #3 | 24" R.C.P. @ 10.89 |
| Outlet #4 | rip rap spillway @ 15.2' |

### rev watershed to Basin B Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 14.2 cfs (1-yr/24 hr) | 9.9 cfs | 11.8' | 25,809 cu.ft. | #1 |
| 20.6 cfs (2yr/24hr) | 12.9 cfs | 12.3' | 36,897 cu.ft. | #1, #2 &#3 |
| 44.9 cfs (10yr/24hr) | 25.3 cfs | 14.3' | 81,281 cu.ft. | #1, #2 &#3 |
| 91.6 cfs (100yr/24hr) | 78.2 cfs | 15.8' | 122,059 cu.ft. | #1 - #4 |

| | |
|---|---|
| Outlet #1 | 6" pipe @ 10.89' |
| Outlet #2 | concrete inlet @ 11.1' |
| Outlet #3 | 24" R.C.P. @ 10.89 |
| Outlet #4 | rip rap spillway @ 15.2' |

In consideration of the Clearwater Apartments site plan, a minor adjustment of the watershed for Basin B and additional storm water management basins within the project have been proposed to bring it in compliance with the City's ordinance. This is reflected above with revised watershed data where the watershed is reduced by 0.2 acres to allow only the most easterly portion of the site to continue to drain to Clearwater Lane. This area is mostly comprised of open space, but would include the access drive to the 3 town homes in the east side of the project.

## Proposed Conditions

A fairly large area north of the Clearwater Apartment lot, all the way to CTH X, drains towards and through the site. We are proposing two additional storm water basins be incorporated into the site plan to address both quantity and quality of the storm water to meet the ordinance requirements. The watershed map is available in the Appendix and the basin design summary is as follows:

### Proposed Basin D (Infiltration Basin with Wet Forebay)

**Site Assessment Data**

| | |
|---|---|
| Contributing drainage area to basin | 1.5 ac |
| Runoff Curve Number (CN) | 89.5 |
| Time of Concentration | 10.0 min. |

## Basin D Inflow, Outflow & Storage Data

| Inflow Peak | Max Outflow Rate | Max. Water Surface Elev. | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 2.9 cfs(1-yr/24 hr) | 0.0 cfs | 15.91',15.00' | 5,018 cu.ft. | #1,#3 |
| 3.6 cfs (2yr/24hr) | 0.10 cfs | 16.01',15.23' | 6,232 cu.ft. | #1,#2,#3,#4 |
| 6.1 cfs (10yr/24hr) | 0.38 cfs | 16.06',16.00' | 9,718 cu.ft. | #1,#2,#3 ,#4 |
| 9.1 cfs 100yr/24hr) | 2.24 cfs | 16.11',16.44' | 13,056 cu.ft. | #1,#2,#3,#4,#5 |

**Outflow Control Structures Summary**

**Wet Forebay**

| | |
|---|---|
| Outlet #1 | 90-degree "v"-notch weir @ 15.0' |
| Outlet #2 | Spillway (weir between cells) @ 16.0' |

**Infiltration Cell**

| | |
|---|---|
| Outlet #3 | Infiltration (3.6 in/hr.) - bottom of basin at 14.0' |
| Outlet #4 | 4" orifice @ 15.0' |
| Outlet #5 | 2' dia. concrete riser @ 16.25' |
| Outlet #6 | Matted spillway @ 16.5' |

A 12" diameter pipe would carry flow from the infiltration cell outlet structure downstream towards Basin D.

**Note:**
Parking lot drainage within the watershed is directed to wet forebay and pre-treated prior to discharge into infiltration cell. A 90-degree v-notch weir is proposed to allow controlled flow into infiltration for smaller storm events. An earthen berm between the cells (16.0' elevation) would allow water to overtop wet cell and drain to infiltration cell. The weir bottom would be set at 15.0' and this would be the normal water surface elevation of the wet forebay, allowing for 1 foot of storage behind the v-notch weir prior to overtopping the earthen weir spillway. Basin D has been modeled as an interconnected basin; the report only shows the max. elevation of the downstream basin (infiltration cell) but the reported storage area utilized accounts for both cells, as they interact. Both the wet forebay and infiltration cell max. water surface elevations are shown above, separated by a comma. The outflow rate shown is the flow coming out of the outlet structure pipe. For the 1-year storm no discharge from the basin is expected.

Outflow from Basin D would be directed to the storm sewer (10-year storm outflow accounted for in storm sewer sizing) and would flow to Basin C (below). The inflow below accounts for both the flow directly to the basin, as well as the outflow from Basin D. The summary of this is below.

## Proposed Basin C (Wet Detention Basin)

| | Design Data |
|---|---|
| **Site Assessment Data** | |
| Contributing drainage area to basin | 14.4 ac |
| Runoff Curve Number (CN) | 72.6 |
| Time of Concentration | 41.2 min. |

## Basin C Inflow, Outflow & Storage Data

| Inflow Peak | Max Outflow Rate | Max. Water Surface Elev. | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 3.5 cfs(1-yr/24 hr) | 0.48 cfs | 12.51' | 10,402 cu.ft. | #1 |
| 5.7 cfs (2yr/24hr) | 0.88 cfs | 12.95' | 16,192 cu.ft. | #1,#2 |
| 15.0 cfs (10yr/24hr) | 5.55 cfs | 14.09' | 32,983 cu.ft. | #1,#2,#3, #4 |
| 29.7 cfs 100yr/24hr) | 17.56 cfs | 15.00' | 47,606 cu.ft. | #1,#2,#3, #4 |

**Outflow Control Structures Summary**

| | |
|---|---|
| Outlet #1 | 5" orifice @ 11.70' |
| Outlet #2 | 12" orifice @ 12.70' |
| Outlet #3 | 4' diameter concrete riser @ 14.0' |
| Outlet #4 | 15' wide matted spillway @ 15.0' |

A 24" diameter outlet pipe would carry flow from the basin outlet structure.

The 24" outlet pipe would be constructed to the south and would outlet to the existing drainage swale on the west side of existing Basin B. An existing 15" culvert pipe that carries flow under the existing sidewalk would be connected to this 24" pipe using a manhole and the flows would be combined. The 24" pipe would be installed along the existing swale line, as the swale would no longer be necessary. At the outlet end, an existing 12" CMP that carried the swale flow under sidewalk and downstream to the adjacent stream would be replaced with twin 21" x 15" CMPs to carry the combined Basin C outflow and existing swale drainage. Rip-rap would be place between the 24" outlet end section and new CMPs to help reduce erosive forces.

An additional rain garden is proposed on-site but not included in the report, it is meant to only provide water quality for the pod of townhouses and parking on the northeast portion of the site, prior to discharge to the adjacent wetlands. This rain garden was included in the water quality calculations and reflected in the WinSLAMM output. Due to generally high groundwater, the site is not very conducive to infiltration. Basin D has been proposed to accommodate infiltration on-site.

## Water Quality and Infiltration

Infiltration for this site would be provided by the infiltration cell within Basin D. For this site, the overall flow to the basins is approximately 44,000 cu.ft. for the 2-year storm event. In order to achieve the 25% volume of infiltration, approximately 11,000 cu.ft. of water needs to be infiltrated. Based on the Hydraflow modeling calculations approximately 8,900 cu.ft. is infiltrated for the 2-year storm event. This leaves the site slightly below the requirement however it is anticipated that the grass swales that are proposed throughout the site, as well as the rain garden not modeled would provide some additional infiltration and should satisfy the intent of the requirement. It should be noted that gravelly soils are present on much of the site but those same areas tend to have higher groundwater making infiltration less desirable and therefore the plan should meet the requirements for infiltration.

Water quality for the site will be addressed with three storm water quality facilities, Basins C & D, as well as the above-mentioned Rain Garden. It is anticipated that the grass swales located on-site would also provide some water quality and infiltration but have not been analyzed for the site, as water quality requirements will be met with the 3 facilities summarized below. Based on the WinSLAMM version 10, the output summary finds that there would be a 91.5% reduction is total suspended solids compared to no controls. From the analysis, 2,430 lbs of sediment would be expected with no controls and with the proposed controls only 207 lbs of sediment are expected to leave the site. Based on the model, Basin C would reduce 83% of the total suspended solids, the wet forebay within Basin D provides nearly 70% load reduction prior to discharging to the infiltration cell where there is then a 100% reduction, the rain garden located on the northeast side of the site would provide approximately 80% reduction. Based on the modeling, the 80% reduction requirement is met and well exceeded.

## Pre- vs. Post Development Peak Flow Comparison

Comparing the pre-developed to developed flows for the Clearwater Apartments drainage is as follows:

The ultimate discharge at this location for all storm events, adding the outflows from Basins B and C is as follows:

Ultimate Discharge-Rivers Crossing at Stillwater Circle

| Summary Data Elements | To Swale west of Basin B | |
|---|---|---|
| | Existing | Proposed |
| **1 yr/24 hr. Peak Flow** | 10.9 cfs | 10.3 cfs |
| **2 yr/24 hr. Peak Flow** | 14.6 cfs | 13.6 cfs |
| **10 yr/24 hr. Peak Flow** | 31.2 cfs | 30.7 cfs |
| **100 yr/24 hr. Peak Flow** | 96.0 cfs | 95.6 cfs |

The flows shown above are a combination of the outflow from the existing, as-built Basin B and the outflow from Basin C, through the 24" outlet pipe being piped to the south and discharged near where Basin B outlets. This convergence point is the ultimate discharge and is being used for comparing pre- and post developed site.

It should also be noted that the proposed flows that ultimately reach existing B have been slightly reduced due to this development, a small area of drainage that was previously accounted for would be re-directed to the proposed storm water facilities on-site and therefore the previously approved flows have been maintained or reduced.

Based on the analysis and modeling performed, the proposed storm water management facilities and improvements proposed should meet the City and State's requirements for storm water quality and quantity.

## Data Summary Sheet for Storm Water Management Basins

Date: **July 30, 2014**
Project Name: **Clearwater Apartments-Rivers Crossing**
Location: **City of Waukesha**

### Existing Basins A & B — Design Data

| Site Assessment Data | Basin A | Basin B | rev. Basin B |
|---|---|---|---|
| Contributing drainage area to basin | 13.8 acres | 42.9 acres | 42.5 acres |
| Runoff Curve Number (CN) | 75 | 75.6 | 75.5 |
| Time of Concentration | 28.7 min. | 56.4 min. | 56.4 min. |

### Basin A Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 5.7 cfs(1-yr/24 hr) | 2.6 cfs | 13.5' | 4,677 cu.ft. | #1 |
| 8.8 cfs (2yr/24hr) | 3.0 cfs | 14.1' | 9,477 cu.ft. | #1 |
| 20.4 cfs (10yr/24hr) | 3.8 cfs | 15.7' | 30,994 cu.ft. | #1 |
| 36.8 cfs (100yr/24hr) | 17.9 cfs | 16.9' | 51,831 cu.ft. | #1, #2 |

| | |
|---|---|
| Outlet #1 | 12" R.C.P. @ 10.89' |
| Outlet #2 | grass swale overflow @ 16.0' |

### Basin B Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 14.4 cfs (1-yr/24 hr) | 10.0 cfs | 11.8' | 26,112 cu.ft. | #1 |
| 20.9 cfs (2yr/24hr) | 13.1 cfs | 12.3' | 37,381 cu.ft. | #1, #2 &#3 |
| 45.5 cfs (10yr/24hr) | 25.5 cfs | 14.3' | 82,495 cu.ft. | #1, #2 &#3 |
| 92.6 cfs (100yr/24hr) | 79.4 cfs | 15.8' | 122,363 cu.ft. | #1 - #4 |

| | |
|---|---|
| Outlet #1 | 6" pipe @ 10.89' |
| Outlet #2 | concrete inlet @ 11.1' |
| Outlet #3 | 24" R.C.P. @ 10.89 |
| Outlet #4 | rip rap spillway @ 15.2' |

### rev watershed to Basin B Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 14.2 cfs (1-yr/24 hr) | 9.9 cfs | 11.8' | 25,809 cu.ft. | #1 |
| 20.6 cfs (2yr/24hr) | 12.9 cfs | 12.3' | 36,897 cu.ft. | #1, #2 &#3 |
| 44.9 cfs (10yr/24hr) | 25.3 cfs | 14.3' | 81,281 cu.ft. | #1, #2 &#3 |
| 91.6 cfs (100yr/24hr) | 78.2 cfs | 15.8' | 122,059 cu.ft. | #1 - #4 |

| | |
|---|---|
| Outlet #1 | 6" pipe @ 10.89' |
| Outlet #2 | concrete inlet @ 11.1' |
| Outlet #3 | 24" R.C.P. @ 10.89 |
| Outlet #4 | rip rap spillway @ 15.2' |

## Data Summary Sheet for Storm Water Management Basins

Date: **July 30, 2014**
Project Name: **Clearwater Apartments-Rivers Crossing**
Location: **City of Waukesha**

### Proposed Basins C & D — Design Data

| Site Assessment Data | Basin C | Basin D |
|---|---|---|
| Contributing drainage area to basin | 14.4 ac+ Basin D | 1.5 acres |
| Runoff Curve Number (CN) | 72.6 | 89.5 |
| Time of Concentration | 41.2 min | 10.0 min |

### Basin C Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 3.5 cfs(1-yr/24 hr) | 0.48 cfs | 12.51' | 10,402 cu.ft. | #1 |
| 5.7 cfs (2yr/24hr) | 0.88 cfs | 12.95' | 16,192 cu.ft. | #1, #2 |
| 15.0 cfs (10yr/24hr) | 5.55 cfs | 14.09' | 32,983 cu.ft. | #1,#2, #3, #4 |
| 29.7 cfs (100yr/24hr) | 17.56 cfs | 15.00' | 47,606 cu.ft. | #1,#2, #3, #4 |

| | |
|---|---|
| Outlet #1 | 5" orifice @ 11.7' |
| Outlet #2 | 12" orifice @ 12.70' |
| Outlet #3 | 4' diameter concrete riser @ 14.0' |
| Outlet #4 | 15' wide matted spillway @ 15.0' |

### Basin D Inflow, Outflow & Storage Data

| Inflow Peak | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. | Outflow Control Structures |
|---|---|---|---|---|
| 2.9 cfs (1-yr/24 hr) | 0.0 cfs | 15.91', 15.00' | 5,018 cu.ft. | #1, #3 |
| 3.6 cfs (2yr/24hr) | 0.10 cfs | 16.01', 15.23' | 6,232 cu.ft. | #1,#2,#3,#4 |
| 6.1 cfs (10yr/24hr) | 0.38 cfs | 16.06', 16.00' | 9,718 cu.ft. | #1,#2,#3,#4 |
| 9.1 cfs (100yr/24hr) | 2.24 cfs | 16.11', 16.44' | 13,056 cu.ft. | #1,#2,#3,#4,#5 |

**Outflow Control Structures Summary**

**Wet Forebay**

| | |
|---|---|
| Outlet #1 | 90-degree "v"-notch weir @ 15.0' |
| Outlet #2 | Spillway (weir between cells) @ 16.0' |

**Infiltration Cell**

| | |
|---|---|
| Outlet #3 | Infiltration (3.6 in/hr.) - bottom of basin at 14.0' |
| Outlet #4 | 4" orifice @ 15.0' |
| Outlet #5 | 2' dia. concrete riser @ 16.25' |
| Outlet #6 | Matted spillway @ 16.5' |

## Data Summary Sheet for Storm Water Management Basins

Date: **July 30, 2014**
Project Name: **Clearwater Apartments-Rivers Crossing**
Location: **City of Waukesha**

| Design Elements | Design Data | |
|---|---|---|
| **Site Assessment Data** | **Basin C** | **Basin D** |
| Contributing drainage area to basin | 14.4 ac+ Basin D | 1.5 acres |
| Distance to nearest private well | ~150 ft. | ~600 ft. |
| Distance to municipal well | ~800 ft. | ~1200 ft. |
| Wellhead protection involved? | N/A | N/A |
| Ground slope at site of proposed basin | ave. 2-3% | ave 0.5-1% |
| Any buried or overhead utilities in the area? | Yes | Yes |
| Proposed outfall conveyance system/discharge (w/distances) | Weir Overflow, Concrete Pipe (54') | Weir Overflow, Concrete Pipe (304'), Infiltration |
| Any downstream roads or other structures? | Yes | No |
| Floodplain, shoreland or wetlands? | Wetlands | Wetlands |
| **Soils investigation data (see attached map and borings log)** | | |
| Number of soil investigations completed | 2 borings total | (same) |
| Do elevations of test holes extend 4 ft. below prop bottom? | Yes | (same) |
| Average soil texture at pond bottom elevation (USDA) | Gravelly Sand | Very Gravelly Sand |
| Hydrologic Soil Group Classifications | Type "A" | (same) |
| Infiltration rate at basin bottom and method of analysis | N/A | 3.7 in/hr. soil approximation |
| Distance from pond bottom to bedrock | N/A | (same) |
| Distance from pond bottom to seasonal water table | -1 to -3 ft. +/- | 7.5 to 7.8 ft. +/- |
| **General Basin Design Data** | | |
| Basin bottom area | 5,200 sq.ft. | 1975 sq.ft. |
| Basin bottom elevation | 6' | 14' |
| Weir (overflow) elevation | 15' | 16.5' |
| Top of berm elevation (after settling) and width | 16', 4' width | 17', 4' width |
| Basin storage below outlet | 0.89 ac.ft. | .054 ac.ft. |
| 10% of 2-yr 24-hr post-development runoff volume | 0.08 ac.ft. | .02 ac.ft. |
| Time to completely infiltrate stored water | N/A | Approx. 7 hours |
| Pre-treatment | Infiltration Basin D, Biofilters | Forebay |
| Sediment storage depth & design maintenance | N/A | 5' |

## SCS Curve Numbers Summary

**Project:** Clearwater Apartments
**Location:** Rivers Crossing-City of Waukesha
**Date:** July 30, 2014
**Project No:** 16146
**Prepared by:** M. Mickelson

### Entire Developed Park Area to Existing Storm Water Basins

### Developed Conditions to Basin A

| Land Use | CN | Area | cn*area |
|---|---|---|---|
| 1/4 Acre Lots Residential District | 75 | 13.8 | 1035.0 |
| **Avg CN=** | **75.0** | **13.8** | **1035.0** |

### Developed Conditions to Basin B

| Land Use | CN | Area | cn*area |
|---|---|---|---|
| 1/4 Acre Lots Residential District | 75 | 37.5 | 2812.5 |
| Commercial Lands | 92 | 2.7 | 248.4 |
| Apartments-Condo's | 85 | 0.7 | 59.5 |
| Open - Good Condition (B-Soils) | 61 | 2.0 | 122.0 |
| **Avg CN=** | **75.6** | **42.9** | **3242.4** |

### Revised Watershed to Basin B

| Land Use | CN | Area | cn*area |
|---|---|---|---|
| 1/4 Acre Lots Residential District | 75 | 37.5 | 2812.5 |
| Commercial Lands | 92 | 2.7 | 248.4 |
| Apartments-Condo's | 85 | 0.5 | 42.5 |
| Open - Good Condition (B-Soils) | 61 | 2.0 | 122.0 |
| **Avg CN=** | **75.5** | **42.7** | **3225.4** |

### Existing Clearwater Apartments Watershed (Area C)

| Land Use | CN | Area | cn*area |
|---|---|---|---|
| Open Space-Meadow (B-Soils) | 58 | 2.8 | 162.4 |
| Open Space-Meadow (D-Soils) | 78 | 5.5 | 429.0 |
| Open - Good Condition (B-Soils) | 61 | 7.8 | 475.8 |
| **Avg CN=** | **66.3** | **16.1** | **1067.2** |

### Prop. Clearwater Apartments Watershed to Basin C

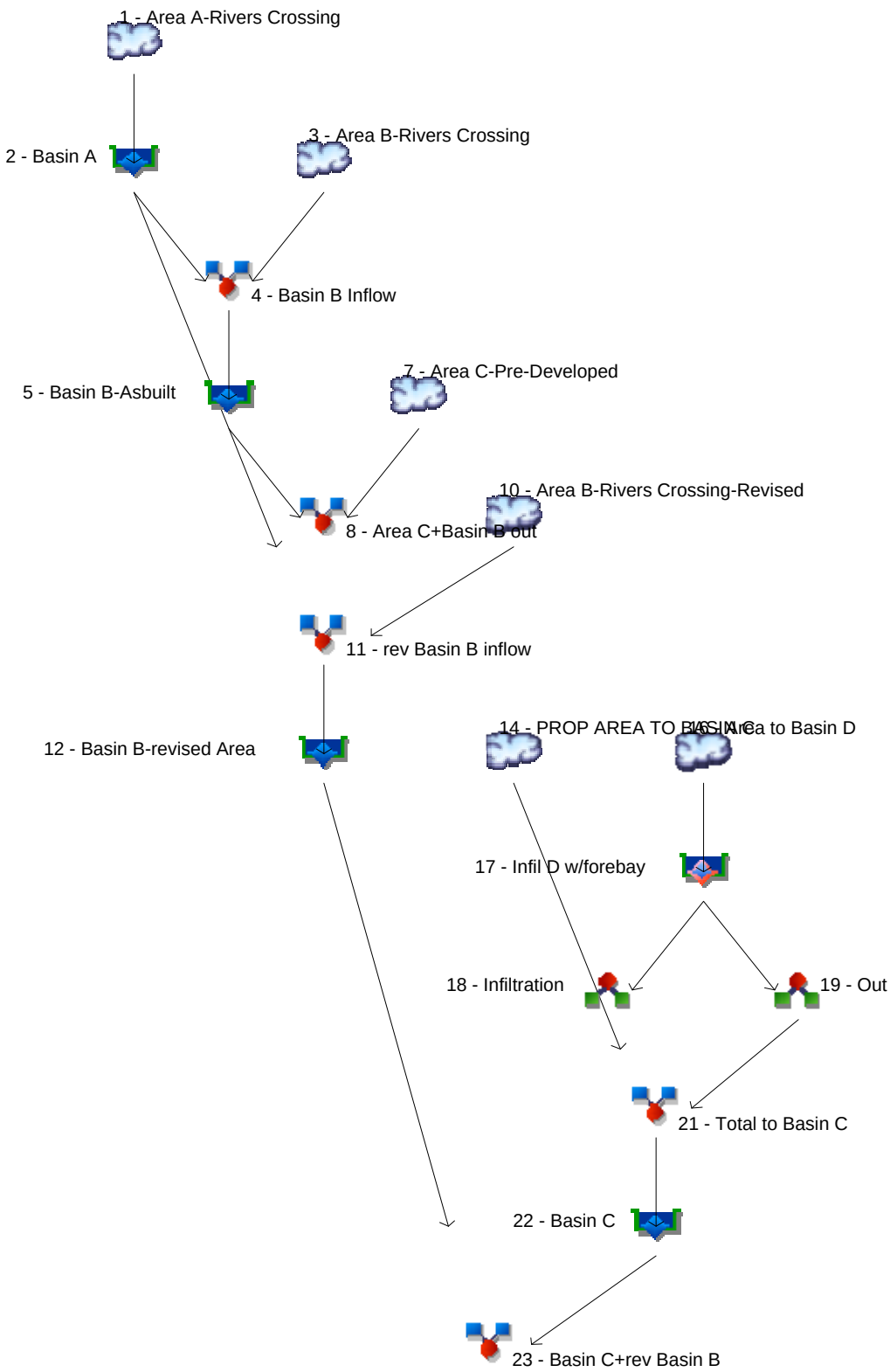
| Land Use | CN | Area | cn*area |
|---|---|---|---|
| Impervious | 98 | 2.0 | 196.0 |
| Open - Good Condition (B-Soils) | 61 | 6.9 | 420.9 |
| Open Space-Meadow (D-Soils) | 78 | 5.5 | 429.0 |
| **Avg CN=** | **72.6** | **14.4** | **1045.9** |

### Prop. Clearwater Apartments Watershed to Basin D

| Land Use | CN | Area | cn*area |
|---|---|---|---|
| Impervious | 98 | 1.1 | 111.7 |
| Open - Good Condition (B-Soils) | 61 | 0.3 | 20.7 |
| **Avg CN=** | **89.5** | **1.5** | **132.5** |

# Watershed Model Schematic





# Hydrograph Return Period Recap



| Hyd. No. | Hydrograph type (origin) | Inflow hyd(s) | Peak Outflow (cfs) | | | | | | | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 1 | SCS Runoff | ------ | 5.685 | 8.754 | ------- | ------- | 20.41 | ------- | ------- | 36.77 | Area A-Rivers Crossing |
| 2 | Reservoir | 1 | 2.625 | 3.000 | ------- | ------- | 3.772 | ------- | ------- | 17.89 | Basin A |
| 3 | SCS Runoff | ------ | 11.77 | 17.95 | ------- | ------- | 41.78 | ------- | ------- | 75.07 | Area B-Rivers Crossing |
| 4 | Combine | 2, 3 | 14.38 | 20.93 | ------- | ------- | 45.45 | ------- | ------- | 92.57 | Basin B Inflow |
| 5 | Reservoir | 4 | 9.978 | 13.11 | ------- | ------- | 25.51 | ------- | ------- | 79.44 | Basin B-Asbuilt |
| 7 | SCS Runoff | ------ | 1.597 | 3.218 | ------- | ------- | 11.13 | ------- | ------- | 23.91 | Area C-Pre-Developed |
| 8 | Combine | 5, 7 | 10.93 | 14.56 | ------- | ------- | 31.16 | ------- | ------- | 95.99 | Area C+Basin B out |
| 10 | SCS Runoff | ------ | 11.54 | 17.65 | ------- | ------- | 41.19 | ------- | ------- | 74.13 | Area B-Rivers Crossing-Revised |
| 11 | Combine | 2, 10 | 14.16 | 20.63 | ------- | ------- | 44.86 | ------- | ------- | 91.63 | rev Basin B inflow |
| 12 | Reservoir | 11 | 9.851 | 12.89 | ------- | ------- | 25.27 | ------- | ------- | 78.15 | Basin B-revised Area |
| 14 | SCS Runoff | ------ | 3.503 | 5.711 | ------- | ------- | 14.67 | ------- | ------- | 27.60 | PROP AREA TO BASIN C |
| 16 | SCS Runoff | ------ | 2.850 | 3.600 | ------- | ------- | 6.072 | ------- | ------- | 9.113 | Area to Basin D |
| 17 | Reservoir(i) | 16 | 0.293 | 0.422 | ------- | ------- | 0.781 | ------- | ------- | 2.807 | Infil D w/forebay |
| 18 | Diversion1 | 17 | 0.293 | 0.318 | ------- | ------- | 0.398 | ------- | ------- | 0.566 | Infiltration |
| 19 | Diversion2 | 17 | 0.000 | 0.104 | ------- | ------- | 0.383 | ------- | ------- | 2.241 | Out |
| 21 | Combine | 14, 19, | 3.503 | 5.740 | ------- | ------- | 15.03 | ------- | ------- | 29.66 | Total to Basin C |
| 22 | Reservoir | 21 | 0.481 | 0.884 | ------- | ------- | 5.551 | ------- | ------- | 17.56 | Basin C |
| 23 | Combine | 12, 22 | 10.28 | 13.59 | ------- | ------- | 30.67 | ------- | ------- | 95.62 | Basin C+rev Basin B |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 5.685 | 2 | 732 | 26,907 | ------ | ------ | ------ | Area A-Rivers Crossing |
| 2 | Reservoir | 2.625 | 2 | 754 | 26,907 | 1 | 13.45 | 4,677 | Basin A |
| 3 | SCS Runoff | 11.77 | 2 | 750 | 86,674 | ------ | ------ | ------ | Area B-Rivers Crossing |
| 4 | Combine | 14.38 | 2 | 750 | 113,581 | 2, 3 | ------ | ------ | Basin B Inflow |
| 5 | Reservoir | 9.978 | 2 | 782 | 113,452 | 4 | 11.77 | 26,112 | Basin B-Asbuilt |
| 7 | SCS Runoff | 1.597 | 2 | 746 | 15,258 | ------ | ------ | ------ | Area C-Pre-Developed |
| 8 | Combine | 10.93 | 2 | 776 | 128,710 | 5, 7 | ------ | ------ | Area C+Basin B out |
| 10 | SCS Runoff | 11.54 | 2 | 750 | 85,258 | ------ | ------ | ------ | Area B-Rivers Crossing-Revised |
| 11 | Combine | 14.16 | 2 | 750 | 112,165 | 2, 10 | ------ | ------ | rev Basin B inflow |
| 12 | Reservoir | 9.851 | 2 | 782 | 112,036 | 11 | 11.75 | 25,809 | Basin B-revised Area |
| 14 | SCS Runoff | 3.503 | 2 | 742 | 23,684 | ------ | ------ | ------ | PROP AREA TO BASIN C |
| 16 | SCS Runoff | 2.850 | 2 | 720 | 7,396 | ------ | ------ | ------ | Area to Basin D |
| 17 | Reservoir(i) | 0.293 | 2 | 784 | 7,357 | 16 | 15.91 | 5,018 | Infil D w/forebay |
| 18 | Diversion1 | 0.293 | 2 | 784 | 7,357 | 17 | ------ | ------ | Infiltration |
| 19 | Diversion2 | 0.000 | 2 | 732 | 0 | 17 | ------ | ------ | Out |
| 21 | Combine | 3.503 | 2 | 742 | 23,684 | 14, 19, | ------ | ------ | Total to Basin C |
| 22 | Reservoir | 0.481 | 2 | 894 | 23,474 | 21 | 12.51 | 10,402 | Basin C |
| 23 | Combine | 10.28 | 2 | 782 | 135,510 | 12, 22 | ------ | ------ | Basin C+rev Basin B |

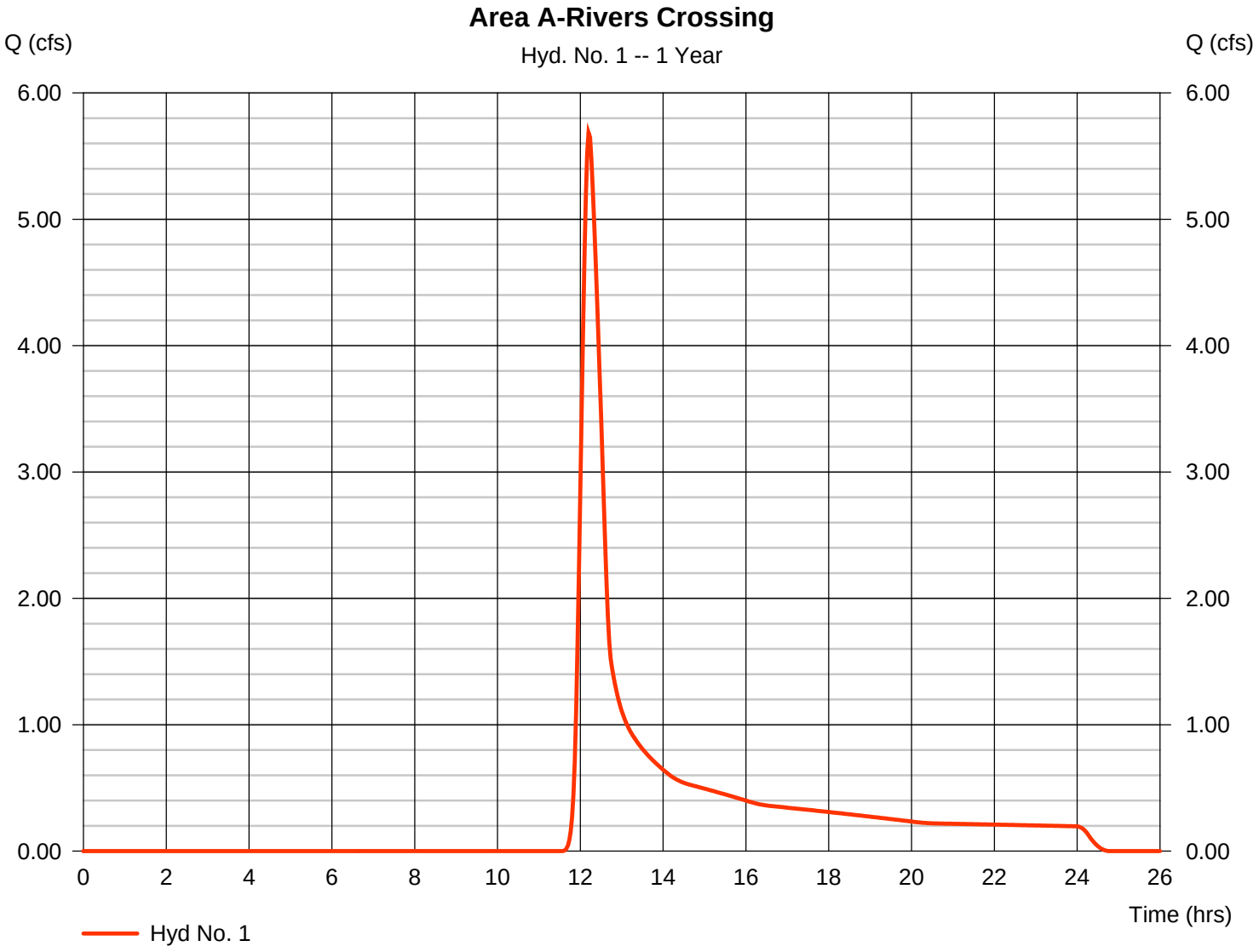
# Hydrograph Report



## Hyd. No. 1

Area A-Rivers Crossing

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 5.685 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.20 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 26,907 cuft |
| Drainage area | = | 13.800 ac | Curve number | = | 75 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | TR55 | Time of conc. (Tc) | = | 28.70 min |
| Total precip. | = | 2.30 in | Distribution | = | Type II |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



# TR55 Tc Worksheet



## Hyd. No. 1

Area A-Rivers Crossing

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 100.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.60 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 2.00 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 15.83** | **+** | **0.00** | **+** | **0.00** | **=** | **15.83** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 320.00 | | 740.00 | | 0.00 | | |
| Watercourse slope (%) | = 1.00 | | 0.40 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =1.61 | | 1.29 | | 0.00 | | |
| **Travel Time (min)** | **= 3.31** | **+** | **9.59** | **+** | **0.00** | **=** | **12.90** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 28.70 min**

# Hydrograph Report

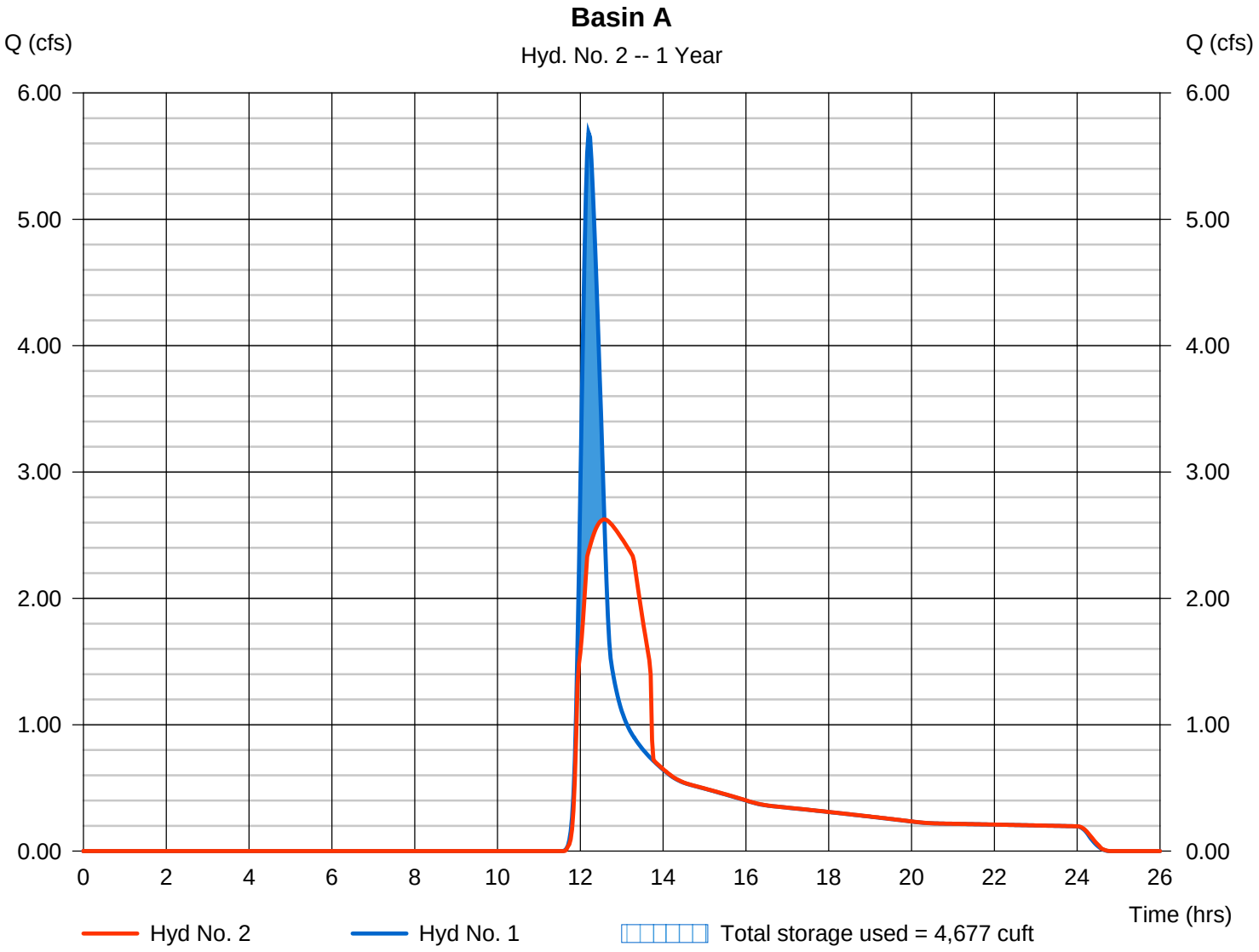


## Hyd. No. 2

Basin A

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 2.625 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.57 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 26,907 cuft |
| Inflow hyd. No. | = | 1 - Area A-Rivers Crossing | Max. Elevation | = | 13.45 ft |
| Reservoir name | = | Basin A-asbuilt | Max. Storage | = | 4,677 cuft |

Storage Indication method used.



## Pond No. 1 - Basin A-asbuilt

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 10.89 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 10.89 | 10 | 0 | 0 |
| 0.11 | 11.00 | 31 | 2 | 2 |
| 1.11 | 12.00 | 299 | 142 | 144 |
| 2.11 | 13.00 | 3,378 | 1,561 | 1,705 |
| 3.11 | 14.00 | 10,388 | 6,563 | 8,267 |
| 4.11 | 15.00 | 13,733 | 12,020 | 20,288 |
| 5.11 | 16.00 | 16,663 | 15,173 | 35,461 |
| 6.11 | 17.00 | 19,924 | 18,267 | 53,728 |
| 6.61 | 17.50 | 21,500 | 10,352 | 64,081 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 12.00 | 0.00 | 0.00 | 0.00 |
| **Span (in)** | = 12.00 | 0.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 0 | 0 | 0 |
| **Invert El. (ft)** | = 10.89 | 0.00 | 0.00 | 0.00 |
| **Length (ft)** | = 345.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.16 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 15.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 16.40 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.60 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Broad | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 10.89 | 0.00 | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 0.01 | 0 | 10.90 | 0.00 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 0.02 | 0 | 10.91 | 0.00 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.001 |
| 0.03 | 1 | 10.92 | 0.00 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.003 |
| 0.04 | 1 | 10.93 | 0.01 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.005 |
| 0.05 | 1 | 10.94 | 0.01 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.008 |
| 0.07 | 1 | 10.96 | 0.01 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.012 |
| 0.08 | 2 | 10.97 | 0.02 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.017 |
| 0.09 | 2 | 10.98 | 0.02 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.023 |
| 0.10 | 2 | 10.99 | 0.03 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.029 |
| 0.11 | 2 | 11.00 | 0.04 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.036 |
| 0.21 | 16 | 11.10 | 0.14 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.136 |
| 0.31 | 31 | 11.20 | 0.29 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.287 |
| 0.41 | 45 | 11.30 | 0.48 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.478 |
| 0.51 | 59 | 11.40 | 0.69 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.693 |
| 0.61 | 73 | 11.50 | 0.92 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.916 |
| 0.71 | 87 | 11.60 | 1.13 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.126 |
| 0.81 | 102 | 11.70 | 1.30 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.303 |
| 0.91 | 116 | 11.80 | 1.41 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.413 |
| 1.01 | 130 | 11.90 | 1.35 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.353 |
| 1.11 | 144 | 12.00 | 1.47 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.469 |
| 1.21 | 300 | 12.10 | 1.58 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.576 |
| 1.31 | 456 | 12.20 | 1.68 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.676 |
| 1.41 | 612 | 12.30 | 1.77 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.770 |
| 1.51 | 768 | 12.40 | 1.86 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.860 |
| 1.61 | 924 | 12.50 | 1.95 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 1.946 |
| 1.71 | 1,081 | 12.60 | 2.03 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.028 |
| 1.81 | 1,237 | 12.70 | 2.11 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.107 |
| 1.91 | 1,393 | 12.80 | 2.18 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.183 |
| 2.01 | 1,549 | 12.90 | 2.26 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.256 |
| 2.11 | 1,705 | 13.00 | 2.33 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.327 |
| 2.21 | 2,361 | 13.10 | 2.40 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.396 |
| 2.31 | 3,017 | 13.20 | 2.46 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.463 |
| 2.41 | 3,674 | 13.30 | 2.53 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.528 |

*Continues on next page...*

Basin A-asbuilt

## Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.51 | 4,330 | 13.40 | 2.59 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.592 |
| 2.61 | 4,986 | 13.50 | 2.65 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.654 |
| 2.71 | 5,642 | 13.60 | 2.71 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.715 |
| 2.81 | 6,299 | 13.70 | 2.77 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.774 |
| 2.91 | 6,955 | 13.80 | 2.83 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.832 |
| 3.01 | 7,611 | 13.90 | 2.89 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.889 |
| 3.11 | 8,267 | 14.00 | 2.95 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 2.945 |
| 3.21 | 9,469 | 14.10 | 3.00 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.000 |
| 3.31 | 10,671 | 14.20 | 3.05 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.054 |
| 3.41 | 11,873 | 14.30 | 3.11 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.107 |
| 3.51 | 13,076 | 14.40 | 3.16 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.159 |
| 3.61 | 14,278 | 14.50 | 3.21 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.210 |
| 3.71 | 15,480 | 14.60 | 3.26 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.260 |
| 3.81 | 16,682 | 14.70 | 3.31 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.310 |
| 3.91 | 17,884 | 14.80 | 3.36 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.359 |
| 4.01 | 19,086 | 14.90 | 3.41 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.407 |
| 4.11 | 20,288 | 15.00 | 3.45 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.454 |
| 4.21 | 21,805 | 15.10 | 3.50 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.501 |
| 4.31 | 23,322 | 15.20 | 3.55 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.547 |
| 4.41 | 24,840 | 15.30 | 3.59 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.593 |
| 4.51 | 26,357 | 15.40 | 3.64 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.638 |
| 4.61 | 27,874 | 15.50 | 3.68 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.683 |
| 4.71 | 29,392 | 15.60 | 3.73 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.727 |
| 4.81 | 30,909 | 15.70 | 3.77 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.770 |
| 4.91 | 32,426 | 15.80 | 3.81 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.813 |
| 5.01 | 33,943 | 15.90 | 3.86 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.856 |
| 5.11 | 35,461 | 16.00 | 3.90 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.898 |
| 5.21 | 37,287 | 16.10 | 3.94 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.939 |
| 5.31 | 39,114 | 16.20 | 3.98 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 3.980 |
| 5.41 | 40,941 | 16.30 | 4.02 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 4.021 |
| 5.51 | 42,768 | 16.40 | 4.06 oc | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 4.061 |
| 5.61 | 44,594 | 16.50 | 4.10 oc | --- | --- | --- | 1.23 | --- | --- | --- | --- | --- | 5.335 |
| 5.71 | 46,421 | 16.60 | 4.14 oc | --- | --- | --- | 3.49 | --- | --- | --- | --- | --- | 7.629 |
| 5.81 | 48,248 | 16.70 | 4.18 oc | --- | --- | --- | 6.41 | --- | --- | --- | --- | --- | 10.59 |
| 5.91 | 50,075 | 16.80 | 4.22 oc | --- | --- | --- | 9.87 | --- | --- | --- | --- | --- | 14.09 |
| 6.01 | 51,901 | 16.90 | 4.26 oc | --- | --- | --- | 13.79 | --- | --- | --- | --- | --- | 18.05 |
| 6.11 | 53,728 | 17.00 | 4.30 oc | --- | --- | --- | 18.13 | --- | --- | --- | --- | --- | 22.42 |
| 6.16 | 54,763 | 17.05 | 4.31 oc | --- | --- | --- | 20.44 | --- | --- | --- | --- | --- | 24.75 |
| 6.21 | 55,799 | 17.10 | 4.33 oc | --- | --- | --- | 22.84 | --- | --- | --- | --- | --- | 27.17 |
| 6.26 | 56,834 | 17.15 | 4.35 oc | --- | --- | --- | 25.33 | --- | --- | --- | --- | --- | 29.68 |
| 6.31 | 57,869 | 17.20 | 4.37 oc | --- | --- | --- | 27.91 | --- | --- | --- | --- | --- | 32.28 |
| 6.36 | 58,904 | 17.25 | 4.39 oc | --- | --- | --- | 30.56 | --- | --- | --- | --- | --- | 34.95 |
| 6.41 | 59,940 | 17.30 | 4.41 oc | --- | --- | --- | 33.30 | --- | --- | --- | --- | --- | 37.71 |
| 6.46 | 60,975 | 17.35 | 4.43 oc | --- | --- | --- | 36.11 | --- | --- | --- | --- | --- | 40.54 |
| 6.51 | 62,010 | 17.40 | 4.44 oc | --- | --- | --- | 39.00 | --- | --- | --- | --- | --- | 43.44 |
| 6.56 | 63,045 | 17.45 | 4.46 oc | --- | --- | --- | 41.96 | --- | --- | --- | --- | --- | 46.42 |
| 6.61 | 64,081 | 17.50 | 4.48 oc | --- | --- | --- | 44.99 | --- | --- | --- | --- | --- | 49.47 |

...End

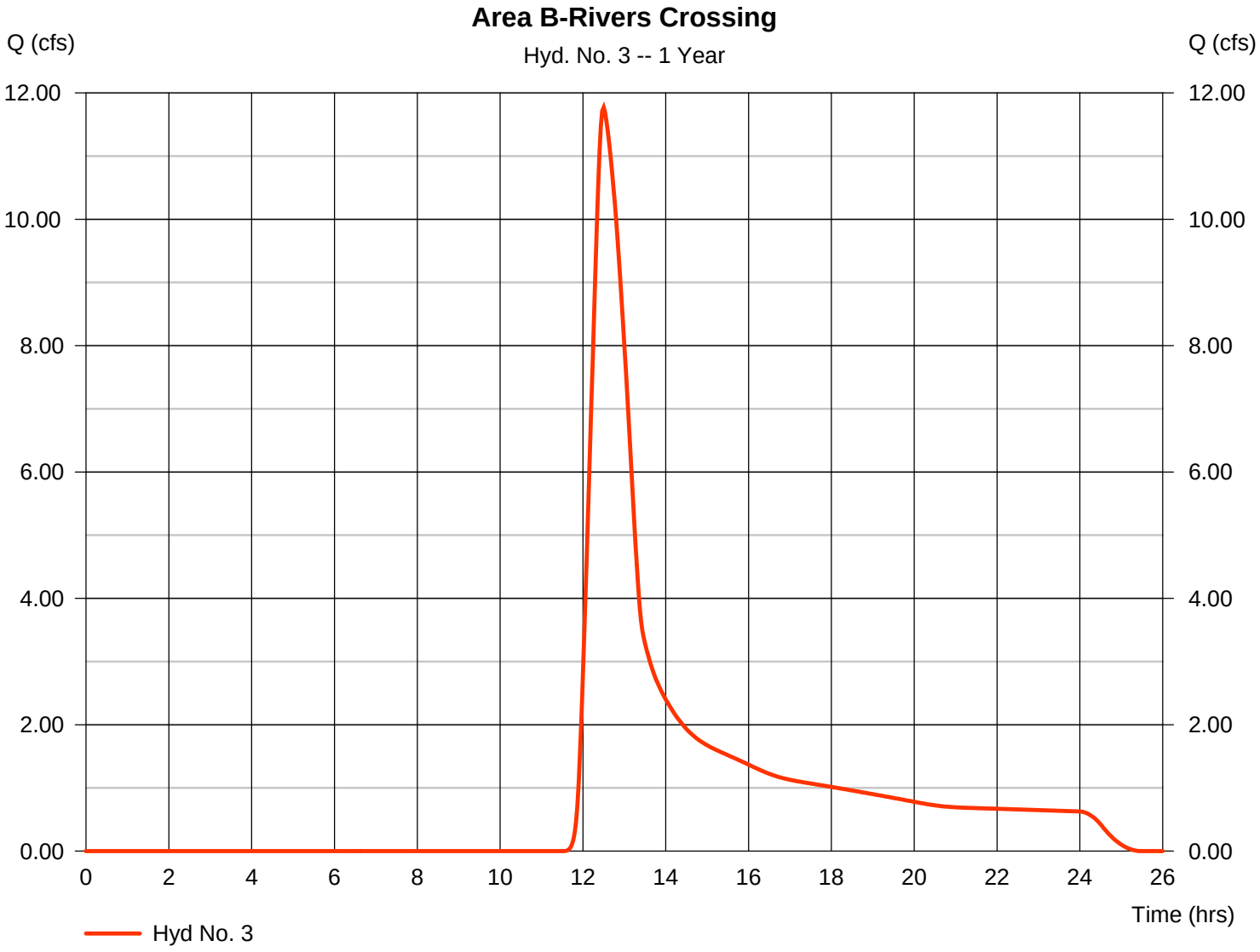
# Hydrograph Report



## Hyd. No. 3

Area B-Rivers Crossing

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 11.77 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.50 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 86,674 cuft |
| Drainage area | = | 42.900 ac | Curve number | = | 75.6 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | TR55 | Time of conc. (Tc) | = | 56.40 min |
| Total precip. | = | 2.30 in | Distribution | = | Type II |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



# TR55 Tc Worksheet



## Hyd. No. 3

Area B-Rivers Crossing

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 300.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.60 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 3.30 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 31.20** | **+** | **0.00** | **+** | **0.00** | **=** | **31.20** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 800.00 | | 1600.00 | | 0.00 | | |
| Watercourse slope (%) | = 3.50 | | 0.40 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =3.02 | | 1.29 | | 0.00 | | |
| **Travel Time (min)** | **= 4.42** | **+** | **20.74** | **+** | **0.00** | **=** | **25.16** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 56.40 min**

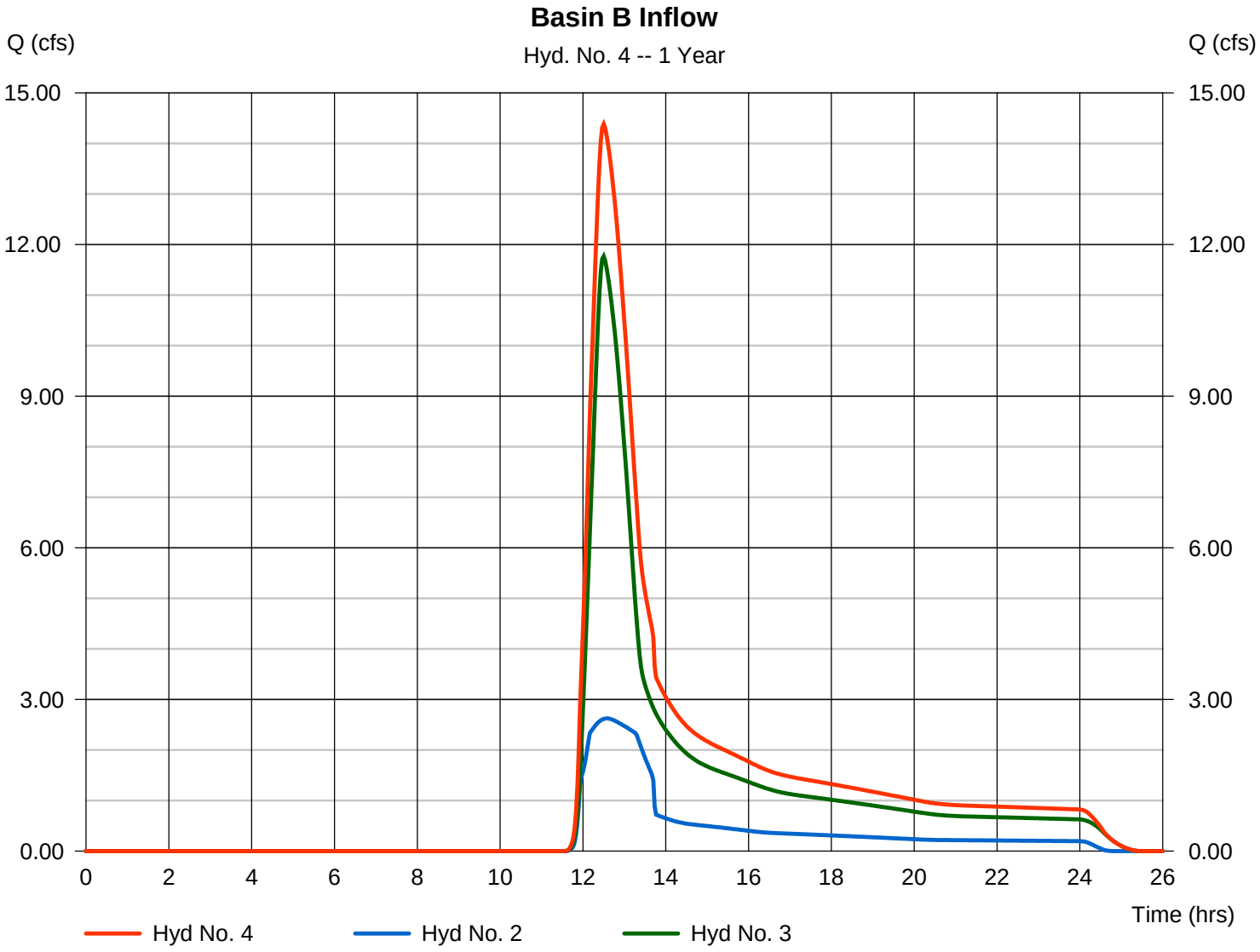
# Hydrograph Report



## Hyd. No. 4

Basin B Inflow

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Combine | Peak discharge | = | 14.38 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.50 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 113,581 cuft |
| Inflow hyds. | = | 2, 3 | Contrib. drain. area | = | 42.900 ac |



# Hydrograph Report

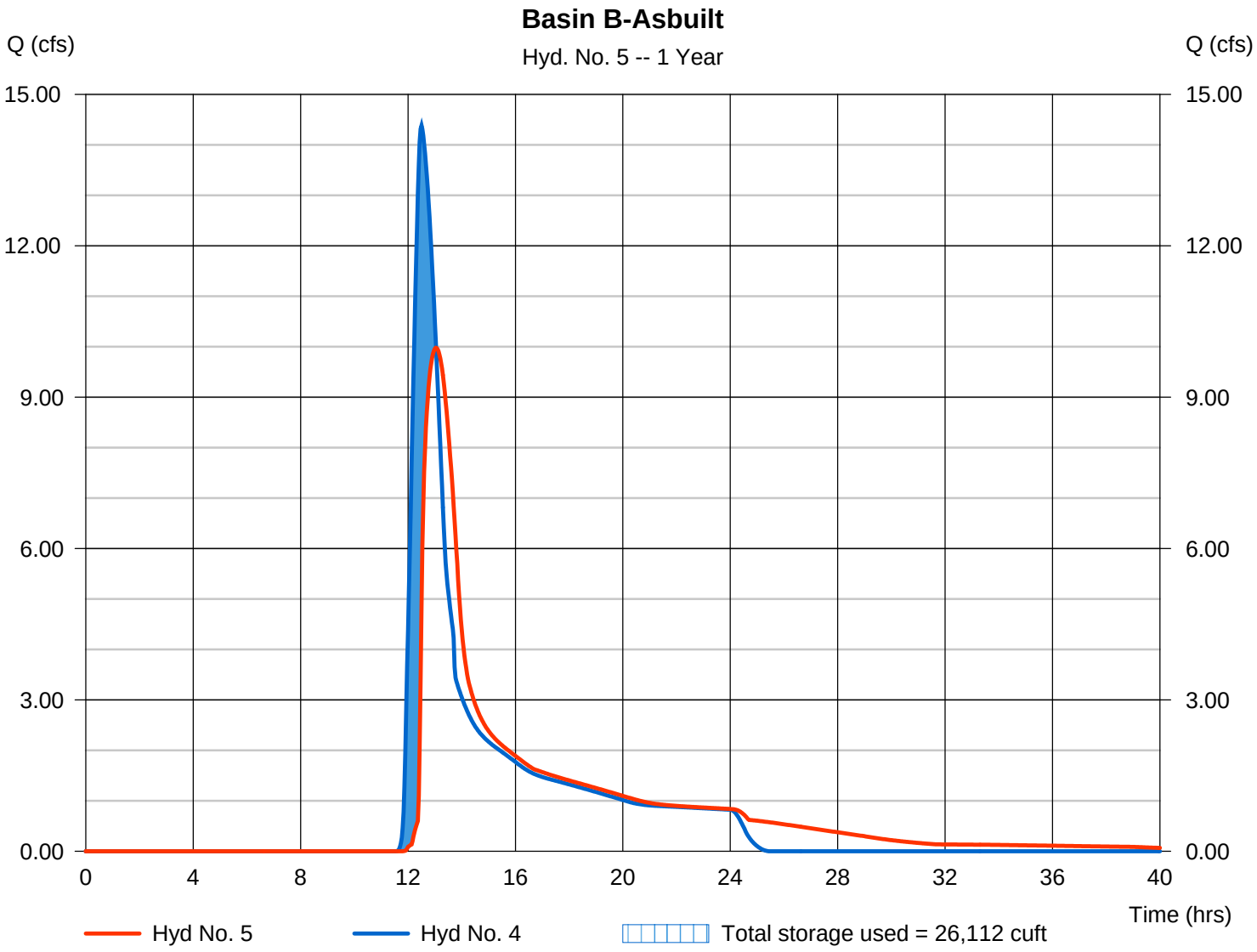


## Hyd. No. 5

Basin B-Asbuilt

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 9.978 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 13.03 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 113,452 cuft |
| Inflow hyd. No. | = | 4 - Basin B Inflow | Max. Elevation | = | 11.77 ft |
| Reservoir name | = | Basin B-Asbuilt | Max. Storage | = | 26,112 cuft |

Storage Indication method used.



## Pond No. 2 - Basin B-Asbuilt

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 10.10 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 10.10 | 00 | 0 | 0 |
| 0.30 | 10.40 | 16,000 | 1,600 | 1,600 |
| 0.90 | 11.00 | 17,667 | 10,095 | 11,695 |
| 1.90 | 12.00 | 19,950 | 18,795 | 30,490 |
| 2.90 | 13.00 | 22,164 | 21,045 | 51,535 |
| 3.90 | 14.00 | 24,361 | 23,252 | 74,787 |
| 4.90 | 15.00 | 26,639 | 25,489 | 100,276 |
| 5.90 | 16.00 | 28,940 | 27,779 | 128,054 |
| 6.40 | 16.50 | 30,500 | 14,857 | 142,911 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 24.00 | 6.00 | 0.00 | 0.00 |
| **Span (in)** | = 24.00 | 6.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 10.10 | 10.10 | 0.00 | 0.00 |
| **Length (ft)** | = 120.00 | 24.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.40 | 0.10 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 9.00 | 40.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 11.10 | 15.20 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 2.60 | 3.33 | 3.33 |
| **Weir Type** | = Rect | Broad | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 10.10 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.03 | 160 | 10.13 | 0.00 | 0.00 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.001 |
| 0.06 | 320 | 10.16 | 0.00 | 0.01 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.005 |
| 0.09 | 480 | 10.19 | 0.00 | 0.01 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.011 |
| 0.12 | 640 | 10.22 | 0.00 | 0.02 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.019 |
| 0.15 | 800 | 10.25 | 0.00 | 0.03 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.029 |
| 0.18 | 960 | 10.28 | 0.00 | 0.04 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.039 |
| 0.21 | 1,120 | 10.31 | 0.00 | 0.05 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.051 |
| 0.24 | 1,280 | 10.34 | 0.00 | 0.06 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.063 |
| 0.27 | 1,440 | 10.37 | 0.00 | 0.07 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.075 |
| 0.30 | 1,600 | 10.40 | 0.00 | 0.09 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.087 |
| 0.36 | 2,609 | 10.46 | 0.00 | 0.11 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.109 |
| 0.42 | 3,619 | 10.52 | 0.00 | 0.13 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.128 |
| 0.48 | 4,628 | 10.58 | 0.00 | 0.14 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.137 |
| 0.54 | 5,638 | 10.64 | 0.00 | 0.22 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.217 |
| 0.60 | 6,647 | 10.70 | 0.00 | 0.30 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.302 |
| 0.66 | 7,657 | 10.76 | 0.00 | 0.37 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.368 |
| 0.72 | 8,666 | 10.82 | 0.00 | 0.42 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.424 |
| 0.78 | 9,676 | 10.88 | 0.00 | 0.47 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.473 |
| 0.84 | 10,685 | 10.94 | 0.00 | 0.52 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.518 |
| 0.90 | 11,695 | 11.00 | 0.00 | 0.56 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.559 |
| 1.00 | 13,574 | 11.10 | 0.00 | 0.62 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.621 |
| 1.10 | 15,454 | 11.20 | 0.95 ic | 0.68 oc | --- | --- | 0.95 | 0.00 | --- | --- | --- | --- | 1.626 |
| 1.20 | 17,333 | 11.30 | 2.70 ic | 0.73 oc | --- | --- | 2.68 | 0.00 | --- | --- | --- | --- | 3.411 |
| 1.30 | 19,213 | 11.40 | 4.94 oc | 0.78 oc | --- | --- | 4.92 | 0.00 | --- | --- | --- | --- | 5.704 |
| 1.40 | 21,092 | 11.50 | 6.58 oc | 0.83 oc | --- | --- | 6.53 s | 0.00 | --- | --- | --- | --- | 7.358 |
| 1.50 | 22,972 | 11.60 | 7.66 oc | 0.87 oc | --- | --- | 7.66 s | 0.00 | --- | --- | --- | --- | 8.526 |
| 1.60 | 24,851 | 11.70 | 8.60 oc | 0.91 oc | --- | --- | 8.54 s | 0.00 | --- | --- | --- | --- | 9.447 |
| 1.70 | 26,731 | 11.80 | 9.29 oc | 0.95 oc | --- | --- | 9.29 s | 0.00 | --- | --- | --- | --- | 10.24 |
| 1.80 | 28,610 | 11.90 | 9.86 oc | 0.99 oc | --- | --- | 9.86 s | 0.00 | --- | --- | --- | --- | 10.85 |
| 1.90 | 30,490 | 12.00 | 10.26 oc | 1.02 oc | --- | --- | 10.26 s | 0.00 | --- | --- | --- | --- | 11.29 |
| 2.00 | 32,594 | 12.10 | 10.37 oc | 1.06 oc | --- | --- | 10.36 s | 0.00 | --- | --- | --- | --- | 11.42 |
| 2.10 | 34,699 | 12.20 | 10.78 oc | 1.09 oc | --- | --- | 10.77 s | 0.00 | --- | --- | --- | --- | 11.86 |
| 2.20 | 36,803 | 12.30 | 11.73 oc | 1.13 oc | --- | --- | 11.72 s | 0.00 | --- | --- | --- | --- | 12.85 |

*Continues on next page...*

Basin B-Asbuilt

## Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.30 | 38,908 | 12.40 | 12.62 oc | 1.16 oc | --- | --- | 12.62 s | 0.00 | --- | --- | --- | --- | 13.78 |
| 2.40 | 41,012 | 12.50 | 13.45 oc | 1.19 oc | --- | --- | 13.44 s | 0.00 | --- | --- | --- | --- | 14.63 |
| 2.50 | 43,117 | 12.60 | 14.24 oc | 1.22 oc | --- | --- | 14.23 s | 0.00 | --- | --- | --- | --- | 15.45 |
| 2.60 | 45,222 | 12.70 | 14.98 oc | 1.25 oc | --- | --- | 14.97 s | 0.00 | --- | --- | --- | --- | 16.22 |
| 2.70 | 47,326 | 12.80 | 15.69 oc | 1.28 oc | --- | --- | 15.67 s | 0.00 | --- | --- | --- | --- | 16.95 |
| 2.80 | 49,431 | 12.90 | 16.36 oc | 1.31 oc | --- | --- | 16.36 s | 0.00 | --- | --- | --- | --- | 17.67 |
| 2.90 | 51,535 | 13.00 | 17.01 oc | 1.34 oc | --- | --- | 17.00 s | 0.00 | --- | --- | --- | --- | 18.34 |
| 3.00 | 53,860 | 13.10 | 17.63 oc | 1.36 oc | --- | --- | 17.62 s | 0.00 | --- | --- | --- | --- | 18.98 |
| 3.10 | 56,185 | 13.20 | 18.23 oc | 1.39 oc | --- | --- | 18.22 s | 0.00 | --- | --- | --- | --- | 19.61 |
| 3.20 | 58,511 | 13.30 | 18.82 oc | 1.42 oc | --- | --- | 18.80 s | 0.00 | --- | --- | --- | --- | 20.22 |
| 3.30 | 60,836 | 13.40 | 19.38 oc | 1.44 oc | --- | --- | 19.38 s | 0.00 | --- | --- | --- | --- | 20.82 |
| 3.40 | 63,161 | 13.50 | 19.93 oc | 1.47 oc | --- | --- | 19.91 s | 0.00 | --- | --- | --- | --- | 21.38 |
| 3.50 | 65,486 | 13.60 | 20.46 oc | 1.49 oc | --- | --- | 20.44 s | 0.00 | --- | --- | --- | --- | 21.93 |
| 3.60 | 67,811 | 13.70 | 20.98 oc | 1.52 oc | --- | --- | 20.97 s | 0.00 | --- | --- | --- | --- | 22.49 |
| 3.70 | 70,136 | 13.80 | 21.49 oc | 1.54 oc | --- | --- | 21.46 s | 0.00 | --- | --- | --- | --- | 23.00 |
| 3.80 | 72,461 | 13.90 | 21.98 oc | 1.56 oc | --- | --- | 21.96 s | 0.00 | --- | --- | --- | --- | 23.53 |
| 3.90 | 74,787 | 14.00 | 22.46 oc | 1.59 oc | --- | --- | 22.42 s | 0.00 | --- | --- | --- | --- | 24.01 |
| 4.00 | 77,335 | 14.10 | 22.94 oc | 1.61 oc | --- | --- | 22.91 s | 0.00 | --- | --- | --- | --- | 24.52 |
| 4.10 | 79,884 | 14.20 | 23.40 oc | 1.63 oc | --- | --- | 23.36 s | 0.00 | --- | --- | --- | --- | 24.99 |
| 4.20 | 82,433 | 14.30 | 23.85 oc | 1.66 oc | --- | --- | 23.84 s | 0.00 | --- | --- | --- | --- | 25.50 |
| 4.30 | 84,982 | 14.40 | 24.30 oc | 1.68 oc | --- | --- | 24.30 s | 0.00 | --- | --- | --- | --- | 25.98 |
| 4.40 | 87,531 | 14.50 | 24.74 oc | 1.70 oc | --- | --- | 24.72 s | 0.00 | --- | --- | --- | --- | 26.42 |
| 4.50 | 90,080 | 14.60 | 25.17 oc | 1.72 oc | --- | --- | 25.11 s | 0.00 | --- | --- | --- | --- | 26.83 |
| 4.60 | 92,629 | 14.70 | 25.59 oc | 1.74 oc | --- | --- | 25.55 s | 0.00 | --- | --- | --- | --- | 27.29 |
| 4.70 | 95,178 | 14.80 | 26.00 oc | 1.76 oc | --- | --- | 25.96 s | 0.00 | --- | --- | --- | --- | 27.72 |
| 4.80 | 97,727 | 14.90 | 26.41 oc | 1.78 oc | --- | --- | 26.34 s | 0.00 | --- | --- | --- | --- | 28.13 |
| 4.90 | 100,276 | 15.00 | 26.81 oc | 1.81 oc | --- | --- | 26.79 s | 0.00 | --- | --- | --- | --- | 28.60 |
| 5.00 | 103,053 | 15.10 | 27.21 oc | 1.83 oc | --- | --- | 27.12 s | 0.00 | --- | --- | --- | --- | 28.94 |
| 5.10 | 105,831 | 15.20 | 27.60 oc | 1.85 oc | --- | --- | 27.53 s | 0.00 | --- | --- | --- | --- | 29.37 |
| 5.20 | 108,609 | 15.30 | 27.99 oc | 1.87 oc | --- | --- | 27.91 s | 3.29 | --- | --- | --- | --- | 33.06 |
| 5.30 | 111,387 | 15.40 | 28.36 oc | 1.89 oc | --- | --- | 28.26 s | 9.30 | --- | --- | --- | --- | 39.45 |
| 5.40 | 114,165 | 15.50 | 28.74 oc | 1.90 oc | --- | --- | 28.73 s | 17.09 | --- | --- | --- | --- | 47.72 |
| 5.50 | 116,943 | 15.60 | 29.11 oc | 1.92 oc | --- | --- | 29.04 s | 26.31 | --- | --- | --- | --- | 57.27 |
| 5.60 | 119,721 | 15.70 | 29.47 oc | 1.94 oc | --- | --- | 29.47 s | 36.77 | --- | --- | --- | --- | 68.18 |
| 5.70 | 122,499 | 15.80 | 29.83 oc | 1.96 oc | --- | --- | 29.72 s | 48.34 | --- | --- | --- | --- | 80.02 |
| 5.80 | 125,276 | 15.90 | 30.19 oc | 1.98 oc | --- | --- | 30.11 s | 60.91 | --- | --- | --- | --- | 93.00 |
| 5.90 | 128,054 | 16.00 | 30.54 oc | 2.00 oc | --- | --- | 30.47 s | 74.42 | --- | --- | --- | --- | 106.88 |
| 5.95 | 129,540 | 16.05 | 30.72 oc | 2.01 oc | --- | --- | 30.64 s | 81.50 | --- | --- | --- | --- | 114.15 |
| 6.00 | 131,026 | 16.10 | 30.89 oc | 2.02 oc | --- | --- | 30.82 s | 88.80 | --- | --- | --- | --- | 121.63 |
| 6.05 | 132,511 | 16.15 | 31.06 oc | 2.03 oc | --- | --- | 30.98 s | 96.30 | --- | --- | --- | --- | 129.31 |
| 6.10 | 133,997 | 16.20 | 31.23 oc | 2.04 oc | --- | --- | 31.14 s | 104.00 | --- | --- | --- | --- | 137.18 |
| 6.15 | 135,483 | 16.25 | 31.41 oc | 2.04 oc | --- | --- | 31.30 s | 111.90 | --- | --- | --- | --- | 145.24 |
| 6.20 | 136,968 | 16.30 | 31.58 oc | 2.05 oc | --- | --- | 31.45 s | 119.98 | --- | --- | --- | --- | 153.49 |
| 6.25 | 138,454 | 16.35 | 31.74 oc | 2.06 oc | --- | --- | 31.59 s | 128.26 | --- | --- | --- | --- | 161.91 |
| 6.30 | 139,940 | 16.40 | 31.91 oc | 2.07 oc | --- | --- | 31.73 s | 136.71 | --- | --- | --- | --- | 170.51 |
| 6.35 | 141,426 | 16.45 | 32.08 oc | 2.08 oc | --- | --- | 32.07 s | 145.34 | --- | --- | --- | --- | 179.49 |
| 6.40 | 142,911 | 16.50 | 32.24 oc | 2.09 oc | --- | --- | 32.21 s | 154.15 | --- | --- | --- | --- | 188.45 |

...End

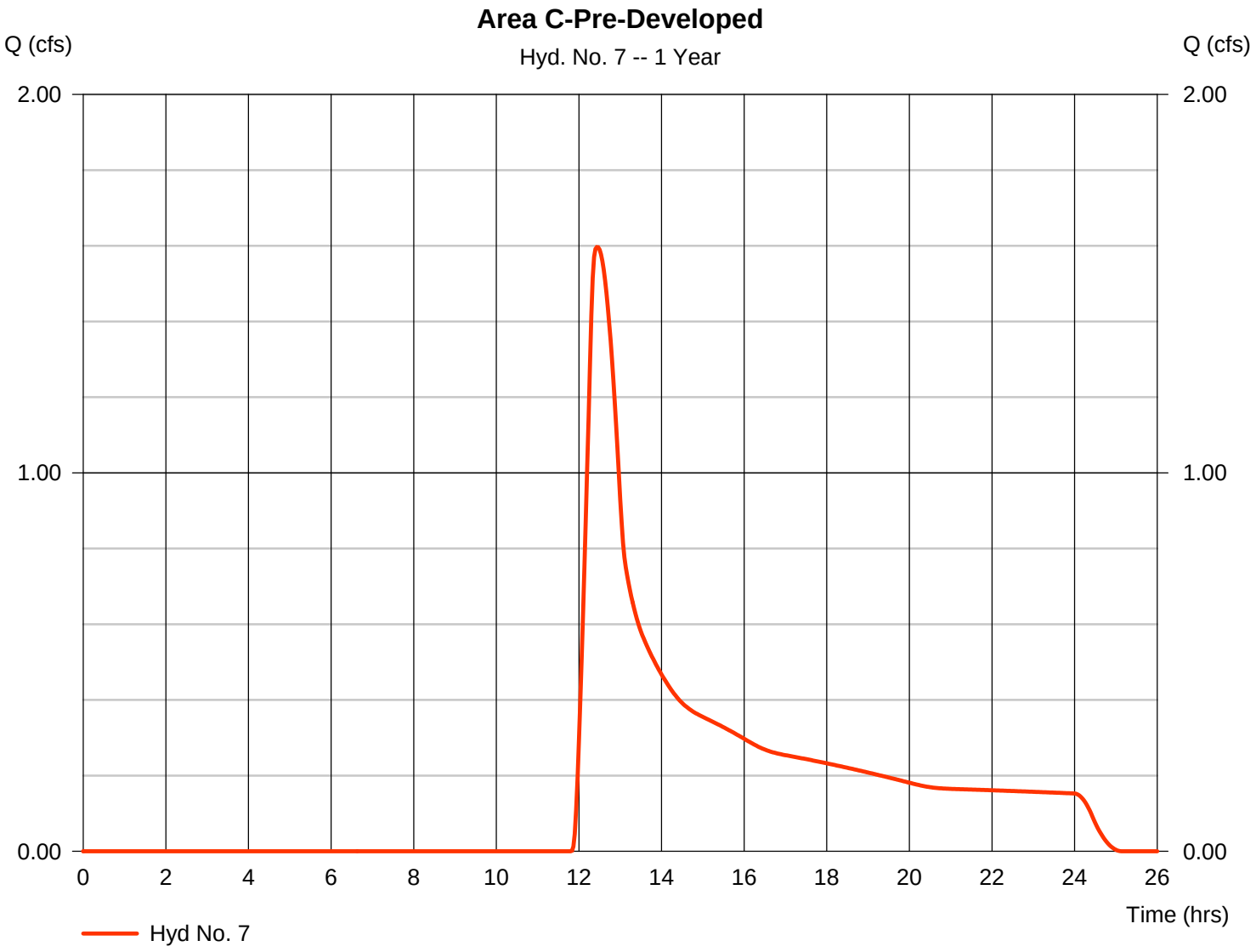
# Hydrograph Report



## Hyd. No. 7

Area C-Pre-Developed

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 1.597 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.43 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 15,258 cuft |
| Drainage area | = | 16.100 ac | Curve number | = | 66.3 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | TR55 | Time of conc. (Tc) | = | 41.10 min |
| Total precip. | = | 2.30 in | Distribution | = | Type II |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



# TR55 Tc Worksheet



## Hyd. No. 7

Area C-Pre-Developed

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 200.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.60 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 2.20 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 26.53** | **+** | **0.00** | **+** | **0.00** | **=** | **26.53** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 800.00 | | 875.00 | | 0.00 | | |
| Watercourse slope (%) | = 3.40 | | 0.80 | | 0.00 | | |
| Surface description | = Unpaved | | Unpaved | | Paved | | |
| Average velocity (ft/s) | =2.98 | | 1.44 | | 0.00 | | |
| **Travel Time (min)** | **= 4.48** | **+** | **10.11** | **+** | **0.00** | **=** | **14.59** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 41.10 min**

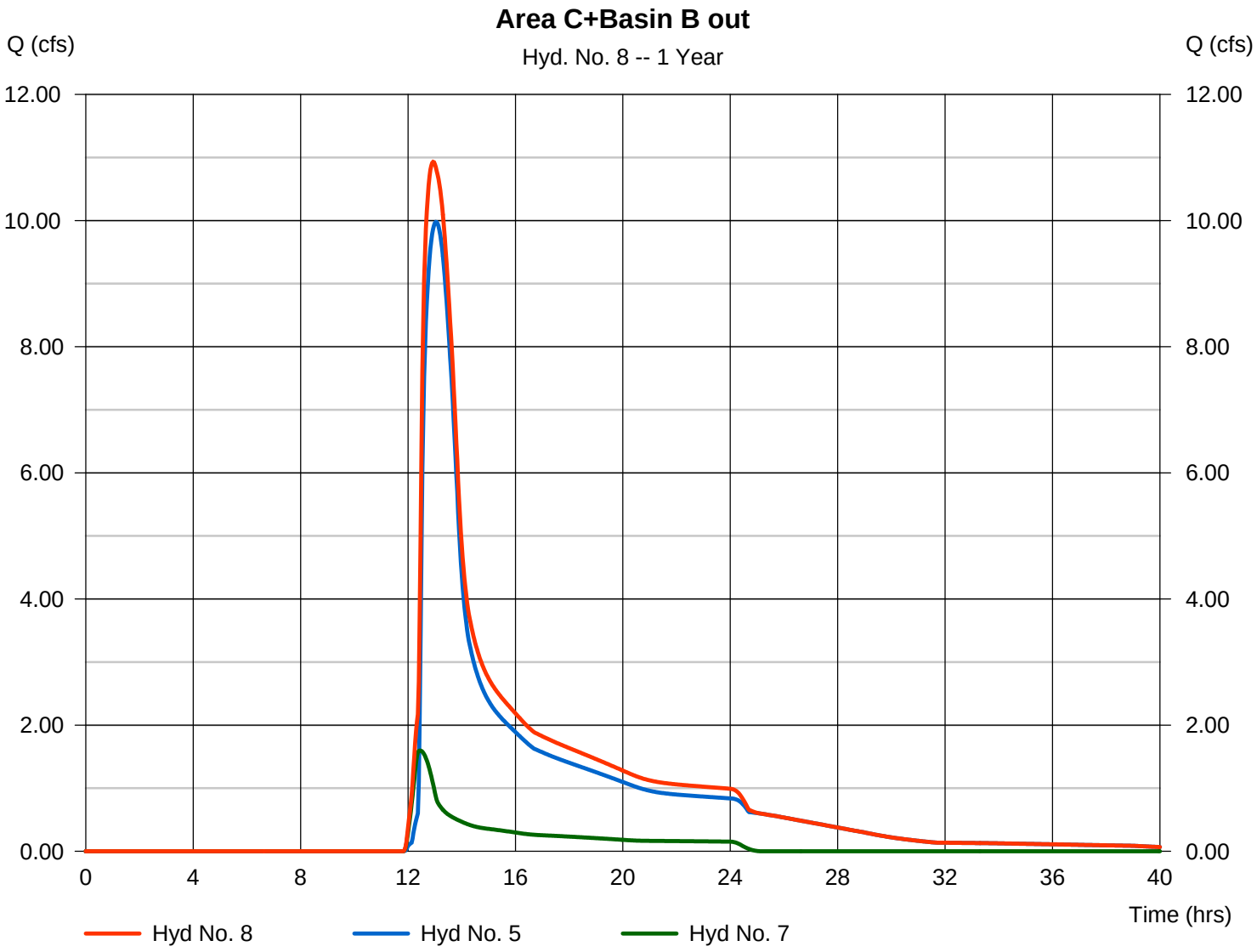
# Hydrograph Report



## Hyd. No. 8

Area C+Basin B out

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Combine | Peak discharge | = | 10.93 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.93 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 128,710 cuft |
| Inflow hyds. | = | 5, 7 | Contrib. drain. area | = | 16.100 ac |



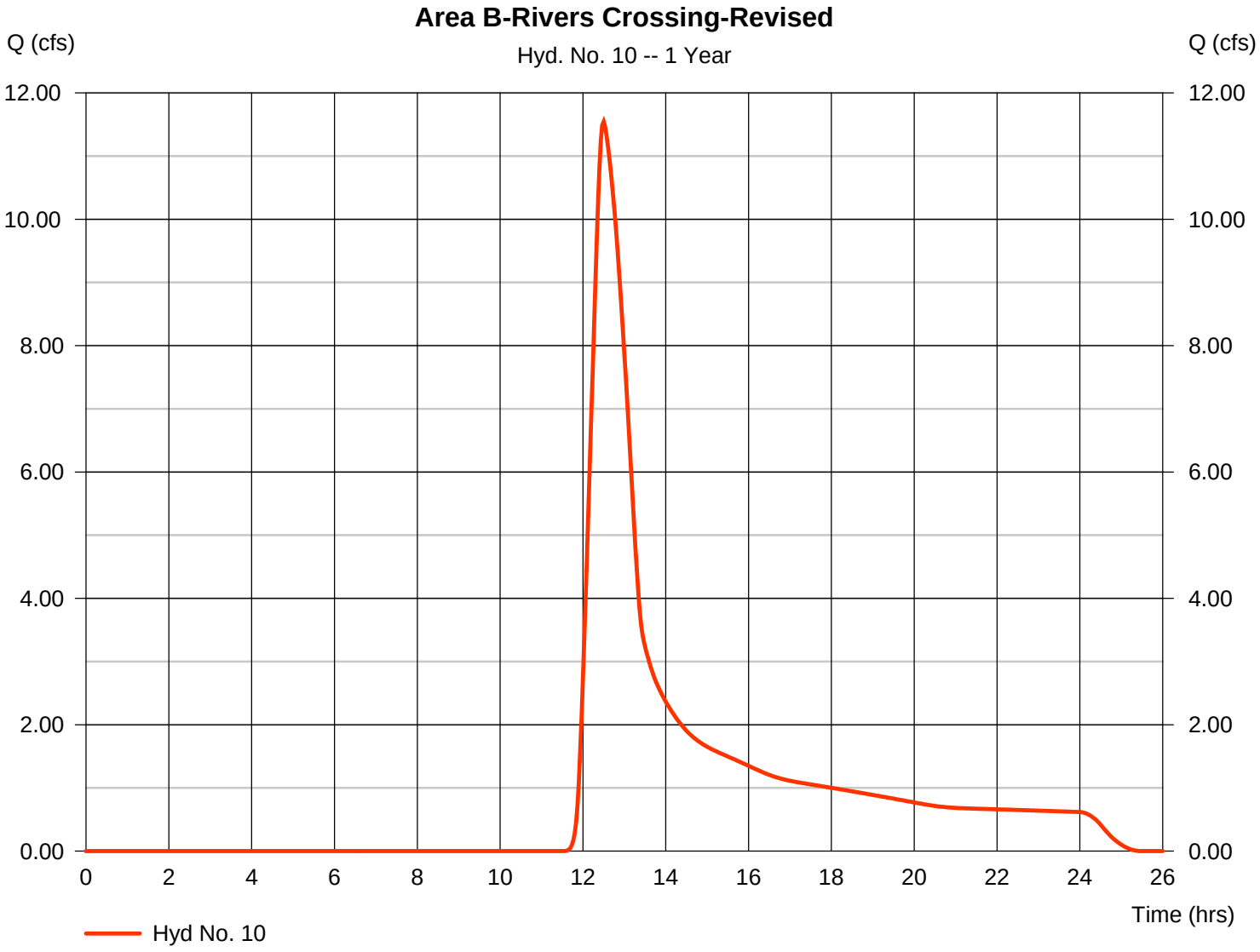
# Hydrograph Report



## Hyd. No. 10

Area B-Rivers Crossing-Revised

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 11.54 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.50 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 85,258 cuft |
| Drainage area | = | 42.500 ac | Curve number | = | 75.5 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | TR55 | Time of conc. (Tc) | = | 56.40 min |
| Total precip. | = | 2.30 in | Distribution | = | Type II |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



# TR55 Tc Worksheet



## Hyd. No. 10

Area B-Rivers Crossing-Revised

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 300.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.60 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 3.30 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 31.20** | **+** | **0.00** | **+** | **0.00** | **=** | **31.20** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 800.00 | | 1600.00 | | 0.00 | | |
| Watercourse slope (%) | = 3.50 | | 0.40 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =3.02 | | 1.29 | | 0.00 | | |
| **Travel Time (min)** | **= 4.42** | **+** | **20.74** | **+** | **0.00** | **=** | **25.16** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 56.40 min**

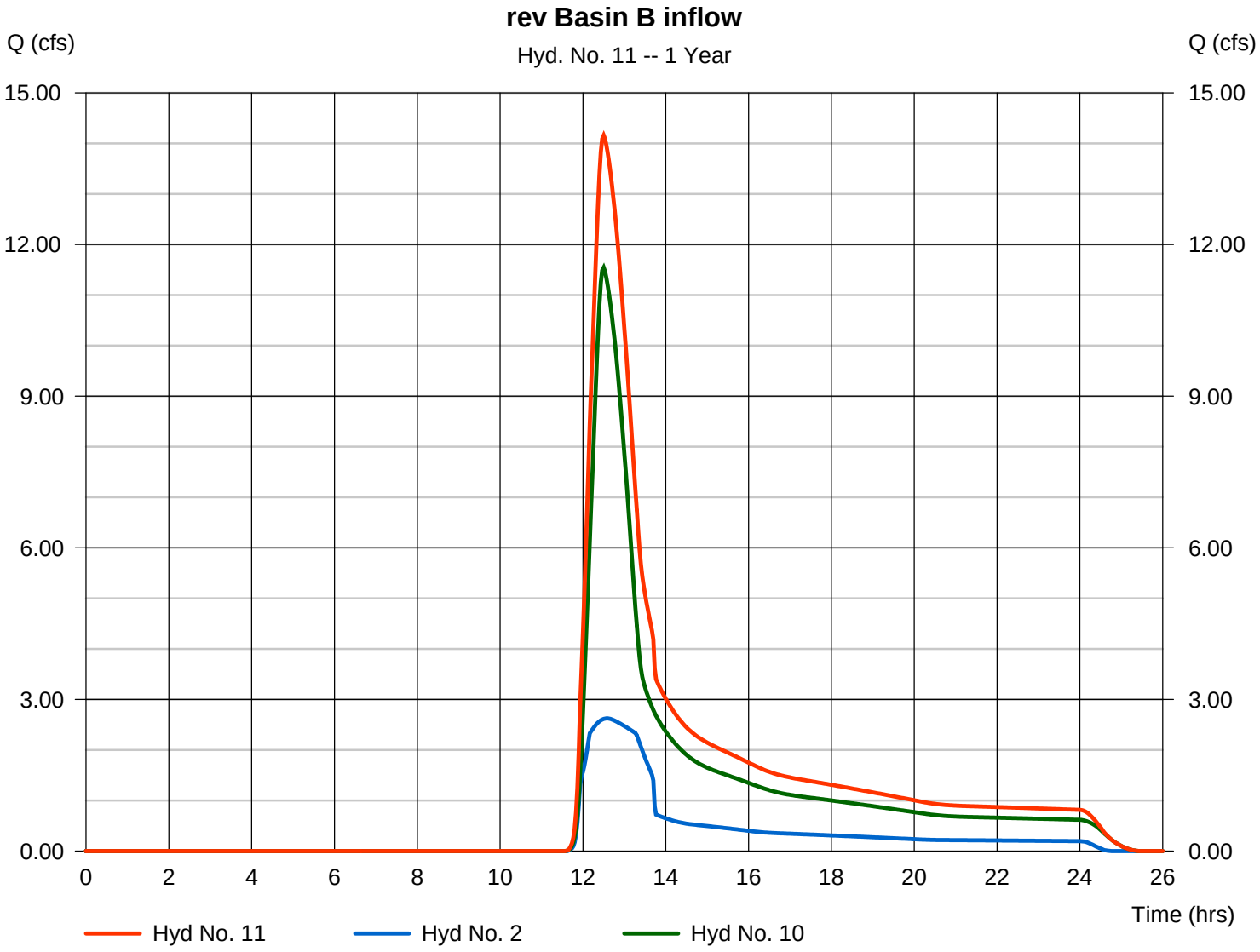
# Hydrograph Report



## Hyd. No. 11

rev Basin B inflow

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 14.16 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 12.50 hrs |
| Time interval | = 2 min | Hyd. volume | = 112,165 cuft |
| Inflow hyds. | = 2, 10 | Contrib. drain. area | = 42.500 ac |



# Hydrograph Report

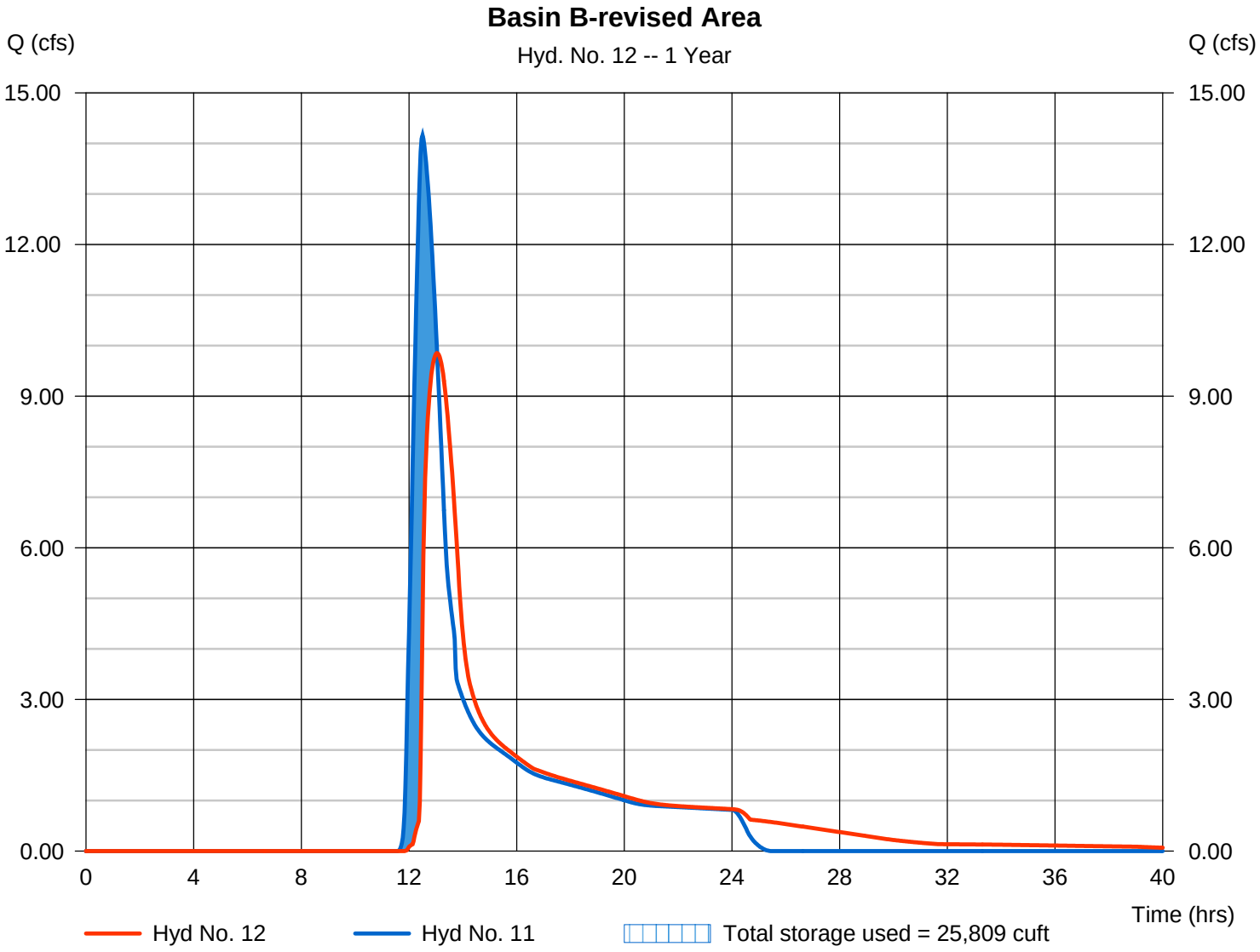


## Hyd. No. 12

Basin B-revised Area

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 9.851 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 13.03 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 112,036 cuft |
| Inflow hyd. No. | = | 11 - rev Basin B inflow | Max. Elevation | = | 11.75 ft |
| Reservoir name | = | Basin B-Asbuilt | Max. Storage | = | 25,809 cuft |

Storage Indication method used.



## Pond No. 2 - Basin B-Asbuilt

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 10.10 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 10.10 | 00 | 0 | 0 |
| 0.30 | 10.40 | 16,000 | 1,600 | 1,600 |
| 0.90 | 11.00 | 17,667 | 10,095 | 11,695 |
| 1.90 | 12.00 | 19,950 | 18,795 | 30,490 |
| 2.90 | 13.00 | 22,164 | 21,045 | 51,535 |
| 3.90 | 14.00 | 24,361 | 23,252 | 74,787 |
| 4.90 | 15.00 | 26,639 | 25,489 | 100,276 |
| 5.90 | 16.00 | 28,940 | 27,779 | 128,054 |
| 6.40 | 16.50 | 30,500 | 14,857 | 142,911 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 24.00 | 6.00 | 0.00 | 0.00 |
| **Span (in)** | = 24.00 | 6.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 10.10 | 10.10 | 0.00 | 0.00 |
| **Length (ft)** | = 120.00 | 24.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.40 | 0.10 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 9.00 | 40.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 11.10 | 15.20 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 2.60 | 3.33 | 3.33 |
| **Weir Type** | = Rect | Broad | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 10.10 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.03 | 160 | 10.13 | 0.00 | 0.00 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.001 |
| 0.06 | 320 | 10.16 | 0.00 | 0.01 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.005 |
| 0.09 | 480 | 10.19 | 0.00 | 0.01 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.011 |
| 0.12 | 640 | 10.22 | 0.00 | 0.02 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.019 |
| 0.15 | 800 | 10.25 | 0.00 | 0.03 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.029 |
| 0.18 | 960 | 10.28 | 0.00 | 0.04 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.039 |
| 0.21 | 1,120 | 10.31 | 0.00 | 0.05 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.051 |
| 0.24 | 1,280 | 10.34 | 0.00 | 0.06 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.063 |
| 0.27 | 1,440 | 10.37 | 0.00 | 0.07 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.075 |
| 0.30 | 1,600 | 10.40 | 0.00 | 0.09 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.087 |
| 0.36 | 2,609 | 10.46 | 0.00 | 0.11 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.109 |
| 0.42 | 3,619 | 10.52 | 0.00 | 0.13 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.128 |
| 0.48 | 4,628 | 10.58 | 0.00 | 0.14 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.137 |
| 0.54 | 5,638 | 10.64 | 0.00 | 0.22 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.217 |
| 0.60 | 6,647 | 10.70 | 0.00 | 0.30 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.302 |
| 0.66 | 7,657 | 10.76 | 0.00 | 0.37 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.368 |
| 0.72 | 8,666 | 10.82 | 0.00 | 0.42 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.424 |
| 0.78 | 9,676 | 10.88 | 0.00 | 0.47 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.473 |
| 0.84 | 10,685 | 10.94 | 0.00 | 0.52 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.518 |
| 0.90 | 11,695 | 11.00 | 0.00 | 0.56 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.559 |
| 1.00 | 13,574 | 11.10 | 0.00 | 0.62 oc | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.621 |
| 1.10 | 15,454 | 11.20 | 0.95 ic | 0.68 oc | --- | --- | 0.95 | 0.00 | --- | --- | --- | --- | 1.626 |
| 1.20 | 17,333 | 11.30 | 2.70 ic | 0.73 oc | --- | --- | 2.68 | 0.00 | --- | --- | --- | --- | 3.411 |
| 1.30 | 19,213 | 11.40 | 4.94 oc | 0.78 oc | --- | --- | 4.92 | 0.00 | --- | --- | --- | --- | 5.704 |
| 1.40 | 21,092 | 11.50 | 6.58 oc | 0.83 oc | --- | --- | 6.53 s | 0.00 | --- | --- | --- | --- | 7.358 |
| 1.50 | 22,972 | 11.60 | 7.66 oc | 0.87 oc | --- | --- | 7.66 s | 0.00 | --- | --- | --- | --- | 8.526 |
| 1.60 | 24,851 | 11.70 | 8.60 oc | 0.91 oc | --- | --- | 8.54 s | 0.00 | --- | --- | --- | --- | 9.447 |
| 1.70 | 26,731 | 11.80 | 9.29 oc | 0.95 oc | --- | --- | 9.29 s | 0.00 | --- | --- | --- | --- | 10.24 |
| 1.80 | 28,610 | 11.90 | 9.86 oc | 0.99 oc | --- | --- | 9.86 s | 0.00 | --- | --- | --- | --- | 10.85 |
| 1.90 | 30,490 | 12.00 | 10.26 oc | 1.02 oc | --- | --- | 10.26 s | 0.00 | --- | --- | --- | --- | 11.29 |
| 2.00 | 32,594 | 12.10 | 10.37 oc | 1.06 oc | --- | --- | 10.36 s | 0.00 | --- | --- | --- | --- | 11.42 |
| 2.10 | 34,699 | 12.20 | 10.78 oc | 1.09 oc | --- | --- | 10.77 s | 0.00 | --- | --- | --- | --- | 11.86 |
| 2.20 | 36,803 | 12.30 | 11.73 oc | 1.13 oc | --- | --- | 11.72 s | 0.00 | --- | --- | --- | --- | 12.85 |

*Continues on next page...*

Basin B-Asbuilt

## Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.30 | 38,908 | 12.40 | 12.62 oc | 1.16 oc | --- | --- | 12.62 s | 0.00 | --- | --- | --- | --- | 13.78 |
| 2.40 | 41,012 | 12.50 | 13.45 oc | 1.19 oc | --- | --- | 13.44 s | 0.00 | --- | --- | --- | --- | 14.63 |
| 2.50 | 43,117 | 12.60 | 14.24 oc | 1.22 oc | --- | --- | 14.23 s | 0.00 | --- | --- | --- | --- | 15.45 |
| 2.60 | 45,222 | 12.70 | 14.98 oc | 1.25 oc | --- | --- | 14.97 s | 0.00 | --- | --- | --- | --- | 16.22 |
| 2.70 | 47,326 | 12.80 | 15.69 oc | 1.28 oc | --- | --- | 15.67 s | 0.00 | --- | --- | --- | --- | 16.95 |
| 2.80 | 49,431 | 12.90 | 16.36 oc | 1.31 oc | --- | --- | 16.36 s | 0.00 | --- | --- | --- | --- | 17.67 |
| 2.90 | 51,535 | 13.00 | 17.01 oc | 1.34 oc | --- | --- | 17.00 s | 0.00 | --- | --- | --- | --- | 18.34 |
| 3.00 | 53,860 | 13.10 | 17.63 oc | 1.36 oc | --- | --- | 17.62 s | 0.00 | --- | --- | --- | --- | 18.98 |
| 3.10 | 56,185 | 13.20 | 18.23 oc | 1.39 oc | --- | --- | 18.22 s | 0.00 | --- | --- | --- | --- | 19.61 |
| 3.20 | 58,511 | 13.30 | 18.82 oc | 1.42 oc | --- | --- | 18.80 s | 0.00 | --- | --- | --- | --- | 20.22 |
| 3.30 | 60,836 | 13.40 | 19.38 oc | 1.44 oc | --- | --- | 19.38 s | 0.00 | --- | --- | --- | --- | 20.82 |
| 3.40 | 63,161 | 13.50 | 19.93 oc | 1.47 oc | --- | --- | 19.91 s | 0.00 | --- | --- | --- | --- | 21.38 |
| 3.50 | 65,486 | 13.60 | 20.46 oc | 1.49 oc | --- | --- | 20.44 s | 0.00 | --- | --- | --- | --- | 21.93 |
| 3.60 | 67,811 | 13.70 | 20.98 oc | 1.52 oc | --- | --- | 20.97 s | 0.00 | --- | --- | --- | --- | 22.49 |
| 3.70 | 70,136 | 13.80 | 21.49 oc | 1.54 oc | --- | --- | 21.46 s | 0.00 | --- | --- | --- | --- | 23.00 |
| 3.80 | 72,461 | 13.90 | 21.98 oc | 1.56 oc | --- | --- | 21.96 s | 0.00 | --- | --- | --- | --- | 23.53 |
| 3.90 | 74,787 | 14.00 | 22.46 oc | 1.59 oc | --- | --- | 22.42 s | 0.00 | --- | --- | --- | --- | 24.01 |
| 4.00 | 77,335 | 14.10 | 22.94 oc | 1.61 oc | --- | --- | 22.91 s | 0.00 | --- | --- | --- | --- | 24.52 |
| 4.10 | 79,884 | 14.20 | 23.40 oc | 1.63 oc | --- | --- | 23.36 s | 0.00 | --- | --- | --- | --- | 24.99 |
| 4.20 | 82,433 | 14.30 | 23.85 oc | 1.66 oc | --- | --- | 23.84 s | 0.00 | --- | --- | --- | --- | 25.50 |
| 4.30 | 84,982 | 14.40 | 24.30 oc | 1.68 oc | --- | --- | 24.30 s | 0.00 | --- | --- | --- | --- | 25.98 |
| 4.40 | 87,531 | 14.50 | 24.74 oc | 1.70 oc | --- | --- | 24.72 s | 0.00 | --- | --- | --- | --- | 26.42 |
| 4.50 | 90,080 | 14.60 | 25.17 oc | 1.72 oc | --- | --- | 25.11 s | 0.00 | --- | --- | --- | --- | 26.83 |
| 4.60 | 92,629 | 14.70 | 25.59 oc | 1.74 oc | --- | --- | 25.55 s | 0.00 | --- | --- | --- | --- | 27.29 |
| 4.70 | 95,178 | 14.80 | 26.00 oc | 1.76 oc | --- | --- | 25.96 s | 0.00 | --- | --- | --- | --- | 27.72 |
| 4.80 | 97,727 | 14.90 | 26.41 oc | 1.78 oc | --- | --- | 26.34 s | 0.00 | --- | --- | --- | --- | 28.13 |
| 4.90 | 100,276 | 15.00 | 26.81 oc | 1.81 oc | --- | --- | 26.79 s | 0.00 | --- | --- | --- | --- | 28.60 |
| 5.00 | 103,053 | 15.10 | 27.21 oc | 1.83 oc | --- | --- | 27.12 s | 0.00 | --- | --- | --- | --- | 28.94 |
| 5.10 | 105,831 | 15.20 | 27.60 oc | 1.85 oc | --- | --- | 27.53 s | 0.00 | --- | --- | --- | --- | 29.37 |
| 5.20 | 108,609 | 15.30 | 27.99 oc | 1.87 oc | --- | --- | 27.91 s | 3.29 | --- | --- | --- | --- | 33.06 |
| 5.30 | 111,387 | 15.40 | 28.36 oc | 1.89 oc | --- | --- | 28.26 s | 9.30 | --- | --- | --- | --- | 39.45 |
| 5.40 | 114,165 | 15.50 | 28.74 oc | 1.90 oc | --- | --- | 28.73 s | 17.09 | --- | --- | --- | --- | 47.72 |
| 5.50 | 116,943 | 15.60 | 29.11 oc | 1.92 oc | --- | --- | 29.04 s | 26.31 | --- | --- | --- | --- | 57.27 |
| 5.60 | 119,721 | 15.70 | 29.47 oc | 1.94 oc | --- | --- | 29.47 s | 36.77 | --- | --- | --- | --- | 68.18 |
| 5.70 | 122,499 | 15.80 | 29.83 oc | 1.96 oc | --- | --- | 29.72 s | 48.34 | --- | --- | --- | --- | 80.02 |
| 5.80 | 125,276 | 15.90 | 30.19 oc | 1.98 oc | --- | --- | 30.11 s | 60.91 | --- | --- | --- | --- | 93.00 |
| 5.90 | 128,054 | 16.00 | 30.54 oc | 2.00 oc | --- | --- | 30.47 s | 74.42 | --- | --- | --- | --- | 106.88 |
| 5.95 | 129,540 | 16.05 | 30.72 oc | 2.01 oc | --- | --- | 30.64 s | 81.50 | --- | --- | --- | --- | 114.15 |
| 6.00 | 131,026 | 16.10 | 30.89 oc | 2.02 oc | --- | --- | 30.82 s | 88.80 | --- | --- | --- | --- | 121.63 |
| 6.05 | 132,511 | 16.15 | 31.06 oc | 2.03 oc | --- | --- | 30.98 s | 96.30 | --- | --- | --- | --- | 129.31 |
| 6.10 | 133,997 | 16.20 | 31.23 oc | 2.04 oc | --- | --- | 31.14 s | 104.00 | --- | --- | --- | --- | 137.18 |
| 6.15 | 135,483 | 16.25 | 31.41 oc | 2.04 oc | --- | --- | 31.30 s | 111.90 | --- | --- | --- | --- | 145.24 |
| 6.20 | 136,968 | 16.30 | 31.58 oc | 2.05 oc | --- | --- | 31.45 s | 119.98 | --- | --- | --- | --- | 153.49 |
| 6.25 | 138,454 | 16.35 | 31.74 oc | 2.06 oc | --- | --- | 31.59 s | 128.26 | --- | --- | --- | --- | 161.91 |
| 6.30 | 139,940 | 16.40 | 31.91 oc | 2.07 oc | --- | --- | 31.73 s | 136.71 | --- | --- | --- | --- | 170.51 |
| 6.35 | 141,426 | 16.45 | 32.08 oc | 2.08 oc | --- | --- | 32.07 s | 145.34 | --- | --- | --- | --- | 179.49 |
| 6.40 | 142,911 | 16.50 | 32.24 oc | 2.09 oc | --- | --- | 32.21 s | 154.15 | --- | --- | --- | --- | 188.45 |

...End

# Hydrograph Report

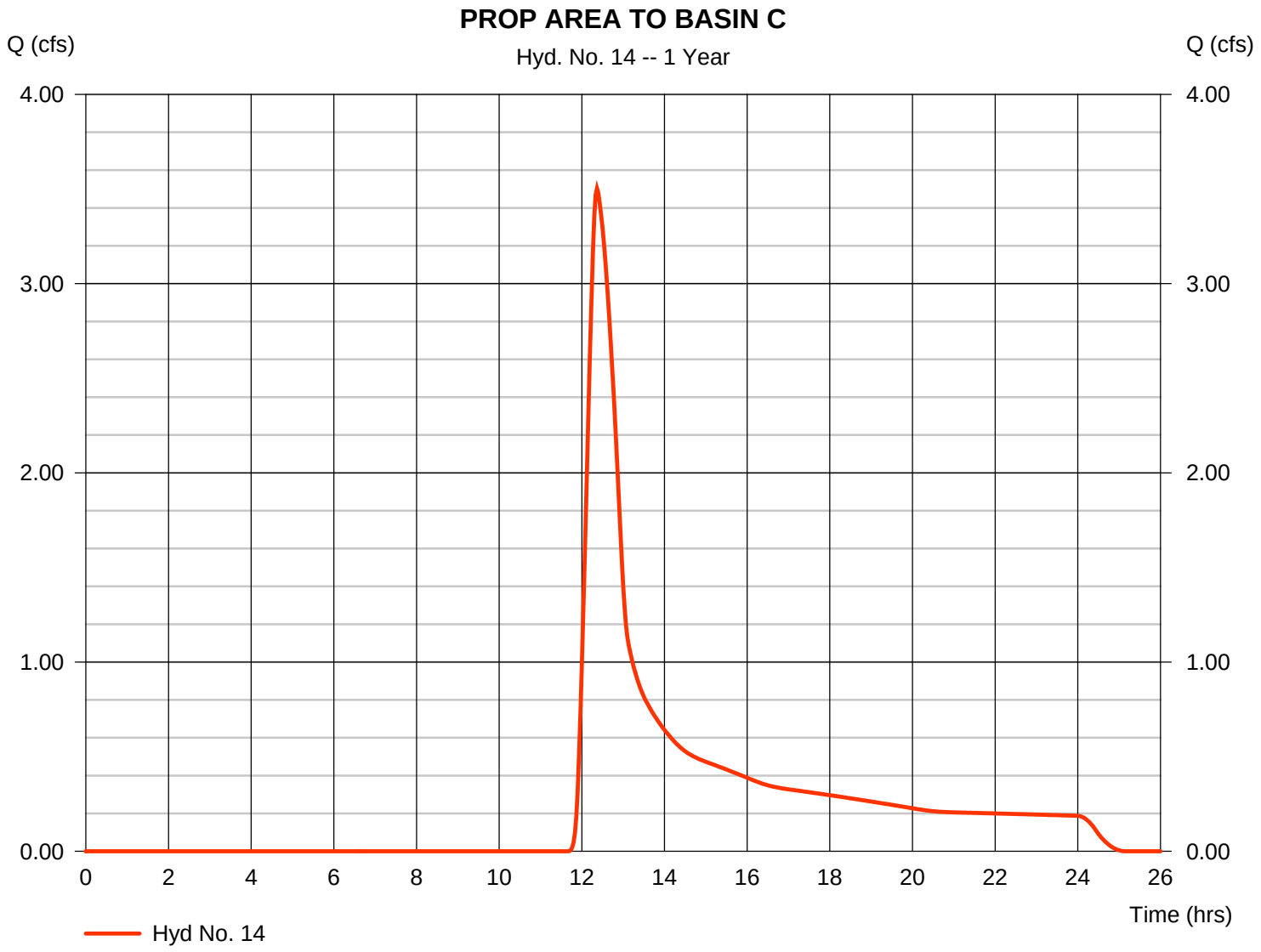


## Hyd. No. 14

PROP AREA TO BASIN C

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.503 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 12.37 hrs |
| Time interval | = 2 min | Hyd. volume | = 23,684 cuft |
| Drainage area | = 14.400 ac | Curve number | = 72.6* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 41.20 min |
| Total precip. | = 2.30 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(2.000 x 98) + (6.900 x 61) + (5.500 x 80)] / 14.400



# TR55 Tc Worksheet



## Hyd. No. 14

PROP AREA TO BASIN C

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 300.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.70 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 3.00 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 31.81** | **+** | **0.00** | **+** | **0.00** | **=** | **31.81** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 1200.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = 2.50 | | 0.00 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =2.55 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 7.84** | **+** | **0.00** | **+** | **0.00** | **=** | **7.84** |
| **Channel Flow** | | | | | | | |
| X sectional flow area (sqft) | = 1.77 | | 0.00 | | 0.00 | | |
| Wetted perimeter (ft) | = 4.71 | | 0.00 | | 0.00 | | |
| Channel slope (%) | = 0.50 | | 0.00 | | 0.00 | | |
| Manning's n-value | = 0.013 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =4.21 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})400.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 1.58** | **+** | **0.00** | **+** | **0.00** | **=** | **1.58** |

**Total Travel Time, Tc ..... 41.20 min**

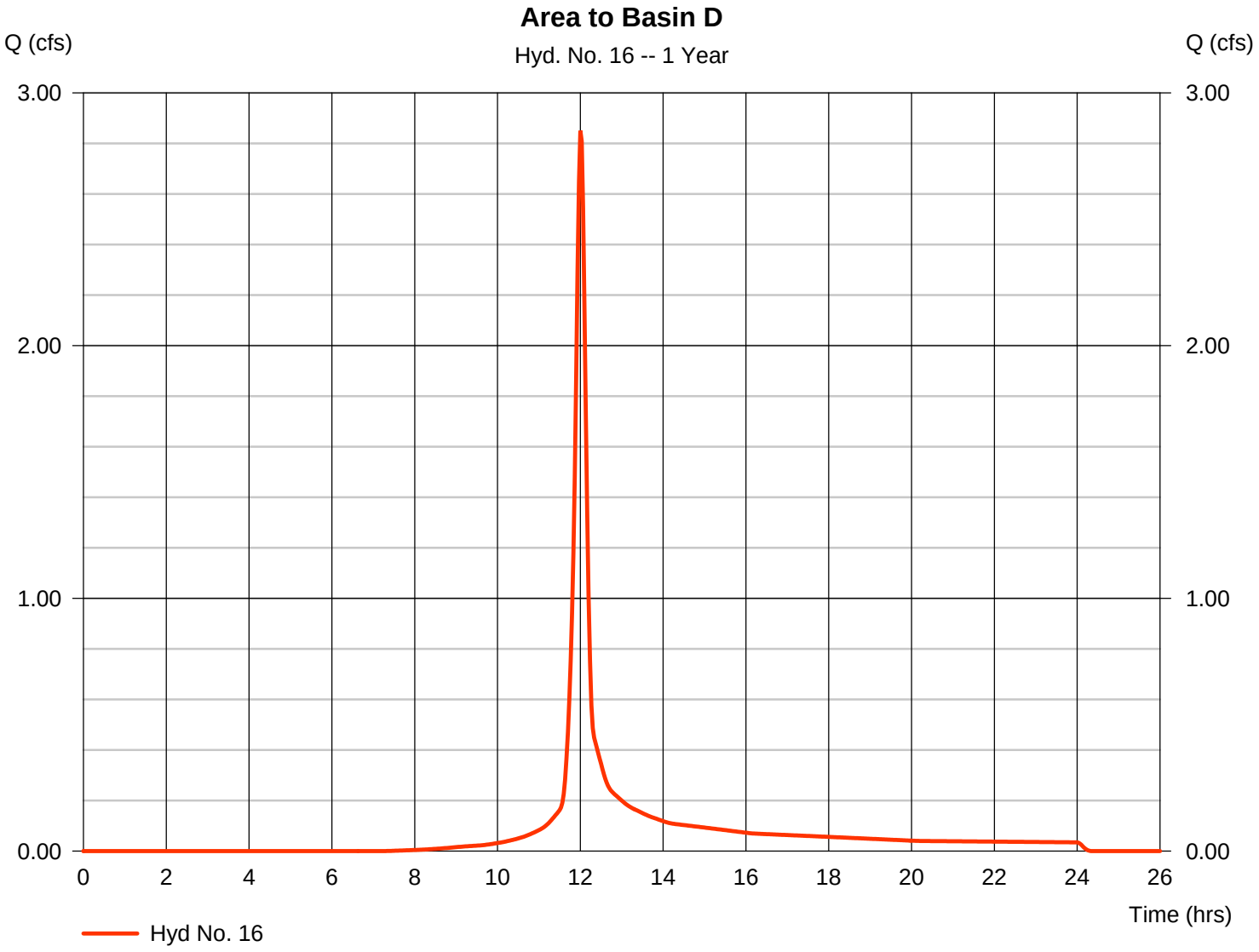
# Hydrograph Report



## Hyd. No. 16

Area to Basin D

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 2.850 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 12.00 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 7,396 cuft |
| Drainage area | = | 1.500 ac | Curve number | = | 89.5 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | User | Time of conc. (Tc) | = | 10.00 min |
| Total precip. | = | 2.30 in | Distribution | = | Type II |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



# Hydrograph Report

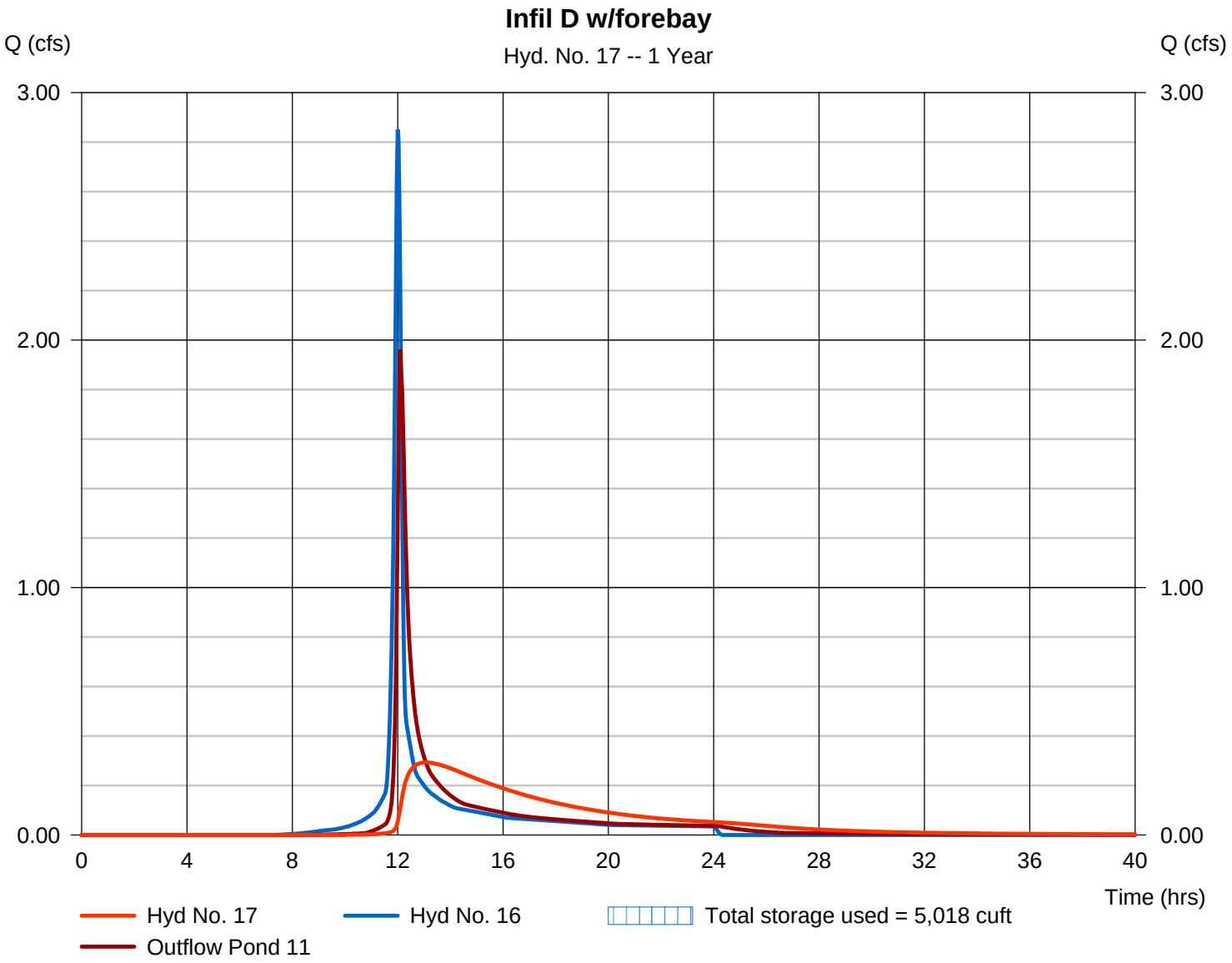


## Hyd. No. 17

Infil D w/forebay

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir (Interconnected) | Peak discharge | = | 0.293 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 13.07 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 7,357 cuft |
| Upper Pond | = | Wet Forebay D | Lower Pond | = | Infiltration Cell D |
| Inflow hyd. | = | 16 - Area to Basin D | Other Inflow hyd. | = | None |
| Max. Elevation | = | 15.91 ft | Max. Elevation | = | 15.00 ft |
| Max. Storage | = | 2,077 cuft | Max. Storage | = | 2,940 cuft |

Interconnected Pond Routing. Storage Indication method used. Outflow includes exfiltration.



# Pond Report



## Pond No. 11 - Wet Forebay D

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 15.00 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 15.00 | 1,975 | 0 | 0 |
| 1.00 | 16.00 | 2,650 | 2,304 | 2,304 |
| 2.00 | 17.00 | 9,350 | 5,659 | 7,963 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Span (in)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **No. Barrels** | = 0 | 0 | 0 | 0 |
| **Invert El. (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Length (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.00 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 60.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 15.00 | 16.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.54 | 2.60 | 3.33 | 3.33 |
| **Weir Type** | = 90 degV | Broad | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 15.00 | --- | --- | --- | --- | --- | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.10 | 230 | 15.10 | --- | --- | --- | --- | 0.01 | 0.00 | --- | --- | --- | --- | 0.008 |
| 0.20 | 461 | 15.20 | --- | --- | --- | --- | 0.05 | 0.00 | --- | --- | --- | --- | 0.045 |
| 0.30 | 691 | 15.30 | --- | --- | --- | --- | 0.13 | 0.00 | --- | --- | --- | --- | 0.125 |
| 0.40 | 922 | 15.40 | --- | --- | --- | --- | 0.26 | 0.00 | --- | --- | --- | --- | 0.257 |
| 0.50 | 1,152 | 15.50 | --- | --- | --- | --- | 0.45 | 0.00 | --- | --- | --- | --- | 0.449 |
| 0.60 | 1,382 | 15.60 | --- | --- | --- | --- | 0.71 | 0.00 | --- | --- | --- | --- | 0.708 |
| 0.70 | 1,613 | 15.70 | --- | --- | --- | --- | 1.04 | 0.00 | --- | --- | --- | --- | 1.041 |
| 0.80 | 1,843 | 15.80 | --- | --- | --- | --- | 1.45 | 0.00 | --- | --- | --- | --- | 1.454 |
| 0.90 | 2,074 | 15.90 | --- | --- | --- | --- | 1.95 | 0.00 | --- | --- | --- | --- | 1.952 |
| 1.00 | 2,304 | 16.00 | --- | --- | --- | --- | 2.54 | 0.00 | --- | --- | --- | --- | 2.540 |
| 1.10 | 2,870 | 16.10 | --- | --- | --- | --- | 3.22 | 4.93 | --- | --- | --- | --- | 8.157 |
| 1.20 | 3,436 | 16.20 | --- | --- | --- | --- | 4.01 | 13.95 | --- | --- | --- | --- | 17.96 |
| 1.30 | 4,002 | 16.30 | --- | --- | --- | --- | 4.89 | 25.63 | --- | --- | --- | --- | 30.53 |
| 1.40 | 4,567 | 16.40 | --- | --- | --- | --- | 5.89 | 39.47 | --- | --- | --- | --- | 45.36 |
| 1.50 | 5,133 | 16.50 | --- | --- | --- | --- | 7.00 | 55.15 | --- | --- | --- | --- | 62.15 |
| 1.60 | 5,699 | 16.60 | --- | --- | --- | --- | 8.22 | 72.50 | --- | --- | --- | --- | 80.73 |
| 1.70 | 6,265 | 16.70 | --- | --- | --- | --- | 9.57 | 91.36 | --- | --- | --- | --- | 100.93 |
| 1.80 | 6,831 | 16.80 | --- | --- | --- | --- | 11.04 | 111.62 | --- | --- | --- | --- | 122.67 |
| 1.90 | 7,397 | 16.90 | --- | --- | --- | --- | 12.64 | 133.20 | --- | --- | --- | --- | 145.83 |
| 2.00 | 7,963 | 17.00 | --- | --- | --- | --- | 14.37 | 156.00 | --- | --- | --- | --- | 170.37 |

# Pond Report



## Pond No. 12 - Infiltration Cell D

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 14.00 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 14.00 | 2,400 | 0 | 0 |
| 1.00 | 15.00 | 3,525 | 2,944 | 2,944 |
| 2.00 | 16.00 | 4,776 | 4,134 | 7,079 |
| 3.00 | 17.00 | 9,350 | 6,935 | 14,014 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 12.00 | 4.00 | 0.00 | 0.00 |
| **Span (in)** | = 12.00 | 4.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 14.00 | 15.00 | 0.00 | 0.00 |
| **Length (ft)** | = 51.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.50 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | Yes | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 6.28 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 16.25 | 16.50 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 2.60 | 3.33 | 3.33 |
| **Weir Type** | = 1 | Broad | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 3.600 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 14.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.000 | --- | 0.000 |
| 0.10 | 294 | 14.10 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.029 | --- | 0.029 |
| 0.20 | 589 | 14.20 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.059 | --- | 0.059 |
| 0.30 | 883 | 14.30 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.088 | --- | 0.088 |
| 0.40 | 1,178 | 14.40 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.117 | --- | 0.117 |
| 0.50 | 1,472 | 14.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.147 | --- | 0.147 |
| 0.60 | 1,767 | 14.60 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.176 | --- | 0.176 |
| 0.70 | 2,061 | 14.70 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.206 | --- | 0.206 |
| 0.80 | 2,355 | 14.80 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.235 | --- | 0.235 |
| 0.90 | 2,650 | 14.90 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.264 | --- | 0.264 |
| 1.00 | 2,944 | 15.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | 0.294 | --- | 0.294 |
| 1.10 | 3,358 | 15.10 | 0.02 ic | 0.02 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.304 | --- | 0.328 |
| 1.20 | 3,771 | 15.20 | 0.08 ic | 0.08 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.315 | --- | 0.398 |
| 1.30 | 4,185 | 15.30 | 0.16 ic | 0.15 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.325 | --- | 0.480 |
| 1.40 | 4,598 | 15.40 | 0.21 ic | 0.20 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.335 | --- | 0.538 |
| 1.50 | 5,011 | 15.50 | 0.25 ic | 0.24 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.346 | --- | 0.588 |
| 1.60 | 5,425 | 15.60 | 0.28 ic | 0.28 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.356 | --- | 0.633 |
| 1.70 | 5,838 | 15.70 | 0.31 ic | 0.31 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.367 | --- | 0.674 |
| 1.80 | 6,252 | 15.80 | 0.34 ic | 0.33 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.377 | --- | 0.711 |
| 1.90 | 6,665 | 15.90 | 0.37 ic | 0.36 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.388 | --- | 0.747 |
| 2.00 | 7,079 | 16.00 | 0.39 ic | 0.38 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.398 | --- | 0.782 |
| 2.10 | 7,772 | 16.10 | 0.41 ic | 0.41 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.436 | --- | 0.842 |
| 2.20 | 8,466 | 16.20 | 0.44 ic | 0.43 ic | --- | --- | 0.00 | 0.00 | --- | --- | 0.474 | --- | 0.901 |
| 2.30 | 9,159 | 16.30 | 0.69 ic | 0.45 ic | --- | --- | 0.23 | 0.00 | --- | --- | 0.512 | --- | 1.193 |
| 2.40 | 9,853 | 16.40 | 1.69 oc | 0.47 ic | --- | --- | 1.21 | 0.00 | --- | --- | 0.550 | --- | 2.232 |
| 2.50 | 10,546 | 16.50 | 3.04 oc | 0.43 ic | --- | --- | 2.61 | 0.00 | --- | --- | 0.589 | --- | 3.631 |
| 2.60 | 11,240 | 16.60 | 4.48 oc | 0.23 ic | --- | --- | 4.24 s | 0.82 | --- | --- | 0.627 | --- | 5.924 |
| 2.70 | 11,933 | 16.70 | 4.82 oc | 0.16 ic | --- | --- | 4.66 s | 2.33 | --- | --- | 0.665 | --- | 7.814 |
| 2.80 | 12,627 | 16.80 | 5.03 oc | 0.13 ic | --- | --- | 4.91 s | 4.27 | --- | --- | 0.703 | --- | 10.01 |
| 2.90 | 13,320 | 16.90 | 5.20 oc | 0.10 ic | --- | --- | 5.09 s | 6.58 | --- | --- | 0.741 | --- | 12.51 |
| 3.00 | 14,014 | 17.00 | 5.34 oc | 0.09 ic | --- | --- | 5.25 s | 9.19 | --- | --- | 0.779 | --- | 15.31 |

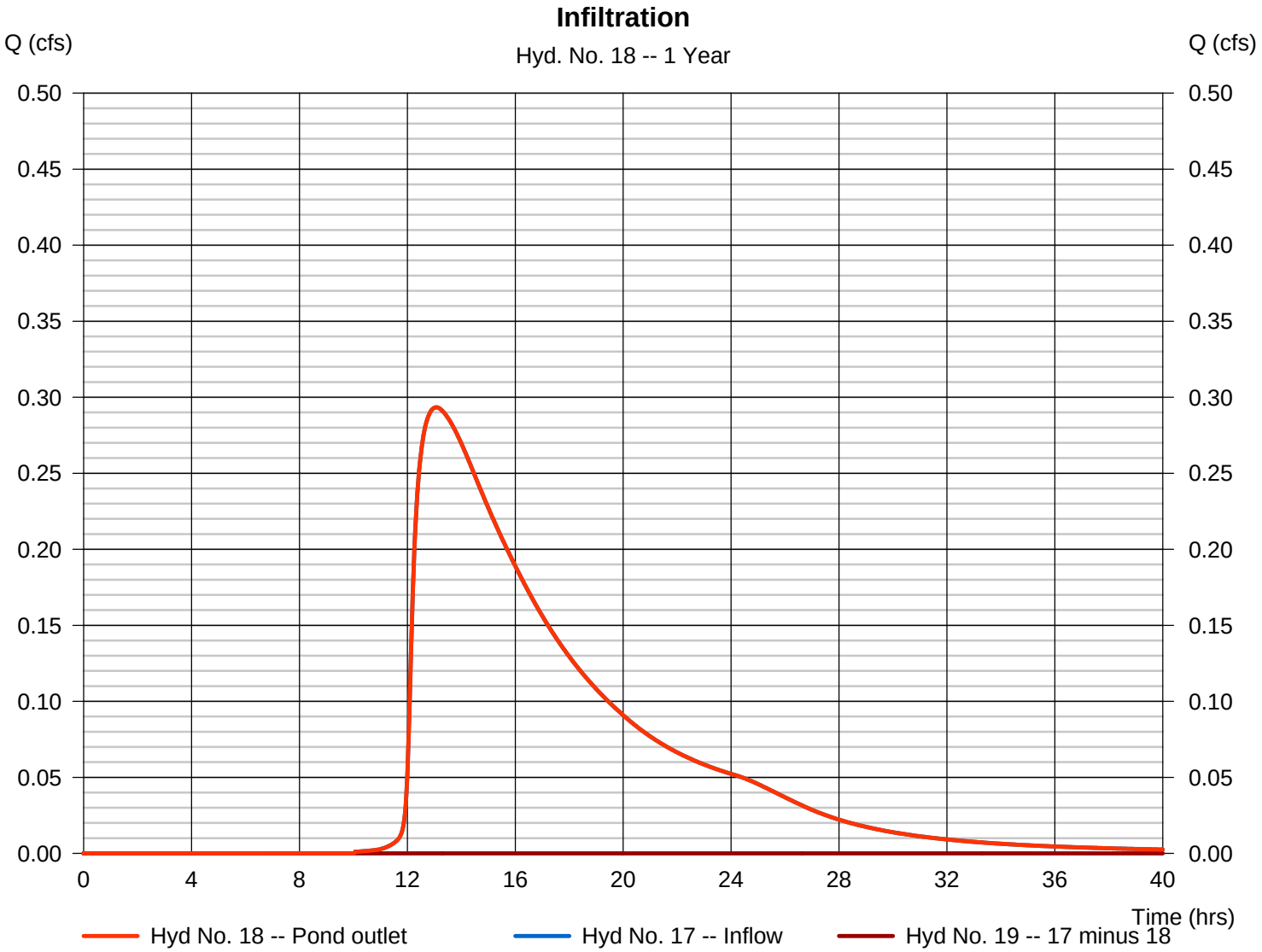
# Hydrograph Report



## Hyd. No. 18

Infiltration

| | | | |
|---|---|---|---|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.293 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 13.07 hrs |
| Time interval | = 2 min | Hyd. volume | = 7,357 cuft |
| Inflow hydrograph | = 17 - Infil D w/forebay | 2nd diverted hyd. | = 19 |
| Diversion method | = Pond - Infiltration Cell D | Pond structure | = Exfiltration |



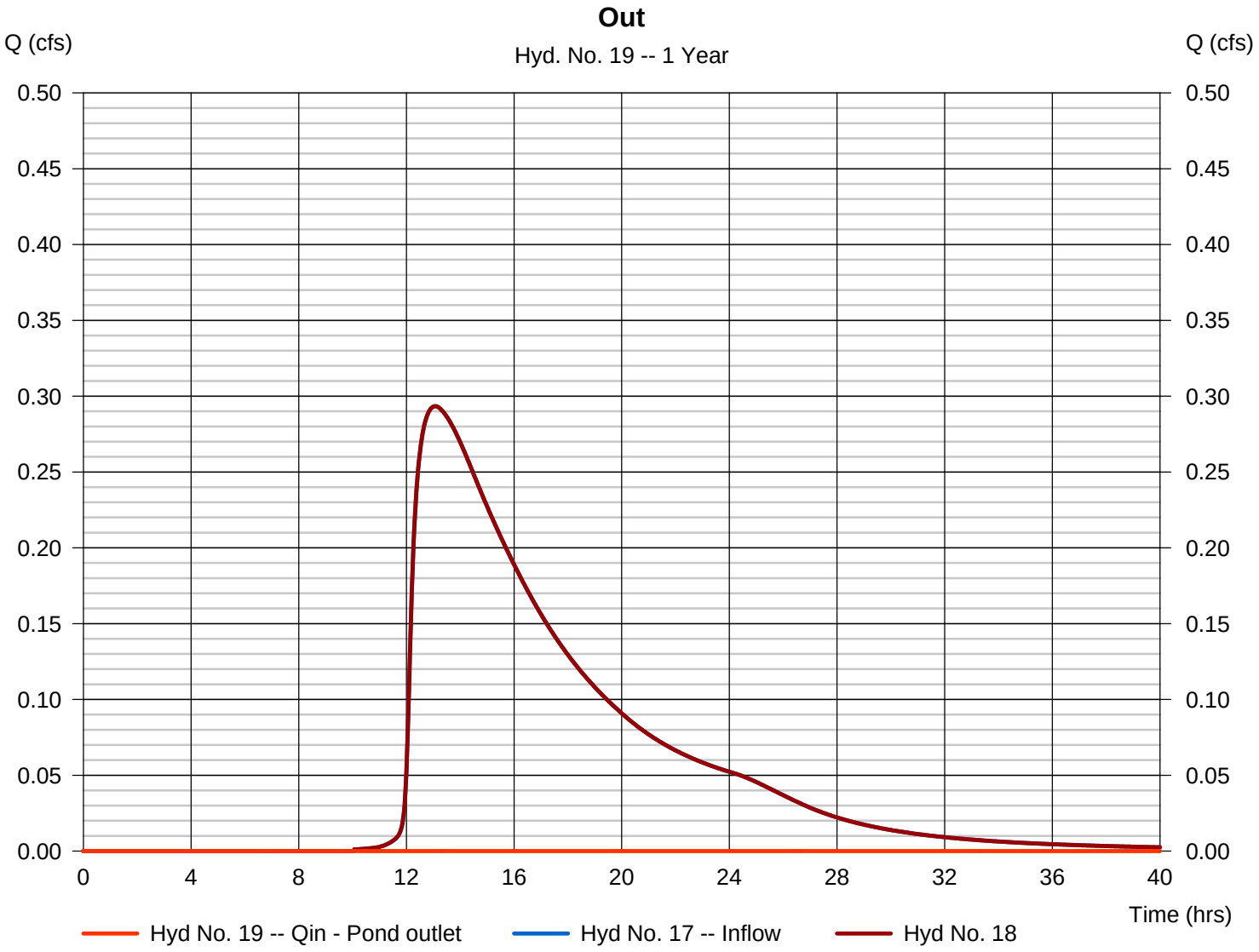
# Hydrograph Report



## Hyd. No. 19

Out

| | | | |
|---|---|---|---|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.000 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 12.20 hrs |
| Time interval | = 2 min | Hyd. volume | = 0 cuft |
| Inflow hydrograph | = 17 - Infil D w/forebay | 2nd diverted hyd. | = 18 |
| Diversion method | = Pond - Infiltration Cell D | Pond structure | = Exfiltration |



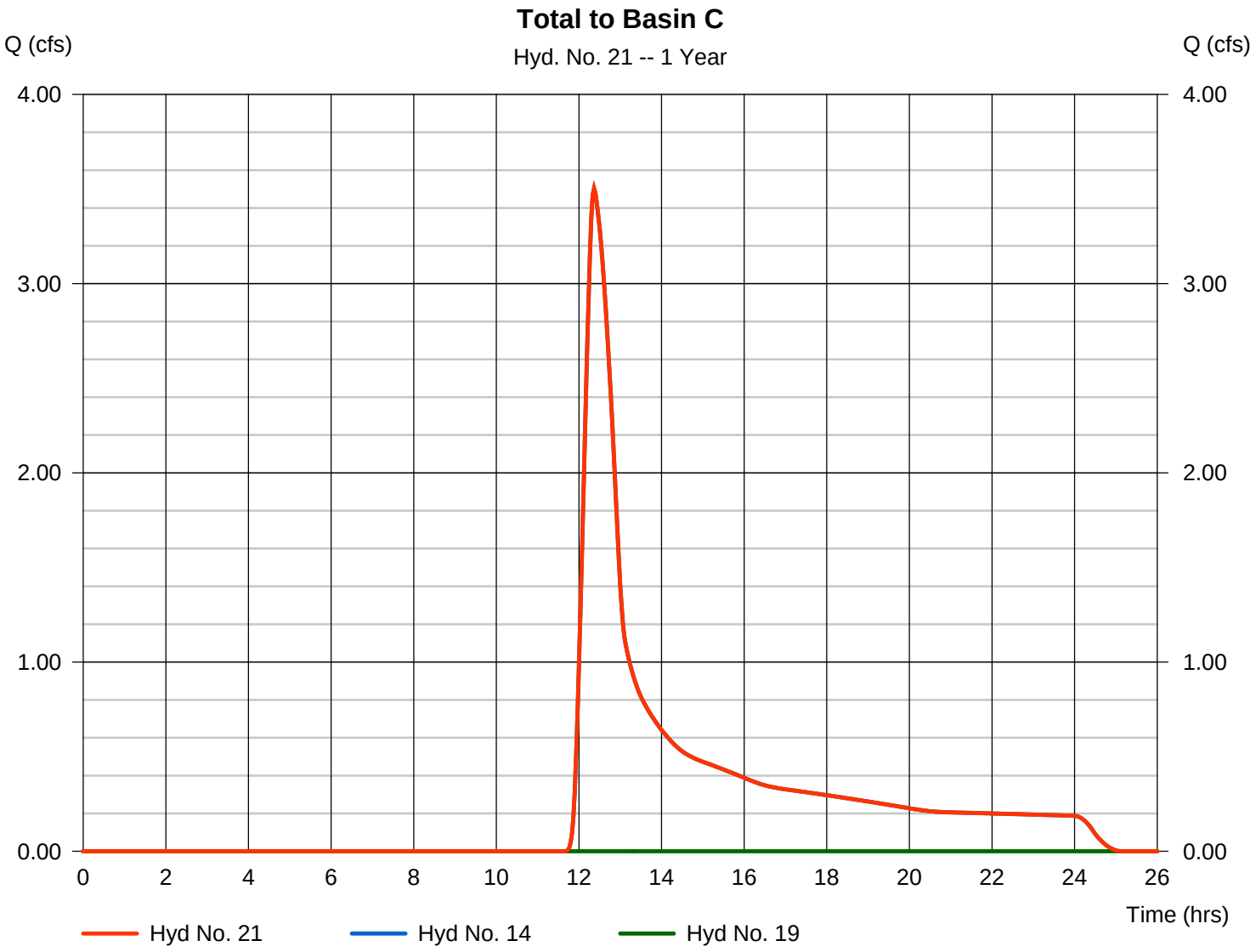
# Hydrograph Report



## Hyd. No. 21

Total to Basin C

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 3.503 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 12.37 hrs |
| Time interval | = 2 min | Hyd. volume | = 23,684 cuft |
| Inflow hyds. | = 14, 19 | Contrib. drain. area | = 14.400 ac |



# Hydrograph Report

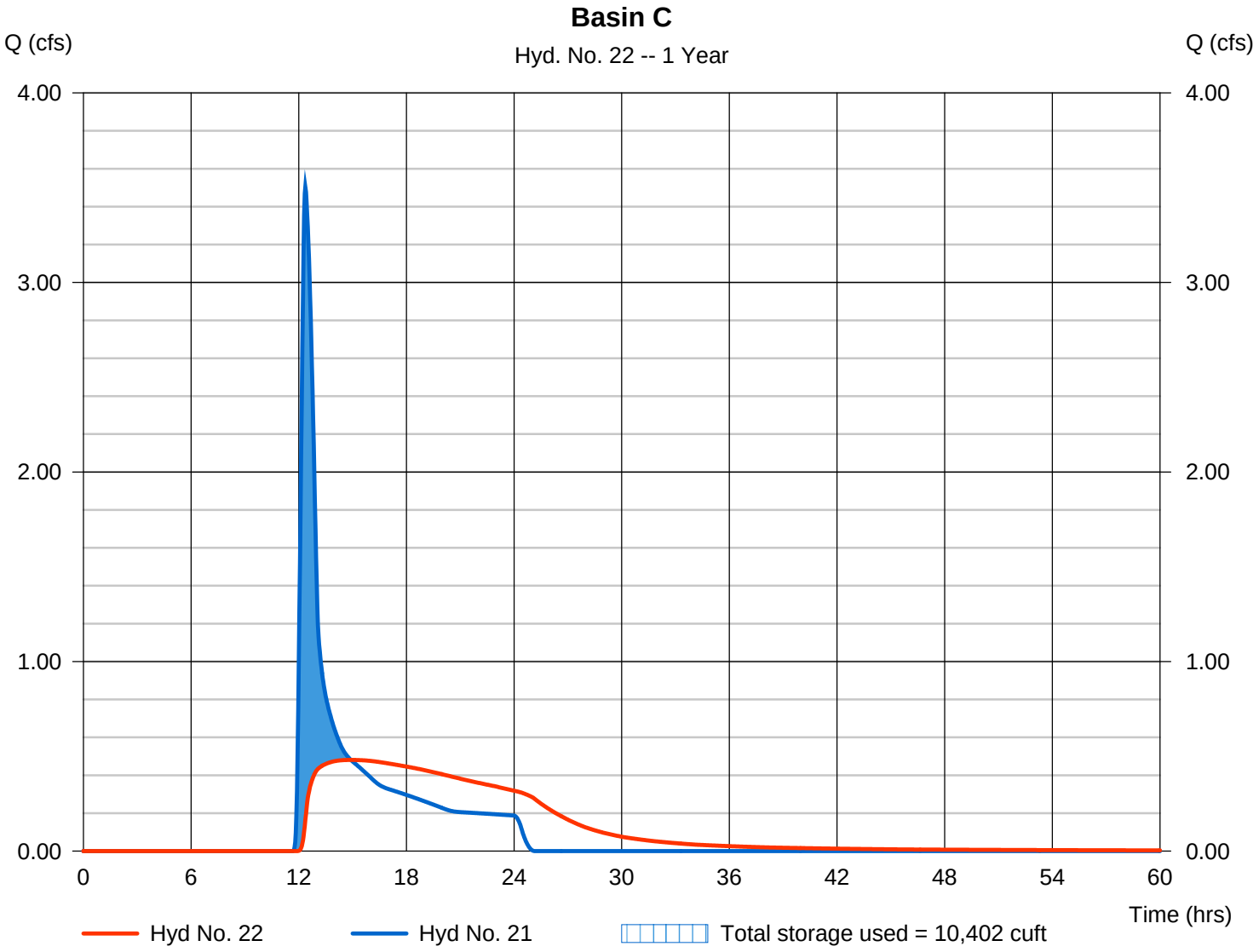


## Hyd. No. 22

Basin C

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.481 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 14.90 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 23,474 cuft |
| Inflow hyd. No. | = | 21 - Total to Basin C | Max. Elevation | = | 12.51 ft |
| Reservoir name | = | Pond C | Max. Storage | = | 10,402 cuft |

Storage Indication method used.



## Pond No. 13 - Pond C

### Pond Data

**Contours -**User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 11.70 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 11.70 | 12,100 | 0 | 0 |
| 0.30 | 12.00 | 12,500 | 3,689 | 3,689 |
| 1.30 | 13.00 | 13,900 | 13,192 | 16,882 |
| 2.30 | 14.00 | 15,325 | 14,605 | 31,487 |
| 3.30 | 15.00 | 16,850 | 16,080 | 47,567 |
| 4.30 | 16.00 | 18,425 | 17,630 | 65,197 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 24.00 | 5.00 | 12.00 | 0.00 |
| **Span (in)** | = 24.00 | 5.00 | 12.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 1 | 0 |
| **Invert El. (ft)** | = 11.70 | 11.70 | 12.70 | 0.00 |
| **Length (ft)** | = 175.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.30 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | Yes | Yes | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 12.56 | 25.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 14.00 | 15.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 2.60 | 3.33 | 3.33 |
| **Weir Type** | = 1 | Broad | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 11.70 | 0.00 | 0.00 | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.03 | 369 | 11.73 | 0.00 oc | 0.00 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.002 |
| 0.06 | 738 | 11.76 | 0.01 oc | 0.01 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.008 |
| 0.09 | 1,107 | 11.79 | 0.02 oc | 0.02 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.019 |
| 0.12 | 1,476 | 11.82 | 0.04 oc | 0.03 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.034 |
| 0.15 | 1,845 | 11.85 | 0.05 oc | 0.05 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.053 |
| 0.18 | 2,214 | 11.88 | 0.08 oc | 0.07 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.074 |
| 0.21 | 2,583 | 11.91 | 0.10 oc | 0.10 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.098 |
| 0.24 | 2,952 | 11.94 | 0.13 oc | 0.12 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.125 |
| 0.27 | 3,321 | 11.97 | 0.16 ic | 0.15 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.154 |
| 0.30 | 3,689 | 12.00 | 0.18 oc | 0.18 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.183 |
| 0.40 | 5,009 | 12.10 | 0.29 ic | 0.28 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.283 |
| 0.50 | 6,328 | 12.20 | 0.35 ic | 0.34 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.341 |
| 0.60 | 7,647 | 12.30 | 0.41 ic | 0.39 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.388 |
| 0.70 | 8,966 | 12.40 | 0.44 ic | 0.44 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.435 |
| 0.80 | 10,286 | 12.50 | 0.48 ic | 0.48 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.477 |
| 0.90 | 11,605 | 12.60 | 0.52 ic | 0.52 ic | 0.00 | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.516 |
| 1.00 | 12,924 | 12.70 | 0.56 ic | 0.55 ic | 0.00 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.552 |
| 1.10 | 14,243 | 12.80 | 0.64 ic | 0.58 ic | 0.04 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.626 |
| 1.20 | 15,563 | 12.90 | 0.78 ic | 0.61 ic | 0.18 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.783 |
| 1.30 | 16,882 | 13.00 | 1.00 ic | 0.62 ic | 0.37 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.995 |
| 1.40 | 18,342 | 13.10 | 1.28 ic | 0.64 ic | 0.65 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.281 |
| 1.50 | 19,803 | 13.20 | 1.64 ic | 0.65 ic | 0.96 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.615 |
| 1.60 | 21,264 | 13.30 | 1.98 oc | 0.66 ic | 1.30 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.966 |
| 1.70 | 22,724 | 13.40 | 2.43 oc | 0.67 ic | 1.69 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 2.362 |
| 1.80 | 24,185 | 13.50 | 2.81 oc | 0.69 ic | 2.05 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 2.738 |
| 1.90 | 25,645 | 13.60 | 3.12 oc | 0.70 ic | 2.41 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 3.117 |
| 2.00 | 27,106 | 13.70 | 3.44 oc | 0.72 ic | 2.67 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 3.394 |
| 2.10 | 28,566 | 13.80 | 3.76 oc | 0.74 ic | 2.93 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 3.665 |
| 2.20 | 30,027 | 13.90 | 3.98 oc | 0.76 ic | 3.16 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 3.919 |
| 2.30 | 31,487 | 14.00 | 4.21 oc | 0.78 ic | 3.38 ic | --- | 0.00 | 0.00 | --- | --- | --- | --- | 4.157 |
| 2.40 | 33,095 | 14.10 | 5.69 oc | 0.75 ic | 3.59 ic | --- | 1.32 | 0.00 | --- | --- | --- | --- | 5.655 |
| 2.50 | 34,703 | 14.20 | 8.21 oc | 0.66 ic | 3.78 ic | --- | 3.74 | 0.00 | --- | --- | --- | --- | 8.185 |
| 2.60 | 36,311 | 14.30 | 10.12 oc | 0.48 ic | 2.77 ic | --- | 6.87 | 0.00 | --- | --- | --- | --- | 10.12 |
| 2.70 | 37,919 | 14.40 | 12.61 oc | 0.37 ic | 2.11 ic | --- | 10.13 s | 0.00 | --- | --- | --- | --- | 12.61 |
| 2.80 | 39,527 | 14.50 | 13.91 oc | 0.30 ic | 1.74 ic | --- | 11.86 s | 0.00 | --- | --- | --- | --- | 13.90 |
| 2.90 | 41,135 | 14.60 | 14.86 oc | 0.26 ic | 1.49 ic | --- | 13.11 s | 0.00 | --- | --- | --- | --- | 14.86 |

*Continues on next page...*

Pond C

## Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.00 | 42,743 | 14.70 | 15.64 oc | 0.22 ic | 1.29 ic | --- | 14.13 s | 0.00 | --- | --- | --- | --- | 15.64 |
| 3.10 | 44,351 | 14.80 | 16.33 oc | 0.20 ic | 1.14 ic | --- | 14.99 s | 0.00 | --- | --- | --- | --- | 16.32 |
| 3.20 | 45,959 | 14.90 | 16.94 oc | 0.18 ic | 1.02 ic | --- | 15.74 s | 0.00 | --- | --- | --- | --- | 16.94 |
| 3.30 | 47,567 | 15.00 | 17.52 oc | 0.16 ic | 0.92 ic | --- | 16.42 s | 0.00 | --- | --- | --- | --- | 17.51 |
| 3.40 | 49,330 | 15.10 | 18.05 oc | 0.15 ic | 0.84 ic | --- | 17.06 s | 2.06 | --- | --- | --- | --- | 20.10 |
| 3.50 | 51,093 | 15.20 | 18.56 oc | 0.13 ic | 0.78 ic | --- | 17.65 s | 5.81 | --- | --- | --- | --- | 24.38 |
| 3.60 | 52,856 | 15.30 | 19.05 oc | 0.12 ic | 0.72 ic | --- | 18.21 s | 10.68 | --- | --- | --- | --- | 29.73 |
| 3.70 | 54,619 | 15.40 | 19.52 oc | 0.12 ic | 0.67 ic | --- | 18.73 s | 16.44 | --- | --- | --- | --- | 35.96 |
| 3.80 | 56,382 | 15.50 | 19.98 oc | 0.11 ic | 0.63 ic | --- | 19.23 s | 22.98 | --- | --- | --- | --- | 42.95 |
| 3.90 | 58,145 | 15.60 | 20.43 oc | 0.10 ic | 0.59 ic | --- | 19.71 s | 30.21 | --- | --- | --- | --- | 50.61 |
| 4.00 | 59,908 | 15.70 | 20.86 oc | 0.10 ic | 0.56 ic | --- | 20.19 s | 38.07 | --- | --- | --- | --- | 58.91 |
| 4.10 | 61,671 | 15.80 | 21.28 oc | 0.09 ic | 0.53 ic | --- | 20.66 s | 46.51 | --- | --- | --- | --- | 67.79 |
| 4.20 | 63,434 | 15.90 | 21.69 oc | 0.09 ic | 0.50 ic | --- | 21.09 s | 55.50 | --- | --- | --- | --- | 77.18 |
| 4.30 | 65,197 | 16.00 | 22.09 oc | 0.08 ic | 0.48 ic | --- | 21.53 s | 65.00 | --- | --- | --- | --- | 87.09 |

...End

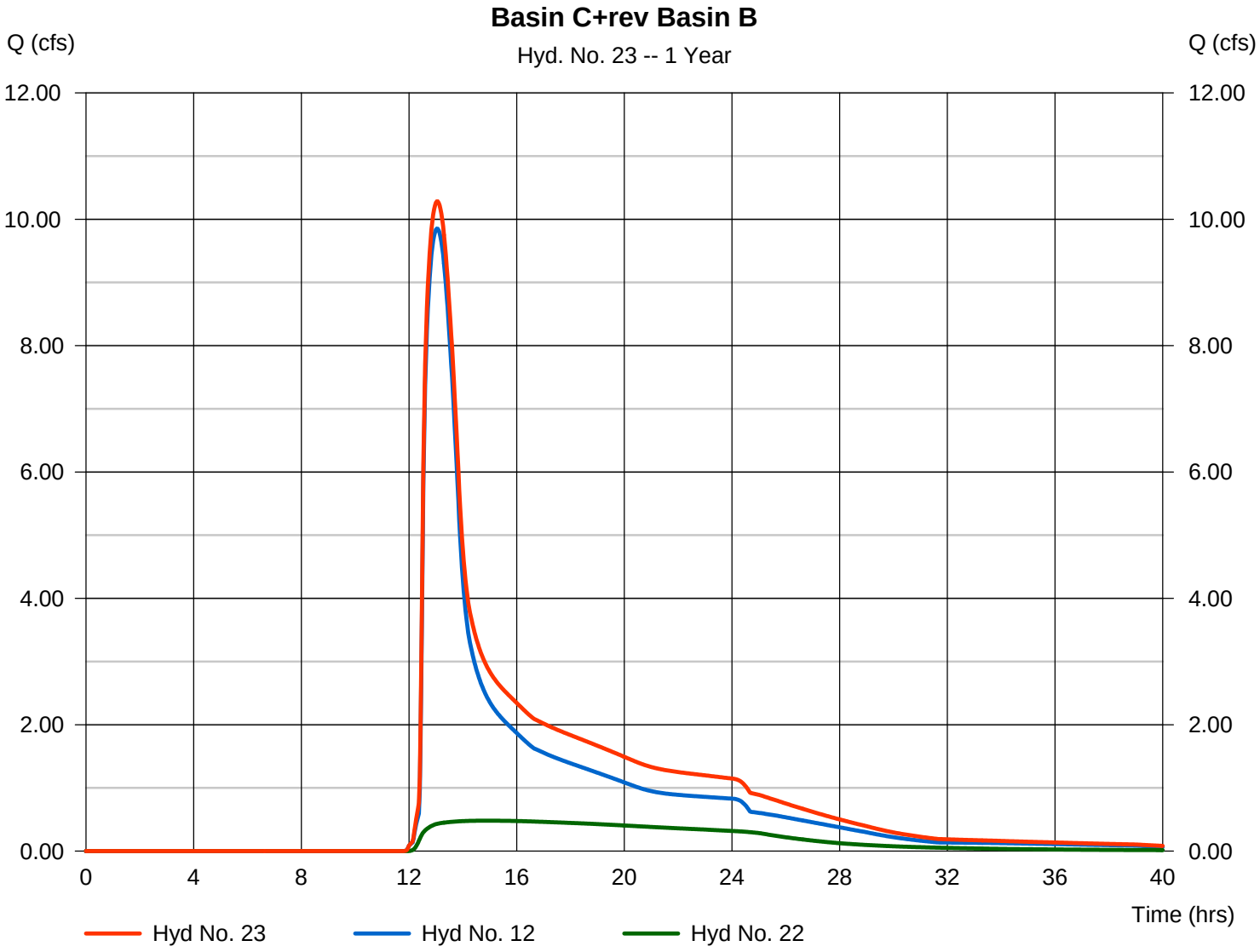
# Hydrograph Report



## Hyd. No. 23

Basin C+rev Basin B

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Combine | Peak discharge | = | 10.28 cfs |
| Storm frequency | = | 1 yrs | Time to peak | = | 13.03 hrs |
| Time interval | = | 2 min | Hyd. volume | = | 135,510 cuft |
| Inflow hyds. | = | 12, 22 | Contrib. drain. area | = | 0.000 ac |



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 8.754 | 2 | 732 | 38,592 | ------ | ------ | ------ | Area A-Rivers Crossing |
| 2 | Reservoir | 3.000 | 2 | 758 | 38,591 | 1 | 14.10 | 9,477 | Basin A |
| 3 | SCS Runoff | 17.95 | 2 | 750 | 123,529 | ------ | ------ | ------ | Area B-Rivers Crossing |
| 4 | Combine | 20.93 | 2 | 750 | 162,121 | 2, 3 | ------ | ------ | Basin B Inflow |
| 5 | Reservoir | 13.11 | 2 | 784 | 161,992 | 4 | 12.33 | 37,381 | Basin B-Asbuilt |
| 7 | SCS Runoff | 3.218 | 2 | 744 | 24,712 | ------ | ------ | ------ | Area C-Pre-Developed |
| 8 | Combine | 14.56 | 2 | 776 | 186,704 | 5, 7 | ------ | ------ | Area C+Basin B out |
| 10 | SCS Runoff | 17.65 | 2 | 750 | 121,638 | ------ | ------ | ------ | Area B-Rivers Crossing-Revised |
| 11 | Combine | 20.63 | 2 | 750 | 160,230 | 2, 10 | ------ | ------ | rev Basin B inflow |
| 12 | Reservoir | 12.89 | 2 | 784 | 160,100 | 11 | 12.31 | 36,897 | Basin B-revised Area |
| 14 | SCS Runoff | 5.711 | 2 | 742 | 34,914 | ------ | ------ | ------ | PROP AREA TO BASIN C |
| 16 | SCS Runoff | 3.600 | 2 | 720 | 9,380 | ------ | ------ | ------ | Area to Basin D |
| 17 | Reservoir(i) | 0.422 | 2 | 772 | 9,370 | 16 | 16.01 | 6,232 | Infil D w/forebay |
| 18 | Diversion1 | 0.318 | 2 | 772 | 8,869 | 17 | ------ | ------ | Infiltration |
| 19 | Diversion2 | 0.104 | 2 | 772 | 501 | 17 | ------ | ------ | Out |
| 21 | Combine | 5.740 | 2 | 742 | 35,415 | 14, 19, | ------ | ------ | Total to Basin C |
| 22 | Reservoir | 0.884 | 2 | 846 | 35,194 | 21 | 12.95 | 16,192 | Basin C |
| 23 | Combine | 13.59 | 2 | 786 | 195,295 | 12, 22 | ------ | ------ | Basin C+rev Basin B |

# Hydrograph Summary Report

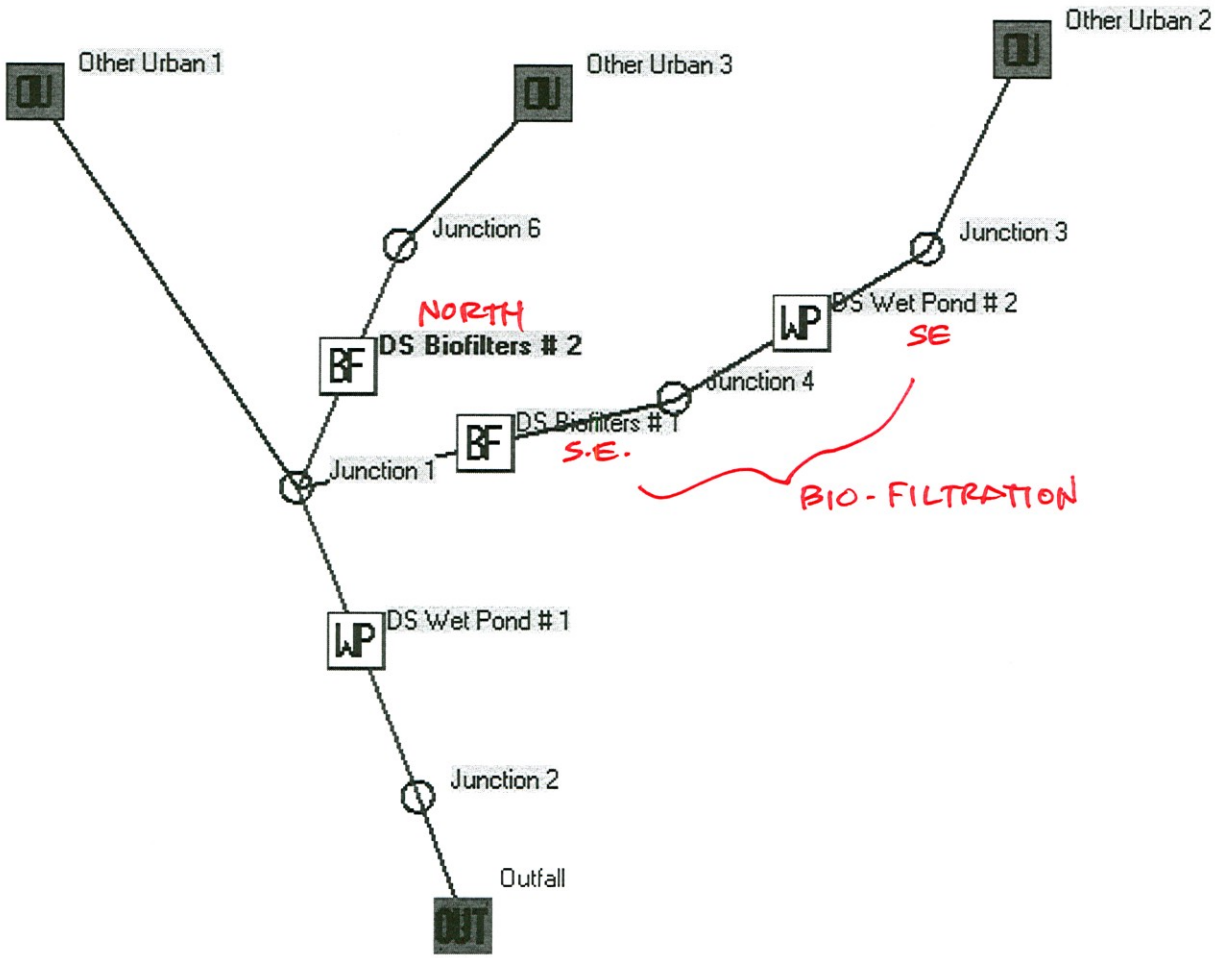
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 20.41 | 2 | 732 | 83,490 | ------ | ------ | ------ | Area A-Rivers Crossing |
| 2 | Reservoir | 3.772 | 2 | 768 | 83,490 | 1 | 15.71 | 30,994 | Basin A |
| 3 | SCS Runoff | 41.78 | 2 | 748 | 264,274 | ------ | ------ | ------ | Area B-Rivers Crossing |
| 4 | Combine | 45.45 | 2 | 748 | 347,764 | 2, 3 | ------ | ------ | Basin B Inflow |
| 5 | Reservoir | 25.51 | 2 | 784 | 347,634 | 4 | 14.30 | 82,495 | Basin B-Asbuilt |
| 7 | SCS Runoff | 11.13 | 2 | 740 | 65,108 | ------ | ------ | ------ | Area C-Pre-Developed |
| 8 | Combine | 31.16 | 2 | 762 | 412,743 | 5, 7 | ------ | ------ | Area C+Basin B out |
| 10 | SCS Runoff | 41.19 | 2 | 748 | 260,708 | ------ | ------ | ------ | Area B-Rivers Crossing-Revised |
| 11 | Combine | 44.86 | 2 | 748 | 344,198 | 2, 10 | ------ | ------ | rev Basin B inflow |
| 12 | Reservoir | 25.27 | 2 | 784 | 344,069 | 11 | 14.25 | 81,281 | Basin B-revised Area |
| 14 | SCS Runoff | 14.67 | 2 | 740 | 79,179 | ------ | ------ | ------ | PROP AREA TO BASIN C |
| 16 | SCS Runoff | 6.072 | 2 | 720 | 16,120 | ------ | ------ | ------ | Area to Basin D |
| 17 | Reservoir(i) | 0.781 | 2 | 760 | 16,105 | 16 | 16.06 | 9,718 | Infil D w/forebay |
| 18 | Diversion1 | 0.398 | 2 | 760 | 12,373 | 17 | ------ | ------ | Infiltration |
| 19 | Diversion2 | 0.383 | 2 | 760 | 3,732 | 17 | ------ | ------ | Out |
| 21 | Combine | 15.03 | 2 | 740 | 82,911 | 14, 19, | ------ | ------ | Total to Basin C |
| 22 | Reservoir | 5.551 | 2 | 776 | 82,678 | 21 | 14.09 | 32,983 | Basin C |
| 23 | Combine | 30.67 | 2 | 780 | 426,747 | 12, 22 | ------ | ------ | Basin C+rev Basin B |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 36.77 | 2 | 730 | 147,481 | ------ | ------ | ------ | Area A-Rivers Crossing |
| 2 | Reservoir | 17.89 | 2 | 750 | 147,481 | 1 | 16.90 | 51,831 | Basin A |
| 3 | SCS Runoff | 75.07 | 2 | 748 | 463,765 | ------ | ------ | ------ | Area B-Rivers Crossing |
| 4 | Combine | 92.57 | 2 | 748 | 611,245 | 2, 3 | ------ | ------ | Basin B Inflow |
| 5 | Reservoir | 79.44 | 2 | 760 | 611,113 | 4 | 15.80 | 122,363 | Basin B-Asbuilt |
| 7 | SCS Runoff | 23.91 | 2 | 740 | 128,234 | ------ | ------ | ------ | Area C-Pre-Developed |
| 8 | Combine | 95.99 | 2 | 758 | 739,348 | 5, 7 | ------ | ------ | Area C+Basin B out |
| 10 | SCS Runoff | 74.13 | 2 | 748 | 458,007 | ------ | ------ | ------ | Area B-Rivers Crossing-Revised |
| 11 | Combine | 91.63 | 2 | 748 | 605,487 | 2, 10 | ------ | ------ | rev Basin B inflow |
| 12 | Reservoir | 78.15 | 2 | 760 | 605,357 | 11 | 15.78 | 122,059 | Basin B-revised Area |
| 14 | SCS Runoff | 27.60 | 2 | 740 | 143,739 | ------ | ------ | ------ | PROP AREA TO BASIN C |
| 16 | SCS Runoff | 9.113 | 2 | 720 | 24,722 | ------ | ------ | ------ | Area to Basin D |
| 17 | Reservoir(i) | 2.807 | 2 | 736 | 24,742 | 16 | 16.44 | 13,056 | Infil D w/forebay |
| 18 | Diversion1 | 0.566 | 2 | 736 | 16,024 | 17 | ------ | ------ | Infiltration |
| 19 | Diversion2 | 2.241 | 2 | 736 | 8,719 | 17 | ------ | ------ | Out |
| 21 | Combine | 29.66 | 2 | 738 | 152,457 | 14, 19, | ------ | ------ | Total to Basin C |
| 22 | Reservoir | 17.56 | 2 | 762 | 152,220 | 21 | 15.00 | 47,606 | Basin C |
| 23 | Combine | 95.62 | 2 | 760 | 757,580 | 12, 22 | ------ | ------ | Basin C+rev Basin B |


Other Urban 1
Other Urban 3
Other Urban 2
Junction 6
Junction 3
NORTH
DS Biofilters # 2
DS Wet Pond # 2
SE
Junction 4
DS Biofilters # 1
S.E.
Junction 1
BIO - FILTRATION
DS Wet Pond # 1
Junction 2
Outfall

SLAMM for Windows Version 10.0.1


Data file name: P:\16146\Cad\Civil\Comps\16146 Clearwater Pond.mdb
Data file description: Clearwater Apartments-Waukesha

Rain file name: C:\WinSLAMM Files\Rain Files\WI Milwaukee 69.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\v10 WI_SL06 Dec06.rsv
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO02.ppdx
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 07-30-2014 Time of run: 11:39:02
Total Area Modeled (acres): 15.850
Years in Model Run: 0.99

| | Runoff Volume (cu ft) | Percent Runoff Volume Reduction | Particulate Solids Conc. (mg/L) | Particulate Solids Yield (lbs) | Percent Particulate Solids Reduction |
|---|---|---|---|---|---|
| Total of all Land Uses without Controls: | 328600 | - | 118.5 | 2430 | - |
| Outfall Total with Controls: | 157813 | 51.97% | 20.98 | 206.7 | 91.49% |
| Annualized Total After Outfall Controls: | 160005 | | | 209.6 | |

Data file name:  P:\16146\Cad\Civil\Comps\16146 Clearwater Pond.mdb
WinSLAMM Version 10.0.1
Rain file name:  C:\WinSLAMM Files\Rain Files\WI Milwaukee 69.RAN
Particulate Solids Concentration file name:  C:\WinSLAMM Files\WI_AVG01.pscx
Runoff Coefficient file name:  C:\WinSLAMM Files\v10 WI_SL06 Dec06.rsv
Residential Street Delivery file name:  C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name:  C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name:  C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance:  False
Pollutant Relative Concentration file name:  C:\WinSLAMM Files\WI_GEO02.ppdx
Cost Data file name:
Seed for random number generator:  -42
Study period starting date:  01/05/69  Study period ending date:  12/31/69
Start of Winter Season:  12/06  End of Winter Season:  03/28
Date:  07-30-2014  Time:  11:39:17
Site information:
Clearwater Apartments-Waukesha

LU# 1 - Other Urban:  Other Urban 1  Total area (ac):  7.700
  1 - Roofs 1:  0.540 ac.  Pitched  Connected
  13 - Paved Parking 1:  0.760 ac.  Connected
  45 - Large Landscaped Areas 1:  6.000 ac.  Silty
  51 - Small Landscaped Areas 1:  0.400 ac.  Silty

LU# 2 - Other Urban:  Other Urban 2  Total area (ac):  1.480
  1 - Roofs 1:  0.340 ac.  Pitched  Connected
  13 - Paved Parking 1:  0.800 ac.  Connected
  51 - Small Landscaped Areas 1:  0.340 ac.  Silty

LU# 3 - Other Urban:  Other Urban 3  Total area (ac):  6.670
  1 - Roofs 1:  0.260 ac.  Pitched  Connected
  13 - Paved Parking 1:  0.410 ac.  Connected
  45 - Large Landscaped Areas 1:  6.000 ac.  Silty

Control Practice 1:  Wet Detention Pond CP# 1 (DS) - DS Wet Pond # 1
  Particle Size Distribution file name:  C:\WinSLAMM Files\NURP.CPZ
  Initial stage elevation (ft):  5.3
  Peak to Average Flow Ratio:  3.8
  Maximum flow allowed into pond (cfs):  No maximum value entered
  Outlet Characteristics:
    Outlet type:  Orifice 1
      1.  Orifice diameter (ft):  0.42
      2.  Number of orifices:  1
      3.  Invert elevation above datum (ft):  5.3
    Outlet type:  Broad Crested Weir
      1.  Weir crest length (ft):  15
      2.  Weir crest width (ft):  4
      3.  Height of weir opening (cfs):  1
      4.  Height from datum to bottom of weir opening:  8.3
    Outlet type:  Vertical Stand Pipe
      1.  Stand pipe diameter (ft):  4
      2.  Stand pipe height above datum (ft):  7.3
  Pond stage and surface area

| Entry Number | Stage (ft) | Pond Area (acres) | Natural Seepage (in/hr) | Other Outflow (cfs) |
|---|---|---|---|---|
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 |
| 1 | 0.10 | 0.1190 | 0.00 | 0.00 |
| 2 | 1.00 | 0.1330 | 0.00 | 0.00 |
| 3 | 2.00 | 0.1480 | 0.00 | 0.00 |
| 4 | 3.00 | 0.1630 | 0.00 | 0.00 |
| 5 | 4.00 | 0.1790 | 0.00 | 0.00 |
| 6 | 5.00 | 0.2600 | 0.00 | 0.00 |
| 7 | 6.00 | 0.2900 | 0.00 | 0.00 |
| 8 | 7.00 | 0.3220 | 0.00 | 0.00 |
| 9 | 8.00 | 0.3550 | 0.00 | 0.00 |

| | | | | |
|---|---|---|---|---|
| 10 | 8.30 | 0.3600 | 0.00 | 0.00 |

Control Practice 2: Wet Detention Pond CP# 2 (DS) - DS Wet Pond # 2
Particle Size Distribution file name: C:\WinSLAMM Files\NURP.CPZ
Initial stage elevation (ft): 5
Peak to Average Flow Ratio: 3.8
Maximum flow allowed into pond (cfs): No maximum value entered
Outlet Characteristics:
Outlet type: V - notch weir
1. Weir angle (degrees): 90
2. Weir height from invert: 0
3. Invert elevation above datum (ft): 5
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 10
2. Weir crest width (ft): 4
3. Height of weir opening (cfs): 1.5
4. Height from datum to bottom of weir opening: 6
Pond stage and surface area

| Entry Number | Stage (ft) | Pond Area (acres) | Natural Seepage (in/hr) | Other Outflow (cfs) |
|---|---|---|---|---|
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 |
| 1 | 0.10 | 0.0010 | 0.00 | 0.00 |
| 2 | 1.00 | 0.0030 | 0.00 | 0.00 |
| 3 | 2.00 | 0.0060 | 0.00 | 0.00 |
| 4 | 3.00 | 0.0100 | 0.00 | 0.00 |
| 5 | 4.00 | 0.0150 | 0.00 | 0.00 |
| 6 | 4.25 | 0.0160 | 0.00 | 0.00 |
| 7 | 5.00 | 0.0450 | 0.00 | 0.00 |
| 8 | 6.00 | 0.0600 | 0.00 | 0.00 |
| 9 | 6.50 | 0.0800 | 0.00 | 0.00 |
| 10 | 7.50 | 0.0950 | 0.00 | 0.00 |

Control Practice 3: Biofilter CP# 1 (DS) - DS Biofilters # 1
1. Top area (square feet) = 9328
2. Bottom aea (square feet) = 2401
3. Depth (ft): 3.5
4. Biofilter width (ft) - for Cost Purposes Only: 50
5. Infiltration rate (in/hr) = 8
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 0.75
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 0
10. Fraction of rock filled volume as voids = 0
11. Engineered soil infiltration rate: 0
12. Engineered soil depth (ft) = 0
13. Engineered soil void ratio = 0
14. Percent solids reduction due to flow through engineered soil = 0
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: C:\WinSLAMM Files\NURP.CPZ
18. Initial water surface elevation (ft): 0
Soil Data Soil Type Fraction in Eng. Soil
Biofilter Outlet/Discharge Characteristics:
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 10
2. Weir crest width (ft): 4
3. Height of datum to bottom of weir opening: 2.5
Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 2
2. Stand pipe height above datum (ft): 2.25
Outlet type: Surface Discharge Pipe
1. Surface discharge pipe outlet diameter (ft): 0.33
2. Pipe invert elevation above datum (ft): 1
3. Number of surface pipe outlets: 1

Control Practice 4: Biofilter CP# 2 (DS) - DS Biofilters # 2
1. Top area (square feet) = 1912
2. Bottom aea (square feet) = 614
3. Depth (ft): 2
4. Biofilter width (ft) - for Cost Purposes Only: 30

5. Infiltration rate (in/hr) = 3.6
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 1
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 0
10. Fraction of rock filled volume as voids = 0
11. Engineered soil infiltration rate: 0
12. Engineered soil depth (ft) = 0
13. Engineered soil void ratio = 0
14. Percent solids reduction due to flow through engineered soil = 0
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: C:\WinSLAMM Files\NURP.CPZ
18. Initial water surface elevation (ft): 0

Soil Data Soil Type Fraction in Eng. Soil

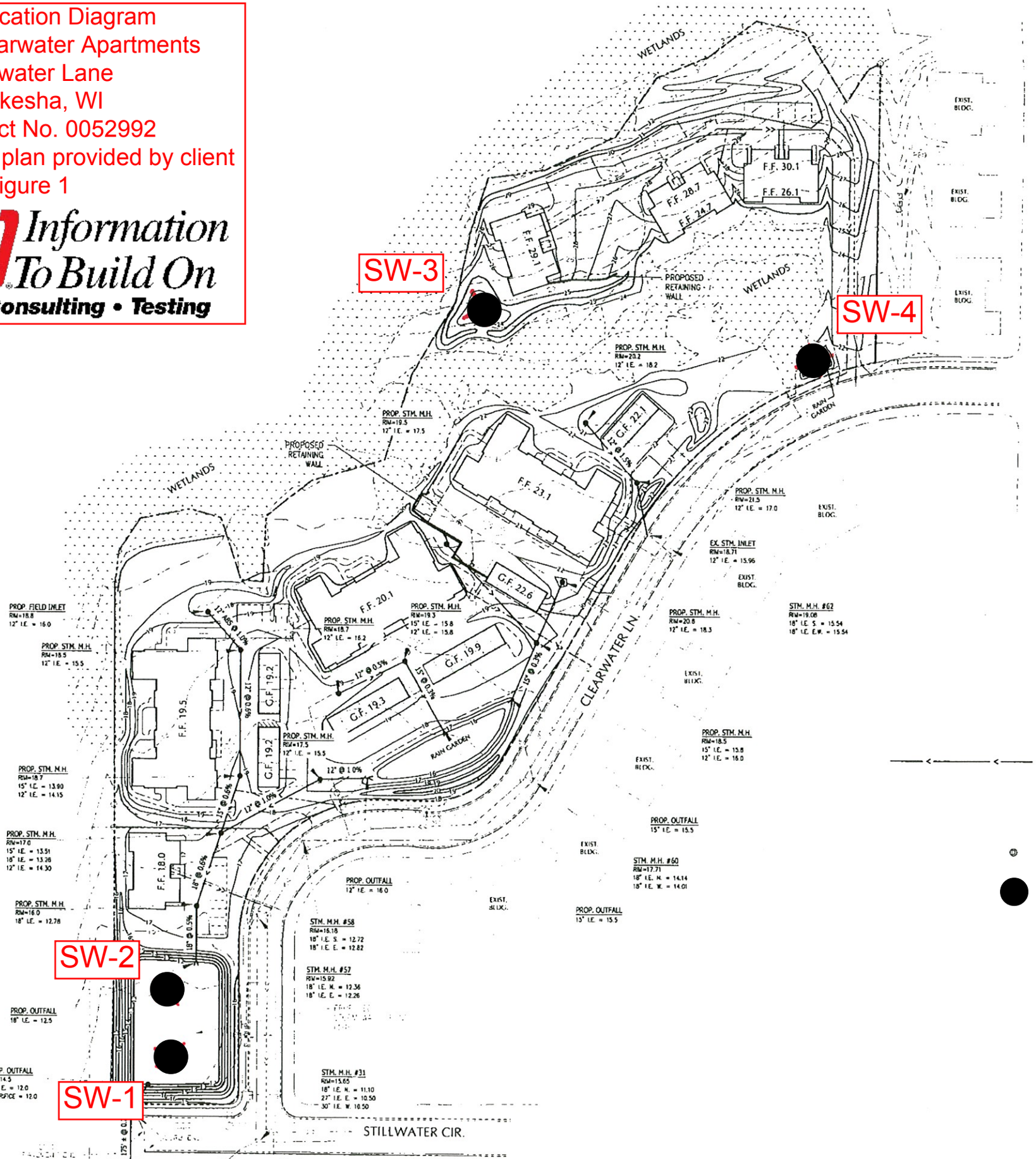
Biofilter Outlet/Discharge Characteristics:

Outlet type: Broad Crested Weir

1. Weir crest length (ft): 4
2. Weir crest width (ft): 4
3. Height of datum to bottom of weir opening: 1.5

Boring Location Diagram
Proposed Clearwater Apartments
Clearwater Lane
Waukesha, WI
PSI Project No. 0052992
*Developed from plan provided by client
Figure 1

psi Information To Build On
Engineering • Consulting • Testing




LEGEND

- PROPOSED STORM SEWER

SEE PRELIMINARY UTILITY PLAN (C-4) FOR PROPOSED SANITARY SEWER

SEE EXISTING SURVEY (C-1) FOR SOIL BORINGS

- STORM MANHOLE

**BORING LOCATION**

N

SCALE IN FEET
0 30 60

Professional Service Industries, Inc.
W237 N2878 Woodgate Road, Suite 2
Pewaukee, WI 53072
Telephone: (262) 347-0898
Fax: (262) 347-2256

# LOG OF BORING SW-1



PSI Job No.: 0052992
Project: Clearwater Apartments
Location: Clearwater Lane
Waukesha, WI

Drilling Method: Hollow Stem Auger
Sampling Method: 2-in SS
Hammer Type: Automatic
Boring Location: S end of South Basin

WATER LEVELS

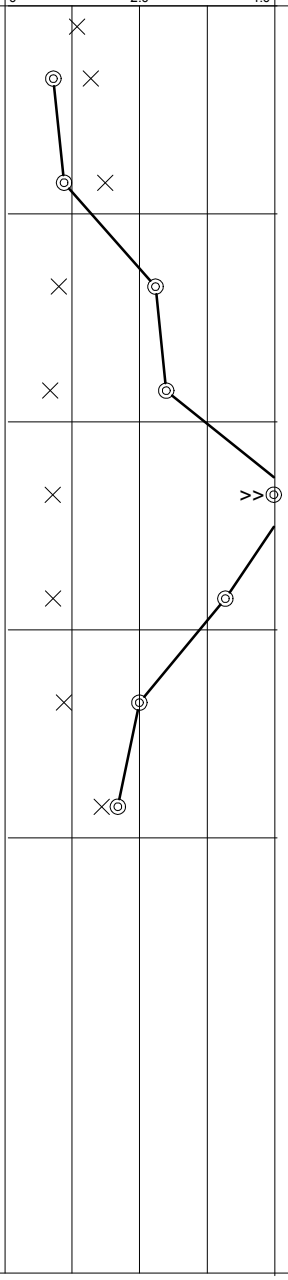
| | |
|---|---|
| While Drilling | 6 feet |
| Upon Completion | 6 feet |
| Delay | N/A |

Station: N/A
Offset: N/A

**Surface Elev.:** 13 ft

| Elevation (feet) | Depth, (feet) | Graphic Log | Sample Type | Sample No. | Recovery (inches) | MATERIAL DESCRIPTION | USCS Classification | SPT Blows per 6-inch (SS) | Moisture, % | Additional Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 0 | | | | | 10YR, 2/1, Black, LOAM, roots (2, vf), 1, abk, vf, mfi, moist (Topsoil) | Tpsl | | 13 | |
| | | | | 1 | 8 | 10YR, 4/6, Dark Yellowish Brown, LOAM, roots (1, vf), with 10YR, 3/2, Very Dark Grayish Brown, m, 1, d, spots, 0, m, mfi, moist | CL | 3-4-5 N=9 | 16 | |
| 10 | | | | 2 | 14 | 10YR, 5/4, Yellowish Brown, SILTY CLAY LOAM, with 10YR, 7/1, Gray, c, 1, d, streaks, 0, m, mvfi, moist | CL | 4-5-6 N=11 | 19 | |
| 5 | | | | | | ▼ 10YR, 6/4, Light Yellowish Brown, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, wet | | | | |
| | | | | 3 | 14 | | | 12-13-15 N=28 | 10 | |
| 5 | | | | 4 | 12 | | | 10-11-19 N=30 | 8 | |
| | 10 | | | 5 | 10 | | SP | 13-19-35 N=54 | 9 | |
| 0 | | | | 6 | 14 | | | 13-18-23 N=41 | 9 | |
| | 15 | | | 7 | 10 | | | 8-10-15 N=25 | 11 | |
| -5 | | | | 8 | 12 | 10YR, 5/3, Brown, VERY GRAVELLY SAND, 3, sg, vf, ml, wet | SP | 7-10-11 N=21 | 18 | |
| | 20 | | | | | End of Boring 20'<br><br>Caved at 6' | | | | |

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0




| | |
|---|---|
| Completion Depth: | 20.0 ft |
| Date Boring Started: | 7/9/14 |
| Date Boring Completed: | 7/9/14 |
| Logged By: | BB |
| Drilling Contractor: | PSI, Inc. |

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 42.964421°
Longitude: -88.286071°
Drill Rig: CME
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
W237 N2878 Woodgate Road, Suite 2
Pewaukee, WI 53072
Telephone: (262) 347-0898
Fax: (262) 347-2256

# LOG OF BORING SW-2



PSI Job No.: 0052992
Project: Clearwater Apartments
Location: Clearwater Lane
Waukesha, WI

Drilling Method: Hollow Stem Auger
Sampling Method: 2-in SS
Hammer Type: Automatic
Boring Location: N end of South Basin

WATER LEVELS

| | |
|---|---|
| While Drilling | 5 feet |
| Upon Completion | 4 feet |
| Delay | N/A |

Station: N/A
Offset: N/A

**Surface Elev.:** 14 ft

| Elevation (feet) | Depth, (feet) | Sample No. | Recovery (inches) | MATERIAL DESCRIPTION | USCS Classification | SPT Blows per 6-inch (SS) | Moisture, % |
|---|---|---|---|---|---|---|---|
| | 0 | | | 10YR, 3/2, Very Dark Grayish Brown, SILTY CLAY LOAM, 2, cr, vf, mvfr, moist (Topsoil) | Tpsl | | 19 |
| | | 1 | 10 | 10YR, 6/6, Brownish Yellow, GRAVELLY SAND, with silt seams, 3, sg, vf, ml, moist | SP | 4-6-6<br>N=12 | 14 |
| 10 | 5 | 2 | 14 | 10YR, 6/4, Light Yellowish Brown, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, damp to wet | SP | 12-17-24<br>N=41 | 4 |
| | | 3 | 8 | 10YR, 6/4, Light Yellowish Brown, EXTREMELY GRAVELLY COARSE SAND, 3, sg, vf, ml, wet | | 12-11-6<br>N=17 | 10 |
| 5 | 10 | 4 | 8 | | SP | 7-10-12<br>N=22 | 11 |
| | | 5 | 6 | | | 9-9-5<br>N=14 | 18 |
| 0 | 15 | 6 | 6 | 10YR, 5/3, Brown, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, wet | SP | 4-4-7<br>N=11 | 22 |
| | | 7 | 18 | 10YR, 6/4, Light Yellowish Brown, EXTREMELY GRAVELLY SAND, with loamy sand seams, 3, sg, vf, ml, wet | SP | 6-21-22<br>N=43 | 8 |
| -5 | 20 | 8 | 16 | | | 20-38-49<br>N=87 | 9 |
| | | | | End of Boring at 20' | | | |
| | | | | Caved at 4' | | | |

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Additional Remarks

>>

Completion Depth: 20.0 ft
Date Boring Started: 7/9/14
Date Boring Completed: 7/9/14
Logged By: BB
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 42.964421°
Longitude: -88.286071°
Drill Rig: CME
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
W237 N2878 Woodgate Road, Suite 2
Pewaukee, WI 53072
Telephone: (262) 347-0898
Fax: (262) 347-2256

# LOG OF BORING SW-3



PSI Job No.: 0052992
Project: Clearwater Apartments
Location: Clearwater Lane
Waukesha, WI

Drilling Method: Hollow Stem Auger
Sampling Method: 2-in SS
Hammer Type: Automatic
Boring Location: W end of North Basin

WATER LEVELS

| | |
|---|---|
| While Drilling | 3 feet |
| Upon Completion | 4 feet |
| Delay | N/A |

Station: N/A
Offset: N/A

**Surface Elev.:** 25 ft

| Elevation (feet) | Depth, (feet) | Sample No. | Recovery (inches) | MATERIAL DESCRIPTION | USCS Classification | SPT Blows per 6-inch (SS) | Moisture, % |
|---|---|---|---|---|---|---|---|
| | 0 | | | 10YR, 2/1, Black, SILTY CLAY LOAM, roots (1, vf), 1, abk, vf, mfr, moist (Topsoil) | Tpsl | | 31 |
| | | 1 | 8 | 7.5YR, 5/6, Strong Brown, GRAVELLY SILTY CLAY LOAM, with sand seams, with 7.5YR, 6/1, Gray, m, 1, d, spots, 0, m, mfr, moist (Possible Fill) | Poss Fill | 2-3-2 N=5 | 16 |
| | | 2 | 10 | 10YR, 6/4, Light Yellowish Brown, VERY GRAVELLY SAND, 3, sg, vf, ml, wet (Possible Fill) | Poss Fill | 3-6-9 | 10 |
| 20 | 5 | | | | | | |
| | | 3 | 16 | 10YR, 5/2, Grayish Brown, SILTY CLAY LOAM/SILTY CLAY, with sand and silt seams, 0, m, mfi, moist to very moist | | 7-7-8 N=15 | 19 |
| | | 4 | 18 | | CL | 3-5-5 N=10 | 21 |
| 15 | 10 | | | | | | |
| | | 5 | 18 | | | 2-3-3 N=6 | 25 |
| | | 6 | 4 | 2.5YR, 7/4, Pale Yellow, GRAVEL, 3, sg, vc, ml, wet | GP | N=50/6" | 6 |
| 10 | 15 | | | | | | |
| | | 7 | 6 | 10YR, 6/1, Gray, VERY GRAVELLY LOAMY SAND, 0, m, mfr, wet | SM | 3-4-3 N=7 | 10 |
| | | 8 | 8 | | | 5-6-10 N=16 | 13 |
| 5 | 20 | | | End of Boring at 20' | | | |
| | | | | Caved at 5' | | | |

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Additional Remarks

>>

| | |
|---|---|
| Completion Depth: | 20.0 ft |
| Date Boring Started: | 7/9/14 |
| Date Boring Completed: | 7/9/14 |
| Logged By: | BB |
| Drilling Contractor: | PSI, Inc. |

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 42.964421°
Longitude: -88.286071°
Drill Rig: CME
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
W237 N2878 Woodgate Road, Suite 2
Pewaukee, WI 53072
Telephone: (262) 347-0898
Fax: (262) 347-2256

# LOG OF BORING SW-4



PSI Job No.: 0052992
Project: Clearwater Apartments
Location: Clearwater Lane
Waukesha, WI

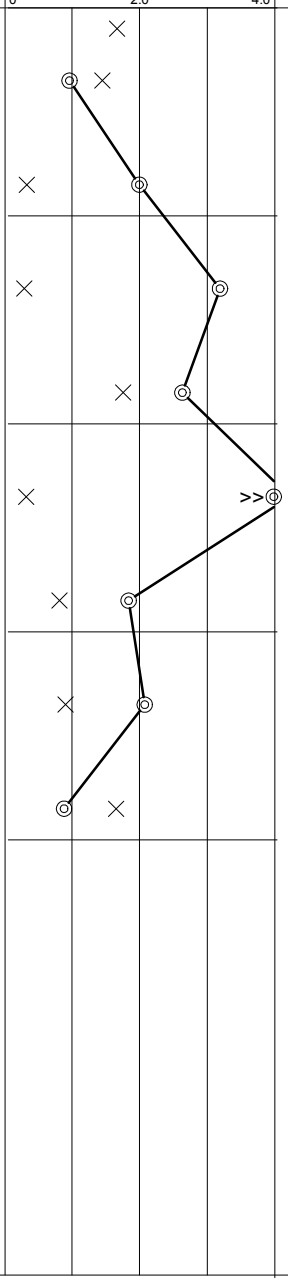
Drilling Method: Hollow Stem Auger
Sampling Method: 2-in SS
Hammer Type: Automatic
Boring Location: E end of North Basin

WATER LEVELS
While Drilling 14 feet
Upon Completion N.O.
Delay N/A

Station: N/A
Offset: N/A

**Surface Elev.:** 21 ft

| Elevation (feet) | Depth, (feet) | Sample No. | Recovery (inches) | MATERIAL DESCRIPTION | USCS Classification | SPT Blows per 6-inch (SS) | Moisture, % |
|---|---|---|---|---|---|---|---|
| 20 | 0 | | | 10YR, 2/1, Black, SILTY CLAY LOAM, roots (1, vf), 3, cr, vf, mvfr, moist (Topsoil) | Tpsl | | 21 |
| | | 1 | 8 | 10YR, 6/4, Light Yellowish Brown, SILTY CLAY LOAM, with fine sand lenses, 0, m, mvfi, moist | CL | 5-6-6 N=12 | 18 |
| | 5 | 2 | 12 | 10YR, 6/3, Pale Brown, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, damp | | 7-12-12 N=25 | 4 |
| 15 | | 3 | 14 | | SW | 19-20-20 N=40 | 4 |
| | 10 | 4 | 1 | | | 17-17-16 N=33 | 22 |
| 10 | | 5 | 10 | 10YR, 6/6, Brownish Yellow, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, moist | SW | 9-21-32 N=53 | 4 |
| | | 6 | 10 | 10YR, 6/3, Pale Brown, EXTREMELY GRAVELLY SAND, 3, sg, vf, ml, wet | | 9-11-12 N=23 | 10 |
| 5 | 15 | 7 | 10 | | SP | 12-14-12 N=26 | 11 |
| | 20 | 8 | 8 | | | 5-5-6 N=11 | 21 |
| | | | | End of Boring at 20' | | | |
| | | | | Caved at 6' | | | |




Additional Remarks

Completion Depth: 20.0 ft
Date Boring Started: 7/9/14
Date Boring Completed: 7/9/14
Logged By: BB
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 42.964421°
Longitude: -88.286071°
Drill Rig: CME
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Wisconsin Department of Commerce
Division of Safety and Buildings

# SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code



Attach complete site plan on paper not less that 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

***Please print all information.***

Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04 (1) (m)).

| County | |
|---|---|
| Waukesha | |
| Parcel I.D. | |
| Reviewed by | Date |

| Property Owner | Property Location |
|---|---|
| Red Sky Partners | Govt. Lot 1/4 1/4 S T N R E (or) W |
| Property Owner's Mailing Address | Lot # / Block # / Subd. Name or CSM# |
| N16 W23217 Stone Ridge Drive, Suite 120 | Rivers Crossing |
| City / State / Zip Code / Phone Number | ☒ City ☐ Village ☐ Town / Nearest Road |
| Waukesha / WI / 53188 / ( ) | Waukesha / Clearwater Lane |

Drainage area _____ ☐ sq. ft. ☐ acres

Optional:

Test Site Suitable for (check all that apply)

☐ Irrigation ☐ Bioretention trench ☐ Trench(es)

☐ Rain Garden ☐ Grassed swale ☐ Reuse

☐ Infiltration trench ☐ SDS (> 15' wide) ☐ Other _____

Hydraulic Application Test Method:

☒ Morphological Evaluation

☐ Double Ring Infiltrometer

☐ Other (specify) _____

1 Obs. #

☒ Boring SW-1
☐ Pit

Ground surface elev. 13 ft.

Depth to limiting factor 0 in. (saturated at 72 in.)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Roots | % Rock Frag. | Hydraulic App. Rate Inches/Hr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-11 | 10YR, 2/1 | | l | 1, vf, abk | mfi | 2, vf | <15 | 0.24 |
| 2 | 11-36 | 10YR, 4/6 | m, 1, d, 10YR, 3/2 | l | 0, m | mfi | 1, vf | <15 | 0.24 |
| 3 | 36-66 | 10YR, 5/4 | c, 1, d, 10YR, 7/1 | sicl | 0, m | mvfi | | <15 | 0.04 |
| 4 | 66-240 | 10YR, 6/4 | | s | 3, vf, sg | ml | | 60-90 | |

2 Obs. #

☒ Boring SW-2
☐ Pit

Ground surface elev. 14 ft.

Depth to limiting factor 60 in. (saturated at 60 in.)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Roots | % Rock Frag. | Hydraulic App. Rate Inches/Hr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-8 | 10YR, 3/2 | | sicl | 2, vf, cr | mvfr | 1, vf | <15 | 0.04 |
| 2 | 8-36 | 10YR, 6/6 | | s | 3, vf, sg | ml | | 15-35 | 3.6 |
| 3 | 36-66 | 10YR, 6/4 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |
| 4 | 66-156 | 10YR, 6/4 | | cs | 3, vf, sg | ml | | 60-90 | 3.6 |
| 5 | 156-186 | 10YR, 5/3 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |
| 6 | 186-240 | 10YR, 6/4 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |

| CST/PSS Name (Please Print) | Signature | CST/PSS Number |
|---|---|---|
| Patrick J. Patterson, P.G., C.S.T. | | 41631 |
| Address | Date Evaluation Conducted | Telephone Number |
| 821 Corporate Court, Waukesha, WI 53188 | 7/28/2014 | 262-521-2125 |

3 Obs. #

☒ Boring SW-3
☐ Pit Ground surface elev. 25 ft. Depth to limiting factor 0 in. (saturated at 36 in.)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Roots | % Rock Frag. | Hydraulic App. Rate Inches/Hr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-9 | 10YR, 2/1 | | sicl | 1, vf, abk | mfr | 1, vf | <15 | 0.04 |
| 2 | 9-36 | 7.5YR, 5/6 | m, 1, d, 7.5YR, 6/1 | sicl[1] | 0, m | mfr | | 15-35 | 0.04 |
| 3 | 36-66 | 10YR, 6/4 | | s[1] | 3, vf, sg | ml | | 35-60 | 3.6 |
| 4 | 66-156 | 10YR, 5/2 | | sicl | 0, m | mfi | | <15 | 0.04 |
| 5 | 156-186 | 2.5YR, 7/4 | | g | 3, vc, sg | ml | | - | 3.6 |
| 6 | 186-240 | 10YR, 6/1 | | ls | 0, m | mfr | | 35-60 | 1.63 |

4 Obs. #

☒ Boring SW-4
☐ Pit Ground surface elev. 21 ft. Depth to limiting factor 168 in. (saturated at 168 in.)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Roots | % Rock Frag. | Hydraulic App. Rate Inches/Hr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-12 | 10YR, 2/1 | | sicl | 3, vf, cr | mvfr | 1, vf | <15 | 0.04 |
| 2 | 12-36 | 10YR, 6/4 | | sicl | 0, m | mvfi | | <15 | 0.04 |
| 3 | 36-126 | 10YR, 6/3 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |
| 4 | 126-156 | 10YR, 6/6 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |
| 5 | 156-24 | 10YR, 6/3 | | s | 3, vf, sg | ml | | 60-90 | 3.6 |

[1] The soils at SW-3 to a depth of 66 in. were classified as Possible Fill.

**CLEARWATER APARTMENTS STORM SEWER SIZING CALCULATIONS PROJECT**
NO. 16146

July 30, 2014

| INCR. AREA (acres) | STRUCTURES from | STRUCTURES to | CUMM. AREA (acres) | INCR. C | AVG. "C" | CA | I (in/hr) | **Q-DESIGN (cfs)** | L (ft) | S (FT/FT) | n | DIA (in) | **Q-CAP (cfs)** | *VEL. (FPS)* | Tt (min) | Tc (min) | UPPER RIM (RIM-F/L) | UPPER ELEV | LOWER ELEV | RIM TO TOP OF PIPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **To Clearwater Lane** | | | | | | | | | | | | | | | | | | | | |
| 0.91 | 1 | 2 | 0.91 | 0.35 | 0.35 | 0.32 | 2.97 | **0.95** | 102.0 | 0.00490 | 0.013 | 12 | **2.5** | *3.2* | | 30.6 | 20.50 | 17.25 | 16.75 | 2.25 |
| 1.05 | 2 | 3 | 1.96 | 0.27 | 0.27 | 0.53 | 2.97 | **1.79** | 150.7 | 0.00450 | 0.013 | 12 | **2.4** | *3.0* | | 30.7 | 19.90 | 16.75 | 16.07 | 2.15 |
| | 3 | Ex. Inlet | 1.96 | 0.30 | 0.30 | 0.59 | 2.96 | **1.79** | 25.5 | 0.00450 | 0.013 | 12 | **2.4** | *3.0* | | 30.8 | 20.50 | 16.07 | 15.96 | 3.43 |
| **To Rain Garden** | | | | | | | | | | | | | | | | | | | | |
| 0.13 | 4 | 6 | 0.13 | 0.60 | 0.60 | 0.08 | 5.23 | **0.41** | 141.2 | 0.00450 | 0.013 | 12 | **2.4** | *3.0* | | 10.0 | 19.50 | 16.43 | 15.79 | 2.07 |
| 0.24 | 5 | 6 | 0.37 | 0.60 | 0.60 | 0.22 | 6.14 | **1.38** | 70.0 | 0.00910 | 0.013 | 12 | **3.4** | *4.3* | | 6.0 | 20.80 | 16.43 | 15.79 | 3.37 |
| 0.26 | 6 | 7 | 0.64 | 0.60 | 0.60 | 0.38 | 6.11 | **2.33** | 73.5 | 0.00450 | 0.013 | 12 | **2.4** | *3.0* | | 6.1 | 18.50 | 15.79 | 15.46 | 1.71 |
| **To Rain Garden** | | | | | | | | | | | | | | | | | | | | |
| 0.15 | 8 | 9 | 0.15 | 0.60 | 0.60 | 0.09 | 6.14 | **0.53** | 79.0 | 0.00460 | 0.013 | 12 | **2.4** | *3.1* | | 6.0 | 18.70 | 15.70 | 15.34 | 2.00 |
| 0.12 | 9 | 10 | 0.27 | 0.60 | 0.60 | 0.16 | 6.14 | **0.99** | 77.0 | 0.00385 | 0.013 | 12 | **2.2** | *2.8* | | 6.0 | 19.30 | 15.34 | 15.04 | 2.96 |
| 0.33 | 10 | Rain G | 0.59 | 0.60 | 0.60 | 0.36 | 6.14 | **2.18** | 11.6 | 0.00450 | 0.013 | 12 | **2.4** | *3.0* | | 6.0 | 17.40 | 15.04 | 14.99 | 1.36 |
| **To Pond** | | | | | | | | | | | | | | | | | | | | |
| | 11 | 12 | 0.00 | 0.60 | 0.60 | 0.00 | 6.14 | **0.38** | 32.9 | 0.00550 | 0.013 | 12 | **2.6** | *3.4* | | 6.0 | 17.00 | 14.65 | 14.47 | 1.35 |
| 0.33 | 12 | 15 | 0.33 | 0.60 | 0.60 | 0.20 | 6.14 | **1.58** | 98.0 | 0.00590 | 0.013 | 12 | **2.7** | *3.5* | | 6.0 | 17.60 | 14.47 | 13.89 | 2.13 |
| 12.40 | 13 | 14 | 12.40 | 0.20 | 0.20 | 2.48 | 2.57 | **6.37** | 53.2 | 0.00500 | 0.013 | 18 | **7.4** | *4.2* | | 38.1 | 17.80 | 14.80 | 14.53 | 1.50 |
| 0.23 | 14 | 15 | 12.63 | 0.60 | 0.60 | 7.58 | 2.56 | **6.72** | 183.0 | 0.00625 | 0.013 | 18 | **8.3** | *4.7* | | 38.2 | 18.35 | 14.53 | 13.39 | 2.32 |
| 0.23 | 15 | 16 | 13.19 | 0.60 | 0.60 | 7.91 | 2.56 | **8.65** | 123.6 | 0.00800 | 0.013 | 18 | **9.4** | *5.3* | | 38.3 | 17.50 | 13.39 | 12.40 | 2.61 |
| 0.15 | 16 | Pond | 13.34 | 0.60 | 0.60 | 8.00 | 2.55 | **8.88** | 28.4 | 0.00850 | 0.013 | 18 | **9.7** | *5.5* | | 38.4 | 17.00 | 12.40 | 12.16 | 3.10 |

**Note: Q-Design from Structure 11 to Structure 12 is the 10-year flow from Basin D (taken from HydraFlow modeling).**

# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

~~Hyd. No. 1~~

Tc to F1#1

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 265.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.70 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 4.50 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 24.49** | **+** | **0.00** | **+** | **0.00** | **=** | **24.49** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 485.00 | | 310.00 | | 0.00 | | |
| Watercourse slope (%) | = 4.10 | | 0.50 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =3.27 | | 1.44 | | 0.00 | | |
| **Travel Time (min)** | **= 2.47** | **+** | **3.59** | **+** | **0.00** | **=** | **6.07** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 30.56 min**

# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

~~Hyd. No. 25~~

Tc to Fl # 13

| Description | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 300.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.70 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 3.30 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 30.62** | **+** | **0.00** | **+** | **0.00** | **=** | **30.62** |
| **Shallow Concentrated Flow** | | | | | | | |
| Flow length (ft) | = 1200.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = 2.75 | | 0.00 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =2.68 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **= 7.47** | **+** | **0.00** | **+** | **0.00** | **=** | **7.47** |
| **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 | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | | | | | |
| | | | 0.00 | | | | |
| | | | | | 0.00 | | |
| Flow length (ft) | ({0})0.0 | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **= 0.00** | **+** | **0.00** | **+** | **0.00** | **=** | **0.00** |

**Total Travel Time, Tc ..... 38.10 min**

Document Number

# Storm Water Management Practice Maintenance Agreement

Clearwater Apartments, LLC, as "Owner" of the property described below, in accordance with Chapter 32 City of Waukesha Storm Water Management and Erosion Control, agrees to install and maintain storm water management practice(s) on the subject property in accordance with approved plans and Storm Water Management Plan conditions. The owner further agrees to the terms stated in this document to ensure that the storm water management practice(s) continues serving the intended functions in perpetuity. This Agreement includes the following exhibits:

**Exhibit A:** Legal Description of the real estate for which this Agreement applies ("Property").
**Exhibit B:** Location Map(s) – shows an accurate location of each storm water management practice affected by this Agreement.
**Exhibit C:** Maintenance Plan – prescribes those activities that must be carried out to maintain compliance with this Agreement.

Note: After construction verification has been accepted by the City of Waukesha, for all planned storm water management practices, an addendum(s) to this agreement shall be recorded by the Owner showing design and construction details. The addendum(s) may contain several additional exhibits, including certification by City of Waukesha of Storm Water and Erosion Control Permit termination, as described below.

Name and Return Address

City of Waukesha
130 Delafield Street
Waukesha, WI 53188

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions and restrictions:

1. The Owner shall be responsible for the routine and extraordinary maintenance and repair of the storm water management practice(s) and drainage easements identified in Exhibit B until Storm Water and Erosion Control Permit termination by the City of Waukesha in accordance with Chapter 32 of the County Code of Ordinances.
2. After Storm Water and Erosion Control Permit termination under 1., the current Owner(s) shall be solely responsible for maintenance and repair of the storm water management practices and drainage easements in accordance with the maintenance plan contained in Exhibit C.
3. Upon written notification by City of Waukesha or their designee, the Owner(s) shall, at their own cost and within a reasonable time period determined by the City of Waukesha, have an inspection of the storm water management practice conducted by a qualified professional, file a report with the City of Waukesha and complete any maintenance or repair work recommended in the report. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs.
4. In addition, and independent of the requirements under paragraph 3 above, the City of Waukesha, or its designee, is authorized to access the property as necessary to conduct inspections of the storm water management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in Exhibit C. The City of Waukesha may require work to be done which differs from the report described in paragraph 3 above, if the City of Waukesha reasonably concludes that such work is necessary and consistent with the intent of this agreement. Upon notification by the City of Waukesha of required maintenance or repairs, the Owner(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the City of Waukesha.
5. If the Owner(s) do not complete an inspection under 3. above or required maintenance or repairs under 4. above within the specified time period, the City of Waukesha is authorized, but not required, to perform the specified inspections, maintenance or repairs. In the case of an emergency situation, as determined by the City of Waukesha, no notice shall be required prior to the City of Waukesha performing emergency maintenance or repairs. The City of Waukesha may levy the costs and expenses of such inspections, maintenance or repair related actions as a special charge against the Property and collected as such in accordance with the procedures under s. 66.0627 Wis. Stats. or subch. VII of ch. 66 Wis. Stats.

6. This Agreement shall run with the Property and be binding upon all heirs, successors and assigns. After the Owner records the addendum noted above, the City of Waukesha shall have the sole authority to modify this agreement upon a 30-day notice to the current Owner(s).

Dated this ___ day of _____, 201_.

**Owner:**

_____
(Owners Signature)

_____
(Owners Typed Name)

## Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 201_, the above named ___[Owners name]_____ to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

**This document was drafted by:**

_____

_____

**[Name and address of drafter]**

*For Certification Stamp*

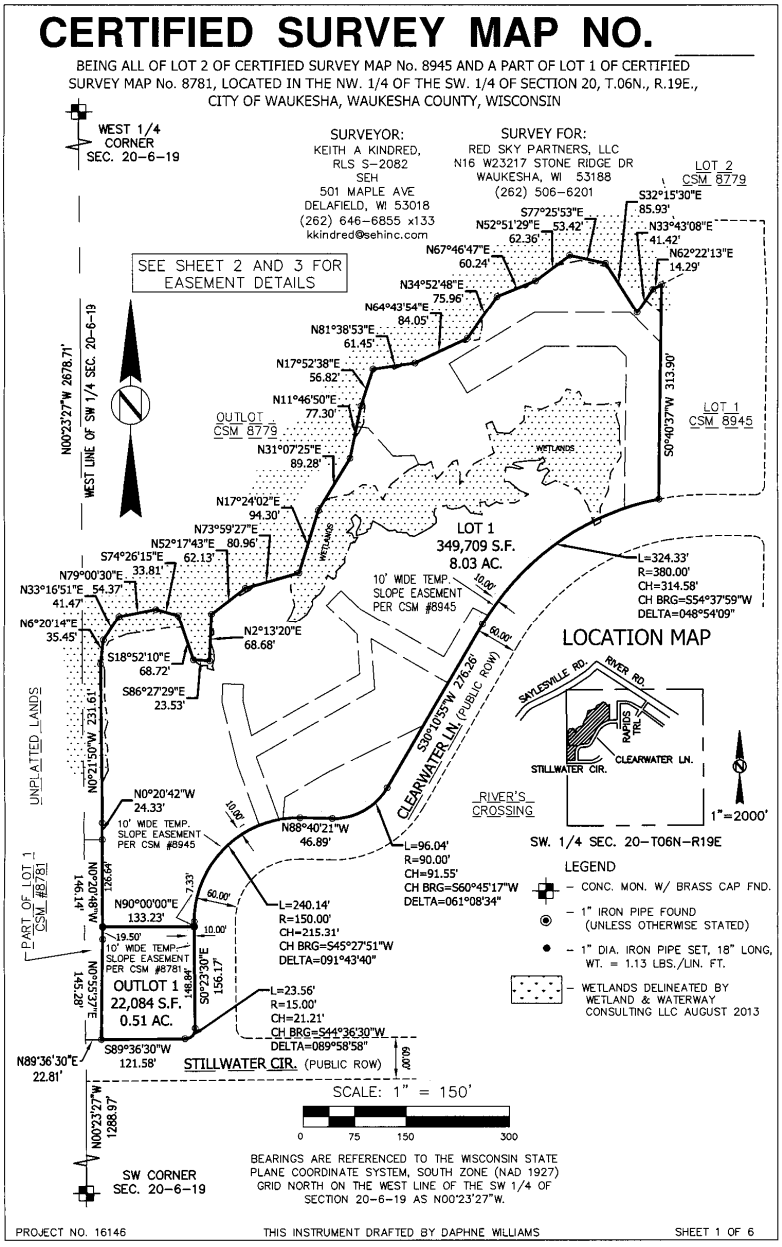
()

# Exhibit A – Legal Description

The following description and reduced copy map identifies the land parcel(s) affected by this Agreement. For a larger scale view of the referenced document, contact the Waukesha County Register of Deeds office.

Project Identifier: **Clearwater Apartments** Acres**: 8.03**
Date of Recording: **(to be recorded)**
Map Produced By: **SEH Yaggy, 501 Maple Ave, Delafield, WI**
Legal Description: **Lot 1, and Outlot 1 of CSM No._____, located in the Northwest 1/4 if the Southwest Quarter (SW ¼) of Section 20, Township 6N, Range 19E (City of Waukesha) Waukesha County, Wisconsin.**

Clearwater Apartments



()

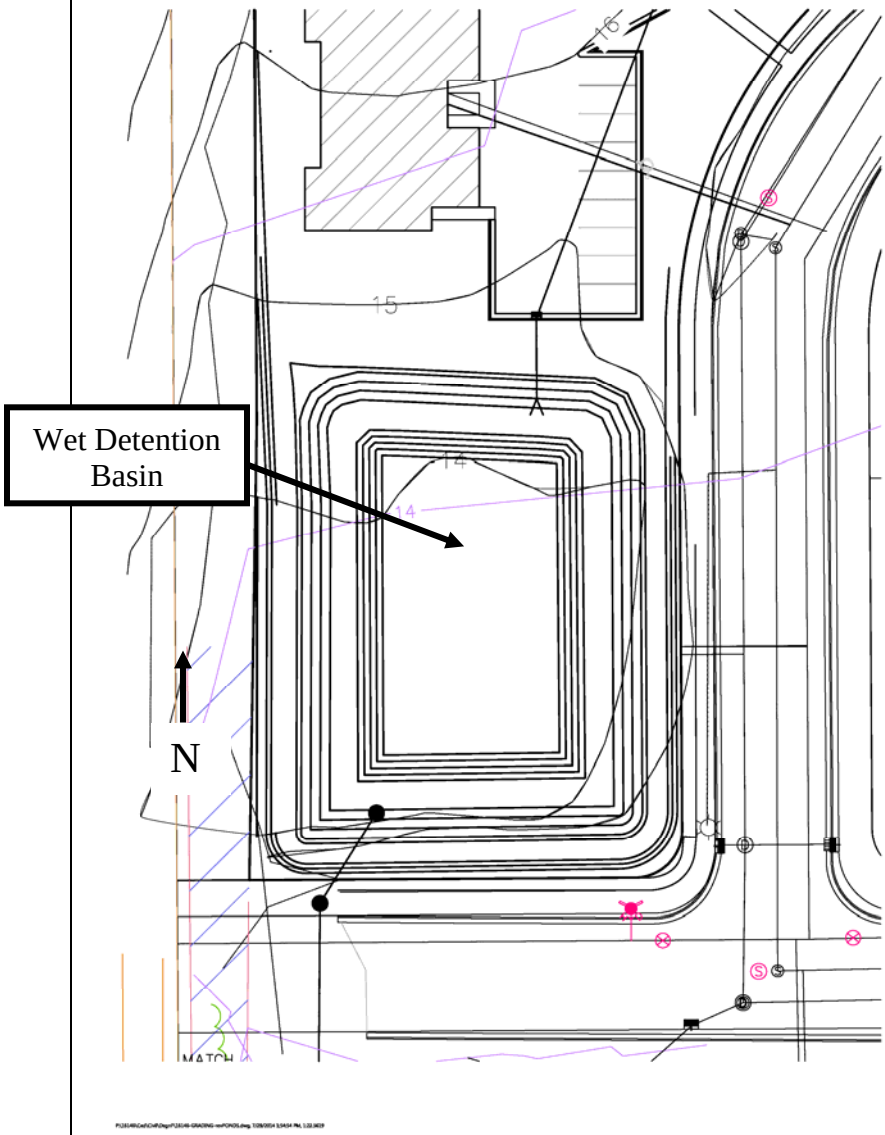
# Exhibit B - Location Map

## Storm Water Management Practices Covered by this Agreement

The storm water management practices covered by this Agreement are depicted in the reduced copy of a portion of the construction plans, as shown below. The practices include one wet detention basin, two forebays, two grass swales (conveying storm water to the forebays) and all associated pipes, earthen berms, rock chutes and other components of these practices. All of the noted storm water management practices are located within drainage easements on the CSM, as noted in Exhibit A.

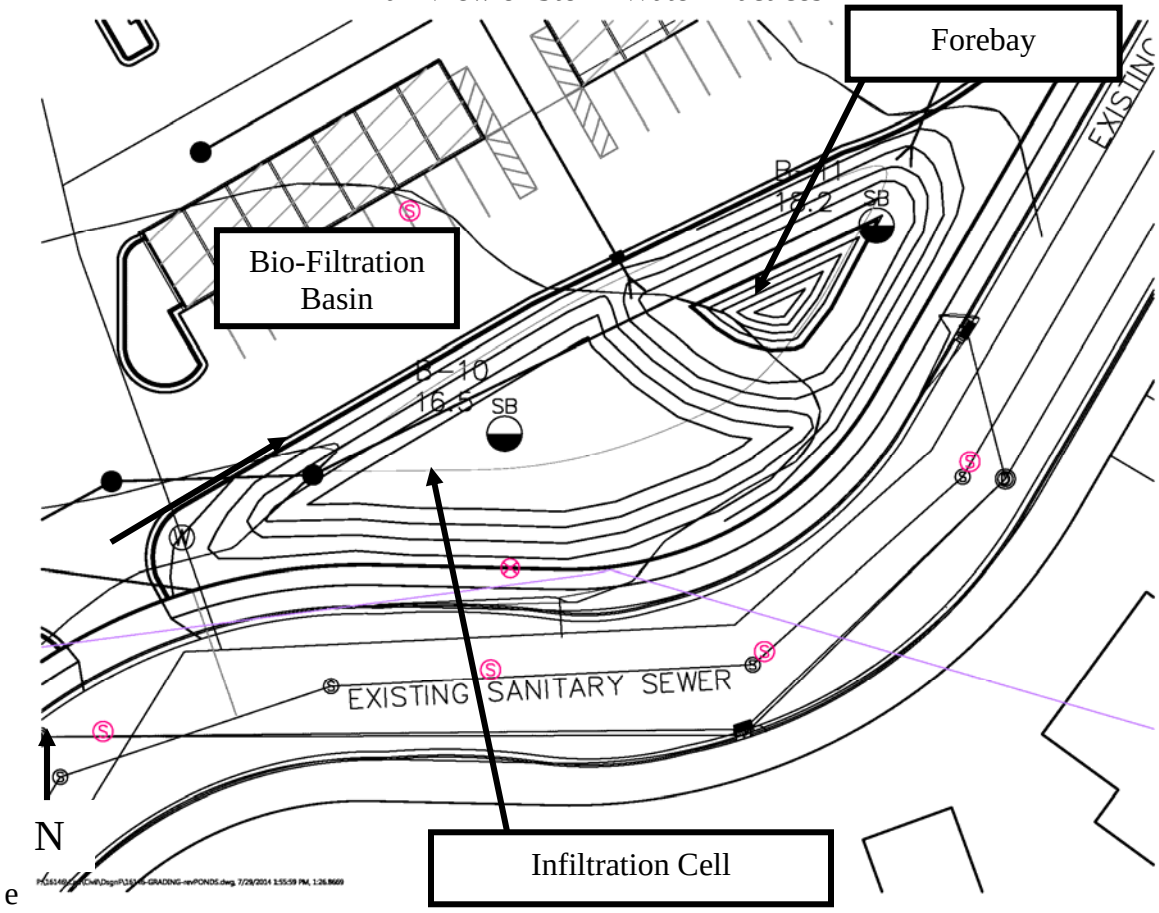
Subdivision Name**:** **Clearwater Apartments**
Storm water Practices**:** **Wet Detention Basin**
Location of Practices**:** **All of Outlot 1 of CSM No._____**
Owners of Outlot 1: **Owners of Lot 1**

**Figure 1**
Plan View of Storm Water Practices



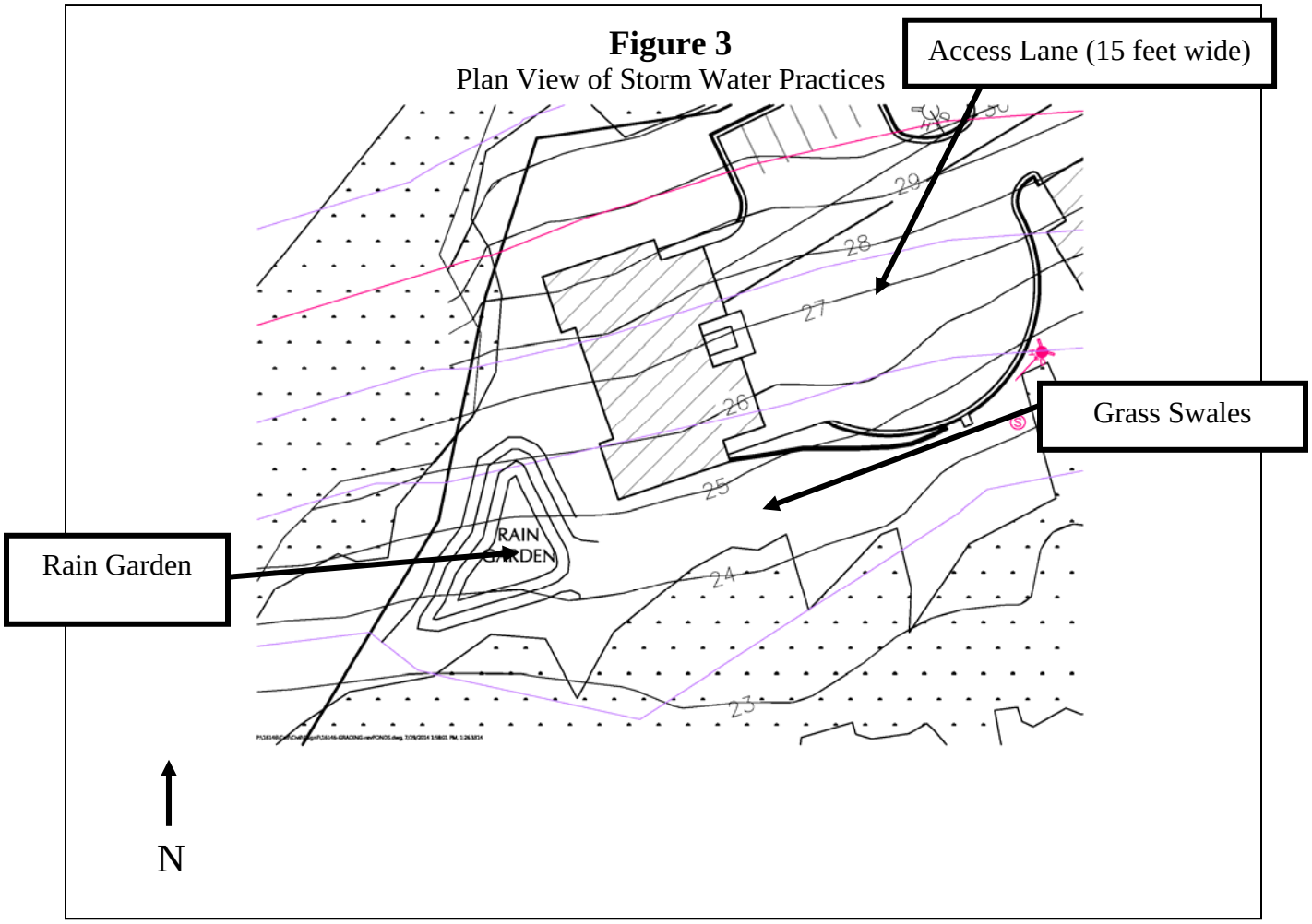
Subdivision Name: **Clearwater Apartments**
Storm water Practices: **Bio-Filtration Basin**
Location of Practices: **Drainage Easement on Lot 1 of CSM No._____**
Owners of Outlot 1: **Owners of Lot 1**

**Figure 2**
Plan View of Storm Water Practices



Subdivision Name: **Clearwater Apartments**
Storm water Practices: **Rain Garden**
Location of Practices: **Drainage Easement on Lot 1 of CSM No._____**
Owners of Outlot 1: **Owners of Lot 1**

**Figure 3**
Plan View of Storm Water Practices



# Exhibit C
# Storm Water Practice Maintenance Plan

This exhibit explains the basic function of each of the storm water practices listed in Exhibit B and prescribes the minimum maintenance requirements to remain compliant with this Agreement. The maintenance activities listed below are aimed to ensure these practices continue serving their intended functions in perpetuity. The list of activities is not all inclusive, but rather indicates the minimum type of maintenance that can be expected for this particular site. Access to the stormwater practices for maintenance vehicles is shown in Exhibit B. Any failure of a storm water practice that is caused by a lack of maintenance will subject the Owner(s) to enforcement of the provisions listed on page 1 of this Agreement by the City of Waukesha.

***System Description***:
There are three BMP's designed to control and treat the storm water from Clearwater Apartments, which include a Wet Detention Basin, Bio-Filtration Basin, and a Rain Garden. The wet detention basin is designed to trap 80% of sediment in runoff and maintain pre-development downstream peak flows. The main pool will trap all of the suspended sediment. To do this, the pond size, water level and outlet structures must be maintained as specified in this Agreement (see Figures 1, 2 and 3).

The wet basin receives direct runoff from a 7.7 acre drainage area, including off-site drainage coming from the north. During high rainfall or snow melt events, the water level will temporarily rise and slowly drain down to the elevation of the control structure. The water level is controlled by a 4-inch orifice, in a concrete riser pipe, through the berm in the southwest corner of the basin (see Figure1). This orifice controls the water level and causes the pond to temporarily rise during runoff events. High flows may enter the grated concrete riser or flow over the rock lined emergency spillway. "As-built" construction drawings of the basin, showing actual dimensions, elevations, outlet structures, etc. will be recorded as an addendum(s) to this agreement within 60 days after City of Waukesha accepts verification of construction from the project engineer.

***Minimum Maintenance Requirements***:
To ensure the proper long-term function of the storm water management practices described above, the following activities must be completed:

1. All outlet pipes must be checked monthly to ensure there is no blockage from floating debris or ice, especially the washed stone in front of the 3-inch orifice and the trash rack on the riser in the main basin. Any blockage must be removed immediately. The washed stone must be replaced when it becomes clogged.
2. Grass swales shall be preserved to allow free flowing of surface runoff in accordance with approved grading plans. No buildings or other structures are allowed in these areas. No grading or filling is allowed that may interrupt flows in any way.
3. Grass swales, inlets and outlets must be checked after heavy rains (minimum of annually) for signs of erosion. Any eroding areas must be repaired immediately to prevent premature sediment build-up in the downstream forebays or basin. Erosion matting is recommended for repairing grassed areas.
4. NO trees are to be planted or allowed to grow on the earthen berms. Tree root systems can reduce soil compaction and cause berm failure. The berms must be inspected annually and any woody vegetation removed.
5. Invasive plant and animal species shall be managed in compliance with Wisconsin Administrative Code Chapter NR 40. This may require eradication of invasive species in some cases.
6. If the permanent pool falls below the safety shelf, a review shall be performed to determine whether the cause is liner leakage or an insufficient water budget. If the cause is leakage, the liner shall be repaired. Leakage due to muskrat burrows may require removal of the animals. If the permanent pool cannot be sustained at the design elevation, benching of the safety shelf may be necessary.
7. If floating algae or weed growth becomes a nuisance (decay odors, etc.), it must be removed from the basin or the forebay and deposited where it cannot drain back into the basin. Removal of the vegetation from the water reduces regrowth the following season (by harvesting the nutrients). Wetland vegetation must be maintained along the waters edge for safety and pollutant removal purposes.
8. When sediment in the forebays or the basin has accumulated to an elevation of three feet below the outlet elevation, it must be removed (see Exhibit D). All removed sediment must be placed in an appropriate upland disposal site and stabilized (grass cover) to prevent sediment from washing back into the basin. The

forebays will likely need sediment removal first. Failure to remove sediment from the forebays will cause resuspension of previously trapped sediments and increase downstream deposition.

9. No grading or filling of the basin or berm other than for sediment removal is allowed, unless otherwise approved by the City of Waukesha.
10. Periodic mowing of the grass swales will encourage vigorous grass cover and allow better inspections for erosion. Waiting until after August 1 will avoid disturbing nesting wildlife. Mowing around the basin or the forebays may attract nuisance populations of geese to the property and is not necessary or recommended.
11. Any other repair or maintenance needed to ensure the continued function of the storm water practices or as ordered by the City of Waukesha under the provisions listed on page 1 of this Agreement.
12. The titleholder(s) or their designee must document all inspections as specified above. Documentation shall include as a minimum: (a) Inspectors Name, Address and Telephone Number, (b) Date of Inspections, (c) Condition Report of the Storm Water Management Practice, (d) Corrective Actions to be Taken and Time Frame for Completion, (e) Follow-up Documentation after Completion of the Maintenance Activities. All documentation is to be delivered to the City of Waukesha Engineering Department.

# Maintenance Provisions for Infiltration Basin

***System Description***:
The Bio-Infiltration basin and Rain Garden are designed to reduce runoff volumes from the site after development by intercepting the runoff and allowing it to slowly seep (infiltrate) into the underlying soil and groundwater. They are designed to infiltrate the first 1/2" to 1" of runoff in an attempt to meet average annual predevelopment runoff volumes.

Infiltration basins can also be designed to reduce peak flows by temporarily detaining runoff from larger storms and releasing it through outlet pipes or other controlled discharge devices. Pretreatment of the runoff is often provided to reduce sedimentation in the basin and prevent the risk of groundwater pollution, depending on the land use of the drainage area served by the basin. For this example, it is assumed that the infiltration basin is seeded with native warm season (prairie) grasses, has a pretreatment forebay, a stone trench in its center, one monitoring well located nearby, and has peak flow control incorporated into the design.

***Minimum Maintenance Requirements***:
To ensure the proper function of storm water infiltration basin, the following list of maintenance activities are recommended:

1. A minimum of 70% soil cover made up of native grasses must be maintained on the basin bottom to ensure infiltration rates. Periodic burning or mowing is recommended to enhance establishment of the prairie grasses (which may take 2-3 years) and maintain the minimum native cover. To reduce competition from cool season grasses (bluegrass, fescues, quack, etc.) and other weeds:
    - For the first year, cut to a 6" height three times – once each in June, July and early August. To prevent damage to the native grasses, do not mow below a 6" height. Remove excessive accumulation of clippings to avoid smothering next year's seedlings.
    - After the first year, mowing may only be needed in early June each year to help control the spread of cool season plants. The mowing should also be raised to 10-12" to avoid damage to the warm season plants.
    - Burning may also be used to manage weeds in 2-5 years intervals. Late spring burns (mid-late May) provide maximum stimulus to warm season grasses and work well to control cool season grasses. Burn when the cool season grasses are growing and the warm season plants are just barely starting to grow to get maximum control of cool season species.
    - Any major bare areas or areas taken over by nonnative species must be reseeded. To clear area of weeds and cool season grasses, treat with an herbicide that contains glysophosphate in accordance with manufacture's instructions. Ensure a firm seedbed is prepared to a depth of 3 inches (a roller is recommended). Seeding should occur in early-mid June. Seed with Big Bluestem, Indian Grass, Little Blue Stem or Switchgrass (preferably an equal mix of all four types). A companion crop of oats is recommended. Seed must be placed at a depth of 1/4 – 1/2" and a minimum rate of 1/4 pound per 100 square feet. If broadcast seeding by hand, drag leaf rake over soil surface after seeding. Then roll it again and cover with a light layer of mulch and staked erosion control netting

to hold it in place until germination. For other planting details, see NRCS standard 342 (Critical Area Planting).

2. Invasive plant and animal species shall be managed in compliance with Wisconsin Administrative Code Chapter NR 40. This may require eradication of invasive species in some cases.
3. The basin and all components (grass swales, forebay, inlets, outlets, etc.) should be inspected after each heavy rain, but at a minimum of once per year. If the basin is not draining properly (within 72 hours), further inspection may be required by persons with expertise in storm water management and/or soils.
    - If soil testing shows that the soil surface has become crusted, sealed or compacted, some deep tillage should be performed. Deep tillage will cut through the underlying soils at a 2-3 foot depth, loosening the soil and improving infiltration rates, with minimal disturbance of the surface vegetation. Types of tillage equipment that can be used include a subsoiler or straight, narrow-shanked chisel plow.
    - If sedimentation is determined to be causing the failure, the accumulated sediment must be removed and the area reseeded in accordance with the notes above.
    - If inspection of the monitoring well shows that groundwater is regularly near the surface, additional design features may need to be considered, such as subsurface drainage or conversion to a wetland treatment system.
    - If the washed stone trench has become clogged, the stone – and possibly the soil immediately around the stone - must be replaced.
4. All outlet pipes, stone trenches and other flow control devices must be kept free of debris. Any blockage must be removed immediately.
5. Any eroding areas must be repaired immediately to prevent premature sediment build-up in the system. Erosion matting is recommended for repairing grassed areas.
6. Heavy equipment and vehicles must be kept off of the bottom and side slopes of infiltration basins to prevent soil compaction. Soil compaction will reduce infiltration rates and may cause failure of the basin, resulting in ponding and possible growth of wetland plants.
7. No trees are to be planted or allowed to grow on the earthen berms of the bottom of the basin. On the berms, tree root systems can reduce soil compaction and cause berm failure. On the basin bottom, trees may shade out the native grasses. The basin must be inspected annually and any woody vegetation removed.
8. Grass swales leading to the basin shall be preserved to allow free flowing of surface runoff in accordance with approved grading plans. No buildings or other structures are allowed in these areas. No grading or filling is allowed that may interrupt flows in any way.
9. If floating algae or weed growth becomes a nuisance in the forebay (decay odors, etc.), it must be removed and deposited where it cannot drain back into the basin or forebay. Removal of the vegetation from the water reduces regrowth the following season (by harvesting the nutrients). Wetland vegetation must be maintained along the waters edge for safety and pollutant removal purposes.
10. When sediment in the forebay has accumulated to an elevation of three feet below the outlet elevation, it must be removed (refer to figure). All removed sediment must be placed in an appropriate upland disposal site and stabilized (grass cover) to prevent sediment from washing back into the basin. Failure to remove sediment from the forebays will cause resuspension of previously trapped sediments and increase deposition in the infiltration basin.
11. No grading or filling of the basin or berms other than for sediment removal is allowed.
12. Periodic mowing of the grass swales will encourage rigorous grass cover and allow better inspections for erosion. Waiting until after August 1 will avoid disturbing nesting wildlife. Mowing around forebay may attract nuisance populations of geese to the property and is not necessary or recommended.
13. Any other repair or maintenance needed to ensure the continued function of the infiltration basin as ordered by the City of Waukesha under the provisions listed on page 1 of this Agreement.
14. The titleholder(s) or their designee must document all inspections as specified above. Documentation shall include as a minimum: (a) Inspectors Name, Address and Telephone Number, (b) Date of Inspections, (c) Condition Report of the Storm Water Management Practice, (d) Corrective Actions to be Taken and Time Frame for Completion, (e) Follow-up Documentation after Completion of the Maintenance Activities. All documentation is to be delivered to the City of Waukesha Engineering Department.

Document number

# Addendum 1
# Storm Water Management Practice Maintenance Agreement

(TO BE PROVIDED AT TIME OF COMPLETION)

The purpose of this addendum is to record verified "as-built" construction details, supporting design data and permit termination documentation for the storm water management practice(s) located on Lot 1 and Outlot 1 of the Clearwater Apartments, described as being all that part of the Southwest Quarter (SW ¼) of Section 4, Township 8N, Range 19E (Town of Lisbon) Waukesha County, Wisconsin. This document shall serve as an addendum to document # _____, herein referred to as the "Maintenance Agreement". This addendum includes all of the following exhibits:

**Exhibit D:** Design Summary – contains a summary of key engineering calculations and other data used to design the wet detention basin.
**Exhibit E:** As-built Survey – shows detailed "as-built" cross-section and plan view of the wet detention basin.
**Exhibit F**: Engineering/Construction Verification – provides verification from the project engineer that the design and construction of the wet detention basin complies with all applicable technical standards and Waukesha County ordinance requirements.
**Exhibit G:** Storm Water Management & Erosion Control Permit Termination – provides certification by the City of Waukesha that the Storm Water and Erosion Control Permit for the above noted site has been terminated.

Name and Return Address

_____
Parcel Identification Number(s) – (PIN)

Dated this ___ day of _____, 201_.

**Owner:**

_____
[Owners Signature – per the Maintenance Agreement]

_____
[Owners Typed Name]

## Acknowledgements

State of Wisconsin County of Waukesha

Personally came before me this ___ day of _____, 201_, the above named ___[Owners name]_____ to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

**This document was drafted by:**

_____

_____
[Name and address of drafter]

*For Certification Stamp*

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# Exhibit D
# Design Summaries for Wet Detention Basin #1

**Project Identifier:** Clearwater Apartments **Project Size:** 8 Acres **No. of Lots:** 2
**Number of Runoff Discharge Points**: 1 **Watershed (ultimate discharge)**: Fox River
**Watershed Area** (including off-site runoff traveling through project area): 14.4 acres

**Watershed Data Summary**. The following table summarizes the watershed data used to determine peak flows and runoff volumes required to design wet detention basin #1.

| **Summary Data Elements** | **Subwatershed C** | |
|---|---|---|
| | **Pre-develop** | **Post-develop** |
| **Watershed Areas *(in acres) (see attached map)*** | 13.8 acres | 41 acres |
| **Average Watershed Slopes (%)** | 2-8% | 2-8% |
| **Land Uses *(% of each) (see attached map)*** | 75 ac. cropland<br>15 ac. brush<br>10 ac. woodland | 110 ac. ½ ac. lots<br>5ac. brush<br>5 ac. woodlands |
| **Runoff Curve Numbers** | 68 x 75ac.= 5100<br>30 x 25ac.= 750<br>*Net 5850\100 ac.*<br>RCN = 59 | 70 x 110 ac.= 7700<br>10 x 10 ac.= 100<br>Net 7800\120ac<br>RCN = 65 |
| **Conveyance Systems Types** | Grass waterway | 50% grass swale<br>50% storm sewer |
| **Summary of Average Conveyance System Data** | 8’ bottom/4:1 ss<br>2’ depth/3% grade | 2’ depth swale/3%<br>30” r/c sewer/2%<br>(see calcs.) |
| **Time of Concentration *(Tc) (see attached map & worksheets)*** | 1.1 hrs. | .97 hrs. |
| **25% of 2-yr 24-hr post-dev runoff volume** | N/A | 2.29 ac. ft. |
| **1-year/24 hour Runoff Volume** | N/A | (.2” x 60 ac.)<br>1.0 ac. ft. |
| **2-yr./24 hour Peak Flow** *(see attached hydrographs)* | 11.2 cfs | 14.3 cfs |
| **10-yr./24 hour Peak Flow** | 21 cfs | 32 cfs |
| **100-yr./24 hour Peak Flow** | 78 cfs | 91 cfs |

# Exhibit D (continued)

**Practice Design Summary**. The following table summarizes the data used to design wet detention basin #1.

| Design Element | Design Data |
|---|---|
| **Site assessment data: (see attached maps)** | |
| Contributing drainage area to basin (subwatershed A & B) | 70 acres |
| Distance to nearest private well (including off-site wells) | > 100 feet |
| Distance to municipal well (including off-site wells) | > 1200 feet |
| Wellhead protection area involved? | No |
| Ground slope at site of proposed basin | average 3% |
| Any buried or overhead utilities in the area? | No |
| Proposed outfall conveyance system/discharge (w/ distances) | 35 ft. to CTH "U" Road ditch<br>1000 ft. to wetland |
| Any downstream roads or other structures? (describe) | Yes – 36" cmp road culvert |
| Floodplain, shoreland or wetlands? | No |
| **Soil investigation data (see attached map & soil logs):** | |
| Number of soil investigations completed | 3 (in basin area) |
| Do elevations of test holes extend 3 ft. below proposed bottom? | Yes (see map) |
| Average soil texture at pond bottom elevation (USDA) | Clay loam |
| Distance from pond bottom to bedrock | > 5 feet |
| Distance from pond bottom to seasonal water table | Pond bottom 2 ft. below mottling<br>No water observed in test holes |
| **General basin design data (see attached detailed drawings):** | |
| Permanent pool surface area | 1.5 acres |
| Design permanent pool water surface elevation | elev. 900.0 |
| Top of berm elevation (after settling) and width | elev. 905.0 / 10 feet wide |
| Length/width (dimensions/ratio) | 445 ft. (L) x 145 ft. (W) = 3:1 |
| Safety shelf design (length, grade, max. depth) | 10 ft. @ 10% slope/1.5' deepest |
| Ave. water depth (minus safety shelf/sediment) | 5 ft. (in center) |
| Sediment forebay size & depth | .16 acres (13% pool size)/5 feet |
| Sediment storage depth & design maintenance | 2 ft. depth for forebay & pool<br>15 year maintenance schedule |

**Design Basin Inflow, Outflow & Storage Data**
**(see attached hydrographs and detail drawings)**

| Inflow Peak/Volume | Maximum Outflow Rate | Max. Water Elevation | Storage Volume at Max. Elev. (above perm. pool) | Outflow Control Structures* |
|---|---|---|---|---|
| 1-yr./24 hr. (volume) | .7 cfs (34 hr. drawdown) | 901.3 ft. | 2 acre feet | #1 |
| 24.3 cfs (Post 2-yr./24 hr. peak) | 11 cfs | 902.0 ft. | 3.1 acre feet | #1 and #2 |
| 72 cfs (Post 10-yr./24 hr. peak) | 35 cfs | 903.0 ft. | 4.5 acre feet | #3 |
| 171 cfs (Post 100-yr./24 hr. peak) | 143 cfs | 904.0 ft. | 6.0 acre feet | #3 and #4 |

* #1 = 6 inch orifice in water level control weir plate – flow line elev. @ 900.0 (1.3 ft. max. head)
#2 = 2 foot wide rectangular weir – flow line elev. @ 901.3 (.7 ft. hydraulic head)
#3 = 30 inch diameter smooth wall pvc pipe – flow line elev. @ 900.0 (3.0 ft. max. hydraulic head)
#4 = 30 foot wide earthen/grass emergency spillway – flow line elev. @ 903.0 (1.0 ft. max. depth)

# Exhibit D (continued)

**Watershed Map**. The watershed map shown below was used to determine the post-development data contained in this exhibit. The post-developed watershed areas are the same as the pre-development watershed areas for this project.

*[Map scale must be sufficiently large enough to show necessary details, but page size should not exceed 11" x 17".]*

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# Exhibit E
# As-built Survey for Wet Detention Basin #1

The wet detention basin depicted in Figure 1 is a reduced copy of the as-built plan.

Project Identifier**:** **Clearwater Apartments**
Storm water Practice**:** **Wet Detention Basin #1**
Location of Practice**:** **All of Outlot 1 of Clearwater Apartments:**
Owners of Outlot 1: **Each owner of Lots 1-22 shall have equal (1/22) undividable interest in Outlot 1.**

## Exhibit E

## Cross-Section A – A'

*[Note: Show plan view of BMP with cross-section location clearly labeled and cross-referenced. On cross-section and plan view, clearly label all key components and elevations of the BMP. Also show outlet details. Map scale must be sufficiently large enough to show necessary details, but page size should not exceed 11" x 17".]*

**Figure 2**

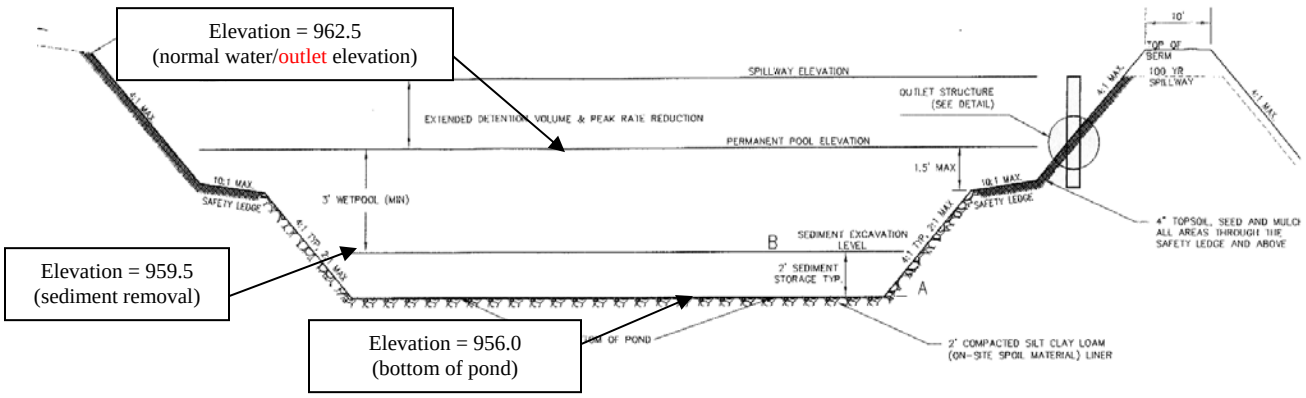
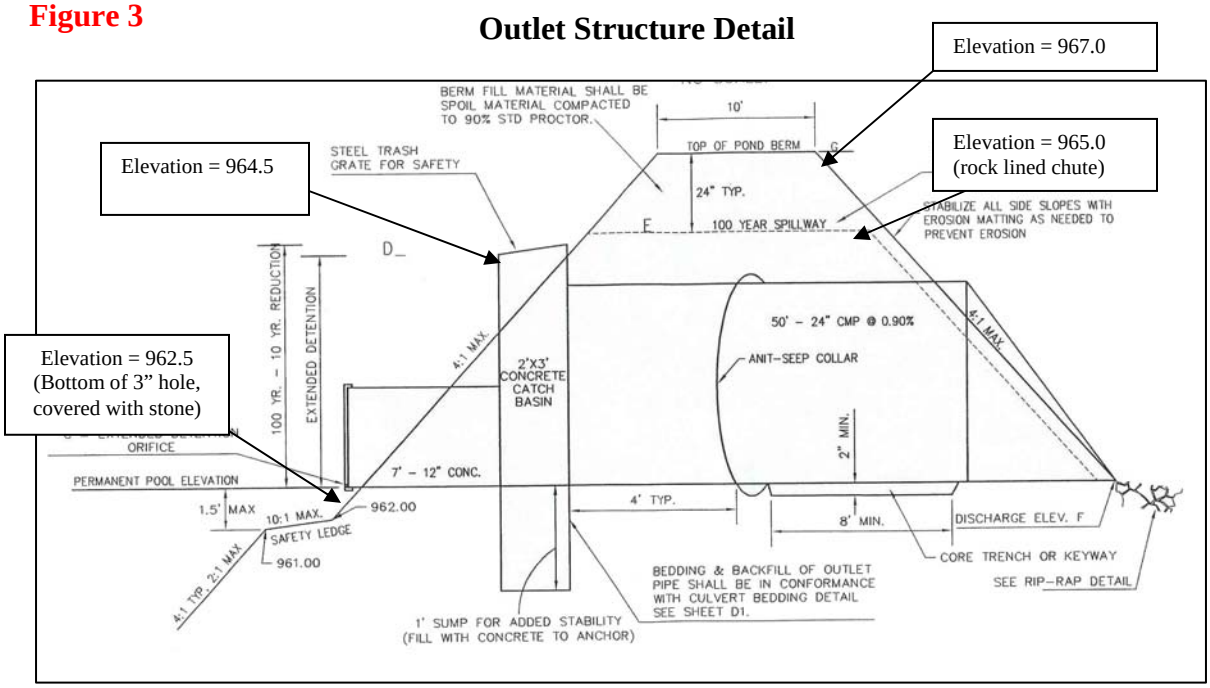



**Figure 3**

### Outlet Structure Detail



# Exhibit "F"
# Engineering/Construction Verification

DATE: _____

TO: City of Waukesha

FROM: _____[Project Engineer's Name/Company]

RE: Engineering/Construction Verification for the following project:

Project Name: _____

Section _____, Town of _____

Storm Water Management & Erosion Control Permit # _____

Storm Water Management Practices: _____

_____

For the above-referenced project and storm water management practices, this correspondence shall serve as verification that: 1) all site inspections outlined in approved inspection plans have been successfully completed; and 2) the storm water management practice design data presented in Exhibit D, and the "as-built" construction documentation presented in Exhibit E comply with all applicable state and local technical standards, in accordance with the City of Waukesha Storm Water Management and Erosion Control Ordinance.

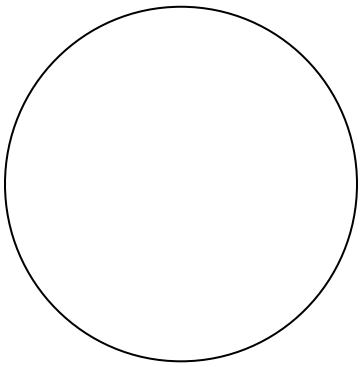
*[Must include one of the following two statements:]*

1. Any variations from the originally approved construction plans are noted in Exhibit E. These variations are considered to be within the tolerances of standard construction techniques and do not affect the original design as presented in Exhibit D in any way.
*[Note: The County may request additional documentation to support this statement depending on the extent of deviations from the approved plans.]*

Or

2. Any design or construction changes from the originally approved construction plans are documented in Exhibits D and E and have been approved by the City of Waukesha.

*[Note: If warm season and wetland planting verification is required, it may be included in this exhibit.]*



(Signed P.E. stamp must be included)

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# Exhibit G
# Storm Water Management and Erosion Control Permit Termination

Project Identifier: Clearwater Apartments

Location: All that part of the Southwest Quarter (SW ¼) of Section 4, Township 8N, Range 19E (Town of Lisbon)

Storm Water Management and Erosion Control Permit Holder's Name:

_____

Storm Water Management & Erosion Control Permit #: _____

Chapter 32 – City of Waukesha Storm Water Management and Erosion Control requires that all newly constructed storm water management practices be maintained by the Storm Water and Erosion Control Permit Holder until permit termination, after which maintenance responsibilities shall be transferred to the responsible party identified on the subdivision plat [or CSM] and referenced in this Maintenance Agreement.

Upon execution below, this exhibit shall serve to certify that the Storm Water Permit Holder has satisfied all requirements of the Storm Water Management and Erosion Control Ordinance and that the City of Waukesha has terminated the Storm Water Management and Erosion Control Permit for the property covered by this Maintenance Agreement.

Dated this ___ day of _____, 201_.

City of Waukesha representative:

_____
(Signature)

_____

(Typed Name and Title)

## Acknowledgements

State of Wisconsin
County of Waukesha

Personally came before me this ____ day of _____, 201_, the above named ___[Owners name]_____ to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]

Notary Public, Waukesha County, WI
My commission expires: _____

# CLEARWATER APARTMENTS - RIVERS CROSSING WATERSHED MAP

REV. AREA B
42.7 AC
CN = 75.5
Tc = 56.4 min.

EX. AREA C
16.1 AC
CN = 66.3
Tc = 41.1 min.

PR. AREA TO
BASIN C
14.4 AC
CN = 72.6
Tc = 41.2 min.

PR. AREA TO
BASIN D
1.5 AC
CN = 89.5
Tc = 10 min.

AREA A
13.8 AC
CN = 75

AREA B
42.9 AC
CN = 75.5

BASIN A

EX.
BASIN B

PR. BASIN C

PARK

CLEARWATER LN.

STILLWATER CIR.

WETLANDS

BLOCK 3

SCALE IN FEET
0 50 100