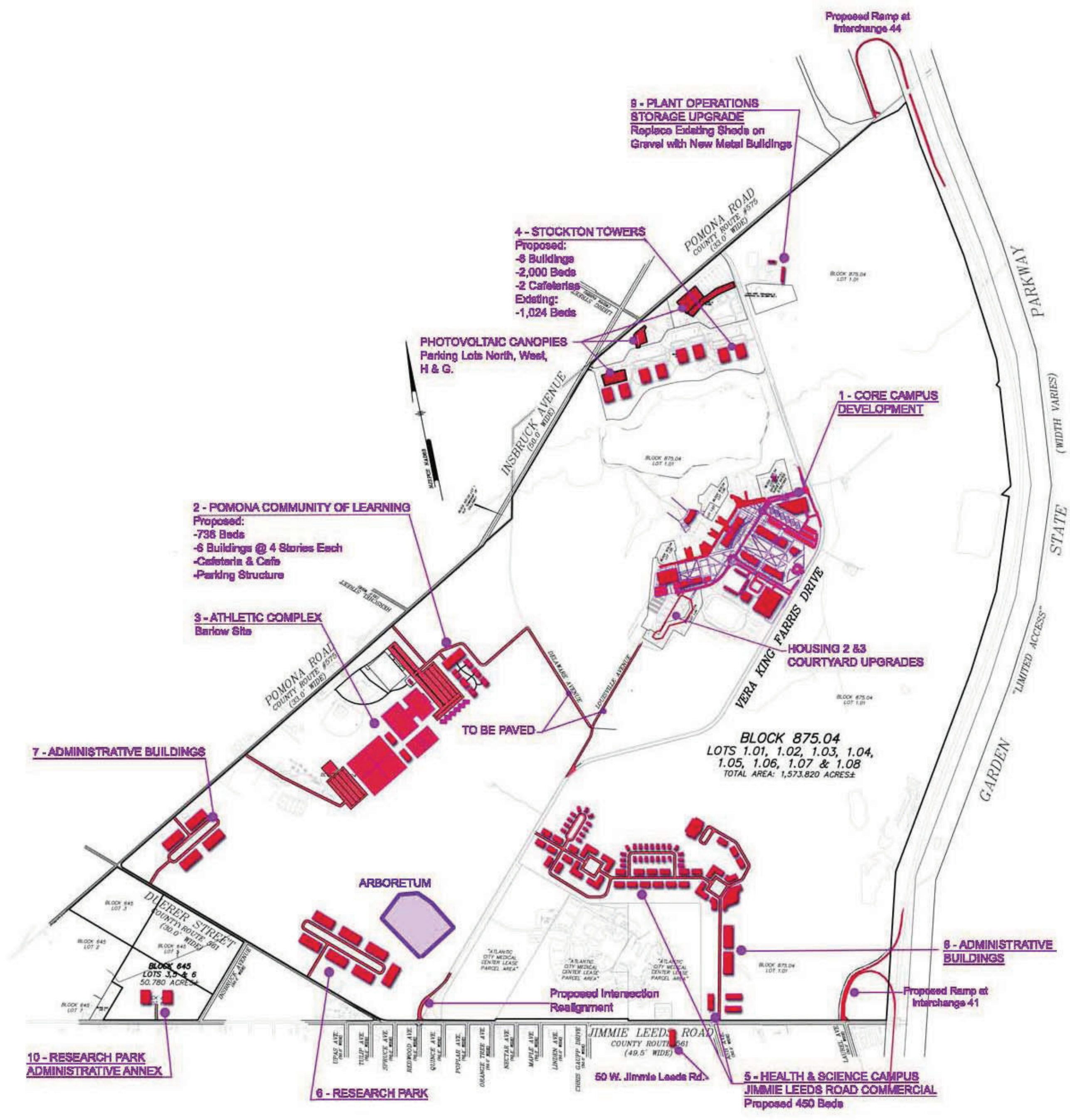
List of Attachments to the November 5, 2014 Memorandum of Agreement Between The Richard Stockton College of New Jersey and the New Jersey Pinelands Commission

1. Exhibit 15 of the 2010 Master Plan: Development Areas (Master Plan, Page 39)
2. Exhibit 16 of the 2010 Master Plan: Description of the Development Areas (Master Plan, Page 40)
3. 2010 Stormwater Management Master Plan
4. Exhibit C of the Executive Director's Report on The Richard Stockton College April 2010 Master Plan: Deed Restricted Lands
5. Supplemental Background Details from the April 2010 Master Plan

Attachment No. 1

EXHIBIT 15: 2010 DEVELOPMENT AREAS



Attachment No. 2

EXHIBIT 16: DESCRIPTION OF DEVELOPMENT AREAS

1 – Core Campus Development	
Campus Center and Academic Space-	150,000 GSF
Academic Space- West Quad	75,000 GSF
Academic and Support- Lakeside Building	75,000 GSF
Recreation and Athletics	10,000 GSF
College Walk Renovation	2,500 LF
Parking Garage I	700 Cars
Science Center	67,000 GSF
Academic Buildings	165,000 GSF
Athletic Facility Expansion with Pool	40,000 GSF
Parking Garage III	1,350 Cars
Housing 2 & 3 Courtyard Renovations	1,600 LF
2 – Pomona Community of Learning	
Apartments	768 Units
Parking Structure	768 Cars
3 – Athletic Complex – Barlow Site	
Field House	12,000 GSF
Synthetic Fields	165,000 GSF
Natural Turf Fields	345,000 GSF
Skate Park	22,500 GSF
Tennis Courts	6 Courts
Parking	826 Cars
4 – Stockton Towers-Existing Housing I	
Apartments	2,000 Units
Parking	2,000 Cars
5 – Heath Science Campus and Jimmie Leeds Road Commercial	
Performing Arts Center	35,000 GSF
Conference Center	
Hotel 150 Rooms	78,000 GSF
Meeting Room	20,000 GSF
Parking	150 Cars
Retail/Commercial	
Building Type 1 (Rectangle)	90,000 GSF
Building Type 2 (Ell)	36,000 GSF
Building Type 3 (Angle)	18,000 GSF
Jimmie Leeds Road Commercial	36,000 GSF

EXHIBIT 16: DESCRIPTION OF DEVELOPMENT AREAS (continued)

Residential	
Apartments Type 1 (Rectangle)	160 Units
Apartments Type 2 (Ell)	64 Units
Apartments 3 (Angle)	32 Units
Town Houses Type 1 (Rectangle)	56 Units
Twin Houses	66 Units
Presidents House	1 Unit
Parking	378 Cars
6 – Research Park	
Head Building	105,000 GSF
Side Buildings	420,000 GSF
Parking	2,625 Cars
7 – Administrative Buildings	
Buildings	70,000 GSF
Parking	350 Cars
8 – Administrative Buildings	
Buildings	210,000 GSF
Parking	1,050 Cars
9 – Plant Operations Storage Upgrade	
Storage Buildings	9,600 GSF
10 – Research Park Administrative Annex	
Buildings	105,000 GSF
Parking	525 Cars
On Site Improvements	
Garden State Parkway Interchange 41	
Garden State Parkway Interchange 44	
Main Entrance Intersection	
Realignment of Jimmie Leeds Road and Vera King Farris Drive	
Louisville Avenue Paving	
Delaware Avenue Paving	
Solar Array Construction	
North Parking Lot	
West Parking Lot	
Housing I Parking Lot	
Off Site Improvements	
50 West Jimmie Leeds Road Office Building	50,000 GSF
Parking	250 Cars

Attachment No. 3

STORMWATER COMPLIANCE REPORT

for

2010 Master Plan
The Richard Stockton College of New Jersey
Block 875.04, Lot 1.01 through 1.08
Galloway Township, Atlantic County, New Jersey

August 2010

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RSC 011.01

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STORMWATER COMPLIANCE STATEMENT
2010 Master Plan
The Richard Stockton College of New Jersey
Pomona, Galloway Township, Atlantic County, New Jersey

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1.0 INTRODUCTION

On behalf of The Richard Stockton College of New Jersey (Stockton), Marathon Engineering & Environmental Services, Inc. (Marathon) interfaced with the New Jersey Pinelands Commission (Pinelands) to establish an approach that will streamline the approval process with the Pinelands for development of future construction projects at Stockton. Previously, each project was submitted to the Pinelands as a stand-alone development; and each one underwent a detailed review by the Pinelands review staff for compliance with the Pinelands Comprehensive Management Plan (CMP). This procedure resulted in increased cost for preparation of applications and design documents, as well as delay due to the lengthy review time.

The goal of the 2010 Master Plan is to establish an agreement with the Pinelands that will remove the need to separately review and approve each project proposed by Stockton. Up to this point, there was no comprehensive "master plan" approach established with the Pinelands for development at Stockton. Each major construction project on campus has been developed with its own independent stormwater management system to address the Pinelands regulations in place at the time the development was proposed.

Marathon recognized that this site-specific approach cost Stockton considerable expense for construction of the individual stormwater management systems (which were almost all underground), consumed valuable developable land area and maximized the degree and level of land disturbance via excavation and clearing. Marathon recommended that the site-specific approach be replaced with a more regional investigation for stormwater management and was contracted by Stockton to prepare a Master Plan stormwater management investigation of the academic core area of the campus for submission to Pinelands. Marathon previously performed an overall environmental investigation of the entire Stockton campus for wetlands and threatened & endangered species, so stormwater was the last piece of the regulations that would need to be addressed to demonstrate compliance with the Pinelands CMP.

Marathon collaborated with Pinelands and submitted documentation in June 2009 that demonstrated the development of the Master Plan for the academic core area of the campus can take place with minimal stormwater management improvements by limiting impervious cover that will be proposed for full build-out conditions. In obtaining Pinelands' agreement with this approach, the only information that needs to be submitted with each project undertaken as part of the core area Master Plan development will be an accounting of existing impervious surface removed and impervious surface constructed. The rest of the Pinelands CMP requirements have been addressed on a regional scale. This approach will save Stockton time and expense and will be the same method for approval from the Pinelands Commission for the rest of the development proposed on the campus.

Stockton's approved Master Plan is described in the document entitled "The Richard Stockton College of New Jersey April, 2010 Master Plan." The Master Plan indicates the areas and buildings proposed for development within the academic core and within the undeveloped portions of the Stockton property fronting Pomona Road to the north, Duerer Street to the west and Jimmie Leeds Road to the south.

There are generally ten different development areas identified in the Master Plan.

- Development Area 1 is the future buildout of the academic core of the campus;
- Fronting Pomona Road is Development Area 2 – the Pomona Community of Learning and Development Area 3 – the Barlow Site;
- On the north side of Lake Fred is Development Area 4 – the Housing 1 overlay;
- Connecting to both Jimmie Leeds Road and Vera King Farris Drive, on the east side of their intersection, is Development Area 5 and 8 – the Health & Science Campus and Administrative Buildings;
- Fronting Jimmie Leeds Road on the west side of the intersection of Vera King Farris Drive is Development Area 6 – the Research Park;
- At the intersection of Duerer Street and Pomona Road is Development Area 7 – Administration Buildings;
- Behind the existing Plant Management Building 70 is Development Area 9 – Additional storage buildings; and
- Development Area 10 – The Research Park Annex fronting Jimmie Leeds Road west of the intersection of Duerer Street.

The Pomona Community of Learning, Housing 1 overlay, and part of the Health & Science campus contain student housing and associated amenities. The Health & Science campus may also contain a Performing Arts Center, the President's House and a Conference Center. The Research Park will contain office space and labs for research related to Stockton programs and initiatives. The Barlow Site will receive new athletic fields, parking areas and field house amenities. The remainder of the commercial space and administrative buildings will contain general office space for both campus staff and possibly leased space for ancillary services associated with Stockton.

Detailed information related to environmental constraints, such as freshwater wetlands and threatened & endangered species on campus, has been documented by Marathon and submitted to the Pinelands Commission. Subsequently, the Stockton Facilities Planning & Construction staff finalized the 2010 Master Plan layout and negotiated with the Pinelands Commission to avoid disturbance to environmentally sensitive areas with the intent to execute an agreement for development of the facilities proposed with the Master Plan. Marathon assisted Stockton by providing advice and guidance on solutions to challenges encountered during preparation of the Master Plan and the general approach to preparing the documents needed by the Pinelands Commission planning and review staff in order for them to draft the agreement. This analysis for the Master Plan quantifies a total area of disturbance and proposed impervious surface allowed to be constructed in connection with the agreement.

It is important to note that Stockton's role as a world-class educational facility, especially in the realm of environmental studies, sustainability, and global awareness and education, is reflected in our approach to the stormwater management facilities provided in this plan. While each development area is similar in proximity to environmentally sensitive areas and position in the landscape, the existing topography and underlying soil conditions allow us to approach the system proposed for each development area differently. As an example, some basin areas will not be created by clearing and excavating; they will instead be created by minimal brush clearing and berming on the downstream side of the area to allow the natural wooded area to remain and act as a bioretention facility that will store runoff at shallow depths and allow it to infiltrate in those natural wooded areas. In other areas clearing may be required due to large variations in topography, but those basin areas are designed to be partially vegetated with low maintenance plantings that will be left to revegetate naturally. The overall goal of this stormwater management design is low impact, low maintenance, low cost measures that will provide water quality treatment the surrounding area deserves and the engineering control the applicable regulations require.

As previously stated, the goal of including a stormwater management master plan in the agreement is to allow Stockton to proceed with the development of the Master Plan components without having to submit to the Pinelands Commission for a Public Development Approval for each separate phase of the future development. After the agreement is executed, Stockton would only have to provide the Pinelands Commission with a notice that work is being started and a running tally of the disturbance and impervious surface proposed with each project. This would allow Pinelands to keep track of the work without a detailed review and limit their involvement to only an accounting of the disturbance area and impervious surface constructed with each project.

2.0 SCOPE OF WORK

Stormwater Management Investigation

The Scope of Work includes preparation of a comprehensive stormwater management plan for the development areas of the Master Plan listed in the introduction above. The Phase 2 Development Areas will generally require individual stormwater management systems that will ultimately discharge towards the intermittent stream on-site that feeds Lake Fred and the unnamed tributary to Morse's Mill Stream on the southeast side of Vera King Farris Drive.

Engineering Design Plans

Utilizing the site survey overseen by Marathon and Master Plan documents prepared by Stockton, Marathon prepared engineering plans entitled "2010 Stormwater Master Plan" for Stockton, depicting the proposed Master Plan layout and required stormwater management features, made part of this report by reference. The plans locate and describe the Best Management Practices utilized on the Project to comply with the applicable requirements and provisions of Subchapters 5 and 6 of the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, except as modified and supplemented pursuant to the minimum standards for point and non-point source discharges of surface water runoff described at Subchapter 6 in the Pinelands CMP (Section 7:50-6.84(a)6).

Detailed Soil Investigation

Marathon performed a soil investigation to evaluate soil conditions and to collect soil profile descriptions at the location of six (6) proposed stormwater management areas. Marathon conducted a total of five (5) test pits at each proposed stormwater management area and logged the soil conditions encountered to determine soil texture, depth to groundwater and the estimated seasonal high water table. The test pits were excavated to a depth of 10 feet or to standing groundwater, whichever was shallower.

For each test pit, two (2) soil samples were taken from the most hydraulically restrictive layer to remain below the basin bottom and those replicate samples were tested for permeability. The permeability results, reported in inches/hour, satisfy the requirements outlined in the New Jersey Best Management Practices Manual and Pinelands CMP.

Stormwater Compliance Statement

This Stormwater Compliance Statement documents the pre and post development hydrological conditions and outlines the compliance with the applicable portions of Subchapter 6 in the Pinelands CMP (Section 7:50-6.84(a)6.) The Stormwater Compliance Statement includes a hydrological and hydraulic analysis for the design of the stormwater management systems.

3.0 DESIGN CRITERIA

The stormwater management analysis and design is in accordance with the Stormwater Management Rules at N.J.A.C. 7:8, subchapters 5 and 6, as amended, except as modified and supplemented by the Pinelands Comprehensive Management Plan minimum standards for point and non-point source discharges of surface water runoff at N.J.A.C. 7:50, subchapter 6; the New Jersey Stormwater Best Management Practices Manual; and the New Jersey Soil Erosion and Sediment Control Standards.

In accordance with the New Jersey Department of Environmental Protection (NJDEP) Stormwater Management Rules at N.J.A.C. 7:8, the development of the various projects is classified as a "Major Development." A Major Development is defined therein as a development which ultimately disturbs one or more acres of land and/or increases impervious coverage by one-quarter of an acre or more. The three technical requirements of the Stormwater Management Rules at N.J.A.C 7:8 as modified and supplemented by the Pinelands Comprehensive Management Plan that must be met are groundwater recharge, runoff quantity control, and runoff quality.

- Groundwater Recharge Standard – N.J.A.C. 7:8-5.4(a)2 as modified by N.J.A.C. 7:50-6.84(a)6iii sets forth the minimum design and performance standards for groundwater recharge as follows:

  i. The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at N.J.A.C. 7:8-5.6, demonstrate that the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm is retained and infiltrated on site.

  iv. The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse hydraulic impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

- Runoff Quantity Control Standard - N.J.A.C. 7:8-5.4(a)3 and N.J.A.C. 7:50-6.84(a)6ii requires that in order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at N.J.A.C. 7:8-5.6, complete one of the following:

  i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events; or

ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area; or

iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed.

- Runoff Quality Standard – N.J.A.C. 7:8-5.5 requires the stormwater management measures be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

  Note that the water quality volume generated by the proposed improvements will be less than that required to be retained and infiltrated to meet the groundwater recharge requirement, so the water quality standard will be met.

The rules emphasize that these standards be met by incorporating the following nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design to the maximum extent practicable. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at N.J.A.C. 7:8-5.7 necessary to meet these standards shall be incorporated into the design.

- Nonstructural stormwater management strategies incorporated into site design shall:

  1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;

2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

3. Maximize the protection of natural drainage features and vegetation;

4. Minimize the decrease in the "time of concentration" from pre-construction to post-construction. "Time of Concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;

5. Minimize land disturbance including clearing and grading;

6. Minimize soil compaction;

7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;

8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and

9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:

   i. Site design features that help to prevent accumulation of trash and debris in drainage systems;
   ii. Site design features that help to prevent discharge of trash and debris from drainage systems;
   iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and
   iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

The NJDEP Stormwater Management rules also set forth requirements for a Special Water Resources Protection Area (SWRPA) which is generally a 300 feet buffer adjacent to a Category One (C1) waters and upstream tributaries of C1 waters within the same Hydrologic Unit Code sub-watershed (HUC-14). Morse's Mill Stream downstream of the Garden State Parkway has been classified as a C1 water. Although SWRPA buffers of 300 feet are required around all Category One waters, buffers of 150 feet are permitted if a site is being redeveloped. No development is permitted within the designated buffer and there are no waivers or variances that can be granted to permit encroachment within these buffers. Most of the existing campus on the northwesterly side of Vera King Farris Drive (a.k.a. College Drive) is already built-out so future development within this area would be considered redevelopment and a reduced buffer of 150 feet should be employed. All of the proposed Phase 1 development, with the exception of some possible road improvements to a section of Vera King Farris Drive, is located outside of the 150 feet buffer. All of the proposed Phase 2 development, with the exception of some possible road improvements to sections of Vera King Farris Drive, is located outside of the 300 feet buffer.

Additionally, riparian zones associated with the NJDEP Flood Hazard Area Control Act, which is a separate, overlapping area of jurisdiction along regulated waters, will also apply to any work at Stockton within 300 feet of the waterways on campus (including Lake Fred) since they drain to, and are in the same HUC-14 as, the portion of Morse's Mill Stream downstream of the Garden State Parkway that is C1. The purpose of the riparian zone, however, is to protect existing vegetation along the waterway. Accordingly, if an area is already disturbed, it can remain disturbed and any improvements will have to be limited to those previously cleared areas. The work proposed by Stockton within 300 feet of the waterways on site (along Farris Drive, portions of the Academic Core Area, and Housing 1) is limited to the previously disturbed areas since those areas are also mostly constrained by wetland buffers associated with those same waterways.

4.0 TECHNIQUES & PROCEDURES OF ANALYSIS

In accordance with the stormwater runoff calculation methodology at N.J.A.C. 7:8-5.6, the quantity (volume and rate) of stormwater runoff for pre and post-developed conditions is calculated based on the USDA NRCS methodology using the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Technical Release 55 - Urban Hydrology for Small Watersheds (TR-55), dated June 1986. A unit peak discharge factor of 285 is applied to the dimensionless unit hydrograph for runoff estimation on lands that are located within the coastal zones of New Jersey rather than the standard factor of 484. This is referred to as the DelMarVa unit hydrograph and will predict a lower peak discharge than that of the standard hydrograph. The volume of runoff will not be affected by the factor change. NRCS 24 hr design storm rainfall depths for New Jersey, as revised September 2004, are used in the calculation.

Pre and post-developed times of concentration (TC) are determined for the pre and post-developed condition using the hydraulically longest flow path. Curve numbers (CN) are chosen for the drainage areas for the pre and post-developed condition based on the hydrologic soil group and land use. Since the developed area is made up of Type A, B, C and D soils, CNs of 30, 55, 70 and 77 were assumed for Natural Woods, respectively; 39, 61, 74 and 80 for lawn and landscaped areas, respectively; and 98 for impervious areas. Note that impervious areas were calculated as separate subareas to generate hydrographs without weighted CNs as outlined in the CMP N.J.A.C. 7:50-6.84(a)6.i(2) and the BMP manual chapter 5.

Using the drainage areas, the TCs and CNs as input data, the 2007 version of *Hydraflow Hydrographs,* a hydrologic/hydraulic software program by Intelisolve, was employed to generate the runoff volumes and rates.

Additionally, since the actual area of disturbance is allowed to be the entire upland portion of the development areas outside of the wetland buffers, it is assumed for the purposes of runoff estimation in the post-developed condition that any area that is not impervious will be open space; that is it is conservatively assumed no woods will be retained to provide the maximum runoff volume that may be produced from built out conditions. Note that in reality there will be wooded area retained since it is a goal of the master plan build-out to retain as much naturally wooded area as possible while still meeting the programmatic needs of Stockton.

5.0 KEY HYDROLOGIC PRINCIPALS

Precipitation and Design Storm Events. Precipitation occurs as a series of events characterized by different rainfall amount, intensity, and duration. Although these events occur randomly, analysis of their distribution over a long period of time indicates that the frequency of occurrence of a given storm event follows a statistical pattern. This statistical analysis characterizes storm events based on their frequency of occurrence or return period. Storm events of specific sizes can be identified to support evaluation of designs. Storms with 2-year, 10-year and 100-year return periods are commonly used for residential, industrial, and commercial development design.

The 2-year storm events are usually selected to protect receiving channels from sedimentation and erosion. The 10-year storm events are selected for adequate flow conveyance design and minor flooding considerations. The 100-year event is used to define the limits of floodplains and for consideration of the impacts of major floods.

In Atlantic County, the 2-year, 10-year and 100-year storms are 3.3 inches, 5.2 inches, and 8.9 inches of rainfall over 24 hours, respectively. The 2-year storm has a 50 percent probability of occurring in any given year, while the 10-year and 100-year storms have a 10 percent and 1 percent probability of occurring in any given year, respectively.

6.0 SOIL SURVEY INFORMATION

The project site is shown on the Pleasantville United States Geological Survey (USGS) quad map. Soils in the project sites are indicated on the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) as:

Soil Type	HSG
AtsA—Atsion sand, 0 to 2 percent slopes	D
AugB—Aura sandy loam, 2 to 5 percent slopes	B
BerAr—Berryland sand, 0 to 2 percent slopes, rarely flooded	B/D
DocB—Downer loamy sand, 0 to 5 percent slopes	B
EveB—Evesboro sand, 0 to 5 percent slopes	A
GamB—Galloway loamy sand, 0 to 5 percent slopes	A
GamkB—Galloway loamy sand, clayey substratum, 0 to 5 percent slopes	A
HboA—Hammonton sandy loam, 0 to 2 percent slopes	B
MakAt—Manahawkin muck, 0 to 2 percent slopes, frequently flooded	D
MbtB—Matawan sandy loam, 0 to 5 percent slopes	C
PHG—Pits, sand and gravel	
SacA—Sassafras sandy loam, 0 to 2 percent slopes	B
WoeA—Woodstown sandy loam, 0 to 2 percent slopes	C

The limits of the listed soil series areas on the project site are shown on the Drainage Area Plans included in Appendix F.

7.0 TYPICAL BASIN CONSTRUCTION TECHNIQUES

Stockton's intent is to fit into their surrounding environment. To that end the basins proposed as the structural measures to address the engineering requirements of the Pinelands CMP are designed to have minimal impact to the area by retaining as much existing natural vegetation within the basin areas as possible, minimizing changes in topography where practical, and designing them so they are shallow, have very little impact to the existing groundwater table, and no adverse impacts to the wetlands and waterways to which any excess runoff will discharge. The overall design approach for the build-out of the Master Plan is low impact with clearing limited to that only required for the proposed facilities, efficient use of land area for shared parking and clustered development, minimizing cartway widths to that required for public safety, and no compaction of areas not intended to receive buildings or pavement.

As mentioned above, each development area is similar in proximity to environmentally sensitive areas and position in the landscape. The existing topography and underlying soil conditions, however, allow us to approach the system proposed for each development area differently. The complete drainage area description and engineering detail for each development area system are provided in the plans, the calculations in Appendix C, and the following sections. Below is a listing of the general approach for the stormwater management system for each development area:

<u>Development Areas 2 & 3 – Pomona Community of Learning and Barlow Field</u>
These development areas are adjacent to one another and have combined facilities. The majority of Barlow Field will be converted from woods to athletic fields with small parking areas and accessory buildings (food stand, restrooms, etc). The Pomona Community of Learning is a clustered building arrangement with a parking garage to

minimize disturbance. Overall, the basin required to meet the engineering standards is large in area, but due to the similarity in topography in most of the downstream area where the basin is situated, much of the basin area is made up of wooded area to remain. That is, a berm will be constructed on the downstream side of the basin and the majority of the upper volume of the basin will remain wooded. The volume is there in the event of a large storm, but will not need to be excavated to create it. Accordingly, the basin proposed for Development Areas 2 & 3 will be made up of about half cleared and graded area (as with most typical structural basins) and half existing natural wooded area. Pretreatment of paved areas in the drainage shed will come in the form of the large downstream open space area of athletic fields and landscaping that will disconnect the proposed impervious surface from the basin. This will provide the requisite pretreatment of runoff prior to infiltration. Where possible and appropriate, small infiltration areas and vegetated conveyance swales will be utilized. The exact layout of those features will depend on the final configuration of the development area. Note that these features will be incorporated into the design not because they are required, but because they can be. Stockton intends to take the most environmentally responsible route possible while providing the most cost-effective solution that will benefit both the environment and the taxpayers who fund the construction.

The soil underlying the stormwater management basin is generally a mix of sands, sandy loams, and clay lenses. A deep substratum of gravelly clay underlies the southwesterly end of the basin. The static groundwater table was observed at a moderately high elevation and as such will act as the controlling restrictive zone below the basin. Since the basin is upgradient to an intermittent stream corridor, it is anticipated that infiltrated runoff will contribute to the base flow of the intermittent stream as the drainage area does naturally. The moderately high groundwater table, or any existing soil strata that could inhibit vertical infiltration, will cause infiltrating groundwater to behave exactly as it does prior to any development – it will move vertically until it contacts a restrictive layer where it will then move laterally to the stream bed. The groundwater mounding analyses in Appendix D provides calculations demonstrating minimal mounding that will not negatively impact the wetlands or stream bed downstream of the development areas.

Development Areas 5 & 8 – Health and Science Campus and Administrative Buildings

These development areas are adjacent to one another and have combined facilities. The Health and Science campus will be a mixed use development containing health service uses such as a hospital, a geriatric center, leased doctor's offices, professional office space for services associated with Stockton, a performing arts center, and residential units. Since this area will be designed to have professional occupancy during work hours and residential occupancy during remaining times, it is a highly efficient use of land area with shared parking and common facilities. Overall, the basins required to meet the engineering standards are not very large in area and due to the difference in topography in most of the downstream area where the basins are situated, the basins will need to be completely made up of excavated area to allow the necessary volume to be constructed. The basin limits follow the wetland buffer line so while they are structural features, they do not have a very rigid shape which adds to the aesthetic appeal of the facilities. They will also be landscaped with native Pinelands vegetation and the downstream side allowed to naturally revegetate. This development area contains more connecting roadway than the other development areas and thus provides more opportunity for roadside vegetated conveyance areas and areas that can be planted with native low-growing Pinelands vegetation and wildflowers that will require less maintenance than turf and still provide the necessary pedestrian and vehicle safety lines of sight. Pretreatment of paved areas in the drainage shed will come in the form of shallow depressed landscape areas within the parking lots to filter and infiltrate smaller storms and allow larger, lower frequency storms to be safely conveyed to the basin area. Where possible and appropriate, small infiltration areas and vegetated conveyance swales will be utilized. The exact layout of those features will depend on the final configuration of the development area and will be the both cost-effective and environmentally responsible.

The soil underlying the stormwater management basins is a mix of sands, sandy loams, and clay bands. Clay bands that are shallow will be excavated during construction of the basins and replaced with sand excavated elsewhere on the project. The static groundwater table was observed at a moderately high elevation and as such will act as the controlling restrictive zone below the basin. Perched groundwater was encountered above some of the clay bands. Since the basins are upgradient to an intermittent stream corridor, it is anticipated that infiltrated runoff will contribute to the base flow of the intermittent stream as it currently does naturally. The moderately high groundwater table, or any existing soil strata that could inhibit vertical infiltration, will cause infiltrating groundwater to behave exactly as it does prior to any development – it will move vertically until it contacts a restrictive layer where it will then move laterally to the stream bed. The groundwater mounding analyses in Appendix D provides calculations demonstrating minimal mounding that will not negatively impact the wetlands or stream bed downstream of the development areas.

<u>Development Area 6 – Research Park</u>

This area has gently sloping topography that allows the proposed basin to be very shallow and require no excavation. Instead of moving a lot of earth to create storage volume, the approach will be to construct a small berm on the downstream side of the area near the wetlands buffer that will effectively dam up the runoff created by the development and allow it to be retained and infiltrated in the existing wooded area. This large downstream area that will receive the runoff from the developed portion of the site will function as a natural bioretention area and be as low impact as any stormwater management feature can be designed and/or constructed. The upstream development area will have pretreatment areas for runoff in the form of vegetated swales, vegetated filter strips and shallow depressions within the parking areas to provide pretreatment of runoff prior to discharge to the natural basin area.

The soil underlying the stormwater management basin is a mix of sands, sandy loams, and a thick band of clay. The static groundwater table was observed at a high elevation and as such will act as the controlling restrictive zone below the basin. Perched groundwater was encountered above the clay band. Since the basins are upgradient to an intermittent stream corridor, it is anticipated that infiltrated runoff will contribute to the base flow of the intermittent stream as it currently does naturally. The moderately high groundwater table, or any existing soil strata that could inhibit vertical infiltration, will cause infiltrating groundwater to behave exactly as it does prior to any development – it will move vertically until it contacts a restrictive layer where it will then move laterally to the stream bed. The groundwater mounding analyses in Appendix D provides calculations demonstrating minimal mounding that will not negatively impact the wetlands or stream bed downstream of the development areas.

Development Area 7 – Administrative Buildings

This development area is immediately southwest of Barlow Field. The stormwater basin proposed for this area is very similar to that proposed for Development Areas 2 and 3. This basin will also be made up of a berm constructed on the downstream side of the basin with the majority of the upper volume of the basin to remain wooded. Again, this basin will be made up of about half cleared and graded area and half existing woods to remain. Pretreatment of paved areas in the drainage shed will come in the form of shallow depressed landscape areas within the parking lots to filter and infiltrate smaller storms and allow larger, lower frequency storms to be safely conveyed to the basin area. Vegetated conveyance features will also be utilized to the maximum extent possible.

The soil underlying the stormwater management basin is generally a mix of sands and sandy loams. A deep substratum of gravelly clay underlies the northeasterly end of the basin. The static groundwater table was observed at a moderately high elevation and as such will act as the controlling restrictive zone below the basin. Since the basin is upgradient to an intermittent stream corridor, it is anticipated that infiltrated runoff will contribute to the base flow of the intermittent stream as it currently does naturally. The moderately high groundwater table, or any existing soil strata that could inhibit vertical infiltration, will cause infiltrating groundwater to behave exactly as it does prior to any development – it will move vertically until it contacts a restrictive layer where it will then move laterally to the stream bed. The groundwater mounding analyses in Appendix D provides calculations demonstrating minimal mounding that will not negatively impact the wetlands or stream bed downstream of the development areas.

Development Area 10 – Research Park Administrative Annex

This development area is off-campus and at the upstream end of the tributary to Morse's Mill Stream that discharges to Lake Fred. The stormwater basin proposed for this area is very similar to that proposed for Development Areas 2, 3 and 7. This basin will be made up of a berm constructed on the downstream side of the basin with the majority of the upper volume of the basin to remain wooded. Again, this basin will be made up of about half cleared and graded area and half existing woods to remain. Pretreatment of paved areas in the drainage shed will come in the form of shallow depressed landscape areas within the parking lots to filter and infiltrate smaller storms and allow larger, lower frequency storms to be safely conveyed to the basin area. Vegetated conveyance features will also be utilized to the maximum extent possible.

The soil underlying the stormwater management basin is generally a mix of sands and sandy loams. A substratum of mixed clay underlies the middle of the basin. The static groundwater table was observed at a moderately high elevation and as such will act as the controlling restrictive zone below the basin. Since the basin is upgradient to an intermittent stream corridor, it is anticipated that infiltrated runoff will contribute to the base flow of the intermittent stream as it currently does naturally. The moderately high groundwater table, or any existing soil strata that could inhibit vertical infiltration, will cause infiltrating groundwater to behave exactly as it does prior to any development – it will move vertically until it contacts a restrictive layer where it will then move laterally to the stream bed. The groundwater mounding analyses in Appendix D provides calculations demonstrating minimal mounding that will not negatively impact the wetlands or stream bed downstream of the development areas.

7.0 AREAS OF IMPROVEMENTS

DEVELOPMENT AREA 1

Development Area 1 is identified on the Existing Drainage Area Plan (Sheet D0103) and the Proposed Drainage Area Plan (Sheet D0104) prepared by Marathon. The area is located along the southerly and easterly side of Lake Fred and extends to the westerly side of Vera King Farris Drive. The area adjacent to the Lake is improved with existing campus buildings and walkways. The area between the improved areas along Lake Fred and Vera King Farris Drive contains large areas of paved parking lots. It is in these existing parking areas where most of the new Phase 1 Master Plan facilities will be constructed.

An Overall Phase 1 Impervious Area Removal Plan (Sheet D0101) prepared by Marathon indicates the existing facilities as shown on the boundary survey prepared by Pennoni Associates, the topographic survey by Promaps, and field evaluations performed by Marathon. An Overall Phase 1 Impervious Area Addition Plan (Sheet D0102) prepared by Marathon indicates the proposed facilities as shown on the aforementioned Master Plan. The wetland areas and effective wetlands buffer as identified in the 2010 Stockton Master Plan are also shown.

There are two areas within the above described overall area that do not contribute stormwater runoff to the Development Area: the area of the existing West Quad, which is recently completed, and the area of the Campus Center, which is currently under construction. These areas were designed with individual stormwater management systems in conformance with the current stormwater regulations and are self contained as to stormwater quality and quantity management requirements. Accordingly, they are not included or addressed in this report.

Under the existing conditions, Development Area 1, which comprises the developed portion of the academic core of the campus, is divided into four distinct drainage sheds: the West (W) Shed consisting of roughly 13.845± acres that flows toward Lake Fred and then into Morse's Mill Stream; a portion of the North (N-1) Shed consisting of roughly 5.502± acres and the remaining North (N-2) Shed consisting of roughly 9.528± acres that also flow toward Lake Fred; and the South (S) Shed consisting of the 23.925± acres that flows toward an unnamed tributary of Morse's Mill Stream that discharges downstream of the dam at Lake Fred into Morse's Mill Stream. The ultimate discharge point for the entire Stockton campus is the point in Morse's Mill Stream immediately upstream of the Garden State Parkway. The Existing Drainage Area Plan (Sheet D0104) graphically depicts the drainage sheds and provides detailed information on the types of land cover associated with the drainage areas. The table below summarizes the volumes and rates of runoff associated with the various design storms:

Existing Peak Runoff Flow Rates and Total Volumes

Drainage Shed Direction of Discharge	Peak Runoff Flow Rate (cfs)			Total Runoff Volume (cf)		
	Q_2	Q_{10}	Q_{100}	V_2	V_{10}	V_{100}
North to Lake Fred	53.70	85.93	161.40	216,843	363,436	677,364
South to unnamed tributary	33.59	63.19	130.45	145,567	263,317	525,913
Total to Morse's Mill Stream	87.29	149.12	291.85	362,409	626,754	1,203,278

The MPRC facility has its own separate self-contained infiltration facility designed, approved and constructed in accordance with CMP standards. The improvements within the drainage area to the MPRC will also be modified with the construction of the elements of the Facilities Master Plan. As such, the runoff volume to the existing MPRC system cannot be increased. The table below summarizes the runoff volume draining to the system under existing conditions:

Existing Runoff Volumes to MPRC System

Drainage Shed	Total Runoff Volume (cf)		
	V_2	V_{10}	V_{100}
Total to MPRC System	40,835	66,253	115,994

Under the proposed conditions, the drainage sheds within the Development Area are slightly altered in size and cover with the implementation of the Master Plan. A majority of the existing at-grade parking areas are replaced with garage structures to make way for the proposed academic buildings and the campus greens. West (W) Shed remains at roughly 13.845± acres but the impervious cover is slightly increased; the North (N-1) Shed remains unchanged; the North (N-2) Shed increases slightly to roughly 9.650± acres; and the South (S) Shed decreases to roughly 23.163± acres. Please also note that the South Shed also has a sub-shed that drains to two (2) proposed depressions to retain and infiltrate runoff generated by 1.900 acres of the campus green landscape and sidewalk areas. The Proposed Overall Drainage Area Plan (Sheet D0104) graphically depicts the drainage sheds and provides detailed information on the types of land cover associated with the drainage areas. The table below shows the reduction of impervious areas for the Development Area:

PROJECT AREA COMPARISON					
	Total Area	Impervious		Pervious	
		Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	56.55 Ac	27.03 Ac	8.31 Ac	10.93 Ac	10.28 Ac
	Subtotal	35.34 Ac		21.21 Ac	
Proposed	56.55 Ac	18.00 Ac	16.02 Ac	16.26 Ac	6.27 Ac
	Subtotal	34.02 Ac		22.53 Ac	
Difference		**-1.32 Ac**		**+1.32 Ac**	

Notes:

1. Refer to Existing Drainage Area Plan sheet D0103 and the Proposed Drainage Area Plan sheet D0104 prepared by Marathon Engineering and Environmental Services, Inc. issued May 27, 2009.
2. The areas of the West Quad, which is already constructed, and the Campus Center, which is currently under construction, are not included in the Area of Improvements.

The above table demonstrates that there will be no increase in the impervious areas in the Development Area as indicated on the aforementioned plan. A determination of the net increase in impervious areas as required by the Pinelands Stormwater Management Regulations indicates that there is a decrease in impervious area of 1.32 acres. Therefore, no storage volume will be required for stormwater infiltration facilities. The table below summarizes the peak rates and volumes of runoff generated from the Development Areas in their post developed condition.

Proposed Peak Runoff Flow Rates and Total Volumes

Drainage Shed Direction of Discharge	Peak Runoff Flow Rate (cfs)			Total Runoff Volume (cf)		
	Q_2	Q_{10}	Q_{100}	V_2	V_{10}	V_{100}
North to Lake Fred	51.46	82.86	158.98	208,383	352,583	664,710
South to unnamed tributary	33.59	61.76	123.74	143,116	257,664	521,979
Total to Morse's Mill Stream	85.05	144.63	282.73	351,499	610,247	1,186,690

The above table demonstrates that there will be no increase in the rate or volume of runoff. Therefore, the only stormwater management measures required in Development Area 1 upon full build-out will be the two small landscaped depressions that accept runoff generated by a portion of the campus green area shown on the Proposed Drainage Area Plan sheet D0104. Soil logs and permeability test results for these two shallow depressions are included in Appendix D.

The self-contained MPRC Shed increases in size to hold a portion (28,000 sf or 0.64 acres) of the footprint of proposed Garage 1. The existing stormwater management system within this shed will remain unchanged and the total volume discharging to it will be slightly decreased. The table below summarizes the runoff volume draining to the system under proposed conditions:

Proposed Runoff Volumes to MPRC System

Drainage Shed	Total Runoff Volume (cf)		
	V_2	V_{10}	V_{100}
Total to MPRC System	36,462	62,305	115,953

As shown in tables above, the pre-developed peak runoff flow rate and total volume leaving the site towards Lake Fred to the north and the unnamed tributary to Morse's Mill Stream to the south, or the total combined flow and volume to both locations, does not increase from pre to post-developed conditions. Any minimal change in runoff timing for the two, ten or one-hundred year storms will not increase flood damages at or downstream of the parcel since the total volume leaving the site is decreased.

The decrease in impervious surface and small infiltration depressions proposed for the Stockton Facilities Stormwater Master Plan allows the design to comply with the requirements of the CMP and State Stormwater Management rules. The combined use of non-structural and structural methods are in accordance with the applicable requirements and show no increase in peak runoff flow rates or total volumes leaving the site or towards any wetlands or waterbodies.

It is also important to note that the post-construction runoff volumes were generated by conservatively assuming the landscaped areas proposed will not contain any existing wooded area that will likely remain. Accordingly, if any of the existing wooded area does remain after construction of the campus green area, there will be a reduction in the amount of runoff leaving the site.

DEVELOPMENT AREAS 2 & 3

Development Areas 2 and 3 are identified on the Phase 2 Stormwater Master Plan (Sheet C1401) prepared by Marathon and are the sites of proposed Pomona Community of Learning and the proposed Barlow recreation facilities. The areas front on the southerly side of Pomona Road. The areas drain in the easterly direction towards a tributary of Morse's Mill Stream which discharges into Lake Fred and then into Morse's Mill Stream. For purposes of determining stormwater management compliance, the stormwater analysis assumes that the entire site under its pre-developed conditions is pervious (woods and open space). The table below shows the pre and post developed cover conditions for the Development Areas:

PROJECT AREA COMPARISON					
	Total Area	Impervious		Pervious	
		Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	106.30 Ac	0 Ac	0 Ac	34.85 Ac	71.45 Ac
	Subtotal	0 Ac		106.30 Ac	
Proposed	106.30 Ac	9.35 Ac	2.6 Ac	84.07 Ac	10.28 Ac
	Subtotal	11.95 Ac		94.35 Ac	

Nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 will be implemented to the maximum extent practicable on the project (Refer to Section 13). Low-impact development measures such as vegetative retention swales and rain gardens disconnect and pre-treat stormwater runoff from parking areas and drives. The excess parking area stormwater is conveyed, along with runoff from the buildings and recreation field, and discharged into an open stormwater management basin that is designed to retain and infiltrate the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm. The basin is designed so that the post-construction peak runoff discharge rates for the 10 and 100-year storm events do not exceed 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The basin absorbs the entire runoff volume from the two-year storm event. Note that the volume retained in the swales and rain garden areas, which will be designed in detail when the actual field layout is determined in the future, is not required to meet the groundwater recharge standard and are solely intended to pretreat runoff prior to infiltration.

The table below summarizes the peak rates of runoff generated from the Development Areas in their pre and post developed condition, the maximum storage volume and elevation, and the provided 10-year net increase in impervious cover (NIC) volume. Drainage shed modeling of the Development Areas are provided in Appendix C.

DEVELOPMENT AREAS 2 & 3						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	77.64	-----	-----	-----	-----
	10-Year	12.63	-----	-----	-----	-----
	2-Year	0.98	-----	-----	-----	-----
Proposed	100-Year	59.72	62.11	690,948	50.99	-----
	10-Year	8.77	9.47	339,400	49.99	195,075
	2-Year	0.00	0.49	208,490	49.46	-----

DEVELOPMENT AREA 4

Development Area 4 is the proposed Housing 1 overlay. The project will replace the existing housing units with new low-rise units within the footprint of the existing buildings and adjacent courtyard. The area sits on the northerly bank of Lake Fred and discharges to that watercourse. Since the area proposed for improvement is previously disturbed and no increase in impervious surface is proposed, no stormwater management measures are required.

DEVELOPMENT AREAS 5 EAST, 5 WEST AND 8

The Development Areas are identified on the Stormwater Plan (Sheet C1402) prepared by Marathon and are the site of the Health & Science campus and proposed administrative buildings. Development Area 8 is situated within the boundary of Development Area 5 East. The areas front on the Jimmie Leeds Road and Vera King Farris Drive and are located on the easterly and northerly sides of the hospital complex. The areas drain towards a tributary of Morse's Mill Stream which discharges downstream of Lake Fred. For purposes of determining stormwater management compliance, the stormwater analysis assumes that the entire site under its pre-developed conditions is wooded. The tables below show the pre and post developed cover conditions for the Development Areas:

PROJECT AREA COMPARISON-5 EAST					
		Impervious		Pervious	
	Total Area	Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	44.00 Ac	0 Ac	0 Ac	0 Ac	44.00 Ac
	Subtotal	0 Ac		44.00 Ac	
Proposed	44.00 Ac	12.34 Ac	8.40 Ac	23.26 Ac	0 Ac
	Subtotal	20.74 Ac		23.26 Ac	

PROJECT AREA COMPARISON-5 WEST					
		Impervious		Pervious	
	Total Area	Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	35.36 Ac	0 Ac	0 Ac	0 Ac	35.36 Ac
	Subtotal	0 Ac		35.36 Ac	
Proposed	35.36 Ac	8.42 Ac	6.26 Ac	20.68 Ac	0 Ac
	Subtotal	14.68 Ac		20.68 Ac	

Nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 will be implemented to the maximum extent practicable on the project (Refer to Section 13).

Low-impact development measures will be employed such as vegetative retention swales and rain gardens disconnect and pre-treat stormwater runoff from parking areas and drives. The stormwater is conveyed and discharged into one of two open stormwater management basins that are designed to retain and infiltrate the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm. The basin are designed so that the post-construction peak runoff discharge rates for the 10 and 100-year storm events do not exceed 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The basins absorb the entire runoff volume from the two-year storm event. Note that the volume retained in the swales and rain garden areas, which will be designed in detail when the actual field layout is determined in the future, is not required to meet the groundwater recharge standard and are solely intended to pretreat runoff prior to infiltration.

The tables below summarize the peak rates of runoff generated from the Development Areas in their pre and post developed condition, the maximum storage volume and elevation, and the provided 10-year net increase in impervious cover (NIC) volume. Drainage shed modeling of the Development Areas are provided in Appendix C.

DEVELOPMENT AREA 5 EAST						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	63.79	-----	-----	-----	-----
	10-Year	21.36	-----	-----	-----	-----
	2-Year	5.69	----	-----	-----	-----
Proposed	100-Year	51.05	51.03	616,820	55.55	-----
	10-Year	4.64	16.02	436,059	54.87	395,981
	2-Year	0.00	2.85	295,529	54.33	-----

DEVELOPMENT AREA 5 WEST						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	45.70	-----	-----	-----	-----
	10-Year	11.61	-----	-----	-----	-----
	2-Year	1.76	-----	-----	-----	-----
Proposed	100-Year	35.85	36.56	426,770	50.33	-----
	10-Year	3.00	8.71	299,778	49.58	264,621
	2-Year	0.00	0.88	195,825	48.85	-----

DEVELOPMENT AREA 6

The Development Area is identified on the Stormwater Plan (Sheet C1401 and C1403) prepared by Marathon and is the site of the proposed Research Park. The Development Area fronts on the northerly side of Duerer Street. The area drains in the northerly direction towards a tributary of Morse's Mill Stream which discharges into Lake Fred and Morse's Mill Stream. For purposes of determining stormwater management compliance, the stormwater analysis assumes that the entire site under its pre-developed conditions is wooded. The table below shows the pre and post developed cover conditions for the Development Area:

PROJECT AREA COMPARISON-6					
	Total Area	Impervious		Pervious	
		Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	48.20 Ac	0 Ac	0 Ac	0 Ac	48.20 Ac
	Subtotal	0 Ac		48.20 Ac	
Proposed	48.20 Ac	16.30 Ac	5.62 Ac	14.21 Ac	12.07 Ac
	Subtotal	21.92 Ac		26.28 Ac	

Nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 will be implemented to the maximum extent practicable on the project (Refer to Section 13). Low-impact development measures such as vegetative retention swales and rain gardens disconnect and pre-treat stormwater runoff from parking areas and drives. The stormwater is conveyed and discharged into an open stormwater management basin that is designed to retain and infiltrate the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm. The basin is designed so that the post-construction peak runoff discharge rates for the 10 and 100-year storm events do not exceed 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The basin absorbs the entire runoff volume from the two-year storm event. Note that the volume retained in the swales and rain garden areas, which will be designed in detail when the actual field layout is determined in the future, is not required to meet the groundwater recharge standard and are solely intended to pretreat runoff prior to infiltration.

The table below summarizes the peak rates of runoff generated from the Development Area in its pre and post developed condition, the maximum storage volume and elevation, and the required 10-year net increase in impervious cover (NIC) volume. Drainage shed modeling of the Development Area is provided in Appendix C.

DEVELOPMENT AREA 6						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	32.13	-----	-----	-----	-----
	10-Year	4.43	-----	-----	-----	-----
	2-Year	0.25	-----	-----	-----	-----
Proposed	100-Year	24.92	25.70	648,534	53.91	-----
	10-Year	2.42	3.32	449,008	53.19	395,981
	2-Year	0.00	0.12	278,250	52.43	-----

DEVELOPMENT AREA 7

The Development Area is identified on the Phase 2 Stormwater Master Plan (Sheet C1401) prepared by Marathon and is the site of proposed administrative buildings. The area fronts on the southeast corner of Pomona Road and Duerer Street. The area drains in the easterly direction towards a tributary of Morse's Mill Stream which discharges into Lake Fred and Morse's Mill Stream. For purposes of determining stormwater management compliance, the stormwater analysis assumes that the entire site under its pre-developed conditions is wooded. The table below shows the pre and post developed cover conditions for the Development Area:

PROJECT AREA COMPARISON					
	Total Area	Impervious		Pervious	
		Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	36.49 Ac	0 Ac	0 Ac	0 Ac	36.49 Ac
	Subtotal	00 Ac		36.49 Ac	
Proposed	36.49 Ac	3.21 Ac	8.76 Ac	10.00 Ac	14.52 Ac
	Subtotal	11.97 Ac		24.52 Ac	

Nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 will be implemented to the maximum extent practicable on the project (Refer to Section 13). Low-impact development measures such as vegetative retention swales and rain gardens disconnect and pre-treat stormwater runoff from parking areas and drives. The stormwater is conveyed and discharged into an open stormwater management basin that is designed to retain and infiltrate the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm. The basin is designed so that the post-construction peak runoff discharge rates for the 10 and 100-year storm events do not exceed 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The basins absorb the entire runoff volume from the two-year storm event. Note that the volume retained in the swales and rain garden areas, which will be designed in detail when the actual field layout is determined in the future, is not required to meet the groundwater recharge standard and are solely intended to pretreat runoff prior to infiltration.

The table below summarizes the peak rates of runoff generated from the Development Area in their pre and post developed condition, the maximum storage volume and elevation, and the provided 10-year net increase in impervious cover (NIC) volume. Drainage shed modeling of the Development Area is provided in Appendix C.

DEVELOPMENT AREA 7						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	44.68	-----	-----	-----	-----
	10-Year	11.83	-----	-----	-----	-----
	2-Year	2.02	-----	-----	-----	-----
Proposed	100-Year	35.67	35.74	366,361	54.07	-----
	10-Year	2.97	8.87	242,751	53.52	212,335
	2-Year	0.00	1.01	158,291	53.14	-----

<u>DEVELOPMENT AREA 9</u>

The Development Area is identified on the Stormwater Plan (Sheet C1400) prepared by Marathon and is the site of the proposed storage facility for Plant Management. The area fronts on Vera King Farris Drive. The project entails construction of two new storage buildings within the area that is currently cleared and covered with a compacted gravel surface. The area drains in the easterly direction towards a tributary of Morse's Mill Stream which discharges downstream of Lake Fred. Since the area proposed for improvement is previously disturbed and no increase in impervious surface is proposed, no stormwater management measures are required

<u>DEVELOPMENT AREA 10</u>

The Development Area is identified on the Stormwater Plan (Sheet C1401 and C1403) prepared by Marathon and is the site of the proposed Research Park Administrative Annex. The Development Area fronts on Jimmie Leeds Road, Insbruck Avenue and Duerer Street. The area drains in the northerly direction towards a tributary of Morse's Mill Stream which discharges into Lake Fred and Morse's Mill Stream. For purposes of determining stormwater management compliance, the stormwater analysis assumes that the entire site under its pre-developed conditions is wooded. The table below show the pre and post developed cover conditions for the Development Area:

PROJECT AREA COMPARISON-10					
	Total Area	Impervious		Pervious	
		Paving & Walks (incl. Gravel)	Roof	Open Space	Woods
Existing	24.35 Ac	0 Ac	0 Ac	0 Ac	24.35 Ac
	Subtotal	0 Ac		24.35 Ac	
Proposed	24.35 Ac	0.94 Ac	5.60 Ac	3.52 Ac	14.29 Ac
	Subtotal	6.54 Ac		17.81 Ac	

Nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 will be implemented to the maximum extent practicable on the project (Refer to Section 13). Low-impact development measures such as vegetative retention swales and rain gardens disconnect and pre-treat stormwater runoff from parking areas and drives. The stormwater is conveyed and discharged into an open stormwater management basin that is designed to retain and infiltrate the total runoff volume generated from the net increase in impervious surfaces by the ten-year storm. The basin is designed so that the post-construction peak runoff discharge rates for the 10 and 100-year storm events do not exceed 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The basins absorb the entire runoff volume from the two-year storm event. Note that the volume retained in the swales and rain garden areas, which will be designed in detail when the actual field layout is determined in the future, is not required to meet the groundwater recharge standard and are solely intended to pretreat runoff prior to infiltration.

The table below summarizes the peak rates of runoff generated from the Development Area in its pre and post developed condition, the maximum storage volume and elevation, and the provided 10-year net increase in impervious cover (NIC) volume. Drainage shed modeling of the Development Area is provided in Appendix C.

DEVELOPMENT AREA 10						
		Peak Discharge (CFS)	Allowable Discharge (CFS)	Maximum Storage Volume (CF)	Maximum Storage Elevation (FT)	10-Year NIC Volume (CF)
Existing	100-Year	22.87	-----	-----	-----	-----
	10-Year	7.50	-----	-----	-----	-----
	2-Year	1.87	-----	-----	-----	-----
Proposed	100-Year	17.81	18.30	275,554	58.13	-----
	10-Year	2.54	5.63	165,897	57.53	124,812
	2-Year	0.00	0.94	111,315	57.22	-----

8.0 COMPLIANCE WITH GROUNDWATER RECHARGE STANDARD AT N.J.A.C. 7:50-6.84(a)6iii

For Development Area 1 (the previously developed core academic area), the groundwater recharge standard does not apply since there is a net decrease in impervious surfaces.

For the development areas in existing vacant portions of the site, in accordance with N.J.A.C. 7:50-6.84(a)6iii, the stormwater runoff volume generated by the ten (10) year twenty-four (24) hour storm from the net increase in impervious surfaces is retained and infiltrated on-site and shown in section 7 above.

The table in Appendix C summarizes the total ten-year runoff volume generated by the site under post-development conditions and the volume infiltrated.

9.0 COMPLIANCE WITH RUNOFF QUANTITY STANDARD AT N.J.A.C. 7:50-6.84(a)6ii

For the Development Area 1, in accordance with N.J.A.C. 7:50-6.84(a)6ii(1), the post-construction runoff hydrographs for the two, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events.

For the development areas in existing vacant portions of the site, in accordance with N.J.A.C. 7:50-6.84(a)6ii(3), the peak post-development stormwater runoff rates for the 2 year, 10 year and 100 year storms do not exceed 50, 75 and 80 percent, respectively, of the peak pre-development stormwater rates for the same storms.

The table in Appendix C summarizes the discharge rates, storage volumes and storage elevation within each basin system for the post-developed conditions under normal operations assuming no depletion of volume due to infiltration:

10.0 COMPLIANCE WITH RUNOFF QUALITY STANDARD AT N.J.A.C. 7:8-5.5

In accordance with N.J.A.C. 7:8-5.5, a land development that creates 0.25 acres or more of new or additional impervious surface must include stormwater management measures that reduce the average annual total suspended solids (TSS) load in the site's post-construction runoff by 80%. Since the development in the Master Plan proposes to construct more than 0.25 acres of additional impervious surface, this project must meet the Runoff Water Quality Standards of the NJ Stormwater Regulations.

The infiltration basins are designed to accommodate the full volume of runoff from the water quality storm. Infiltration basins are assigned a TSS removal rate of 80%. The rate provided is explained in detail in Chapter 9 of the BMP Manual. Additionally, the vegetated conveyance areas and vegetated infiltration areas within the proposed parking lots will provided between 50% and 80% TSS removal prior to discharge to the basins.

11.0 COMPLIANCE WITH INFILTRATION BASIN DESIGN, SITING AND CONSTRUCTION STANDARD AT N.J.A.C. 7:50-6.84(a)6iv

Stormwater infiltration facilities are designed to provide a minimum separation of at least two feet between the elevation of the lowest point of the bottom of the infiltration facility and the seasonal high water level;

Stormwater infiltration facilities are sited in suitable soils verified by laboratory testing to have permeability rates between one and 20 inches per hour. A factor of safety of two was applied to the soil's permeability rate in determining the infiltration facility's design permeability rate;

Groundwater mounding analysis has been performed to assess the hydraulic impacts of mounding of the water table resulting from infiltration of stormwater runoff from the maximum storm designed for infiltration. Groundwater mounding does not cause stormwater or groundwater to breakout to the land surface or cause adverse impacts to adjacent water bodies, wetlands or subsurface structures, including, but not limited to basements and septic systems;

To the maximum extent practical, stormwater management measures are designed to limit site disturbance, maximize stormwater management efficiencies, maintain or improve aesthetic conditions and incorporate pretreatment as a means of extending the functional life and increasing the pollutant removal capability of structural stormwater management facilities;

> The basins are designed to minimize disturbance by avoiding clearing and excavation where possible and maintaining the naturally wooded area to be shallow storage for runoff that will act as a bioretention area for runoff. Aesthetic conditions are maintained in the basin areas by minimizing tree removal and incorporation of functional landscape areas in the parking lots. Those same landscape areas in the parking lots will be pretreatment for the runoff prior to discharge to the stormwater management facilities. They will be low depth vegetated swales and rain gardens designed to accept the first flush of runoff and provide pretreatment of runoff from the parking areas. Any runoff in excess of the pretreatment volume in the landscape areas will be safely conveyed to the basins by a combination of vegetated conveyance areas and inlets and piping that will be designed in detail once the final layout of the respective development areas is determined.

To avoid sedimentation that may result in clogging and reduction of infiltration capability and to maintain maximum soil infiltration capacity, the construction of stormwater infiltration basins shall be managed in accordance with the following standards:

(A) Due to the timelines associated with full build-out of the development areas, the stormwater infiltration basins may be placed into operation prior to the complete stabilization of the upstream drainage areas. Where possible, temporary stormwater management facilities and sediment basins will be utilized upstream of the basins to remove any sedimentation prior to discharge to the facilities. These measures, in conjunction with soil erosion and sediment control measures that will be utilized during construction in accordance with NJ State Soil Erosion and Sediment Control Standards, will ensure no accumulation of sediment will take place within the basins or downstream. Additionally, if possible (where excavation is proposed) the basin's bottom during this period will be constructed at a depth at least two feet higher than its final design elevation. When the drainage area has been completely stabilized, all accumulated sediment shall be removed from the infiltration basin, which shall then be excavated to its final design elevation; and

(B) To avoid compacting the infiltration basin's subgrade soils, no heavy equipment such as backhoes, dump trucks or bulldozers shall be permitted to operate within the footprint of the stormwater infiltration basin. All excavation required to construct a stormwater infiltration basin shall be performed by equipment placed outside the basin where possible. If equipment is required within the basin footprint, it will be low ground pressure equipment that will not compact the subgrade soils. The soils within the excavated area will be renovated and tilled after construction is completed. Earthwork associated with stormwater infiltration basin construction, including excavation, grading, cutting or filling, shall not be performed when soil moisture content is above the lower plastic limit.

12.0 COMPLIANCE WITH AS-BUILT REQUIREMENT AT N.J.A.C. 7:50-6.84(a)6v

In accordance with N.J.A.C. 7:50-6.84(a)6v(1), after all construction activities have been completed on the Project Site and finished grade has been established in the infiltration basin, replicate post-development field permeability tests will be conducted to determine if as-built soil permeability rates are consistent with design permeability rates.

If the results of the post-development field permeability tests fail to achieve the minimum required design permeability rate, utilizing a factor of safety of two, the infiltration basin will be renovated and re-tested until such minimum required permeability rates are achieved; and

In accordance with N.J.A.C. 7:50-6.84(a)6v(2), After all construction activities and required field testing have been completed on the Project Site, as-built plans, including as-built elevations of all stormwater management measures will be prepared to verify sufficient volume exists within the basin(s) to meet the design requirements outlined herein.

13.0 CONFORMANCE WITH NONSTRUCTURAL MANAGEMENT STRATEGIES AT N.J.A.C. 7:8-5.3

In accordance with N.J.A.C. 7:8-5.2(a), nonstructural stormwater management strategies are incorporated into the site design of the development. A total of nine strategies are used to the maximum extent practicable to meet the groundwater recharge, stormwater quality, and stormwater quantity requirements prior to utilizing structural stormwater management measures. Nonstructural stormwater management strategies incorporated into the site design include:

1. Protecting wetland areas and other environmentally sensitive areas by inclusion of three hundred feet buffer;

2. Minimizing impervious surfaces by reducing cartway widths and parking stall dimensions and breaking up or disconnecting the flow of runoff from parking areas, drives and roadways by incorporating small-scale distributed vegetative swales and rain gardens;

3. Protecting and preserving natural drainage features and vegetation to slow runoff, filter out pollutants and facilitate infiltration;

4. Minimizing the decrease in the "time of concentration" from pre-construction to post-construction through grading to encourage sheet flow and to lengthen flow paths.

5. Minimizing land disturbance by limiting clearing and grading to the areas to be developed and protecting vegetation to remain.

6. Minimizing soil compaction by limiting same to cartway, parking and building footprint areas.

7. Providing low-maintenance landscaping that encourages retention and planting of native vegetation and minimizing the use of lawns, fertilizers and pesticides;

8. Providing vegetated open-channel conveyance systems discharging into and through stable vegetated areas to help filter runoff and encourage recharge; and

9. Providing other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:

   i. Preventing the accumulation of trash and debris in drainage systems;
   ii. Preventing the discharge of trash and debris from drainage systems;
   iii. Applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

The New Jersey Nonstructural Stormwater Management Strategies Point System (NSPS) Worksheet will be prepared for each individual project described herein at the time the actual development plans are made. The NSPS Worksheet provides a tool in determining that the strategies have been used to the "maximum extent practicable" at a major development as required by the Rules. If the NSPS demonstrates that sufficient nonstructural stormwater management measures have been utilized at the project, no further proof of compliance with the maximum extent practicable requirement shall be required. However, if the NSPS fails to demonstrate such compliance, such results shall not be used to disapprove any permit application sought by the proposed development. Instead, the College will be required to demonstrate compliance through other and/or additional means. This includes the Low Impact Development (LID) Checklist contained in Appendix A of the New Jersey Stormwater Best Management Practices Manual, which includes a rigorous alternatives analysis for each measure.

14.0 CONFORMANCE WITH LOW IMPACT DEVELOPMENT STANDARD IN CHAPTER 2 OF THE NEW JERSEY STORMWATER BEST MANAGEMENT PRACTICES MANUAL

The rules emphasize the employment of effective alternatives to conventional centralized stormwater management strategy. Strategies have been developed to minimize and prevent adverse stormwater runoff impacts from occurring and to provide necessary treatment closer to the origin of those impacts. Such strategies, known as Low Impact Development or LID, seek to reduce and/or prevent adverse runoff impacts through sound site planning and both nonstructural and structural techniques that preserve or closely mimic the natural or pre-developed hydrologic response to precipitation. Low impact development is a comprehensive technology-based approach to managing stormwater. Stormwater is managed in small, cost-effective landscape features rather than being conveyed and entirely managed in large pond facilities located at the bottom of drainage areas. Low impact development techniques interact with the rainfall-runoff process, controlling stormwater runoff and pollutants closer to the source and providing site design measures that can significantly reduce the overall impact of land development on stormwater runoff.

Effective low impact development includes the use of both nonstructural and structural stormwater management measures that are a division of a larger group of practices and facilities known as Best Management Practices or BMPs. The BMPs utilized in low impact development, known as Integrated Management Practices or IMPs, focus first on minimizing both the quantitative and qualitative changes to a site's predeveloped hydrology through nonstructural practices and then providing treatment as necessary through a network of structural facilities distributed throughout the site.

The primary goal of Low Impact Development methods is to mimic the predevelopment site hydrology by using site design techniques that store, infiltrate, evaporate, and detain runoff. Use of these techniques helps to reduce off-site runoff and ensure adequate groundwater recharge. The objective of low-impact development is accomplished by:

1. Minimizing stormwater impacts to the extent practicable. Techniques include reducing imperviousness, conserving natural resources and ecosystems, maintaining natural drainage courses, reducing use of pipes, and minimizing clearing and grading.
2. Providing runoff storage measures dispersed uniformly throughout a site landscape with the use of a variety of detention, retention, and runoff practices.
3. Maintaining predevelopment time of concentration by strategically routing flows to maintain travel time and control the discharge.

Low-impact development technology employs integrated management practices to achieve desired post development hydrologic conditions. Management practices that are suited to low-impact development and will be incorporated into the development include:

Bioretention - Bioretention is a practice to manage and treat stormwater runoff by using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. The method combines physical filtering and adsorption with biological processes. The system can include the following components: a pretreatment filter strip of grass channel inlet area, a shallow surface water ponding area, a vegetative planting area, a soil zone, an underdrain system, and an overflow outlet structure.

Dry Wells - A dry well consists of a small excavated pit backfilled with stone aggregate. Dry wells function as infiltration systems used to control runoff from building rooftops. Another special application of dry wells is modified catch basins, where inflow is a form of direct surface runoff. Dry wells provide the majority of treatment by processes related to soil infiltration, including adsorption, trapping, filtering, and bacterial degradation.

Filter Strips - Filter strips are typically bands of close-growing vegetation, usually grass, planted between pollutant source areas and a downstream receiving waterbody. They also can be used as outlet or pretreatment devices for other stormwater control practices. For LID sites, a filter strip should be viewed as only one component in a stormwater management system.

Vegetated Buffers - Vegetated buffers are strips of vegetation, either natural or planted, around sensitive areas such as waterbodies, wetlands, woodlands, or highly erodible soils. In addition to protecting sensitive areas, vegetated strips help to reduce stormwater runoff impacts by trapping sediment and sediment-bound pollutants, providing some infiltration, and slowing and dispersing stormwater flows over a wide area.

Level Spreaders - A level spreader typically is an outlet designed to convert concentrated runoff to sheet flow and disperse it uniformly across a slope to prevent erosion. One type of level spreader is a shallow trench filled with crushed stone. The lower edge of the level spreader must be exactly level if the spreader is to work properly.

Grassed Swales - Swales are simple drainage and grassed channels that primarily served to transport stormwater runoff away from roadways and rights-of-way. Two types of grassed swales are being used for this purpose: the dry swale, which provides both quantity (volume) and quality control by facilitating stormwater infiltration, and the wet swale, which uses residence time and natural growth to reduce peak discharge and provide water quality treatment before discharge to a downstream location. The wet swale typically has water tolerant vegetation permanently growing in the retained body of water. These systems are often used on roadway designs.

Cisterns - Stormwater runoff cisterns are roof water management devices that provide retention storage volume in underground storage tanks. On-site storage with later reuse of stormwater also provides an opportunity for water conservation and the possibility of reducing water utility costs.

Infiltration Trenches - An infiltration trench is an excavated trench that has been back-filled with stone to form a subsurface basin. Stormwater runoff is diverted into the trench and is stored until it can be infiltrated into the soil, usually over a period of a few days. Infiltration trenches are very adaptable IMPs, and the availability of many practical configurations make them ideal for small urban drainage areas. They are most effective and have a longer life cycle when some form of pretreatment is included in their design. Pretreatment may include techniques like vegetated filter strips or grassed swales. Care must be taken to avoid clogging of infiltration trenches, especially during site construction activities.

15.0 CONFORMANCE WITH SOIL EROSION CONTROL STANDARD AT N.J.A.C. 7:8-5.4(a)1

The development of each project will comply with the minimum design and performance standards for erosion control established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. and implementing rules. Each project will be submitted to the Cape Atlantic Conservation District for certification of a Soil Erosion and Sediment Control Plan prior to commencement of construction.

16.0 CONCLUSION

This Stormwater Compliance Report demonstrates that Stockton's goal to provide the most environmentally responsible and cost-effective stormwater management system for the development proposed within the Master Plan can be met with low impact techniques that provide both functional and aesthetic benefits. The different development areas, and their associated drainage patterns and underlying soil conditions, provide opportunity for the use of different stormwater management techniques and features to address the applicable Stormwater Management Regulations of the Pinelands Comprehensive Management Plan. The general theme of the development approach is low impact techniques relying on functional landscaping elements and naturally wooded areas to treat and attenuate runoff prior to discharge downstream. This approach ensures existing drainage patterns and intensities are maintained so there are no negative impacts to downstream wetland buffers, wetlands, waterways and waterbodies.

As described above, the stormwater management and collection systems are designed in accordance with applicable state regulations and requirements. The stormwater management and collection systems are designed to accommodate the required design storms and to provide groundwater recharge, runoff control, and water quality measures as outlined in N.J.A.C. 7:8 and the Pinelands CMP N.J.A.C. 7:50-6.84(a)6.

APPENDIX A

Existing and Proposed Conditions

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY
STORMWATER MASTER PLAN AREAS

PROPOSED CONDITION

AREA	Soil Type	HSG	TOTAL AREA	TOTAL Impervious	Building	Roadway	Parking Impervious	Parking pervious	TOTAL Pervious	Open Space	Woods	Meadow
2 & 3	AtsA	D	**0.43**	0.00					0.43		0.43	
	DocB	B	**59.85**	0.00					59.85	50.00	9.85	
	GamB	A	**46.02**	11.95	2.60	1.65	3.37	4.33	34.07	34.07		
		TOTAL	**106.30**	**11.95**	**2.60**	**1.65**	**3.37**	**4.33**	**94.35**	**84.07**	**10.28**	**0.00**
4			**3.77**	3.77	3.77				0.00			
			0.00	0.00					0.00			
		TOTAL	**3.77**	**3.77**	**3.77**	**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**
5-E	SacA	B	**5.25**	2.42	1.03	0.00	1.39		2.83	2.83	0.00	
	DocB	B	**19.16**	10.81	3.47	3.60	3.74		8.35	8.35	0.00	
	MbtB	C	**12.19**	2.69	1.61	0.00	1.08		9.50	9.50	0.00	
	WoeA	C	**7.40**	4.82	2.29	0.00	2.53		2.58	2.58	0.00	
		TOTAL	**44.00**	**20.74**	**8.40**	**3.60**	**8.74**		**23.26**	**23.26**	**0.00**	**0.00**
5-W	AtsA	D	**1.05**	0.00					1.05	1.05	0.00	
	AugB	B	**9.45**	0.00					9.45	9.45	0.00	
	DocB	B	**20.72**	14.68	6.26	3.24	5.18		6.04	6.04	0.00	
	GamkB	A	**2.90**	0.00					2.90	2.90	0.00	
	HboA	C	**1.24**	0.00					1.24	1.24	0.00	
		TOTAL	**35.36**	**14.68**	**6.26**	**3.24**	**5.18**		**20.68**	**20.68**	**0.00**	**0.00**
6	DocB	B	**6.15**	0.00					6.15	6.15		
	EveB	A	**5.46**	0.00					5.46	5.46		
	GamB	A	**24.52**	21.92	5.62		16.30		2.60	2.60		
	WoeA	C	**12.07**	0.00					12.07		12.07	
		TOTAL	**48.20**	**21.92**	**5.62**	**0.00**	**16.30**		**26.28**	**14.21**	**12.07**	**0.00**
7	AtsA	D	**0.69**	0.00					0.69		0.69	
	HboA	B	**35.80**	11.97	3.21		8.76		23.83	10.00	13.83	
		TOTAL	**36.49**	**11.97**	**3.21**	**0.00**	**8.76**		**24.52**	**10.00**	**14.52**	**0.00**
10	SacA	B	**5.49**	3.27	0.47		2.80		2.22	2.22		
	WoeA	C	**8.12**	3.27	0.47		2.80		4.85	4.85		
		TOTAL	**13.61**	**6.54**	**0.94**	**0.00**	**5.60**		**7.07**	**7.07**	**0.00**	**0.00**

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY
STORMWATER MASTER PLAN AREAS

EXISTING CONDITION

AREA	Soil Type	HSG	TOTAL AREA	TOTAL Impervious	Building	Roadway	Parking	TOTAL Pervious	Open Space	Woods	Meadow
2 & 3	AtsA	D	**0.43**	0.00				0.43		0.43	
	DocB	B	**59.85**	0.00				59.85	34.85	25.00	
	GamB	A	**46.02**	0.00				46.02		46.02	
		TOTAL	**106.30**	**0.00**	**0.00**	**0.00**	**0.00**	**106.30**	**34.85**	**71.45**	**0.00**
4			**3.26**	3.26	2.53		0.73	0.00			
			0.00	0.00				0.00			
		TOTAL	**3.26**	**3.26**	**2.53**	**0.00**	**0.73**	**0.00**	**0.00**	**0.00**	**0.00**
5-E	SacA	B	**5.25**	0.00				5.25		5.25	
	DocB	B	**19.16**	0.00				19.16		19.16	
	MbtB	C	**12.19**	0.00				12.19		12.19	
	WoeA	C	**7.40**	0.00				7.40		7.40	
		TOTAL	**44.00**	**0.00**	**0.00**	**0.00**	**0.00**	**44.00**	**0.00**	**44.00**	**0.00**
5-W	AtsA	D	**1.05**	0.00				1.05		1.05	
	AugB	B	**9.45**	0.00				9.45		9.45	
	DocB	B	**20.72**	0.00				20.72		20.72	
	GamkB	A	**2.90**	0.00				2.90		2.90	
	HboA	C	**1.24**	0.00				1.24		1.24	
		TOTAL	**35.36**	**0.00**	**0.00**	**0.00**	**0.00**	**35.36**	**0.00**	**35.36**	**0.00**
6	DocB	B	**6.15**	0.00				6.15		6.15	
	EveB	A	**5.46**	0.00				5.46		5.46	
	GamB	A	**23.47**	0.00				23.47		23.47	
	WoeA	C	**13.12**	0.00				13.12		13.12	
		TOTAL	**48.20**	**0.00**	**0.00**	**0.00**	**0.00**	**48.20**	**0.00**	**48.20**	**0.00**
7	AtsA	D	**0.69**	0.00				0.69		0.69	
	HboA	B	**35.80**					35.80		35.80	
		TOTAL	**36.49**	**0.00**	**0.00**	**0.00**	**0.00**	**36.49**	**0.00**	**0.69**	**0.00**
10	SacA	B	**5.49**	0.00				5.49		5.49	
	WoeA	C	**8.12**	0.00				8.12		8.12	
		TOTAL	**13.61**	**0.00**	**0.00**	**0.00**	**0.00**	**13.61**	**0.00**	**13.61**	**0.00**

Appendix B

Stormwater Management Basin Volumes

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY
PHASE 2 STORMWATER MASTER PLAN

BASIN VOLUMES

	Elevation	Area	Incremental Volume	Cumulative Volume	
Area 2	52	378,731	369,565	1,063,693	
	51	360,399	351,311	694,128	
	50	342,222	248,747	342,817	
	49.5	248,747	101,005	195,075	Primary Spillway
	49	155,272	88,592	94,070	
	48	21,912	5,478	5,478	
	47.5	0	0	0	
Area 5 East	56	269,340	266,306	736,533	
	55	263,271	260,265	470,228	
	54.7	261,467	181,554	391,517	Primary Spillway
	54	257,259	162,737	209,963	
	53	68,215	40,667	47,226	
	52	13,118	6,559	6,559	
	51	0	0	0	
Area 5 West	51	192,920	189,421	553,991	
	50	185,921	153,689	364,570	
	49.4	147,243	53,740	264,621	Primary Spillway
	49	121,457	102,267	210,881	
	48	83,077	68,476	108,614	
	47	53,875	34,703	40,138	
	46	15,530	5,436	5,436	
	45.3	0	0	0	
Area 6	55	345,659	323,499	996,424	
	54	301,338	276,944	672,925	
	53	252,550	208,009	395,981	Primary Spillway
	52	163,467	126,834	187,973	
	51	90,200	53,120	61,139	
	50	16,039	8,020	8,020	
	49	0	0	0	
Area 7	55	271,849	267,511	615,279	
	54	263,172	220,808	347,768	
	53.4	212,335	78,156	205,116	Primary Spillway
	53	178,444	116,178	126,960	
	52	53,912	10,782	10,782	
	51.6	0	0	0	
Area 10	59	187,833	184,934	435,872	
	58	182,035	179,164	250,938	
	57.3	178,015	53,146	124,920	Primary Spillway
	57	176,292	71,774	71,774	
	56.5	110,805	0	0	

APPENDIX C

Pre and Post-Developed
2, 10, 50, and 100-Year Storm Runoff Calculations

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY
PHASE 2 STORMWATER MASTER PLAN

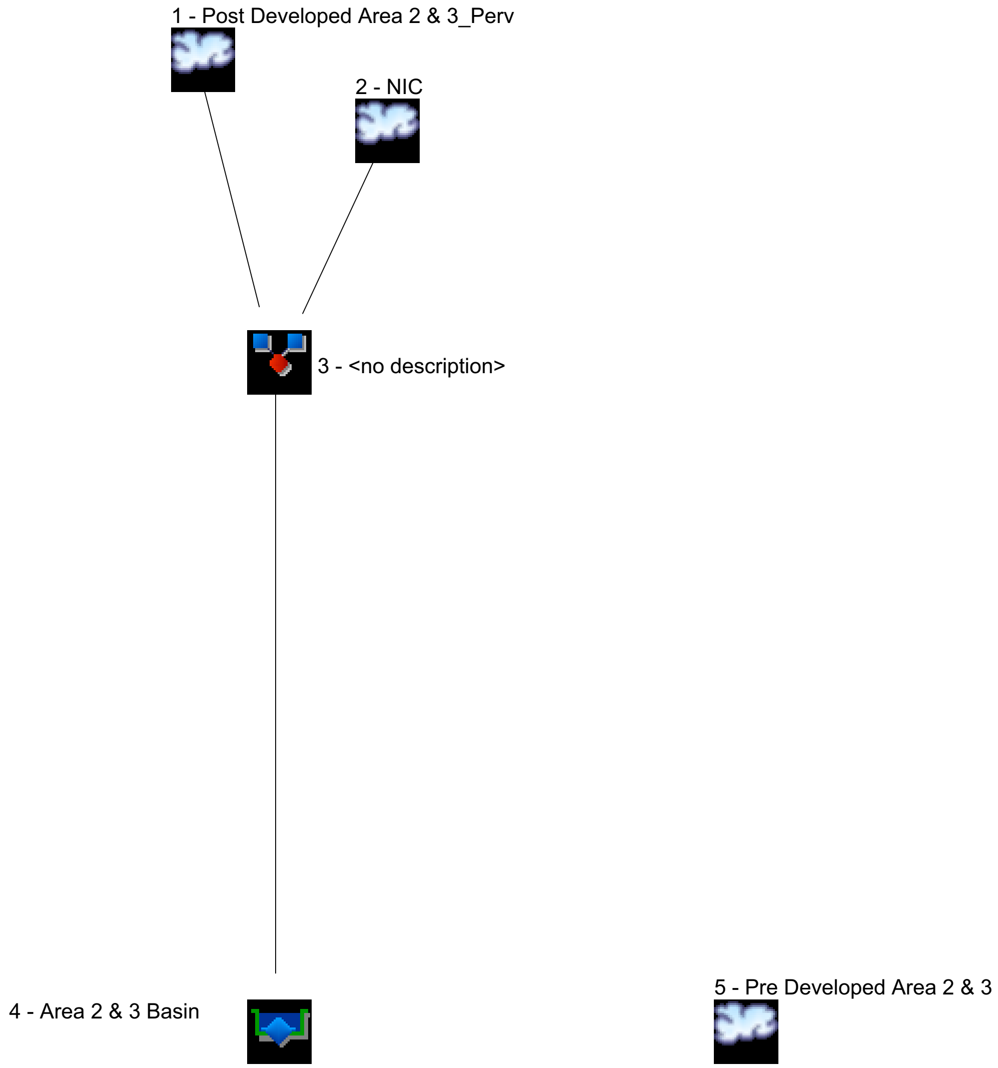
DEVELOPMENT AREA	2 & 3	5 East	5 West	6	7	10
Drainage Shed Area (Acres)	106.30	44.00	35.36	48.20	36.49	13.61
Impervious Cover (Acres)	11.95	20.74	14.68	21.92	11.97	6.54
BASIN DATA						
Top of Berm Elevation	52.00	56.60	51.30	55.00	55.00	59.10
Bottom of Basin Elevation	47.20	51.00	45.30	49.00	51.60	56.50
Height to Top of Berm(Feet)	4.80	5.60	6.00	6.00	3.40	2.60
Pond Depth to Spillway (Feet)	2.40	3.70	4.10	4.00	1.80	0.80
Emergency Spillway Width (Feet)	40	40	40	40	40	40
Emergency Spillway Elevation	51.00	55.60	50.30	54.00	54.00	58.10
Primary Spillway Width (Feet)	14	25	15	11	25	9
Primary Spillway Elevation	49.60	54.70	49.40	53.00	53.40	57.30
Discharge Velocity (CFS) (100 Yr. Storm)	2.53	2.14	2.14	1.96	1.90	1.79

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY
PHASE 2 STORMWATER MASTER PLAN

DEVELOPMENT AREA	2 & 3	5 East	5 West	6	7	10
POST DEVELOPED						
Required 10 Year NIC Volume (CF)	175,409	371,271	262,790	392,395	202,165	117,074
Provided 10 Year NIC Volume (CF)	195,075	395,981	264,621	395,981	205,116	124,812
100 Year Design Storm						
Peak Discharge (CFS)	59.72	51.05	35.85	24.92	35.67	17.81
Max. Storage Volume (CF)	690,948	616,820	426,770	648,534	366,361	275,554
Max. Storage Elevation	50.99	55.55	50.33	53.91	54.07	58.13
10 Year Design Storm						
Peak Discharge (CFS)	8.77	4.64	3.00	2.42	2.97	2.54
Max. Storage Volume (CF)	339,400	436,059	299,778	449,008	242,751	165,897
Max. Storage Elevation	49.99	54.87	49.58	53.19	53.52	57.53
2 Year Design Storm						
Peak Discharge (CFS)	0.00	0.00	0.00	0.00	0.00	0.00
Max. Storage Volume (CF)	208,490	295,529	195,825	278,250	158,291	111,315
Max. Storage Elevation	49.46	54.33	48.85	52.43	53.14	57.22
PREDEVELOPED						
100 Year Design Storm						
Peak Discharge (CFS)	77.64	63.79	45.70	32.13	44.68	22.87
Allowable Discharge (CFS)	62.11	51.03	36.56	25.70	35.74	18.30
10 Year Design Storm						
Peak Discharge (CFS)	12.63	21.36	11.61	4.43	11.83	7.50
Allowable Discharge (CFS)	9.47	16.02	8.71	3.32	8.87	5.63
2 Year Design Storm						
Peak Discharge (CFS)	0.98	5.69	1.76	0.25	2.02	1.87
Allowable Discharge (CFS)	0.49	2.85	0.88	0.12	1.01	0.94

Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 2.gpw	Wednesday, Jun 16, 2010

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	7.597	2	742	76,285	----	------	------	Post Developed Area 2 & 3_Perv
2	SCS Runoff	32.66	2	726	132,206	----	------	------	NIC
3	Combine	33.76	2	726	208,490	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	49.46	208,490	Area 2 & 3 Basin
5	SCS Runoff	0.974	2	942	27,390	----	------	------	Pre Developed Area 2 & 3

Hydrograph Report

Hyd. No. 1

Post Developed Area 2 & 3_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 7.597 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 76,285 cuft
Drainage area	= 94.350 ac	Curve number	= 53*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.430 x 77) + (50.000 x 61) + (9.850 x 55) + (34.070 x 39)] / 94.350

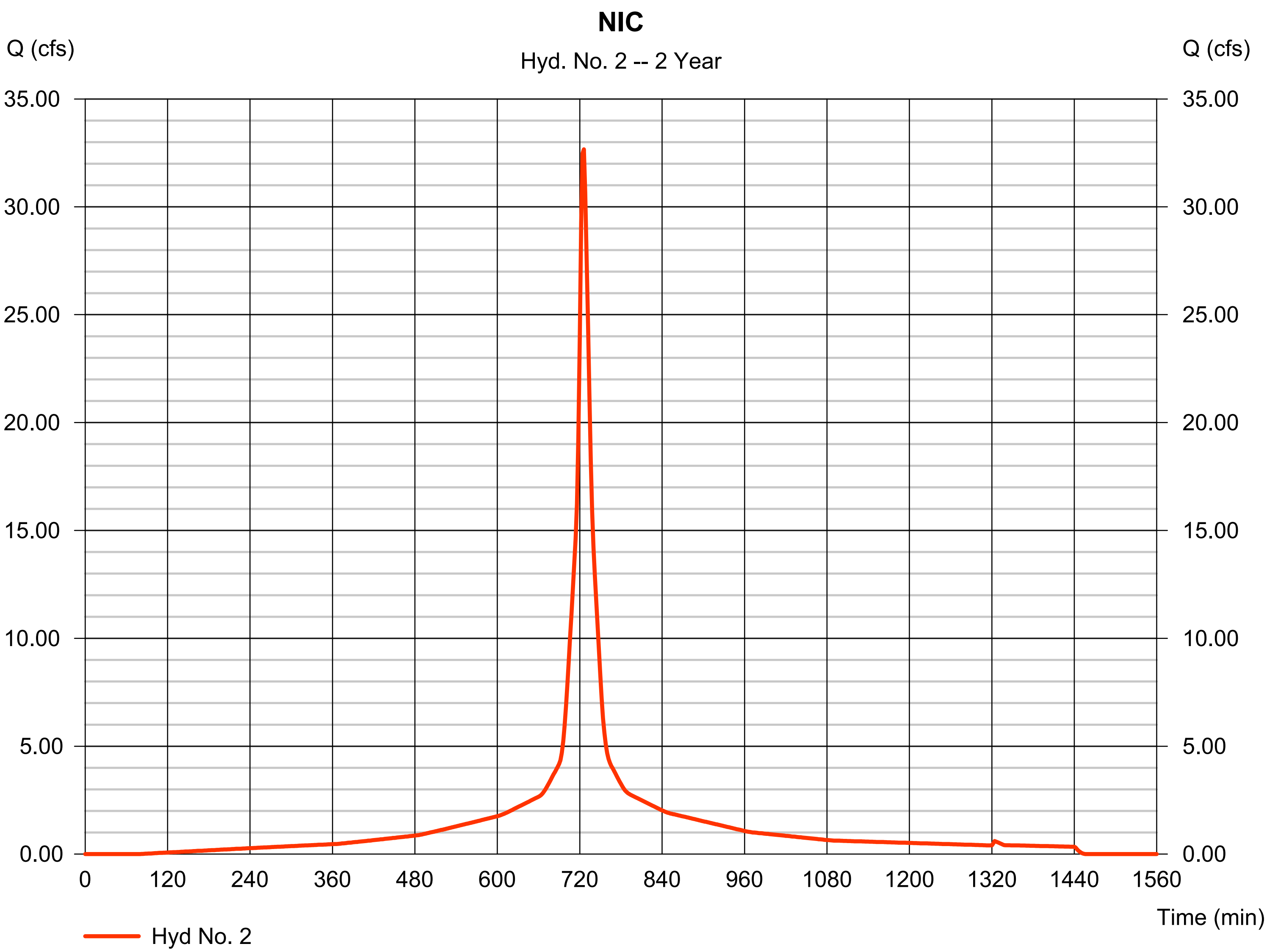
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 32.66 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 132,206 cuft
Drainage area	= 11.950 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.600 x 98) + (1.650 x 98) + (3.370 x 98) + (4.330 x 98)] / 11.950



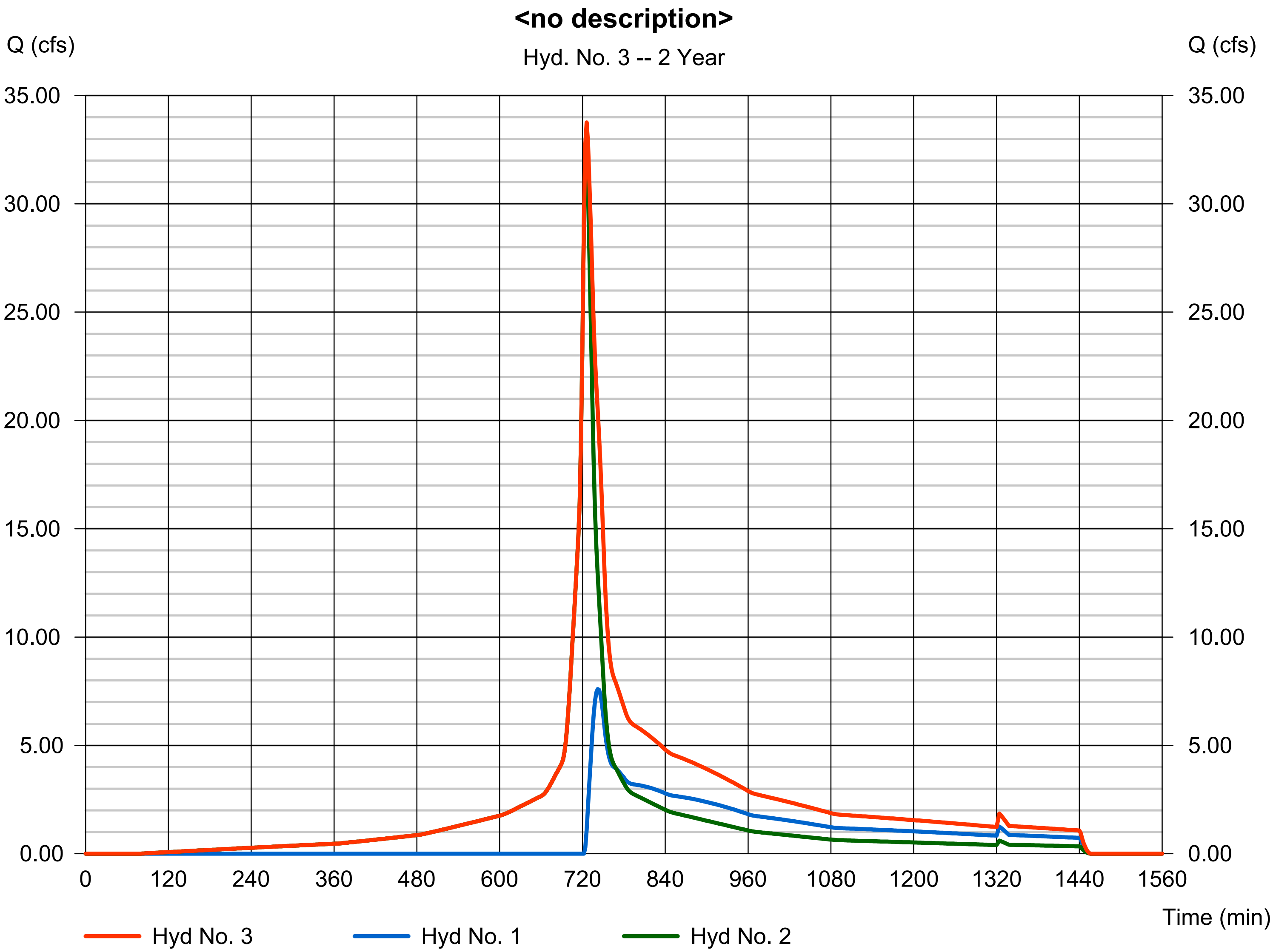
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Jun 16, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 33.76 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 208,490 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 106.300 ac



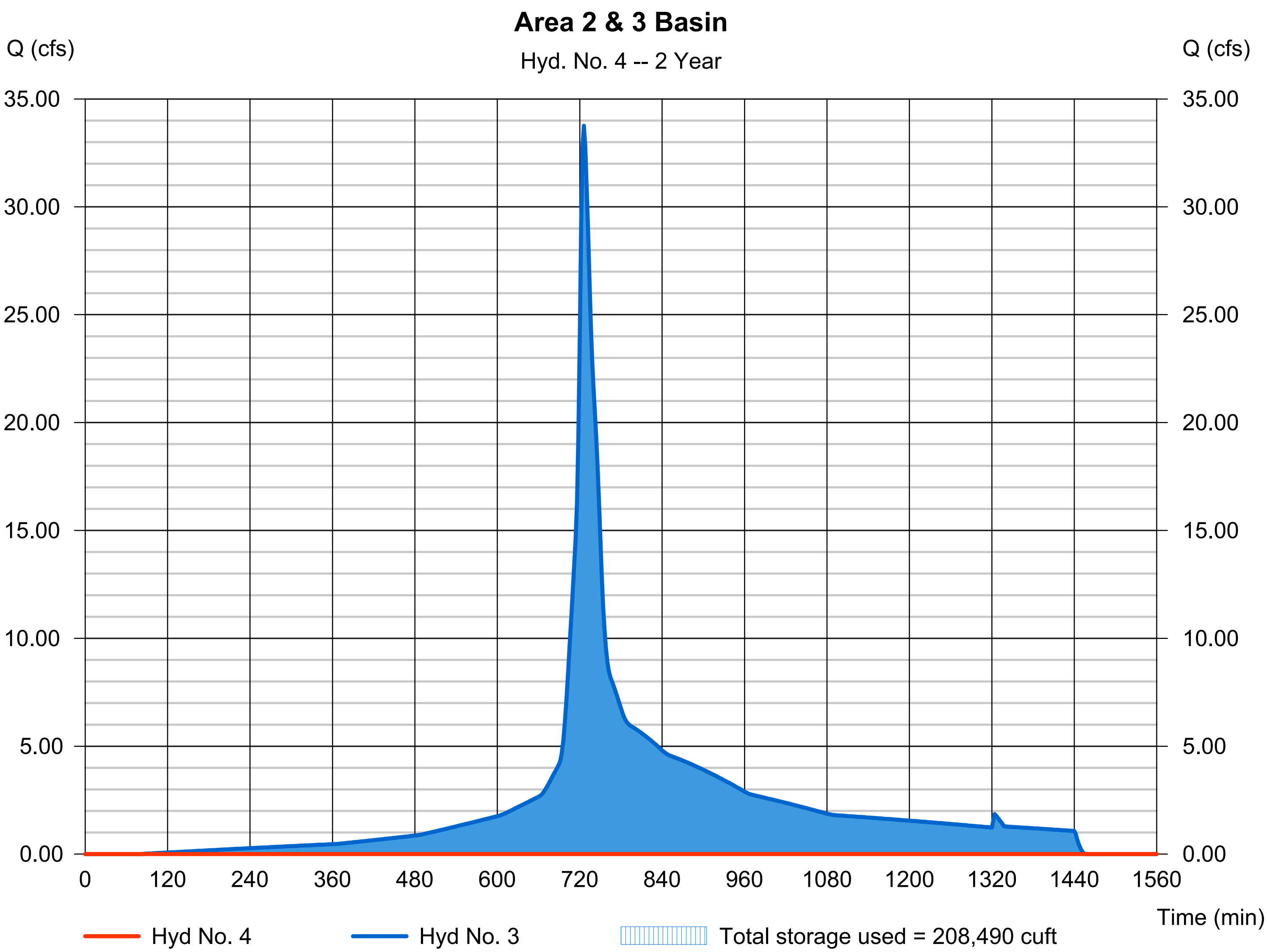
Hydrograph Report

Hyd. No. 4

Area 2 & 3 Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 49.46 ft
Reservoir name	= Area 2 & 3	Max. Storage	= 208,490 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Jun 16, 2010

Pond No. 1 - Area 2 & 3

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 47.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	47.50	00	0	0
0.50	48.00	21,912	5,478	5,478
1.50	49.00	155,272	88,592	94,070
2.50	50.00	342,222	248,747	342,817
3.50	51.00	360,399	351,311	694,128
4.50	52.00	378,731	369,566	1,063,693

Culvert / Orifice Structures

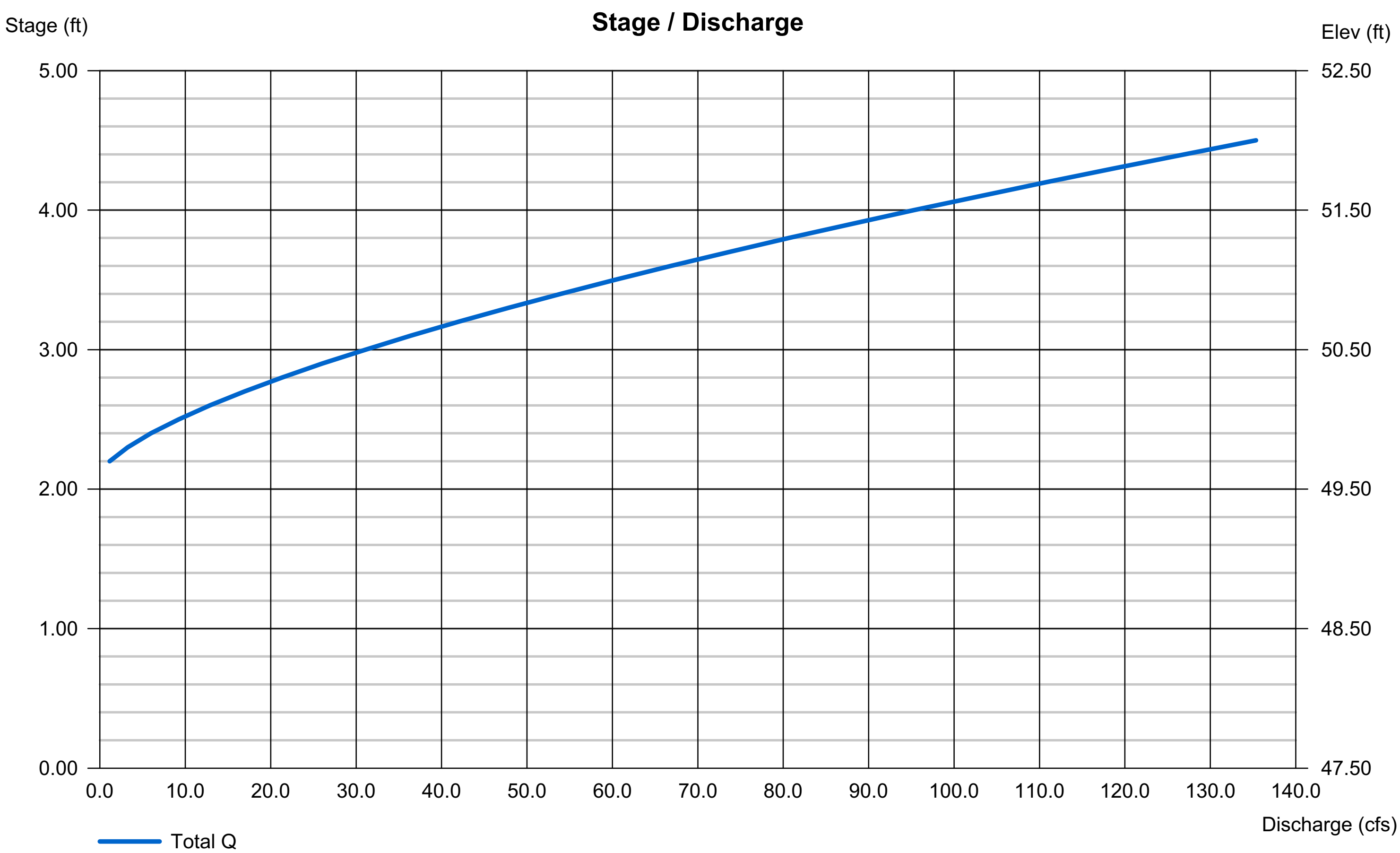
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	0.00	0.00	0.00
Crest El. (ft)	= 49.60	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 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).



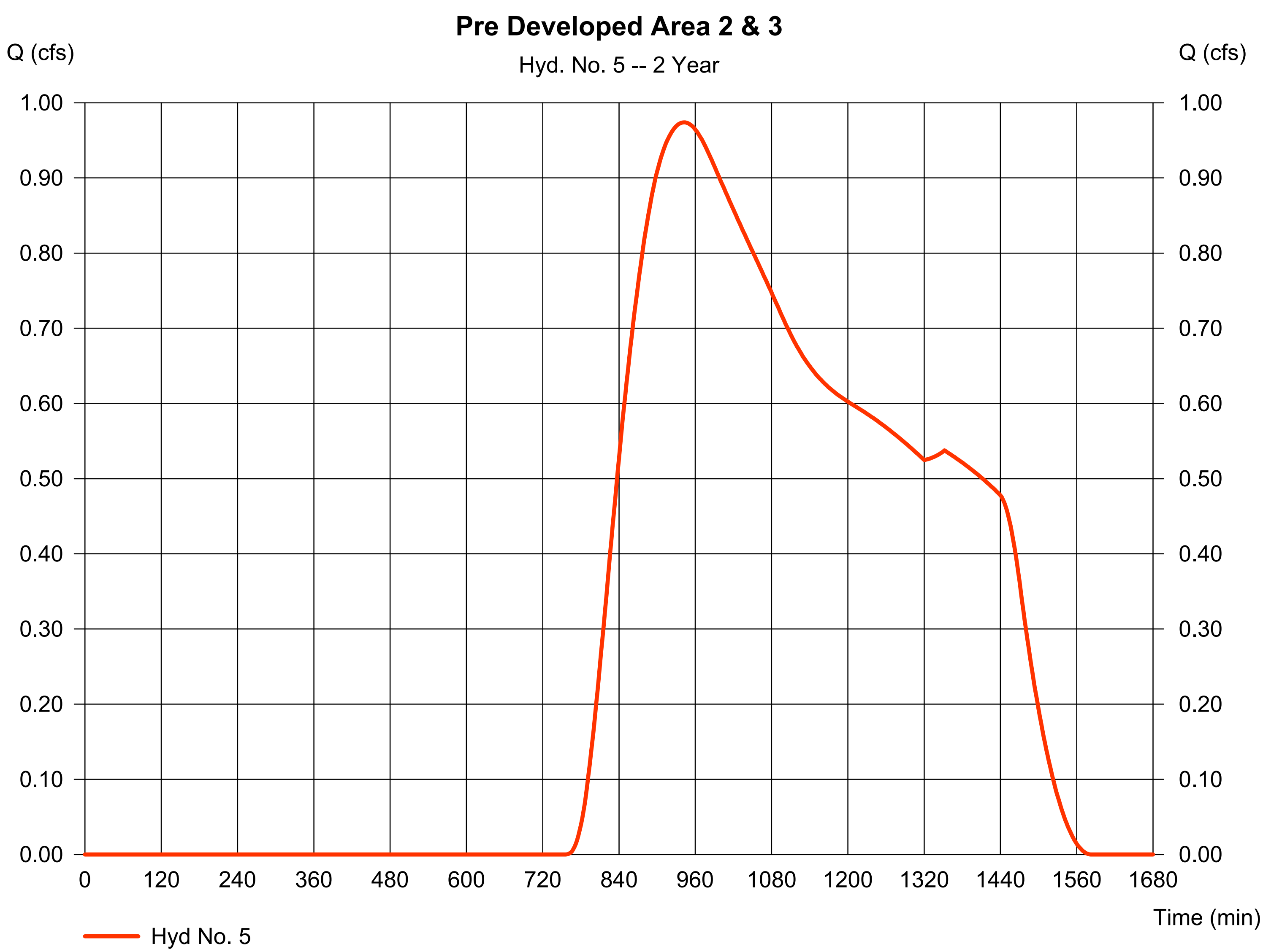
Hydrograph Report

Hyd. No. 5

Pre Developed Area 2 & 3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.974 cfs
Storm frequency	= 2 yrs	Time to peak	= 942 min
Time interval	= 2 min	Hyd. volume	= 27,390 cuft
Drainage area	= 106.300 ac	Curve number	= 46*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 53.30 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 77) + (25.000 x 55) + (46.020 x 30) + (34.850 x 61)] / 106.300



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	68.81	2	728	324,984	----	------	------	Post Developed Area 2 & 3_Perv
2	SCS Runoff	51.85	2	726	213,919	----	------	------	NIC
3	Combine	118.88	2	726	538,904	1, 2	------	------	<no description>
4	Reservoir	8.765	2	930	295,563	3	49.99	339,400	Area 2 & 3 Basin
5	SCS Runoff	12.63	2	798	213,634	----	------	------	Pre Developed Area 2 & 3

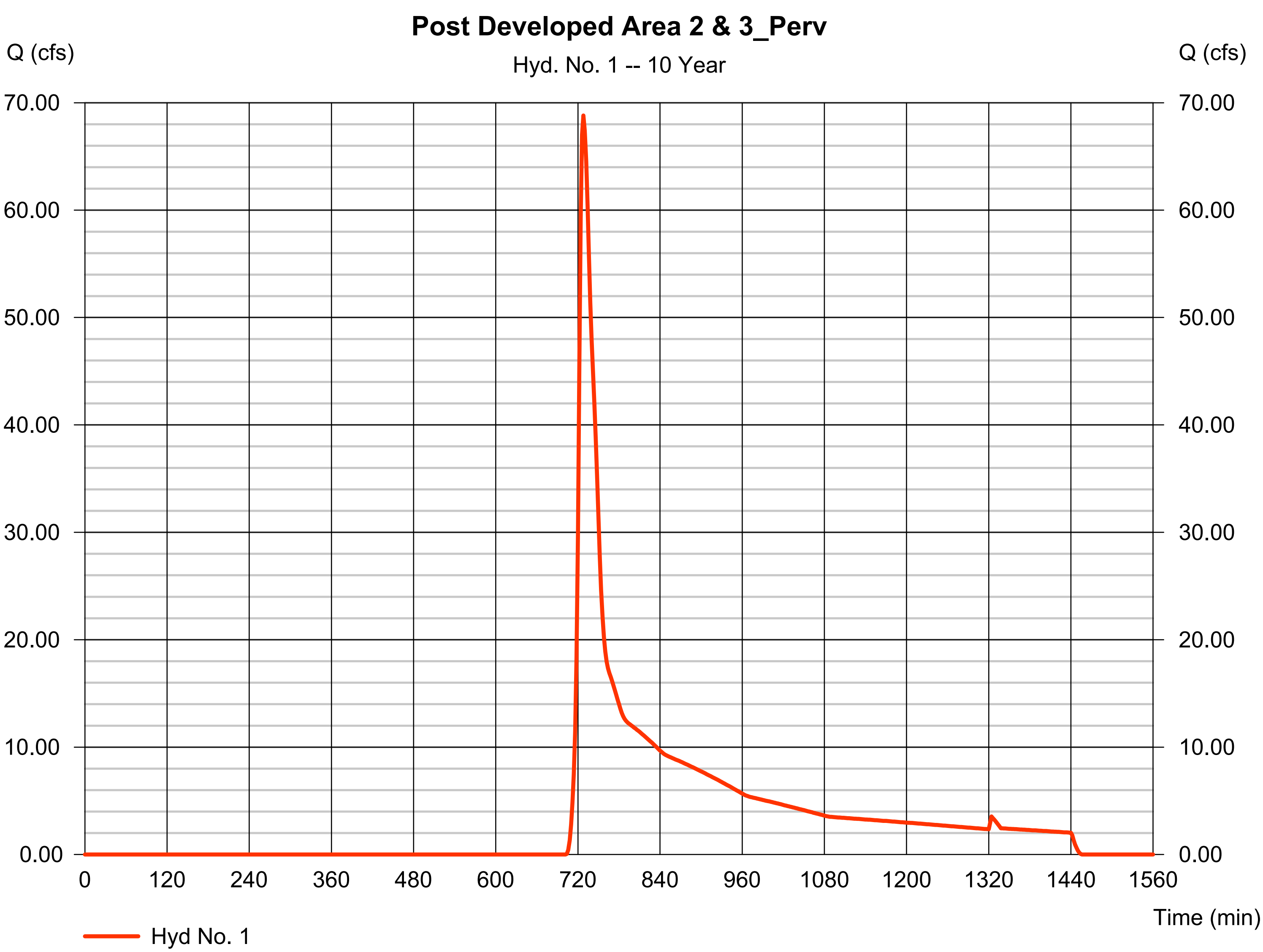
Hydrograph Report

Hyd. No. 1

Post Developed Area 2 & 3_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 68.81 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 324,984 cuft
Drainage area	= 94.350 ac	Curve number	= 53*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.430 x 77) + (50.000 x 61) + (9.850 x 55) + (34.070 x 39)] / 94.350



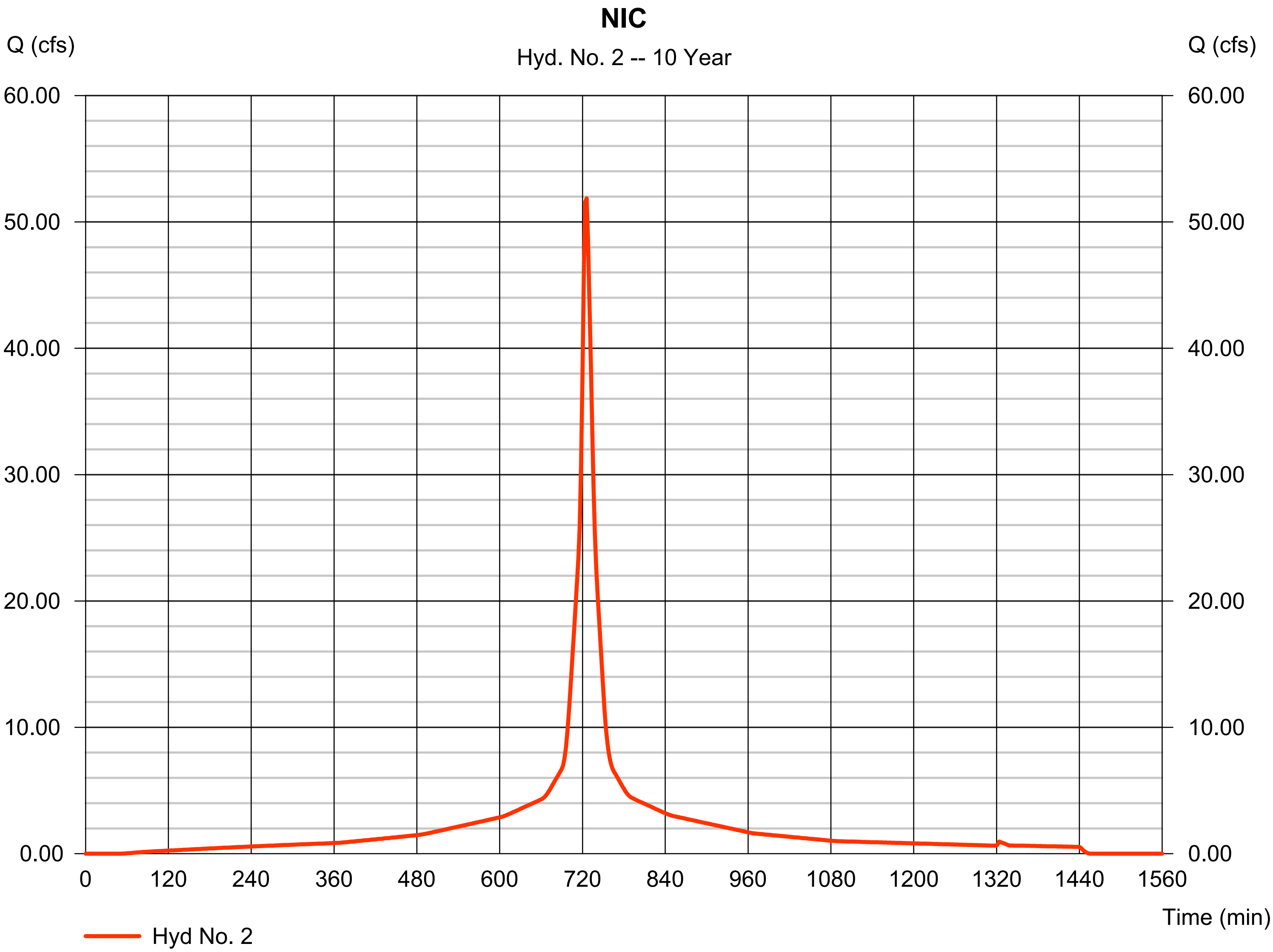
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 51.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 213,919 cuft
Drainage area	= 11.950 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.600 x 98) + (1.650 x 98) + (3.370 x 98) + (4.330 x 98)] / 11.950



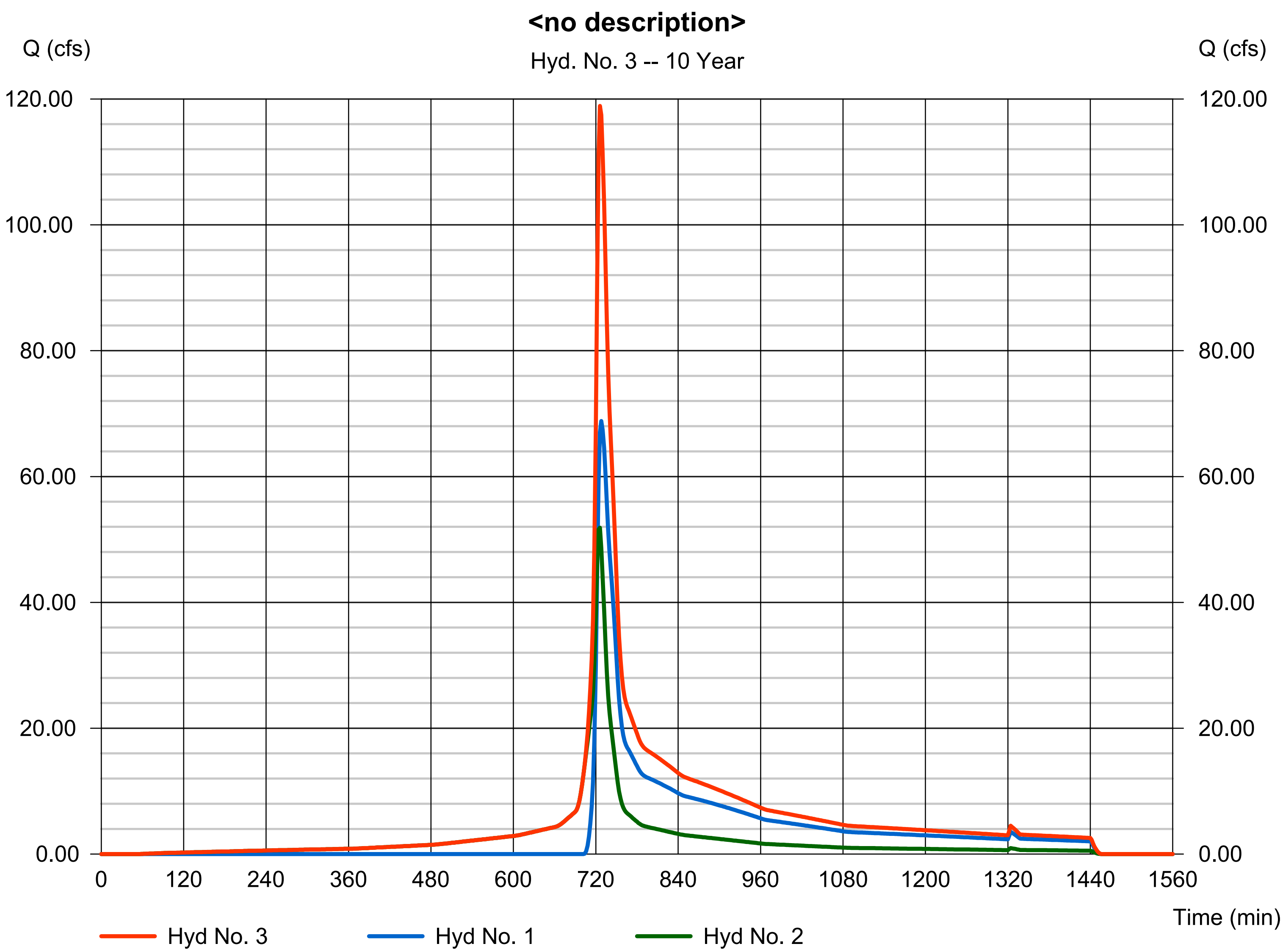
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Jun 16, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 118.88 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 538,904 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 106.300 ac



Hydrograph Report

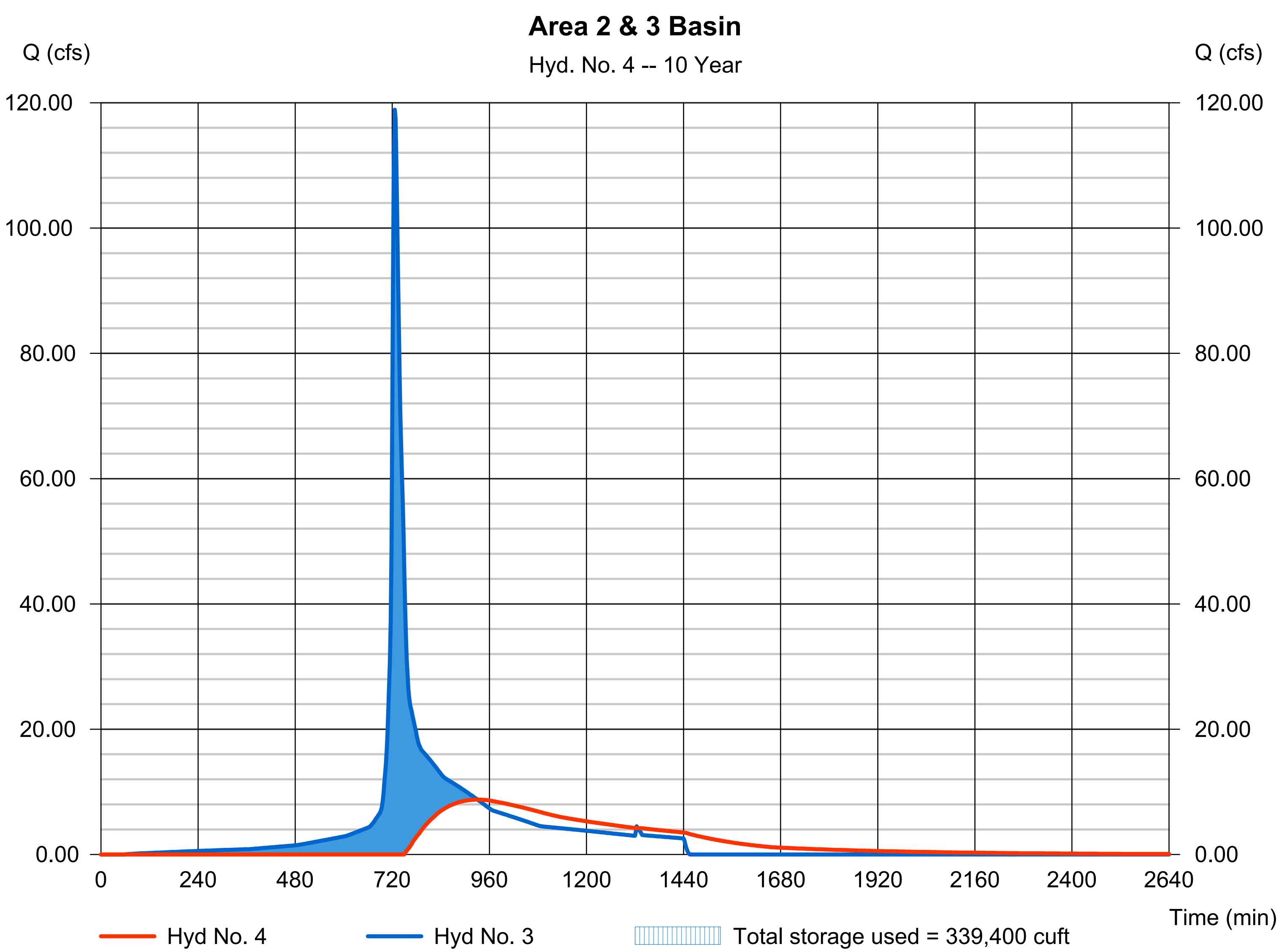
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Jun 16, 2010

Hyd. No. 4

Area 2 & 3 Basin

Hydrograph type	= Reservoir	Peak discharge	= 8.765 cfs
Storm frequency	= 10 yrs	Time to peak	= 930 min
Time interval	= 2 min	Hyd. volume	= 295,563 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 49.99 ft
Reservoir name	= Area 2 & 3	Max. Storage	= 339,400 cuft

Storage Indication method used.



Hydrograph Report

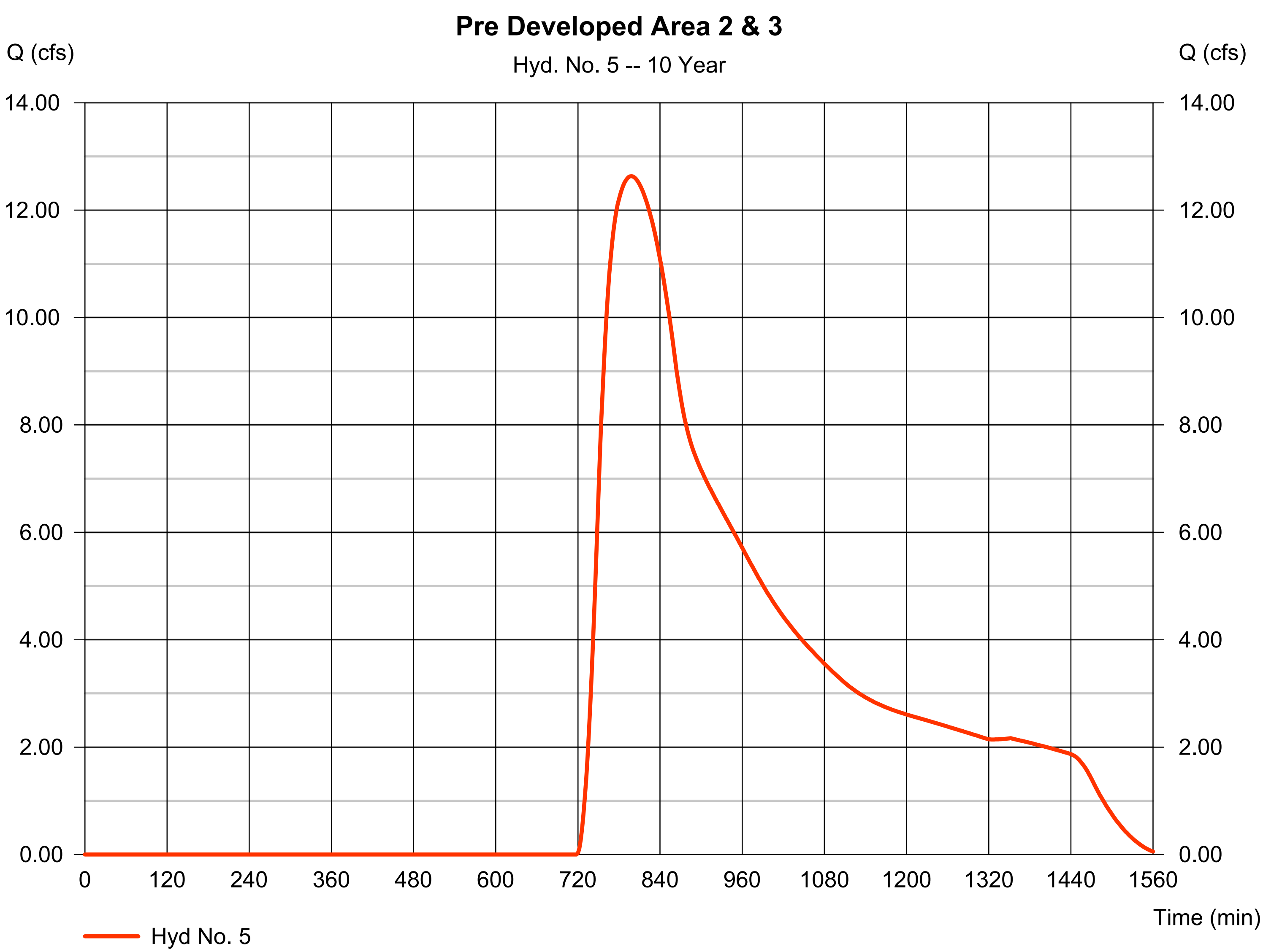
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Jun 16, 2010

Hyd. No. 5

Pre Developed Area 2 & 3

Hydrograph type	= SCS Runoff	Peak discharge	= 12.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 798 min
Time interval	= 2 min	Hyd. volume	= 213,634 cuft
Drainage area	= 106.300 ac	Curve number	= 46*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 53.30 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 77) + (25.000 x 55) + (46.020 x 30) + (34.850 x 61)] / 106.300



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	287.99	2	726	1,080,606	----	------	------	Post Developed Area 2 & 3_Perv
2	SCS Runoff	89.07	2	726	373,268	----	------	------	NIC
3	Combine	377.06	2	726	1,453,873	1, 2	------	------	<no description>
4	Reservoir	59.72	2	768	1,210,534	3	50.99	690,948	Area 2 & 3 Basin
5	SCS Runoff	77.64	2	772	899,930	----	------	------	Pre Developed Area 2 & 3

Area 2.gpw	Return Period: 100 Year	Wednesday, Jun 16, 2010

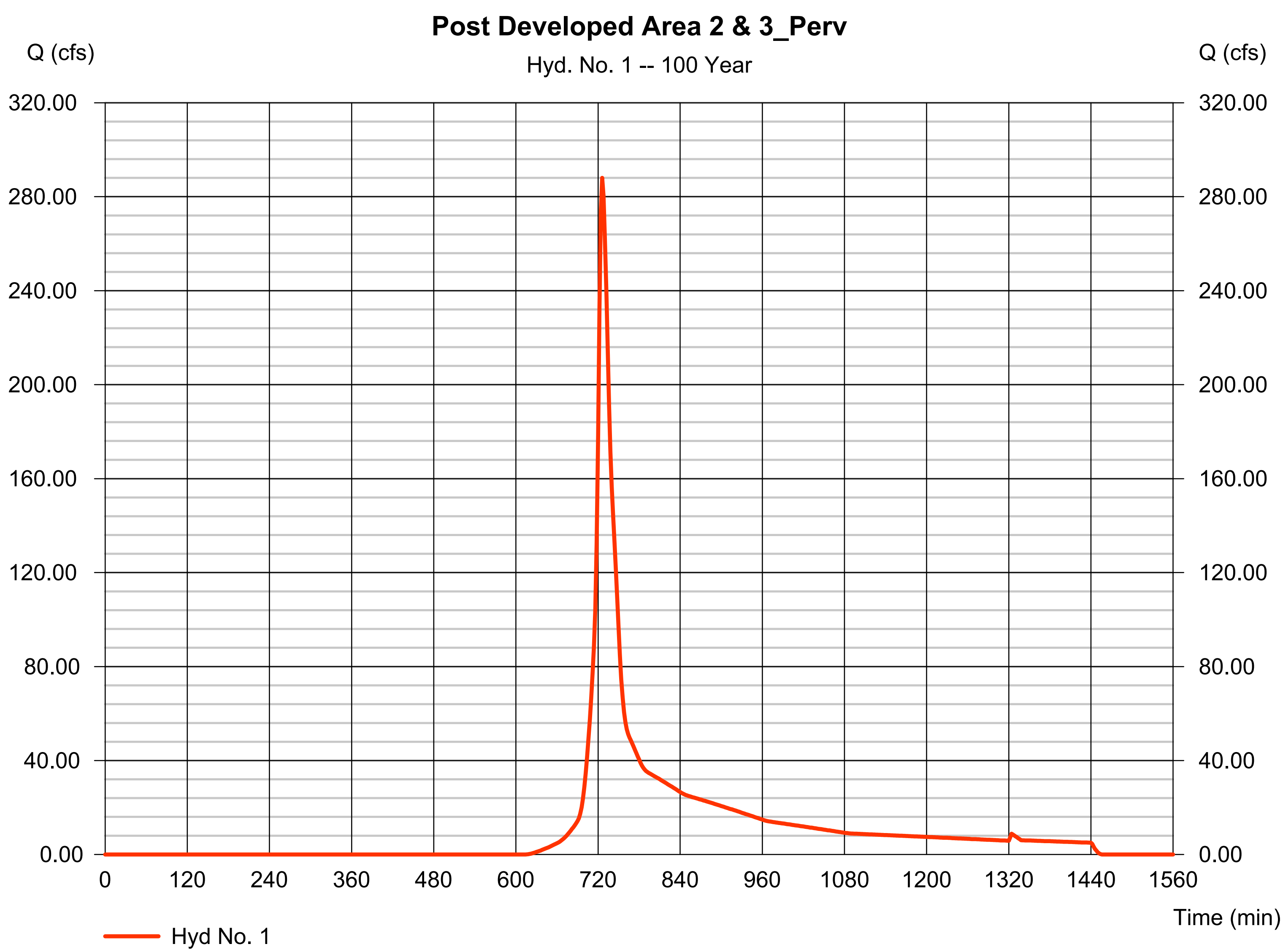
Hydrograph Report

Hyd. No. 1

Post Developed Area 2 & 3_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 287.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,080,606 cuft
Drainage area	= 94.350 ac	Curve number	= 53*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.430 x 77) + (50.000 x 61) + (9.850 x 55) + (34.070 x 39)] / 94.350



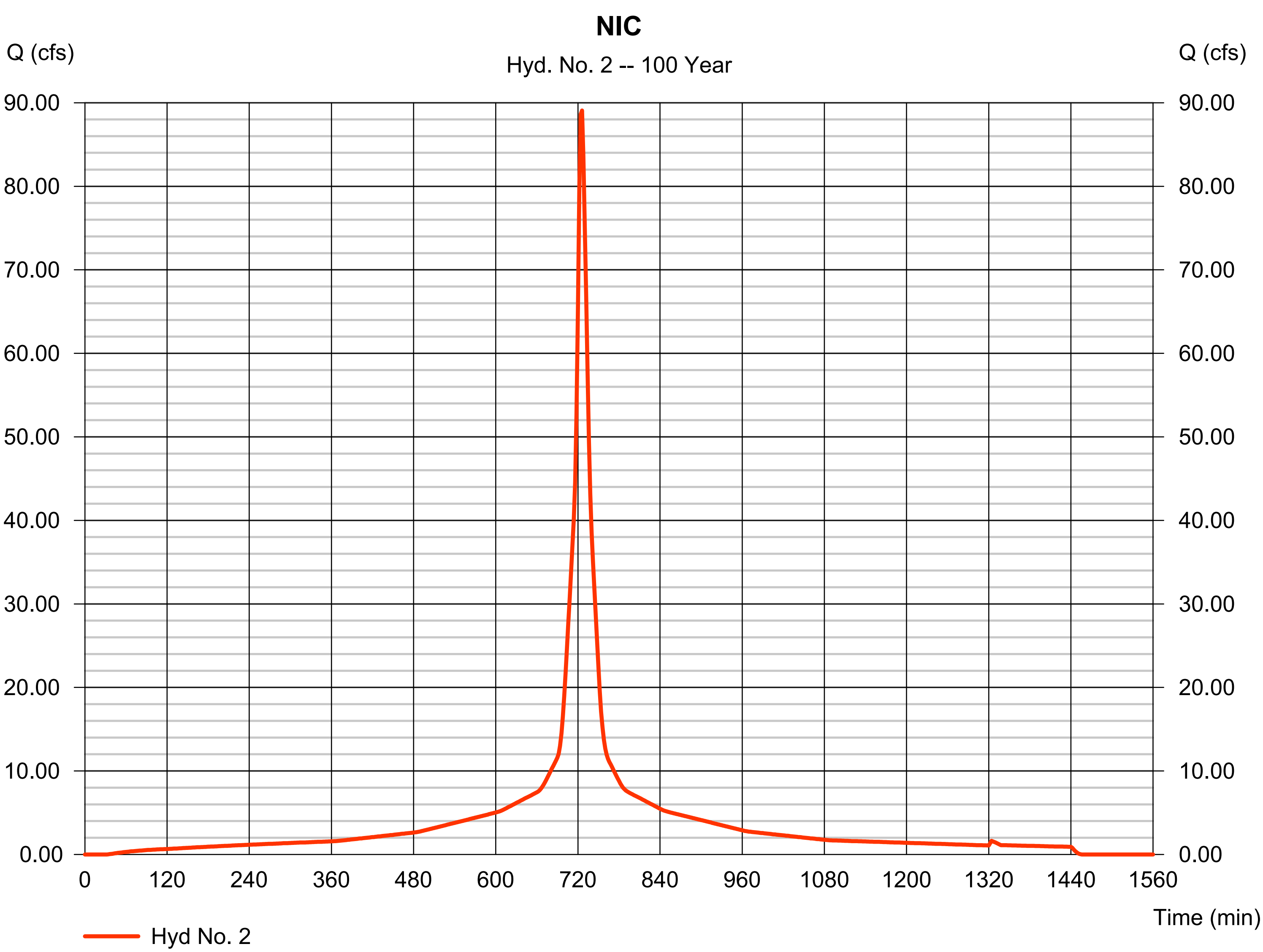
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 89.07 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 373,268 cuft
Drainage area	= 11.950 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.600 x 98) + (1.650 x 98) + (3.370 x 98) + (4.330 x 98)] / 11.950

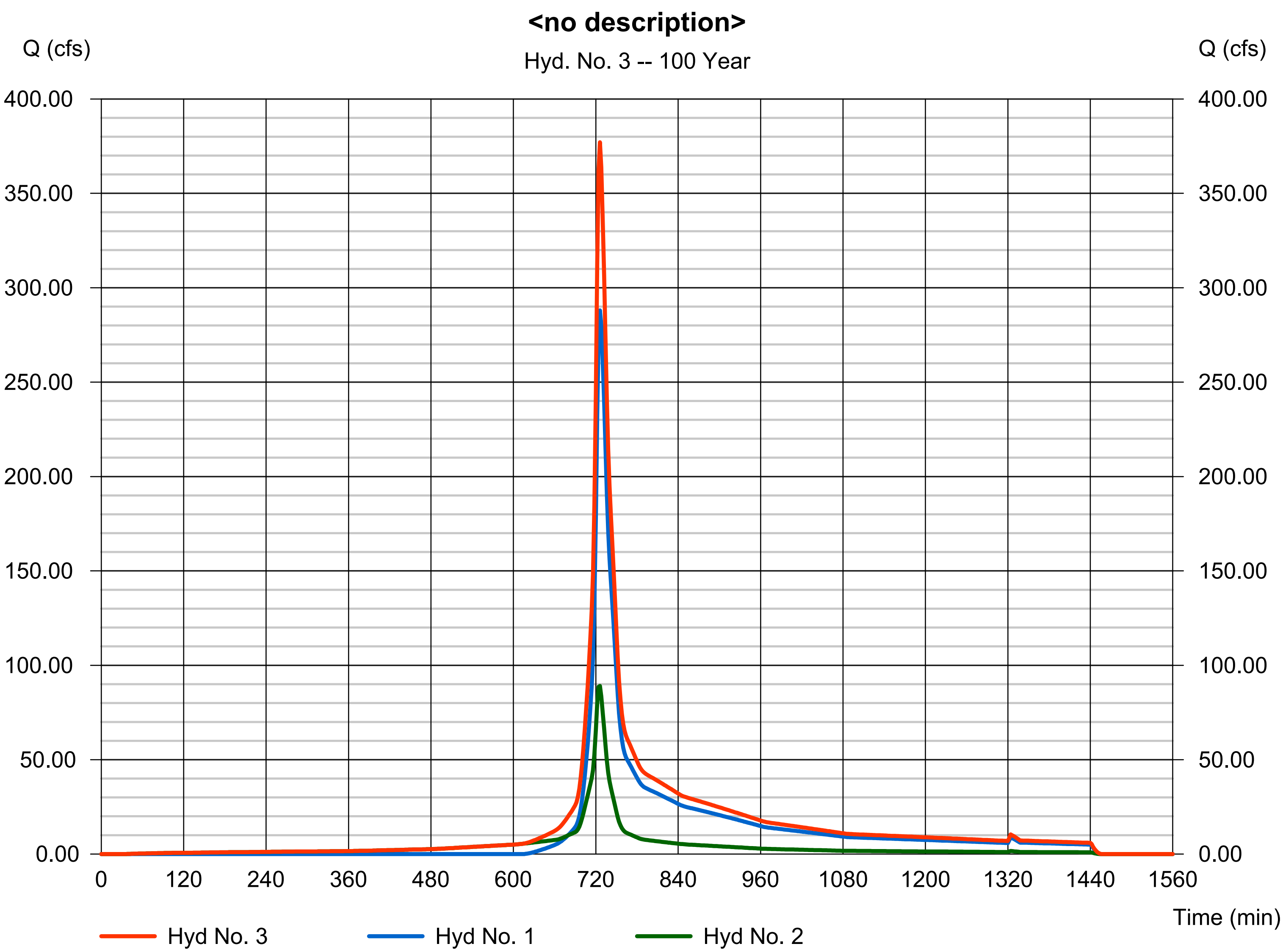


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 377.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,453,873 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 106.300 ac



Hydrograph Report

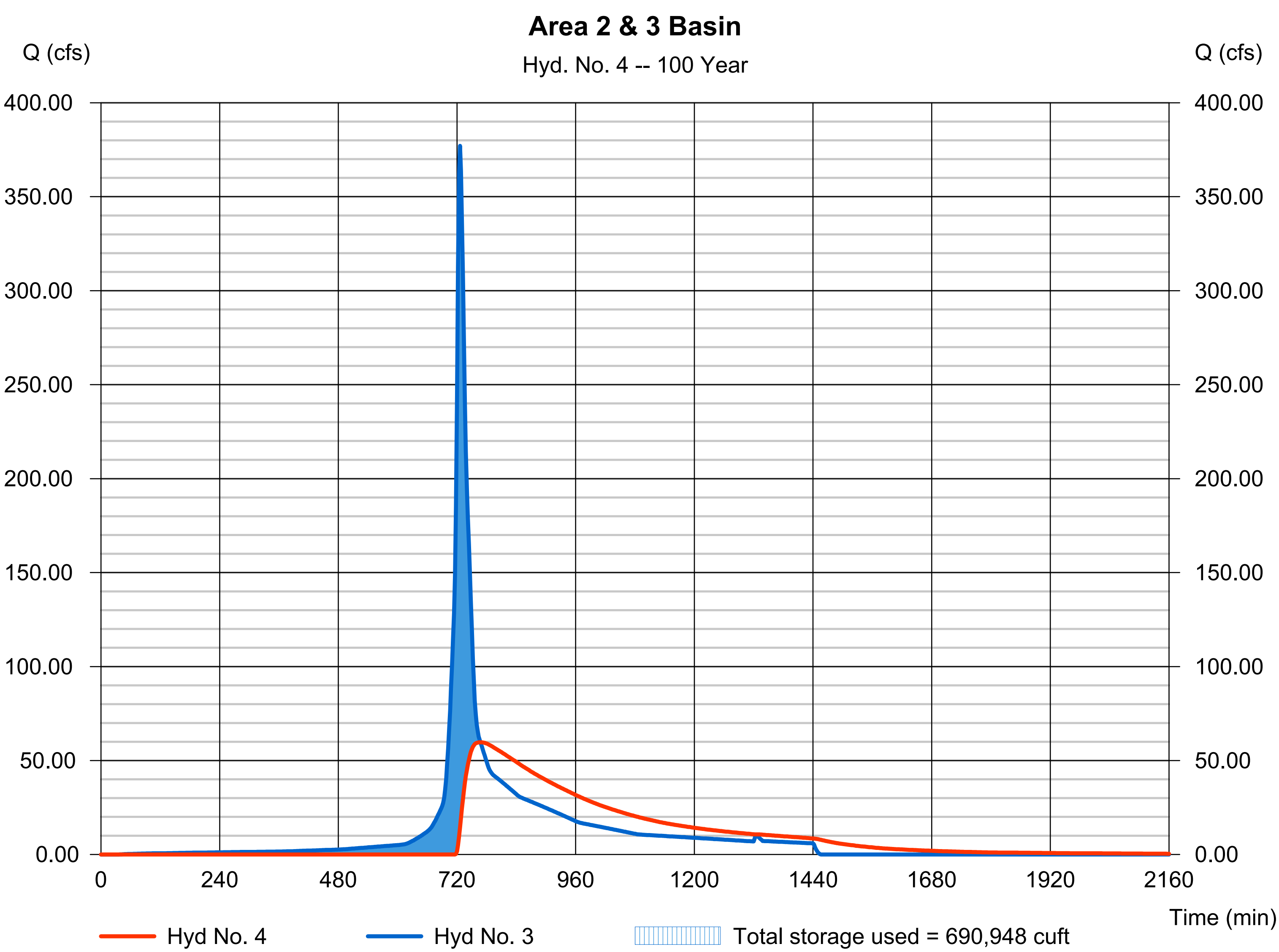
Hydraflow Hydrographs by Intelisolve v9.23 | Wednesday, Jun 16, 2010

Hyd. No. 4

Area 2 & 3 Basin

Hydrograph type	= Reservoir	Peak discharge	= 59.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 1,210,534 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 50.99 ft
Reservoir name	= Area 2 & 3	Max. Storage	= 690,948 cuft

Storage Indication method used.



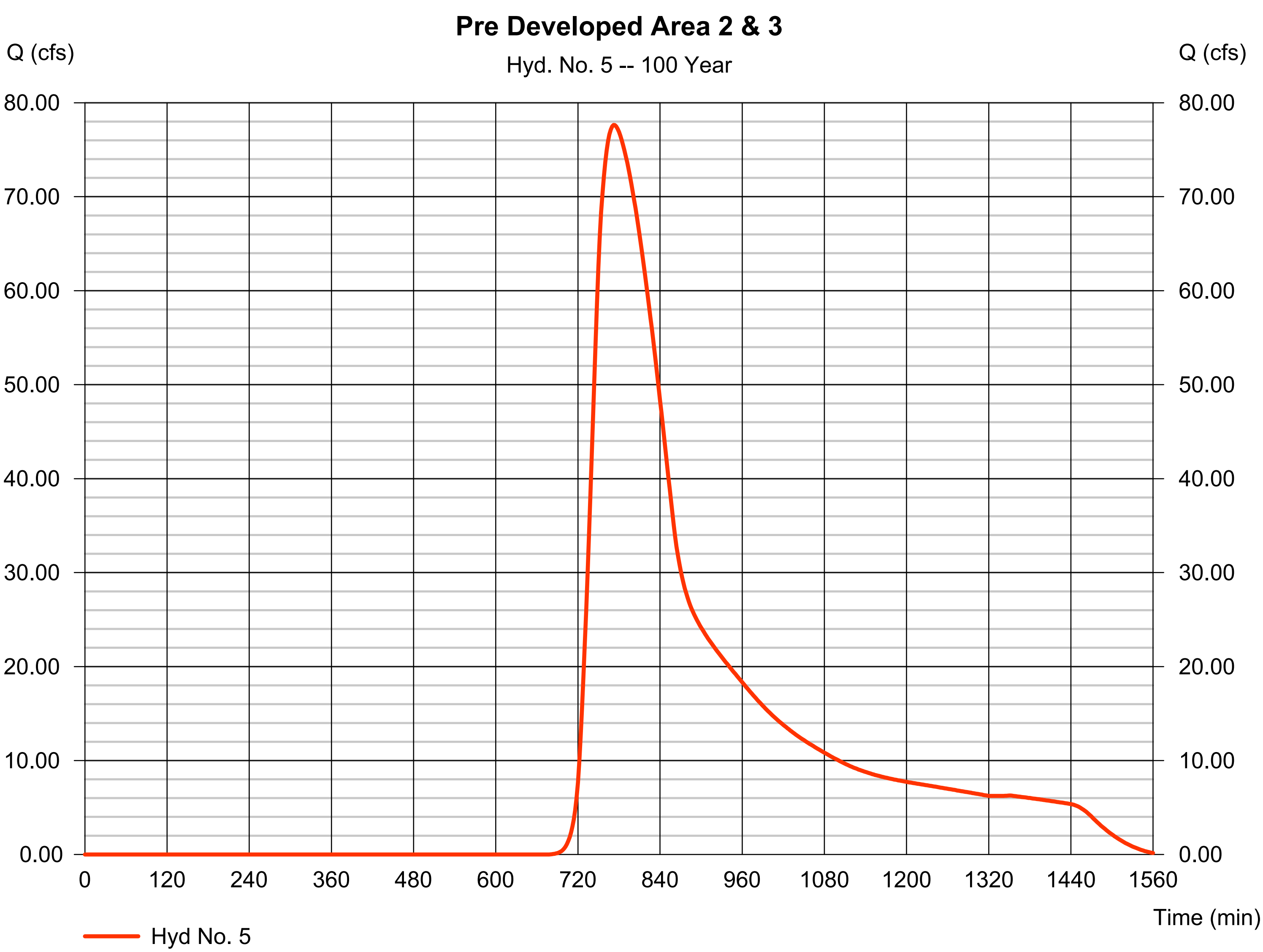
Hydrograph Report

Hyd. No. 5

Pre Developed Area 2 & 3

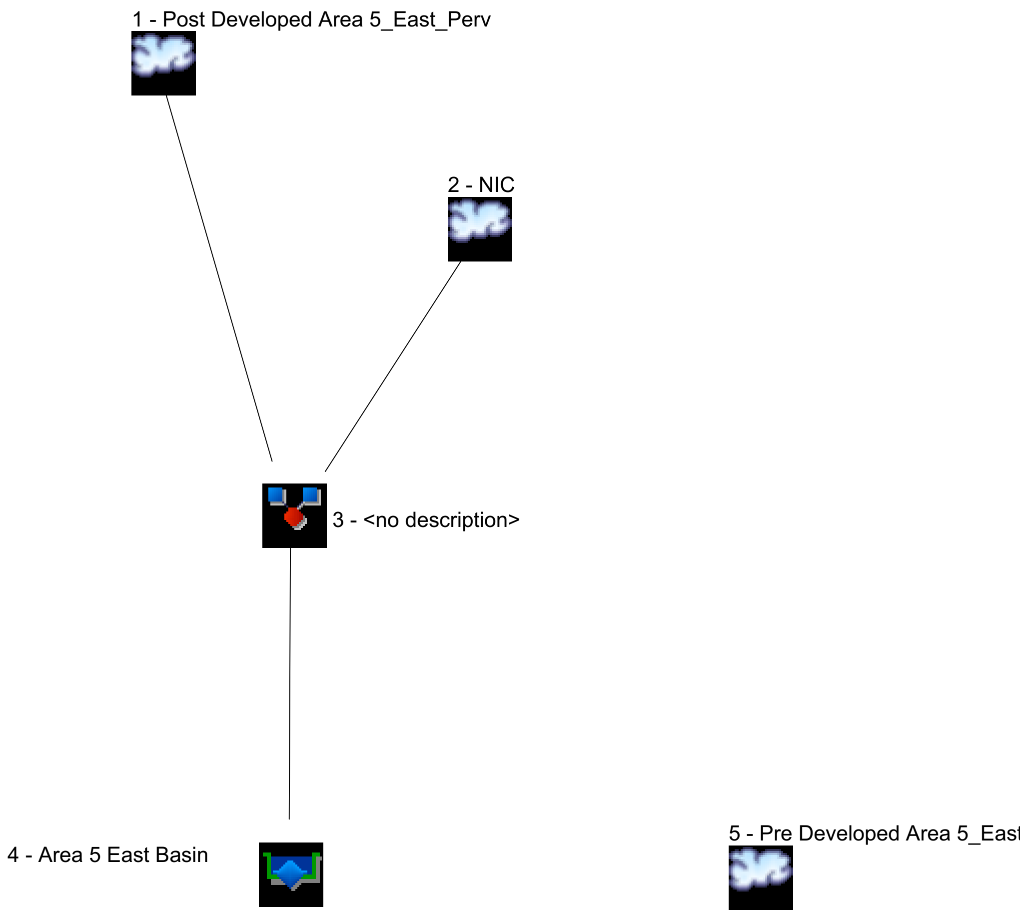
Hydrograph type	= SCS Runoff	Peak discharge	= 77.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 899,930 cuft
Drainage area	= 106.300 ac	Curve number	= 46*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 53.30 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 77) + (25.000 x 55) + (46.020 x 30) + (34.850 x 61)] / 106.300



Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 5_East.gpw	Tuesday, Jun 29, 2010

Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 — Tuesday, Jun 29, 2010

Pond No. 1 - Area 5 East

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 51.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	51.00	00	0	0
1.00	52.00	13,118	6,559	6,559
2.00	53.00	68,215	40,667	47,226
3.00	54.00	257,259	162,737	209,963
4.00	55.00	263,271	260,265	470,228
5.00	56.00	269,340	266,306	736,533

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

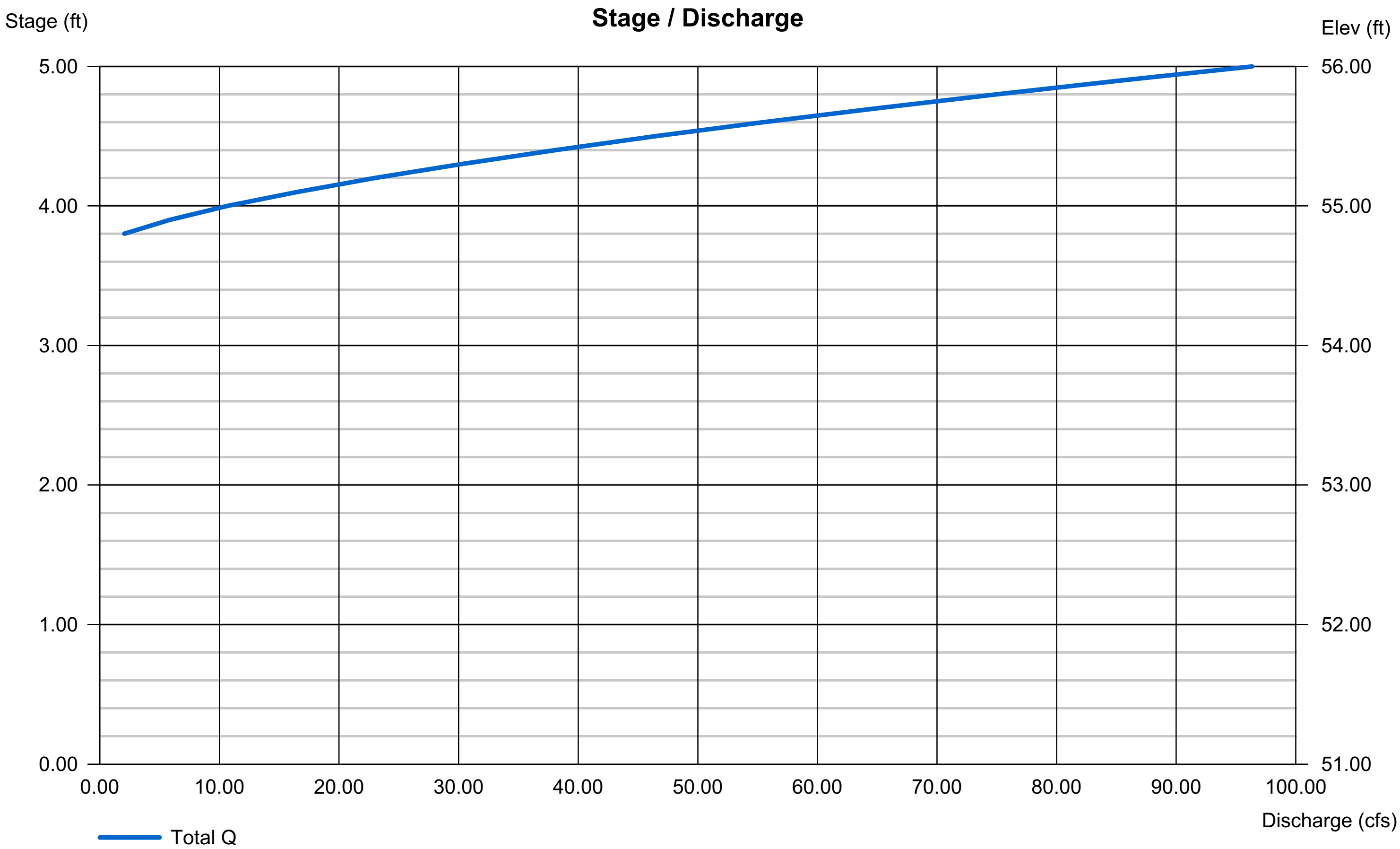
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 25.00	0.00	0.00	0.00
Crest El. (ft)	= 54.70	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 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).



Hydrograph Summary Report

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	15.72	2	726	66,078	----	------	------	Post Developed Area 5_East_Perv
2	SCS Runoff	56.69	2	726	229,451	----	------	------	NIC
3	Combine	72.41	2	726	295,529	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	54.33	295,529	Area 5 East Basin
5	SCS Runoff	5.690	2	788	83,780	----	------	------	Pre Developed Area 5_East

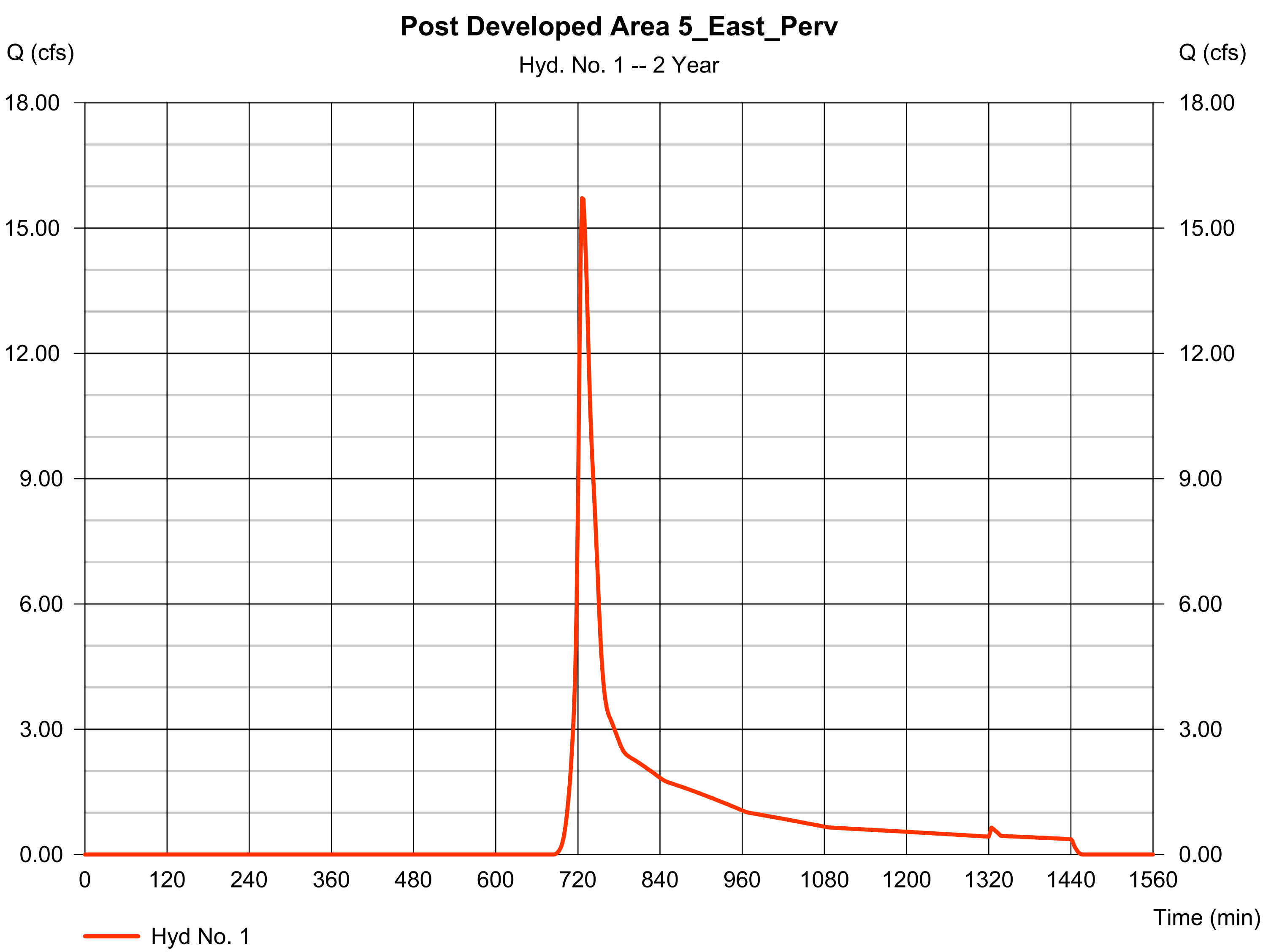
Hydrograph Report

Hyd. No. 1

Post Developed Area 5_East_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 15.72 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 66,078 cuft
Drainage area	= 23.260 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.830 x 61) + (8.350 x 61) + (9.500 x 74) + (2.580 x 74)] / 23.260



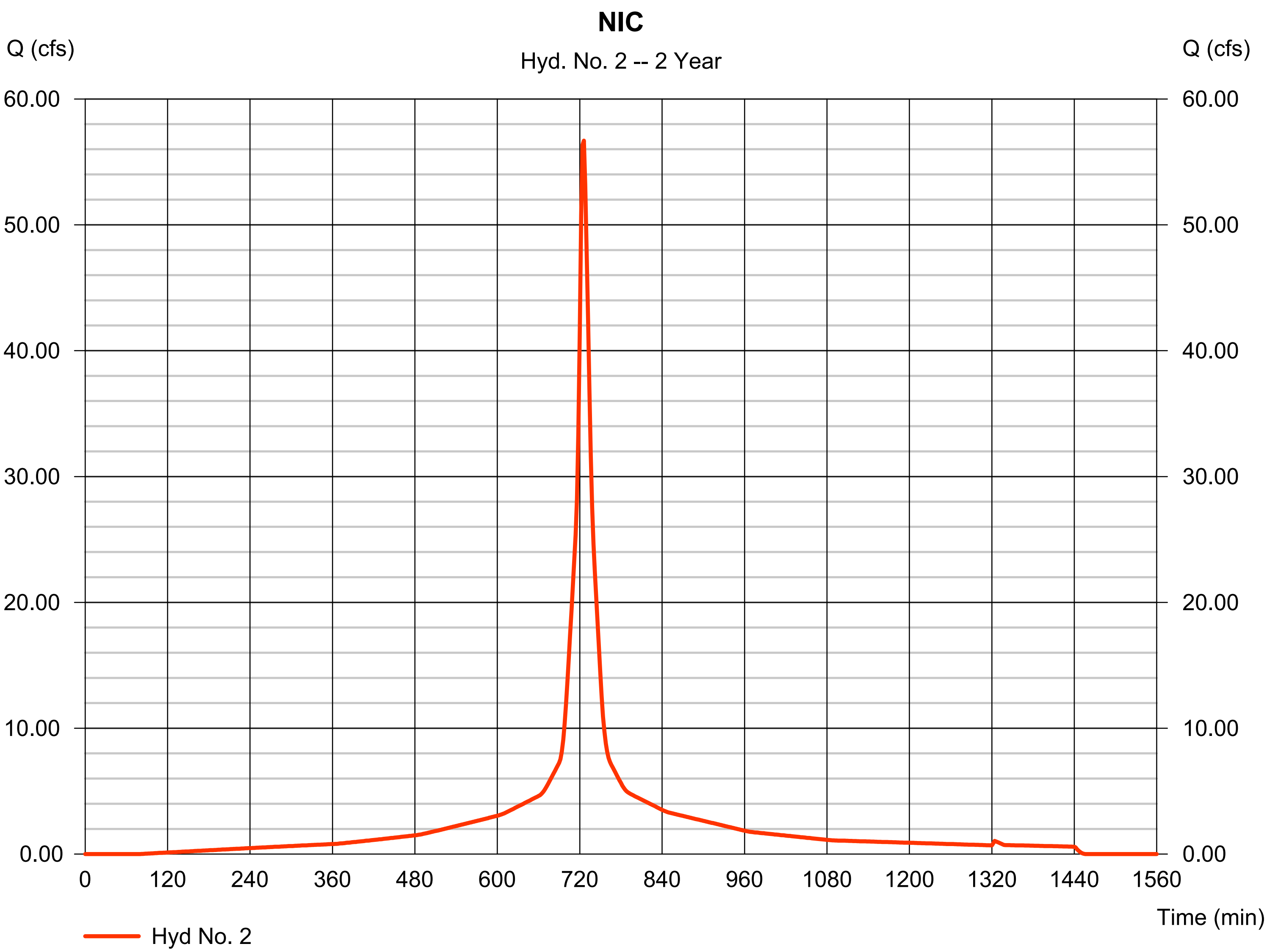
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Tuesday, Jun 29, 2010

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 56.69 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 229,451 cuft
Drainage area	= 20.740 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

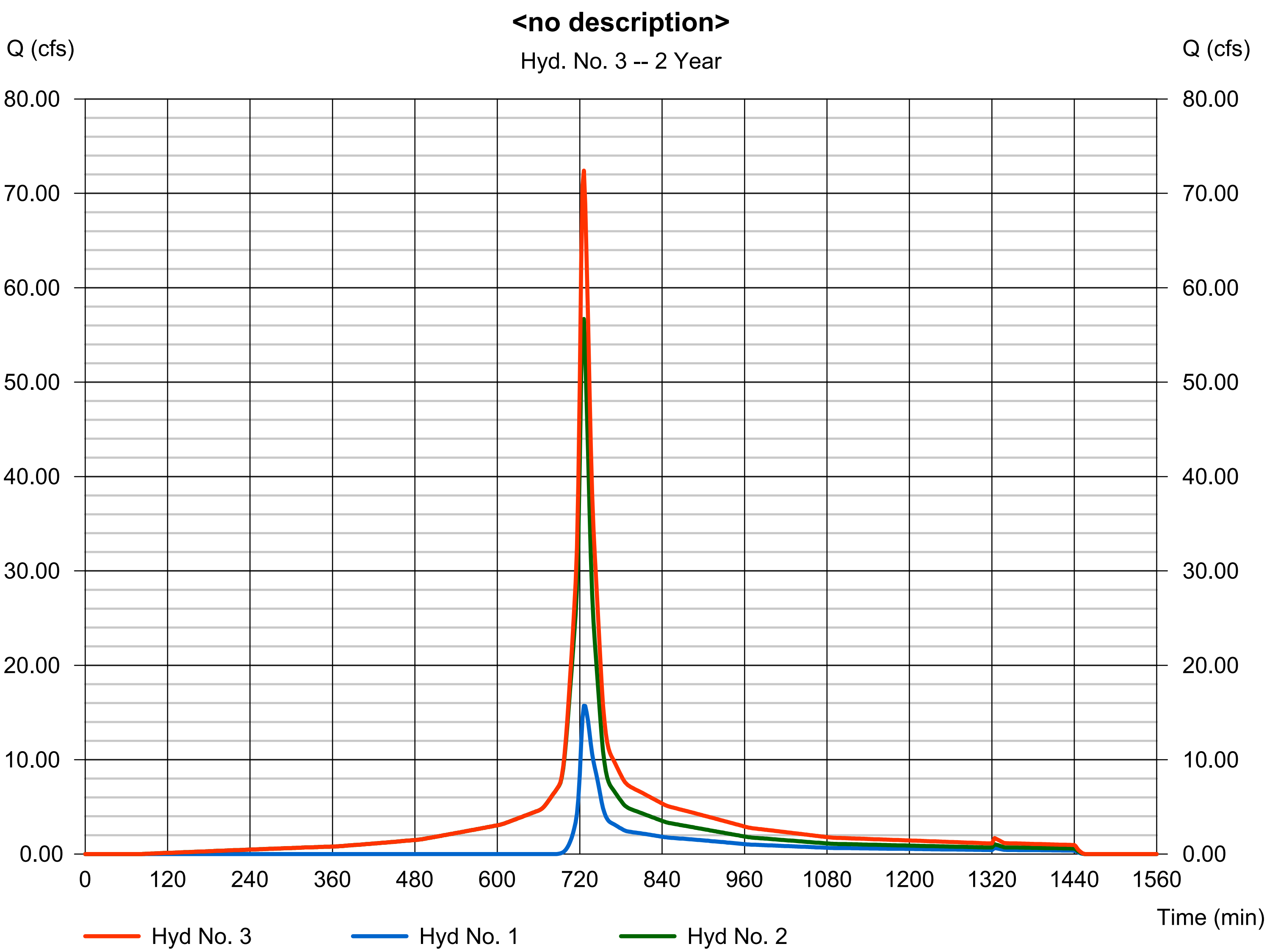


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 72.41 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 295,529 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 44.000 ac



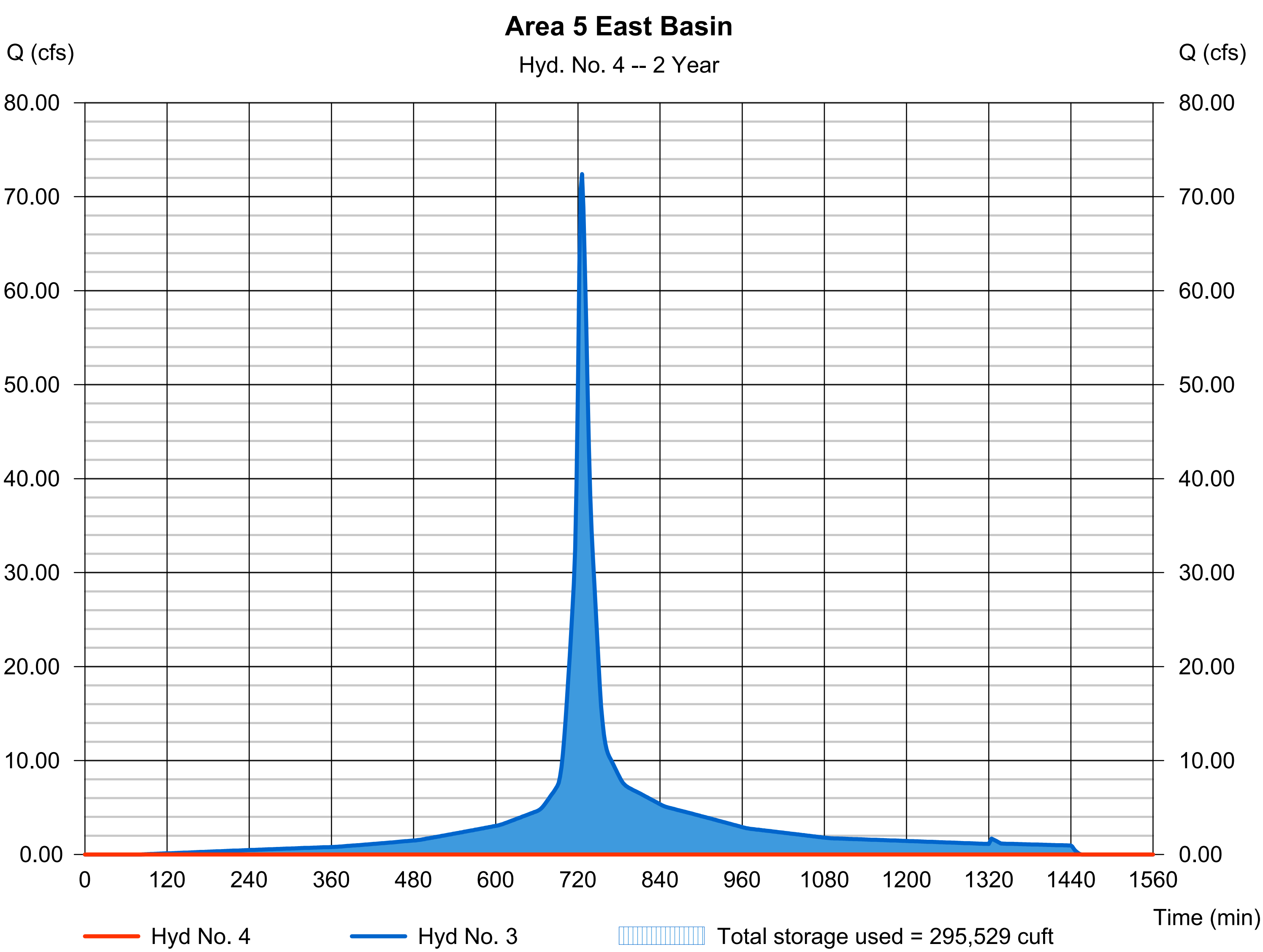
Hydrograph Report

Hyd. No. 4

Area 5 East Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 54.33 ft
Reservoir name	= Area 5 East	Max. Storage	= 295,529 cuft

Storage Indication method used.



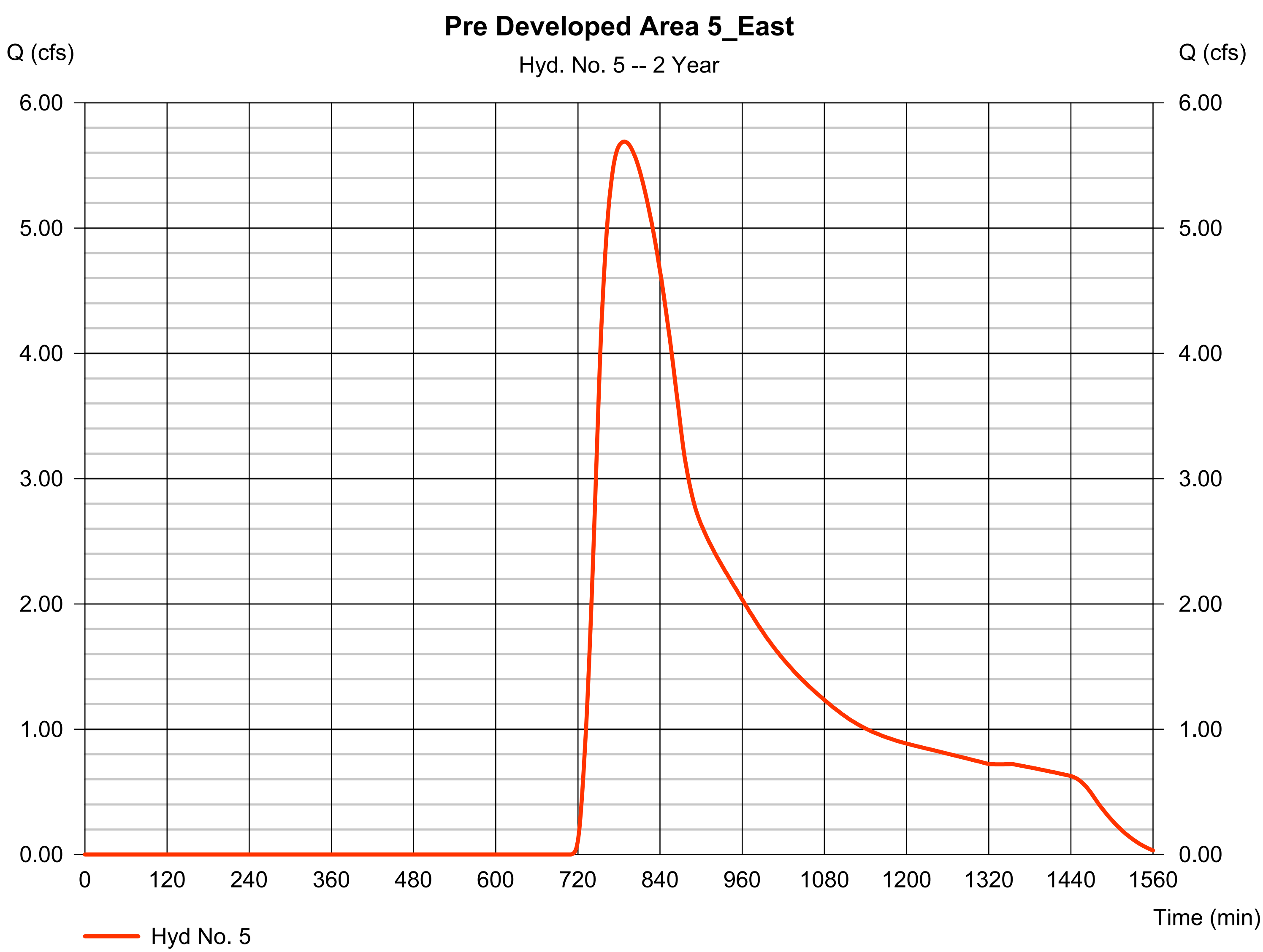
Hydrograph Report

Hyd. No. 5

Pre Developed Area 5_East

Hydrograph type	= SCS Runoff	Peak discharge	= 5.690 cfs
Storm frequency	= 2 yrs	Time to peak	= 788 min
Time interval	= 2 min	Hyd. volume	= 83,780 cuft
Drainage area	= 44.000 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.30 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(24.400 x 55) + (19.600 x 70)] / 44.000



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	45.87	2	726	169,747	----	------	------	Post Developed Area 5_East_Perv
2	SCS Runoff	89.99	2	726	371,271	----	------	------	NIC
3	Combine	135.87	2	726	541,018	1, 2	------	------	<no description>
4	Reservoir	4.638	2	988	148,858	3	54.87	436,059	Area 5 East Basin
5	SCS Runoff	21.36	2	774	249,730	----	------	------	Pre Developed Area 5_East

Area 5_East.gpw | Return Period: 10 Year | Tuesday, Jun 29, 2010

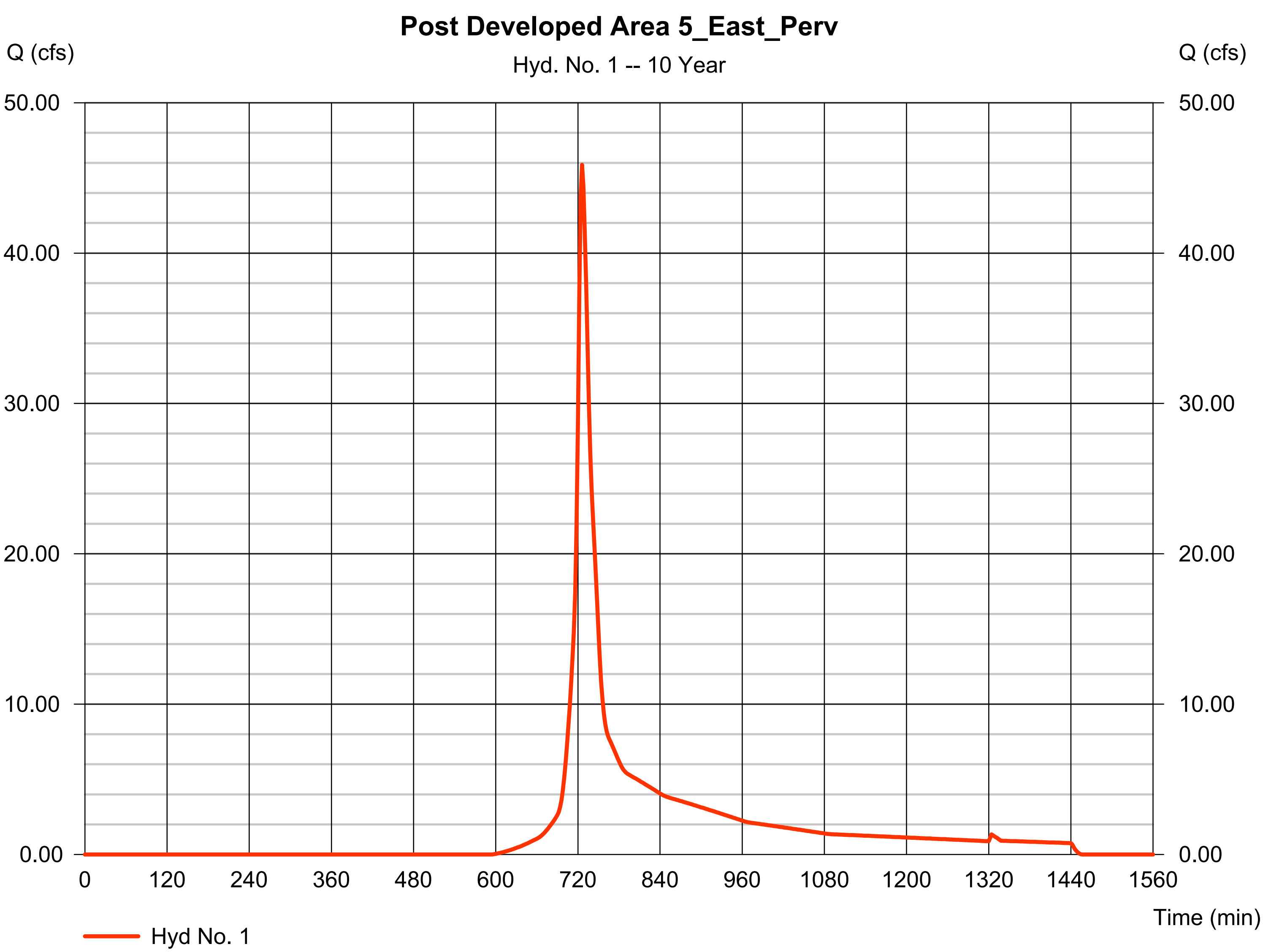
Hydrograph Report

Hyd. No. 1

Post Developed Area 5_East_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 45.87 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 169,747 cuft
Drainage area	= 23.260 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.830 x 61) + (8.350 x 61) + (9.500 x 74) + (2.580 x 74)] / 23.260



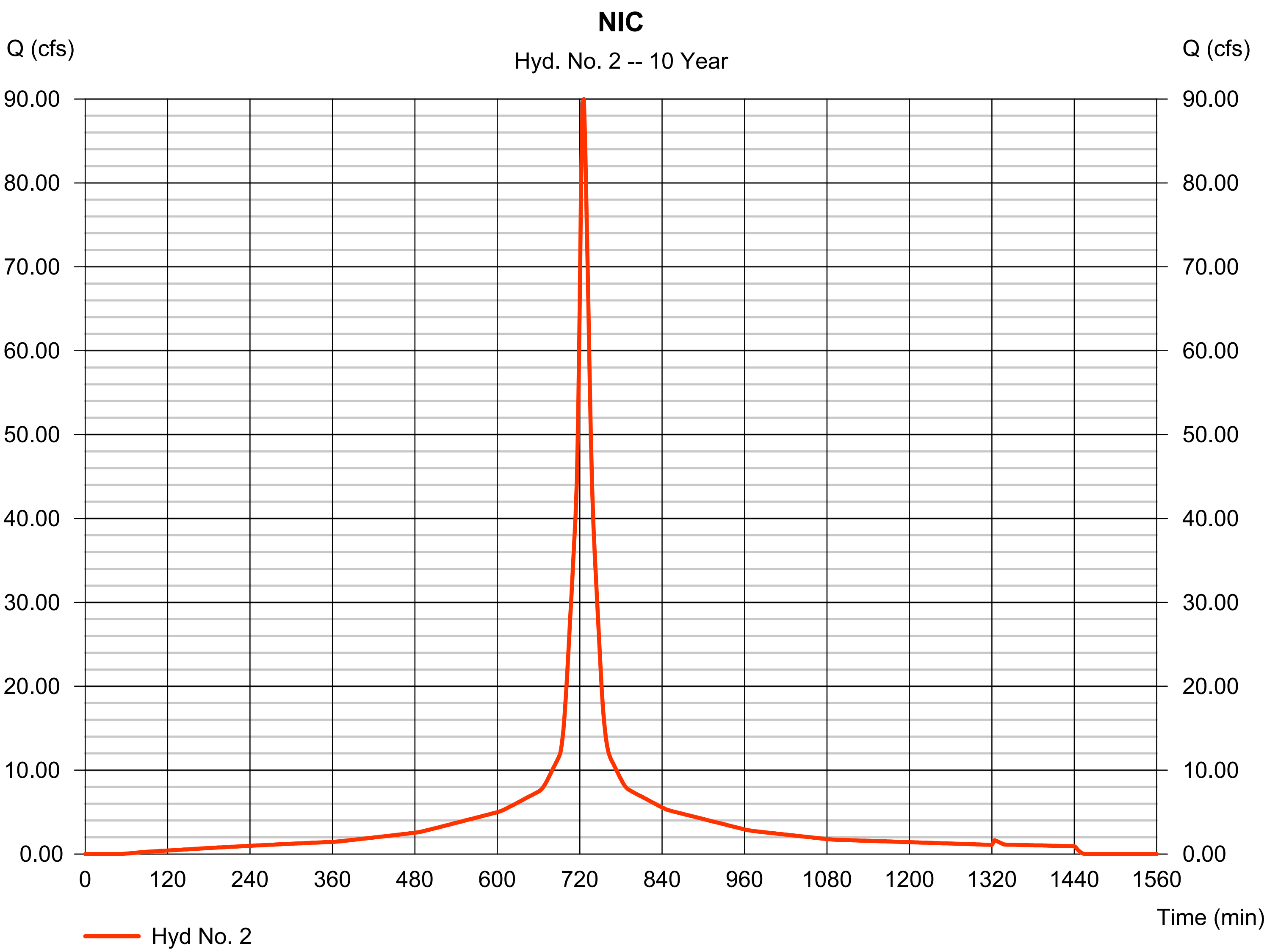
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 | Tuesday, Jun 29, 2010

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 89.99 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 371,271 cuft
Drainage area	= 20.740 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



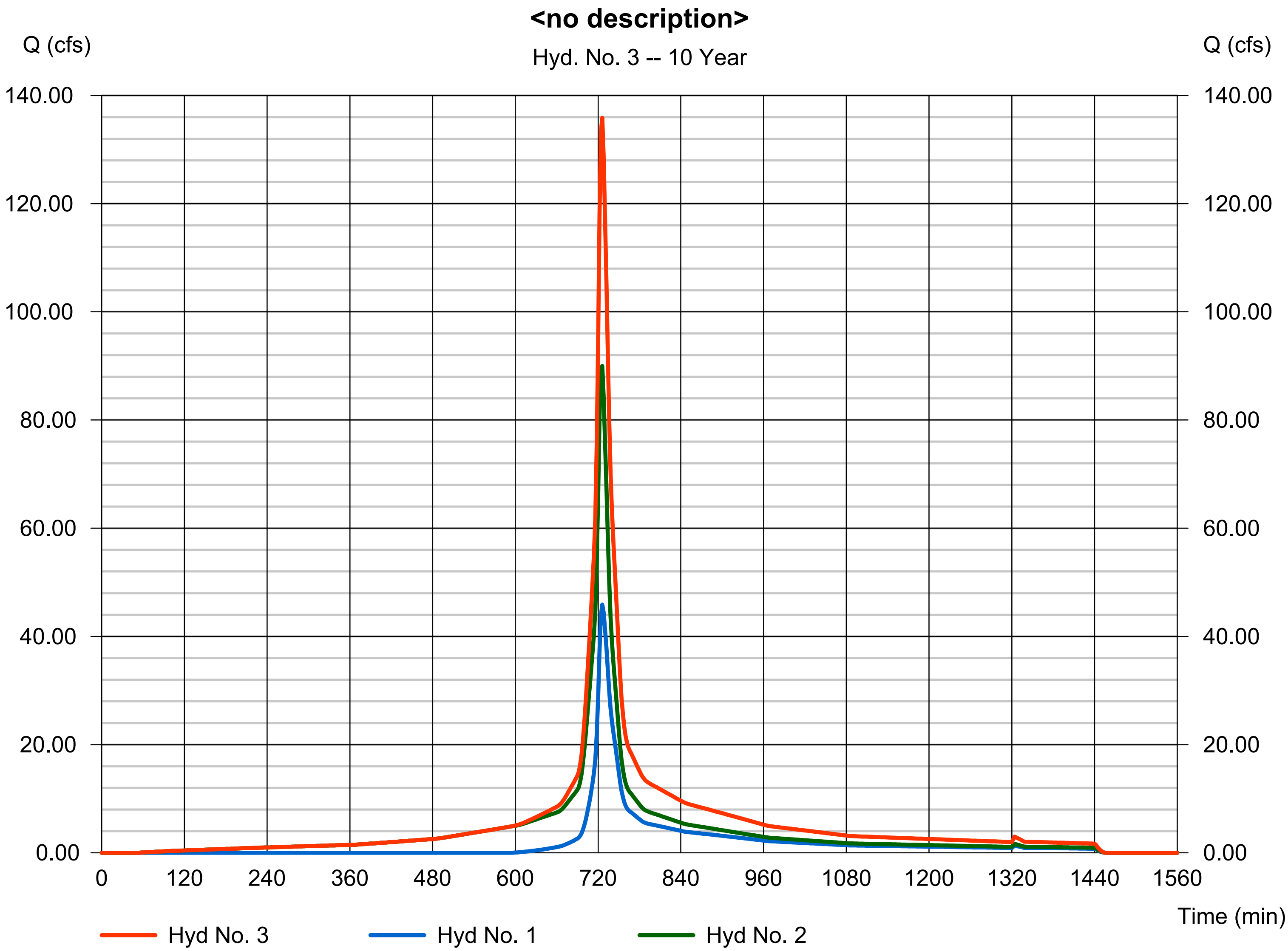
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Tuesday, Jun 29, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 135.87 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 541,018 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 44.000 ac



Hydrograph Report

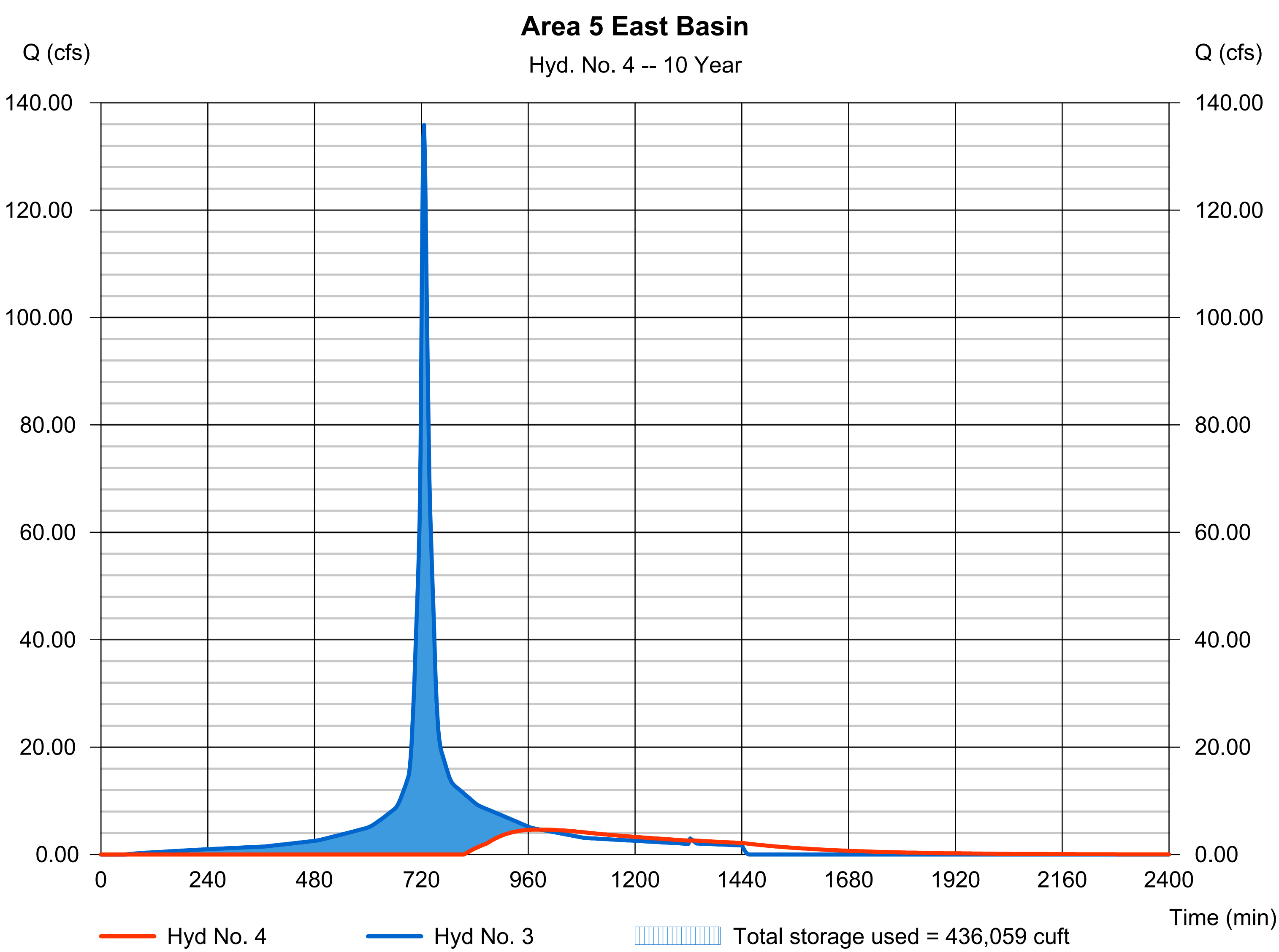
Hydraflow Hydrographs by Intelisolve v9.23 Tuesday, Jun 29, 2010

Hyd. No. 4

Area 5 East Basin

Hydrograph type	= Reservoir	Peak discharge	= 4.638 cfs
Storm frequency	= 10 yrs	Time to peak	= 988 min
Time interval	= 2 min	Hyd. volume	= 148,858 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 54.87 ft
Reservoir name	= Area 5 East	Max. Storage	= 436,059 cuft

Storage Indication method used.



Hydrograph Report

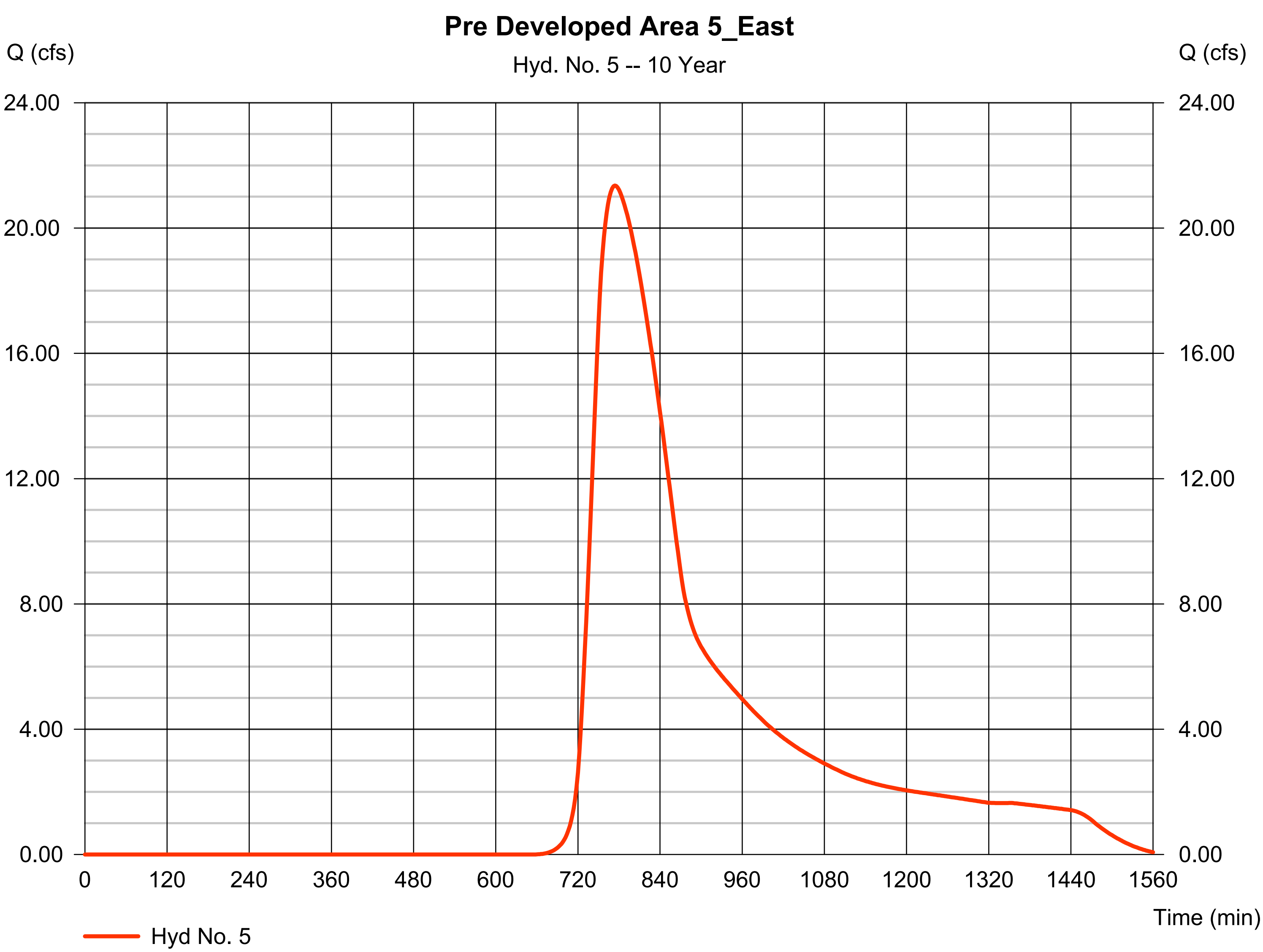
Hydraflow Hydrographs by Intelisolve v9.23 | Tuesday, Jun 29, 2010

Hyd. No. 5

Pre Developed Area 5_East

Hydrograph type	= SCS Runoff	Peak discharge	= 21.36 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 249,730 cuft
Drainage area	= 44.000 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.30 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(24.400 x 55) + (19.600 x 70)] / 44.000



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	116.39	2	726	419,626	----	------	------	Post Developed Area 5_East_Perv
2	SCS Runoff	154.58	2	726	647,831	----	------	------	NIC
3	Combine	270.98	2	726	1,067,456	1, 2	------	------	<no description>
4	Reservoir	51.05	2	756	675,296	3	55.55	616,820	Area 5 East Basin
5	SCS Runoff	63.79	2	768	681,580	----	------	------	Pre Developed Area 5_East

Area 5_East.gpw	Return Period: 100 Year	Tuesday, Jun 29, 2010

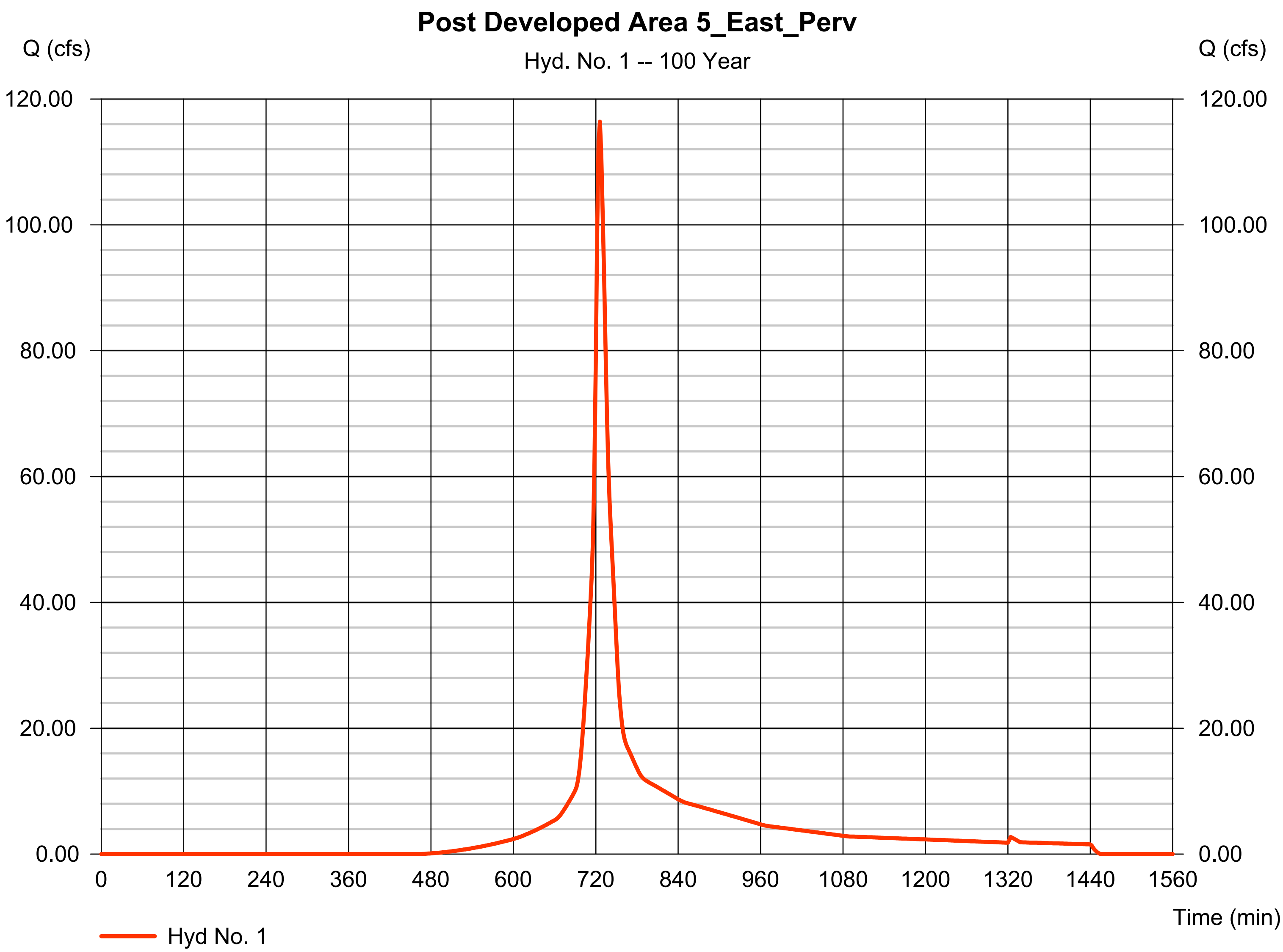
Hydrograph Report

Hyd. No. 1

Post Developed Area 5_East_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 116.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 419,626 cuft
Drainage area	= 23.260 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.830 x 61) + (8.350 x 61) + (9.500 x 74) + (2.580 x 74)] / 23.260

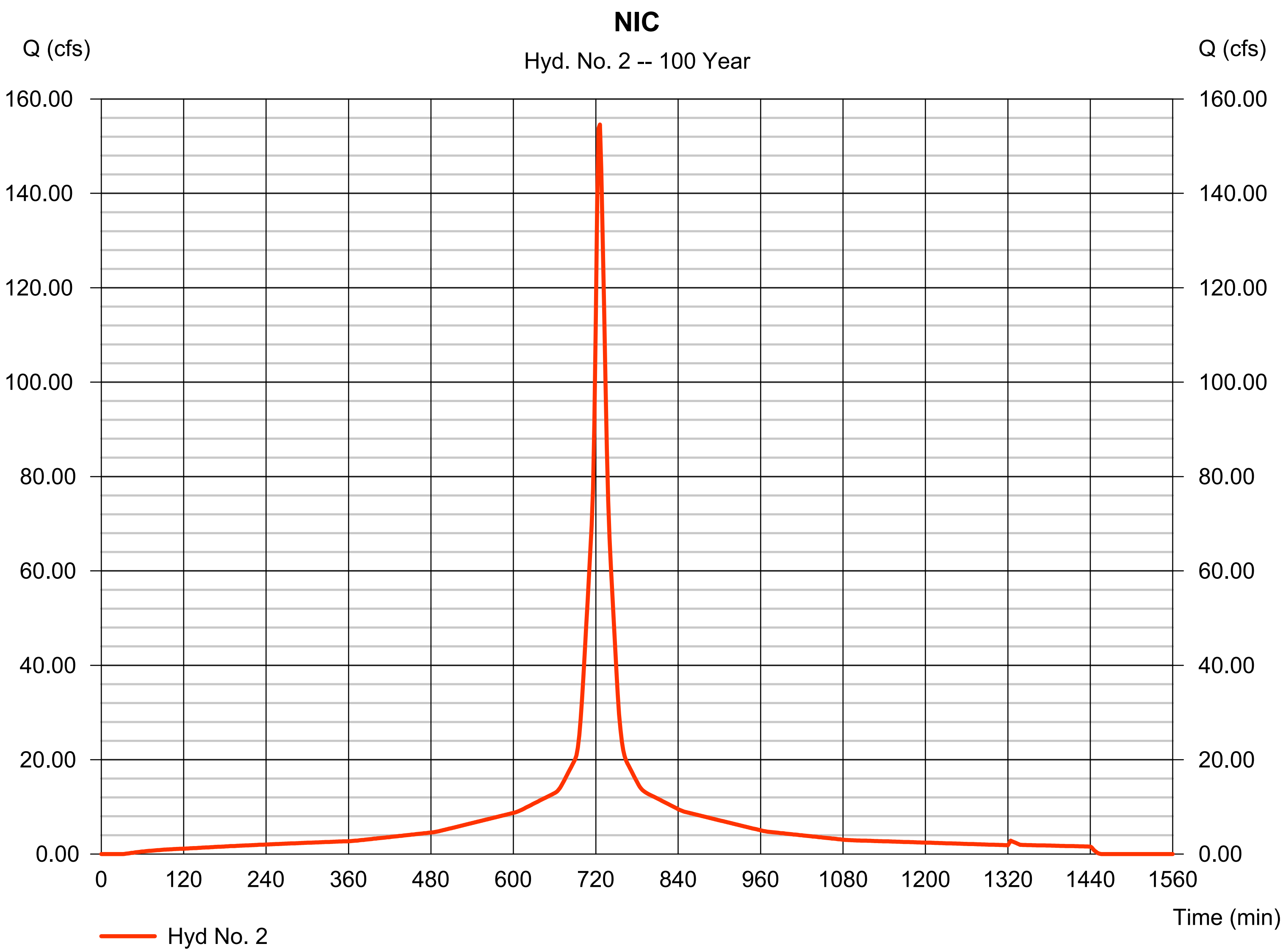


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 154.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 647,831 cuft
Drainage area	= 20.740 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



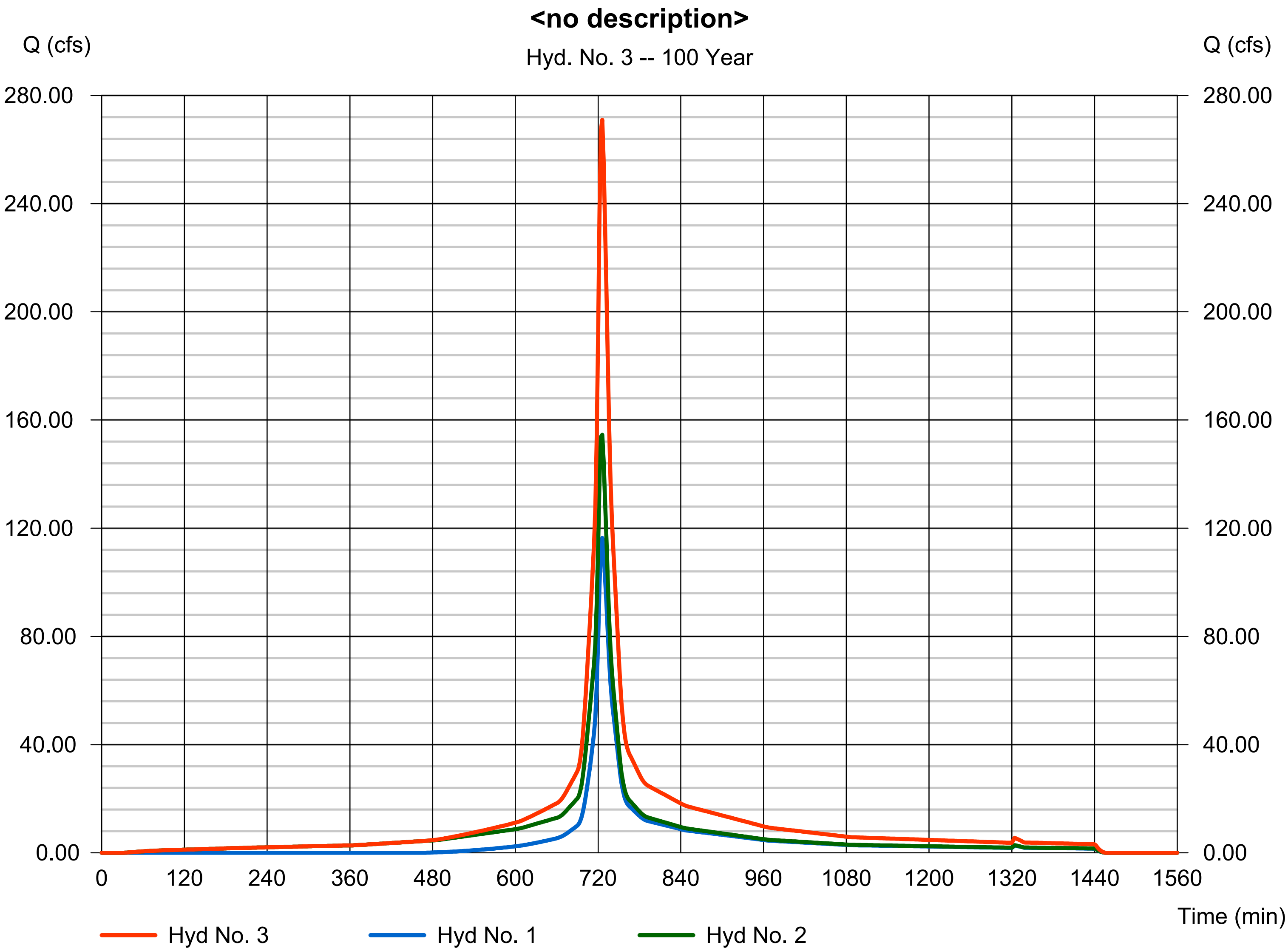
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 — Tuesday, Jun 29, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 270.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,067,456 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 44.000 ac



Hydrograph Report

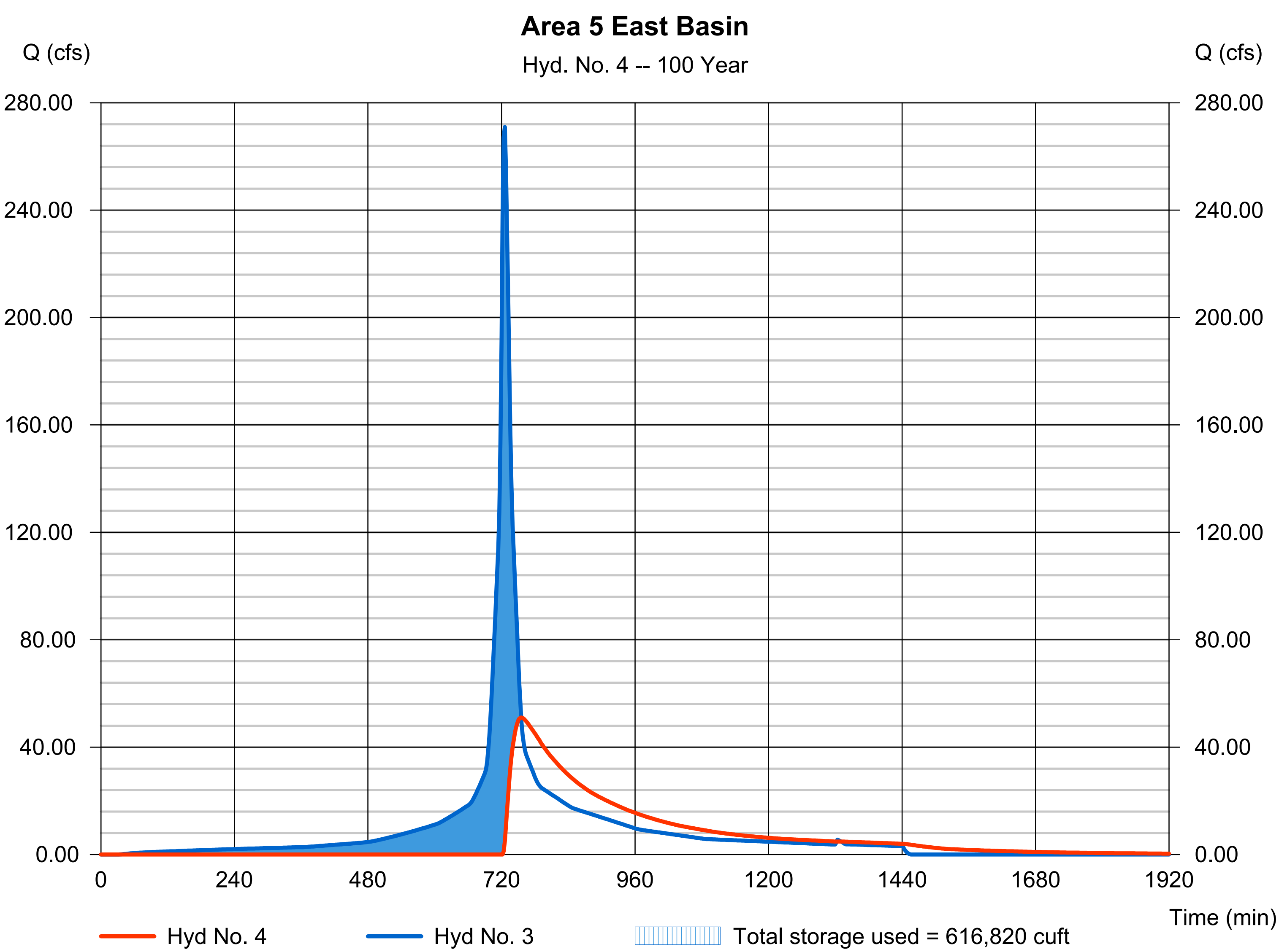
Hydraflow Hydrographs by Intelisolve v9.23 Tuesday, Jun 29, 2010

Hyd. No. 4

Area 5 East Basin

Hydrograph type	= Reservoir	Peak discharge	= 51.05 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 675,296 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 55.55 ft
Reservoir name	= Area 5 East	Max. Storage	= 616,820 cuft

Storage Indication method used.



Hydrograph Report

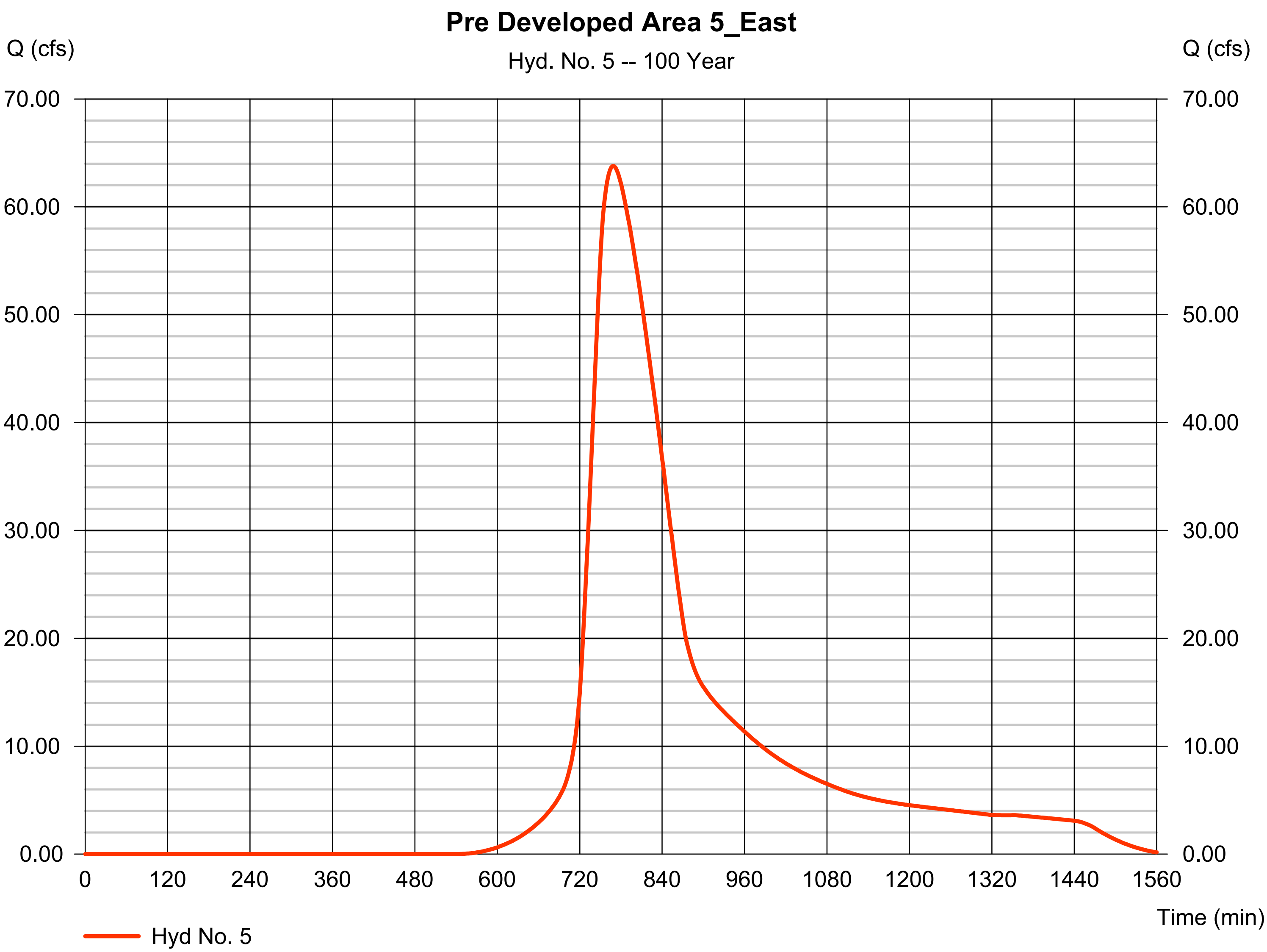
Hydraflow Hydrographs by Intelisolve v9.23 — Tuesday, Jun 29, 2010

Hyd. No. 5

Pre Developed Area 5_East

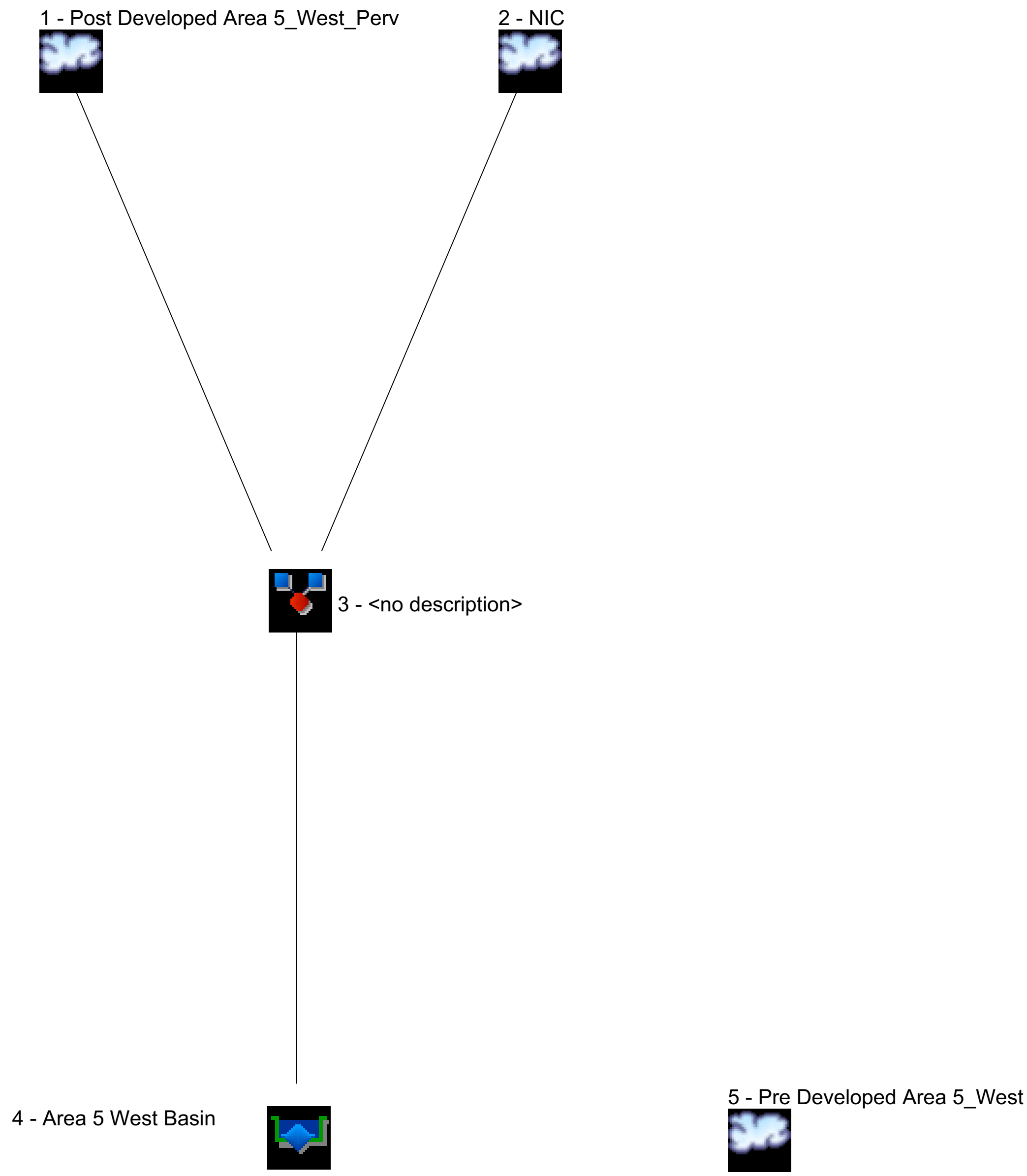
Hydrograph type	= SCS Runoff	Peak discharge	= 63.79 cfs
Storm frequency	= 100 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 681,580 cuft
Drainage area	= 44.000 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.30 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(24.400 x 55) + (19.600 x 70)] / 44.000



Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 5_West.gpw	Thursday, Jul 1, 2010

Pond Report

Pond No. 1 - Area 5 West

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 45.30 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	45.30	00	0	0
0.70	46.00	15,530	5,436	5,436
1.70	47.00	53,875	34,703	40,138
2.70	48.00	83,077	68,476	108,614
3.70	49.00	121,457	102,267	210,881
4.70	50.00	185,921	153,689	364,570
5.70	51.00	192,920	189,421	553,991

Culvert / Orifice Structures

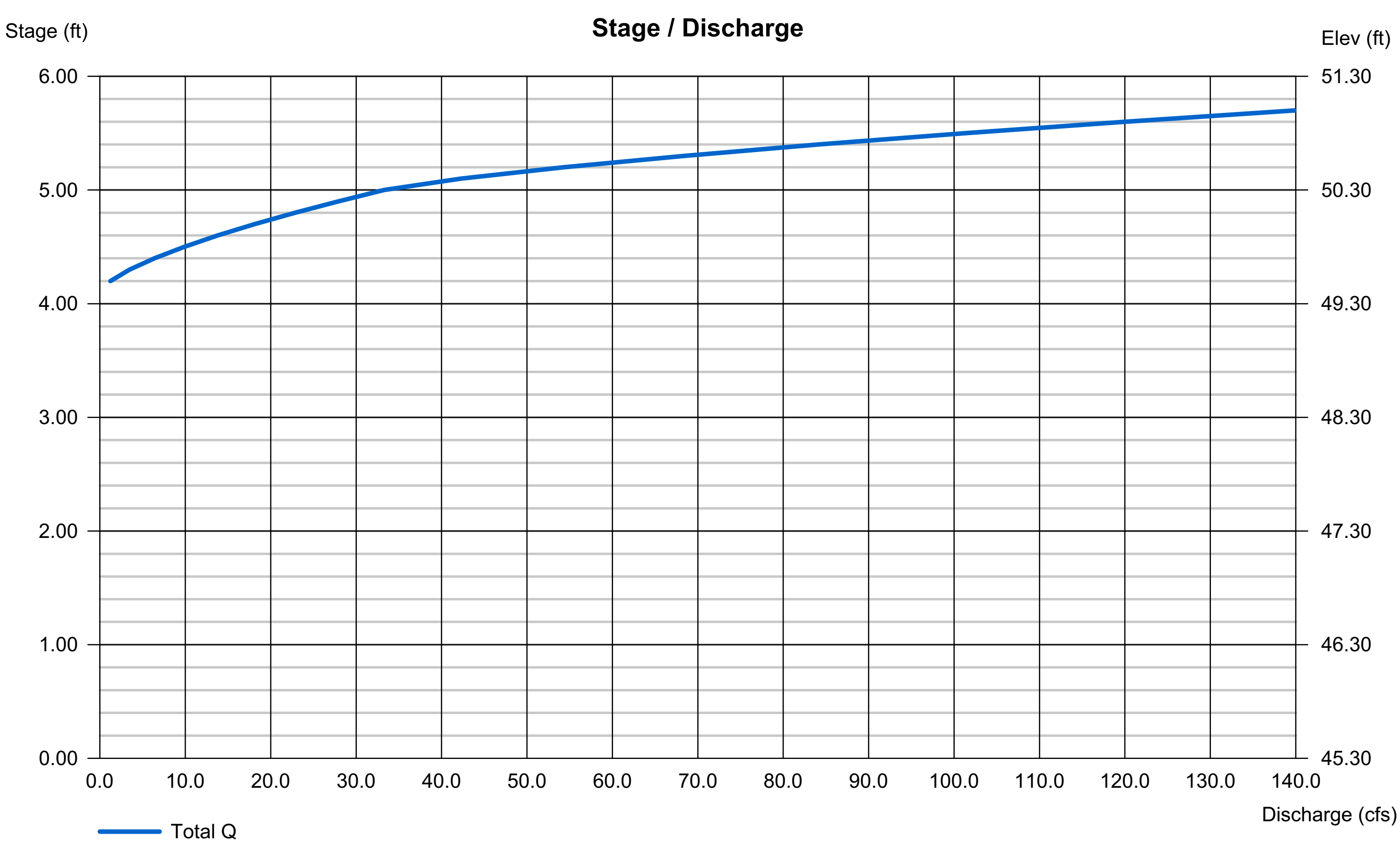
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	40.00	0.00	0.00
Crest El. (ft)	= 49.40	50.30	0.00	0.00
Weir Coeff.	= 2.60	2.60	2.60	3.33
Weir Type	= Broad	Broad	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).



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	5.722	2	732	33,417	----	------	------	Post Developed Area 5_West_Perv
2	SCS Runoff	40.13	2	726	162,408	----	------	------	NIC
3	Combine	45.20	2	726	195,825	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	48.85	195,825	Area 5 West Basin
5	SCS Runoff	1.762	2	798	32,362	----	------	------	Pre Developed Area 5_West

Hydrograph Report

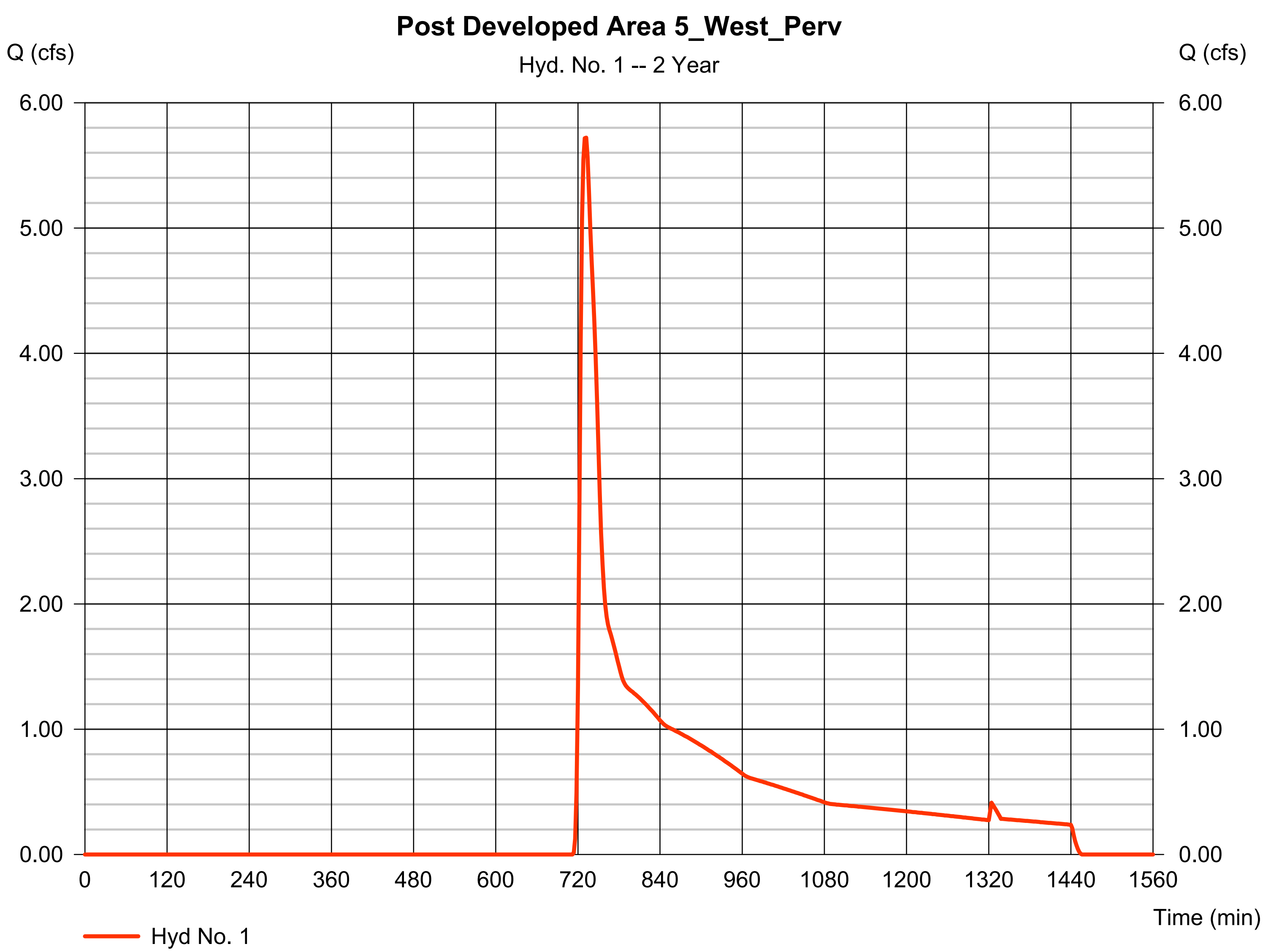
Hydraflow Hydrographs by Intelisolve v9.23 | Thursday, Jul 1, 2010

Hyd. No. 1

Post Developed Area 5_West_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 5.722 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 33,417 cuft
Drainage area	= 20.680 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 80) + (9.450 x 61) + (6.040 x 61) + (2.900 x 39) + (1.240 x 74)] / 20.680

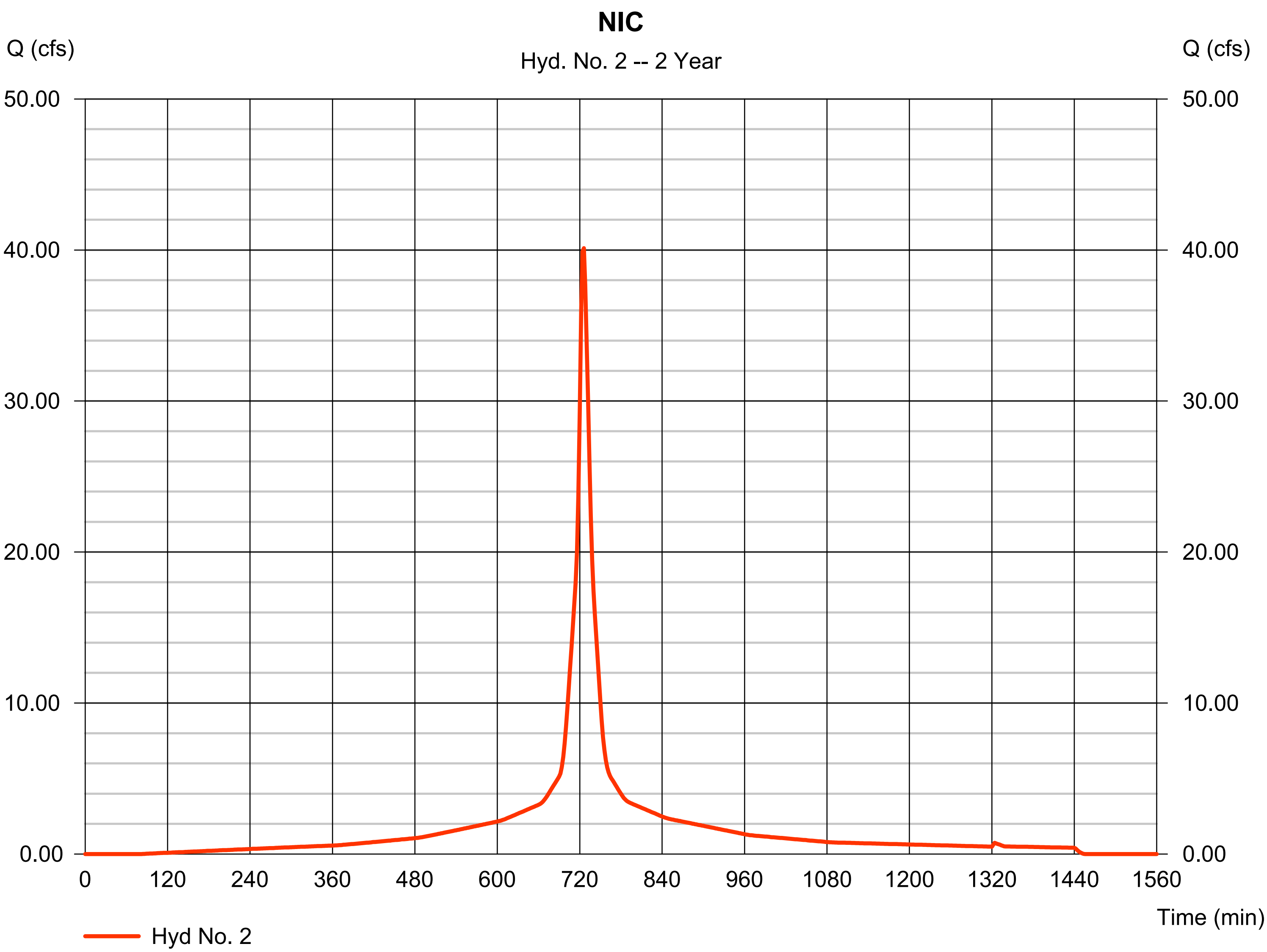


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 40.13 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 162,408 cuft
Drainage area	= 14.680 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



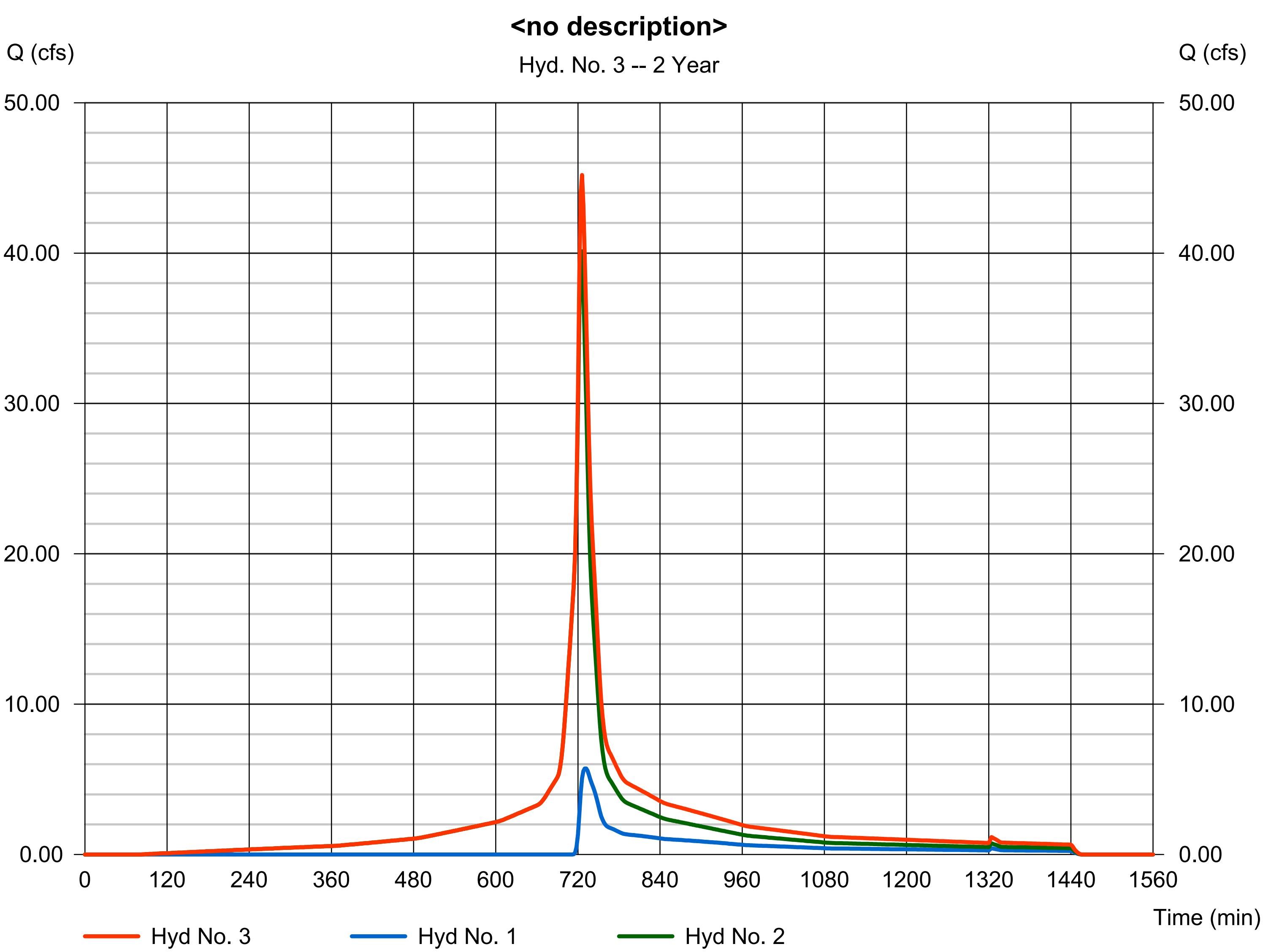
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 45.20 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 195,825 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.360 ac



Hydrograph Report

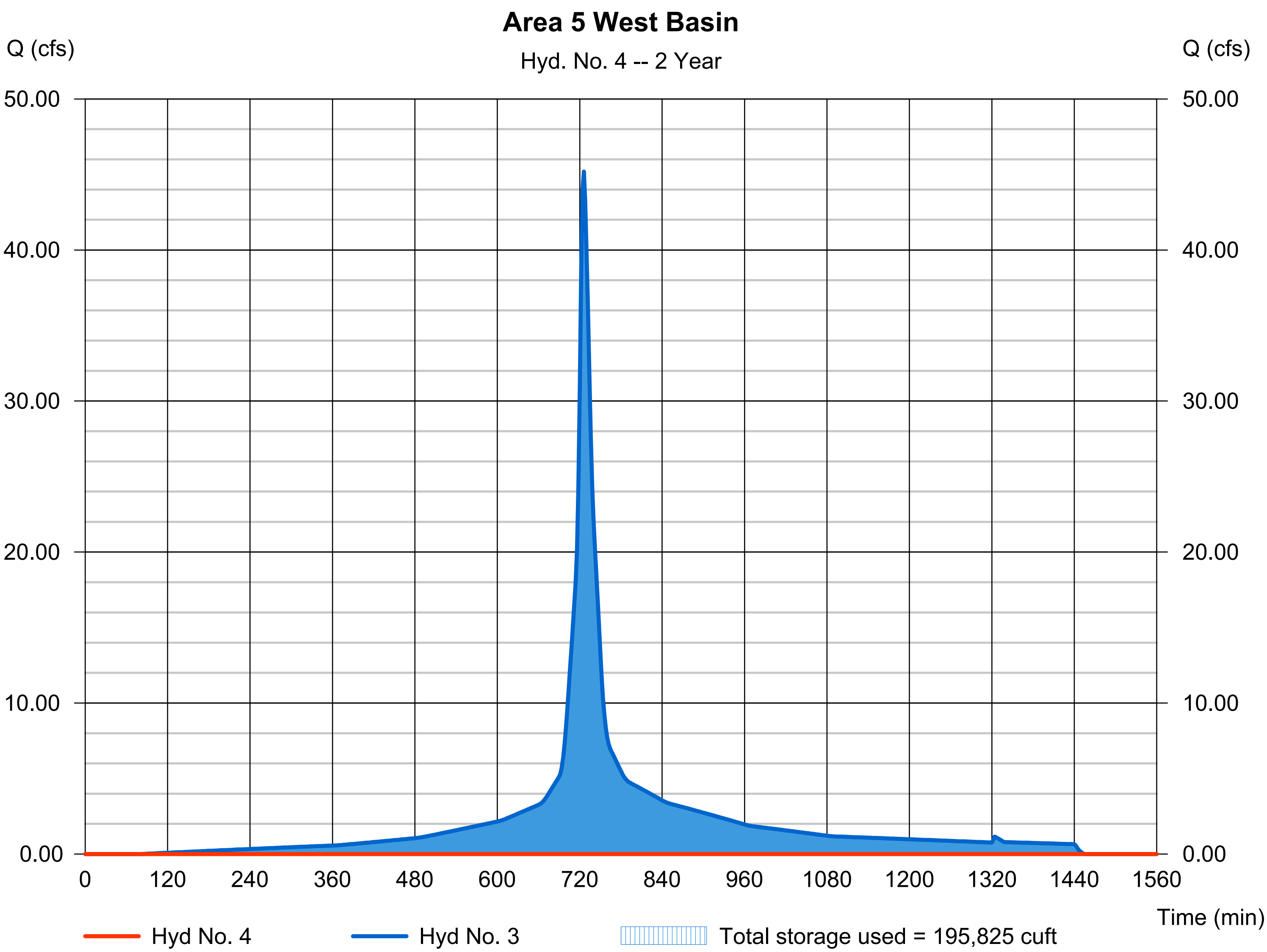
Hydraflow Hydrographs by Intelisolve v9.23 | Thursday, Jul 1, 2010

Hyd. No. 4

Area 5 West Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 48.85 ft
Reservoir name	= Area 5 West	Max. Storage	= 195,825 cuft

Storage Indication method used.



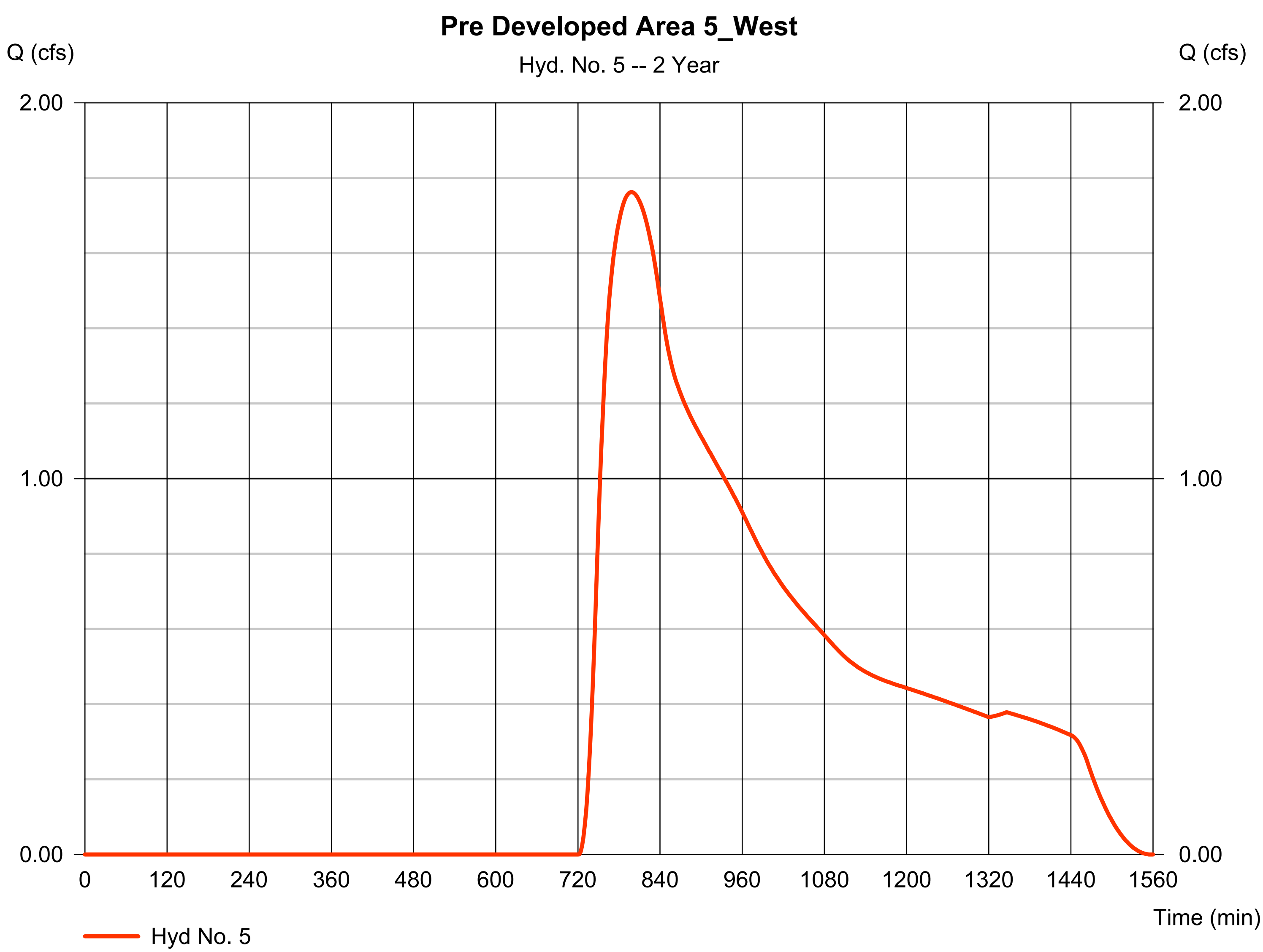
Hydrograph Report

Hyd. No. 5

Pre Developed Area 5_West

Hydrograph type	= SCS Runoff	Peak discharge	= 1.762 cfs
Storm frequency	= 2 yrs	Time to peak	= 798 min
Time interval	= 2 min	Hyd. volume	= 32,362 cuft
Drainage area	= 35.360 ac	Curve number	= 54*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.30 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 77) + (9.450 x 55) + (20.720 x 55) + (2.900 x 30) + (1.240 x 55)] / 35.360



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	26.44	2	726	105,878	----	------	------	Post Developed Area 5_West_Perv
2	SCS Runoff	63.70	2	726	262,790	----	------	------	NIC
3	Combine	90.14	2	726	368,668	1, 2	------	------	<no description>
4	Reservoir	3.001	2	1014	96,299	3	49.58	299,778	Area 5 West Basin
5	SCS Runoff	11.61	2	768	130,873	----	------	------	Pre Developed Area 5_West

Area 5_West.gpw	Return Period: 10 Year	Thursday, Jul 1, 2010

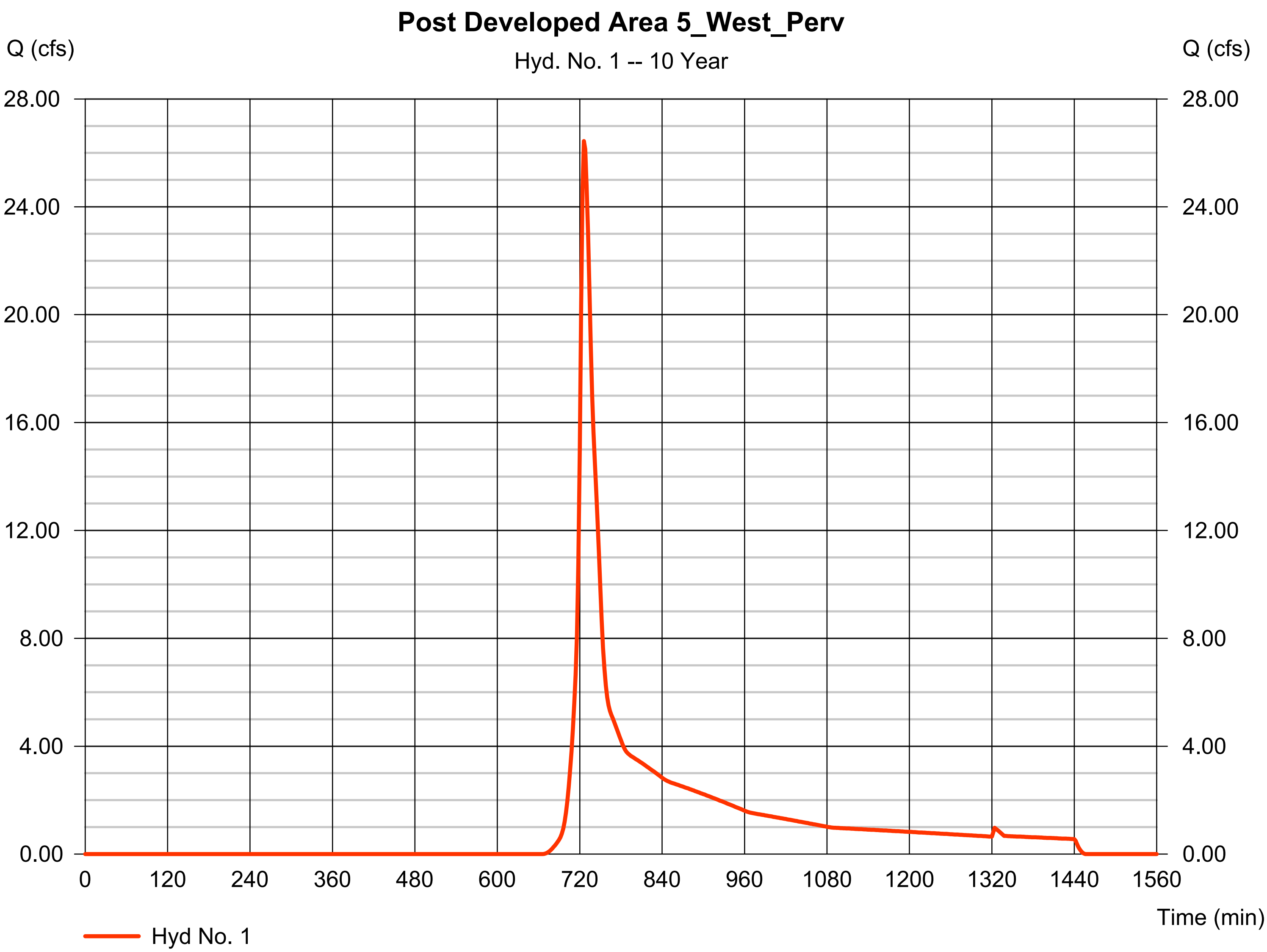
Hydrograph Report

Hyd. No. 1

Post Developed Area 5_West_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 26.44 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 105,878 cuft
Drainage area	= 20.680 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 80) + (9.450 x 61) + (6.040 x 61) + (2.900 x 39) + (1.240 x 74)] / 20.680

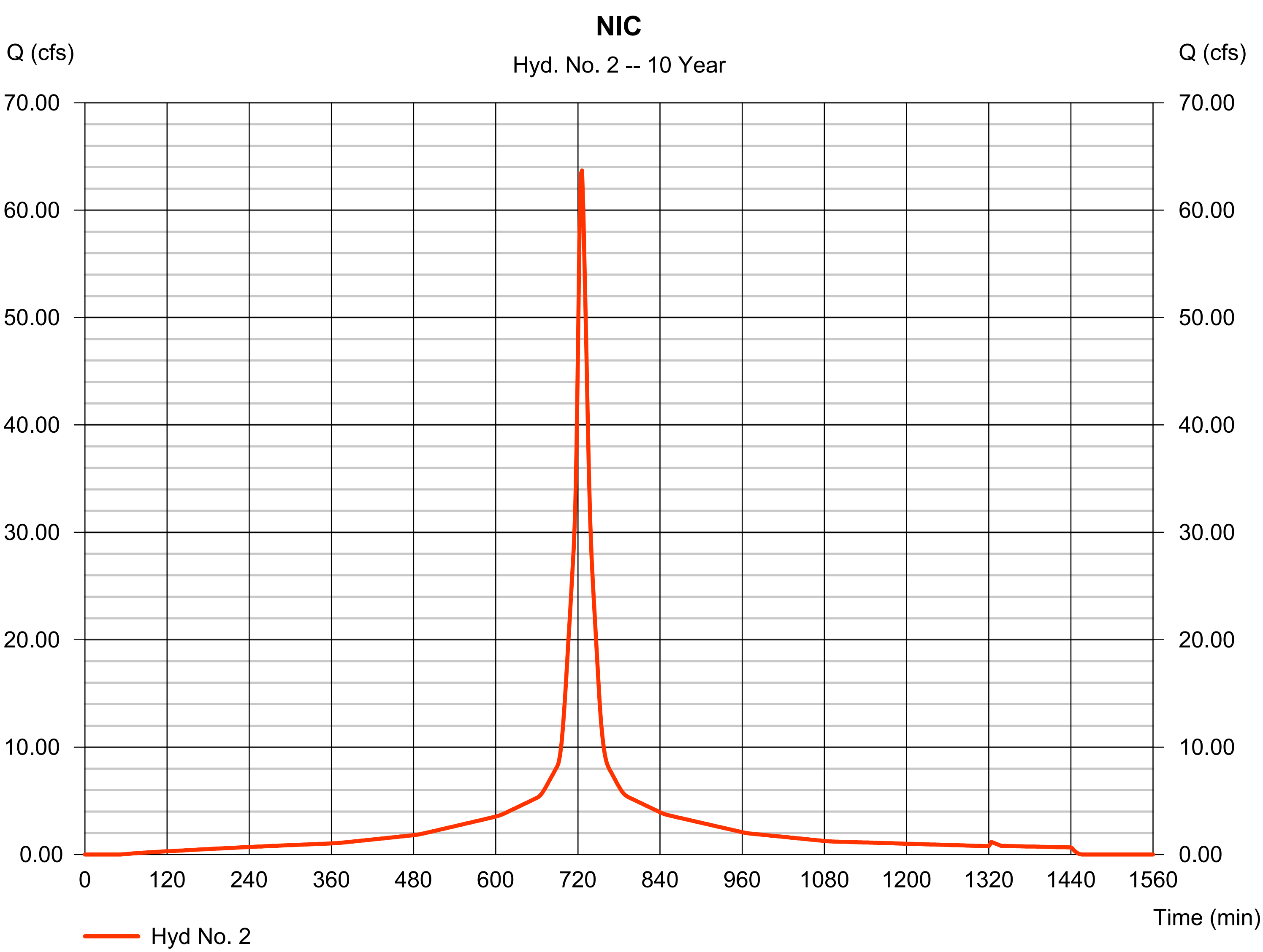


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 63.70 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 262,790 cuft
Drainage area	= 14.680 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

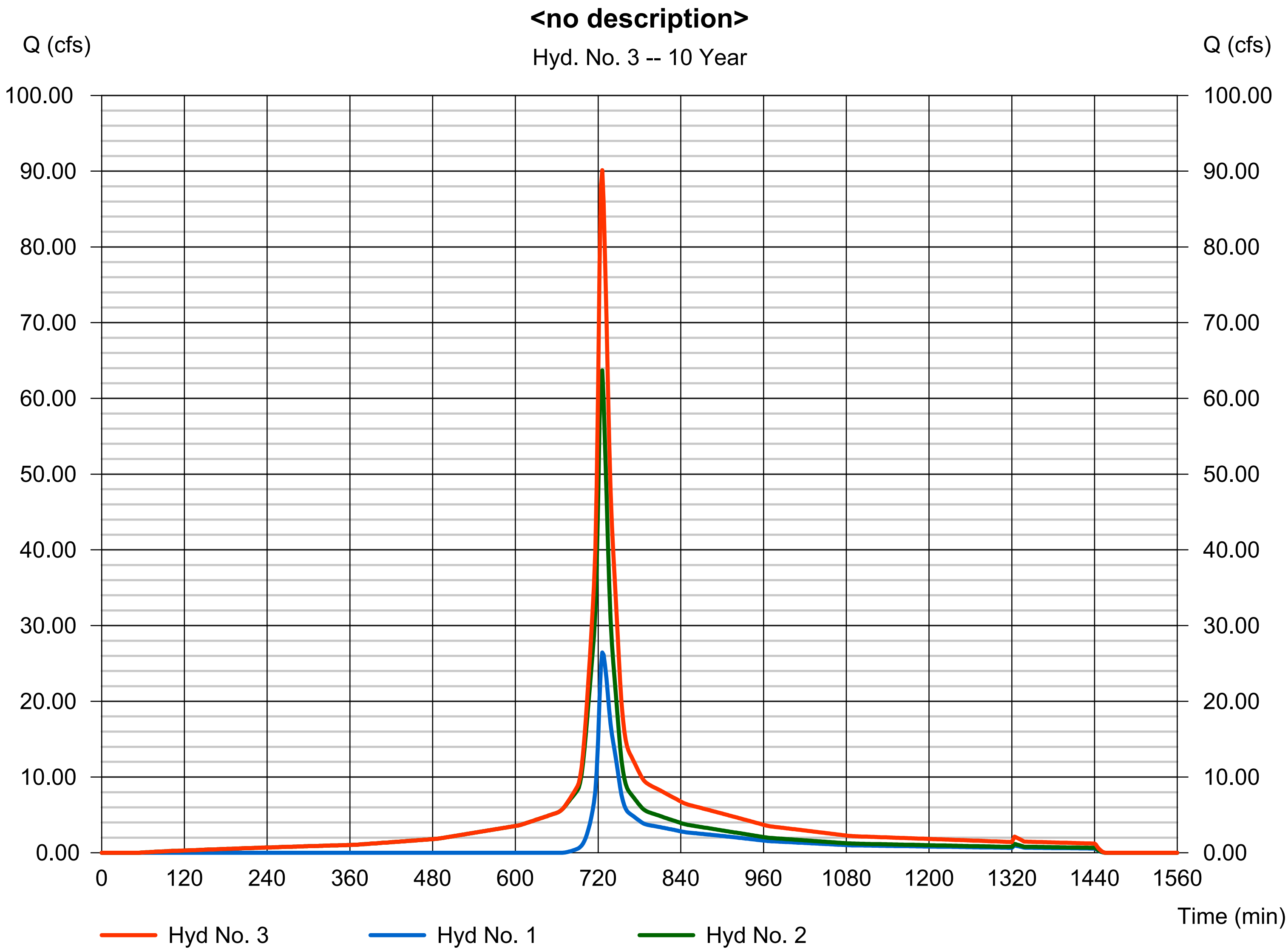


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 90.14 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 368,668 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.360 ac



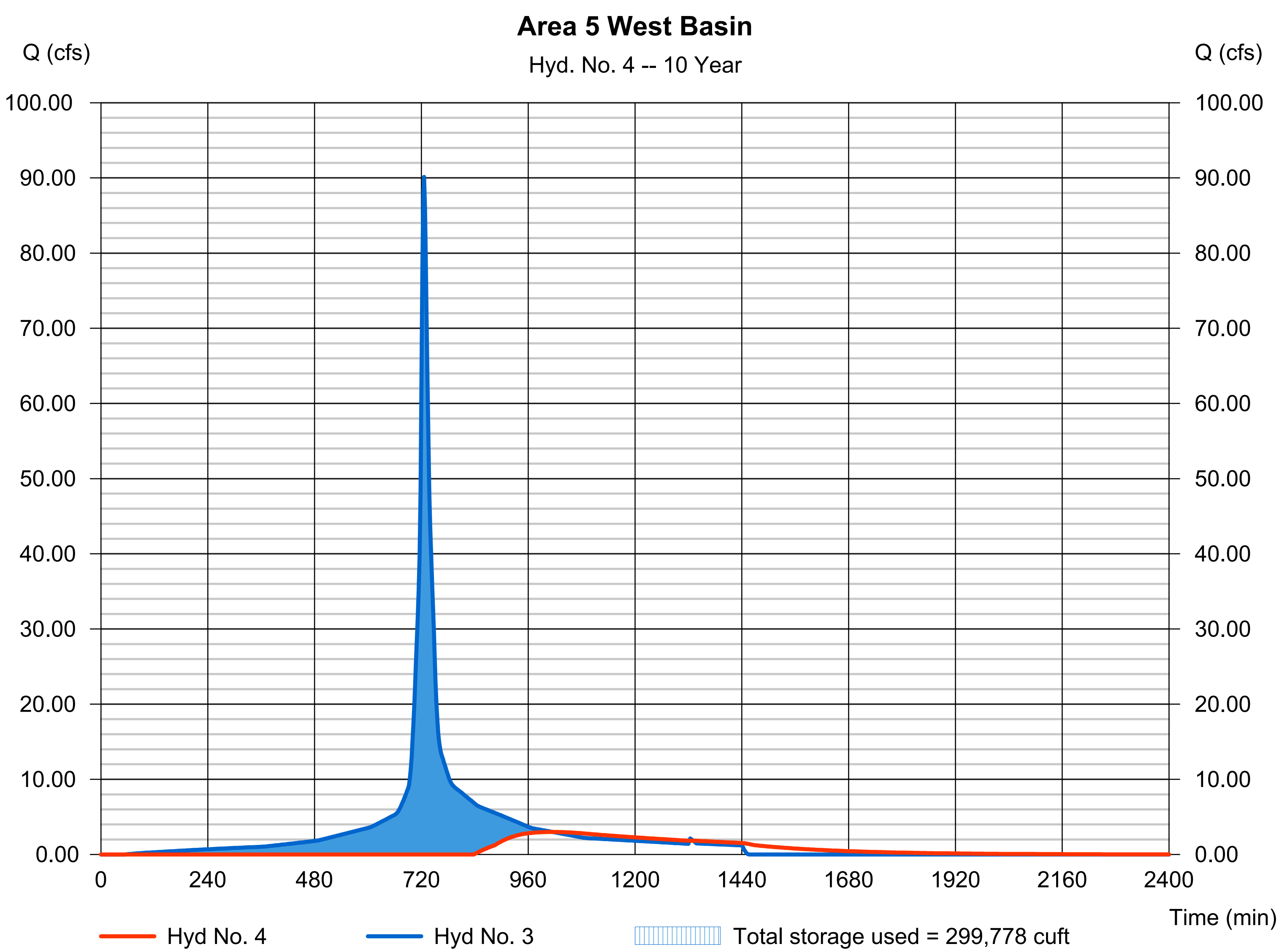
Hydrograph Report

Hyd. No. 4

Area 5 West Basin

Hydrograph type	= Reservoir	Peak discharge	= 3.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 1014 min
Time interval	= 2 min	Hyd. volume	= 96,299 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 49.58 ft
Reservoir name	= Area 5 West	Max. Storage	= 299,778 cuft

Storage Indication method used.



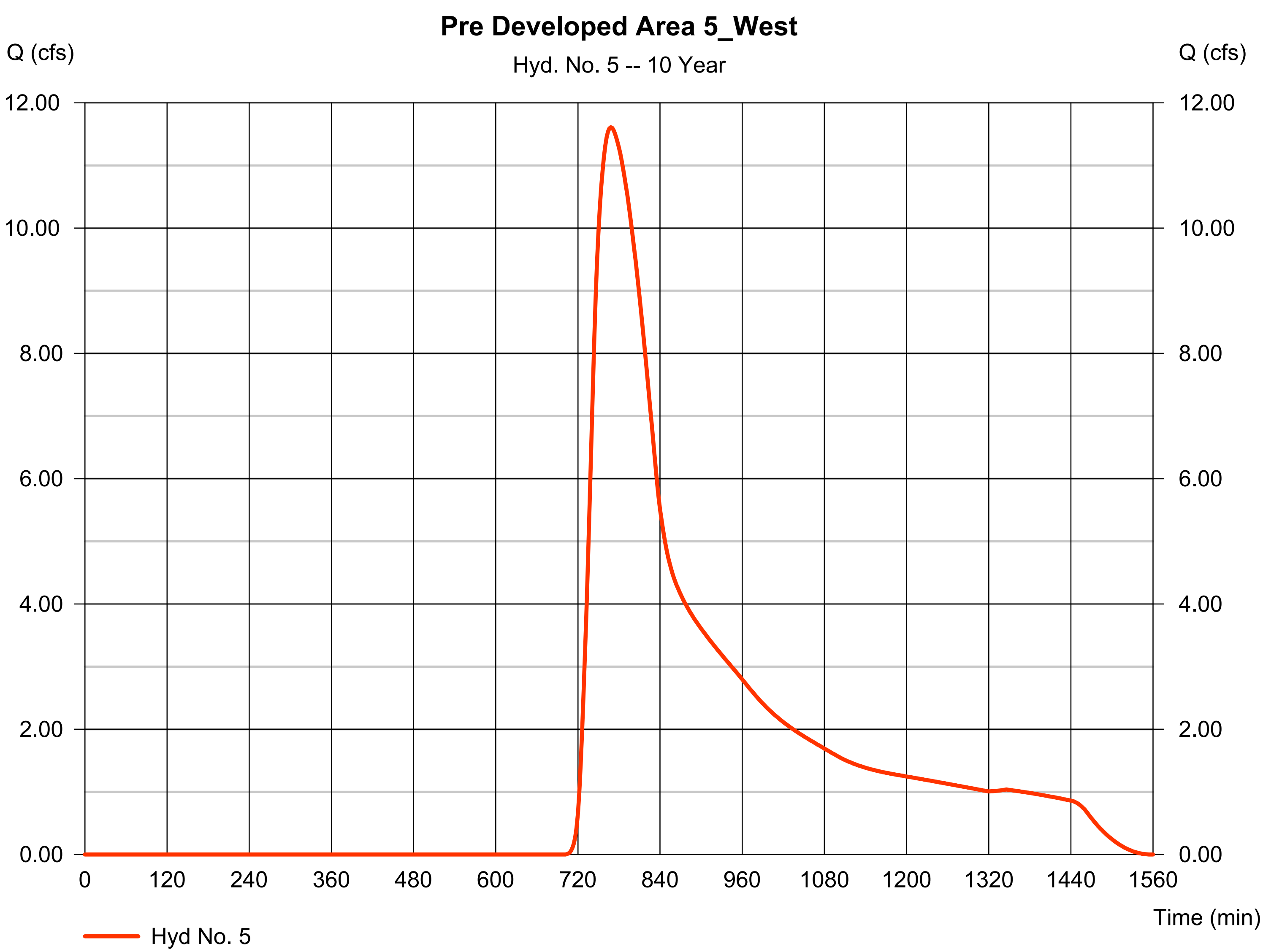
Hydrograph Report

Hyd. No. 5

Pre Developed Area 5_West

Hydrograph type	= SCS Runoff	Peak discharge	= 11.61 cfs
Storm frequency	= 10 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 130,873 cuft
Drainage area	= 35.360 ac	Curve number	= 54*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.30 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 77) + (9.450 x 55) + (20.720 x 55) + (2.900 x 30) + (1.240 x 55)] / 35.360



Hydrograph Summary Report

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	82.49	2	726	300,057	----	------	------	Post Developed Area 5_West_Perv
2	SCS Runoff	109.41	2	726	458,541	----	------	------	NIC
3	Combine	191.90	2	726	758,598	1, 2	------	------	<no description>
4	Reservoir	35.85	2	756	486,229	3	50.33	426,770	Area 5 West Basin
5	SCS Runoff	45.70	2	762	423,903	----	------	------	Pre Developed Area 5_West

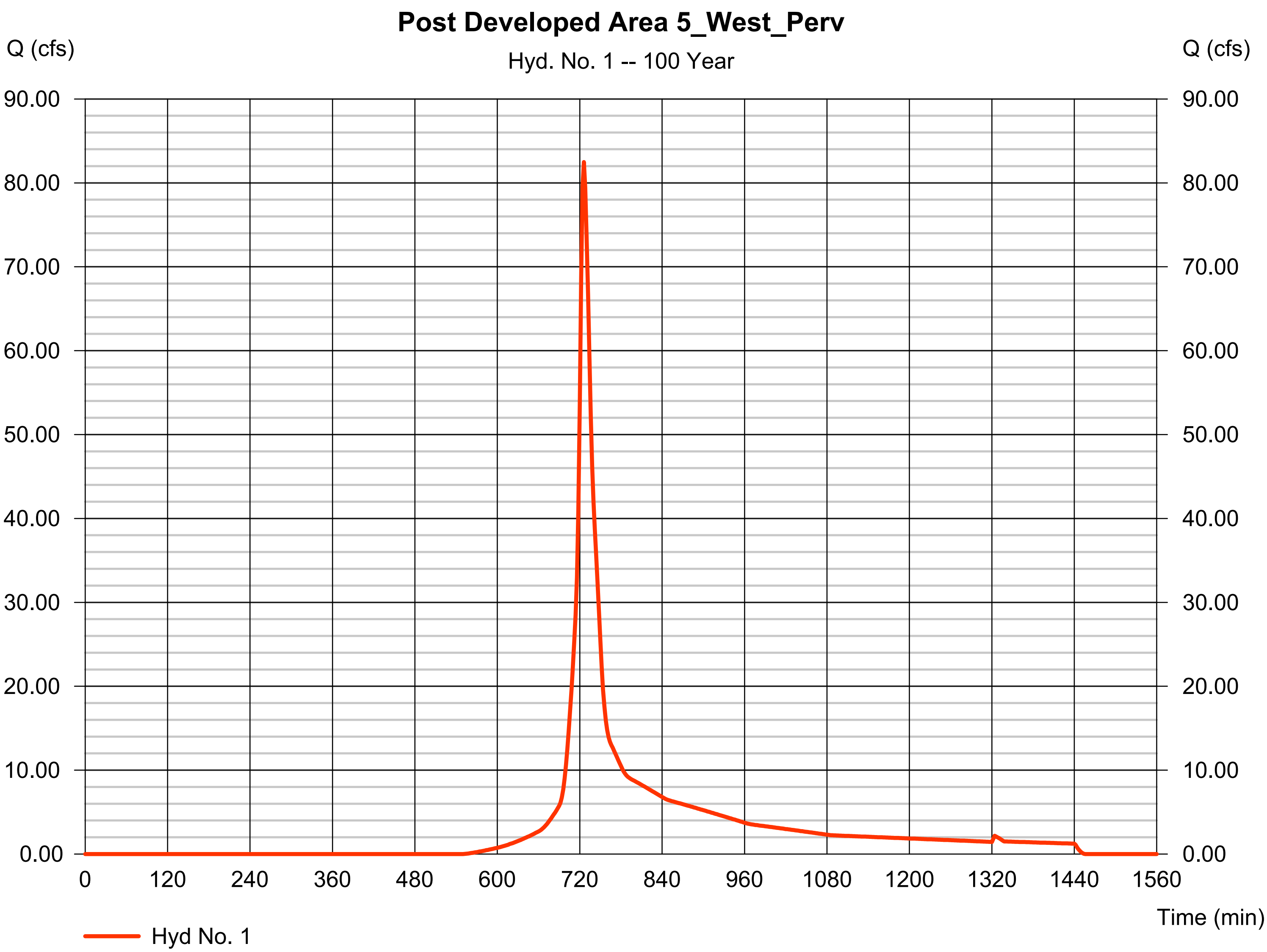
Hydrograph Report

Hyd. No. 1

Post Developed Area 5_West_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 82.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 300,057 cuft
Drainage area	= 20.680 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 80) + (9.450 x 61) + (6.040 x 61) + (2.900 x 39) + (1.240 x 74)] / 20.680

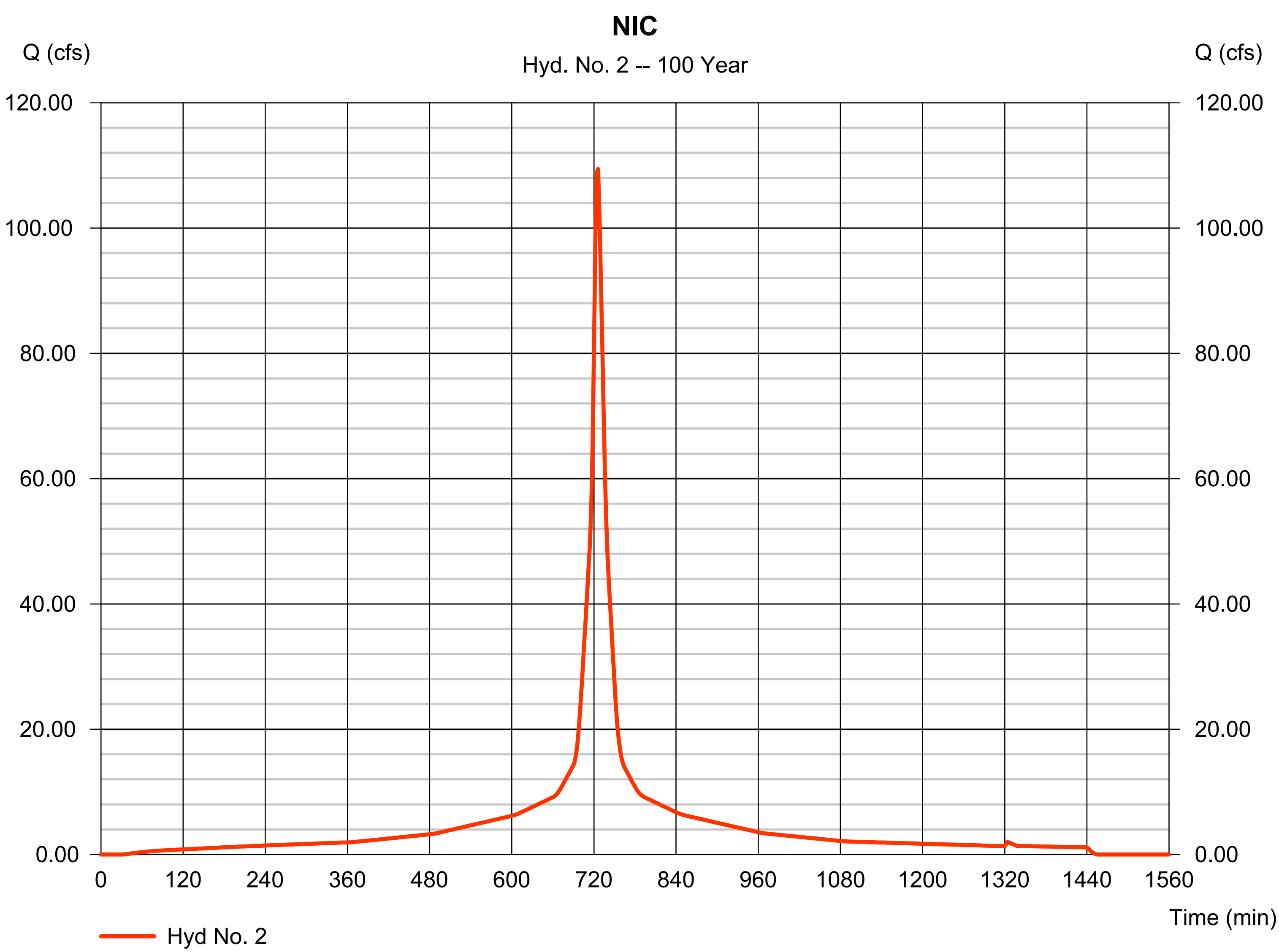


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 109.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 458,541 cuft
Drainage area	= 14.680 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

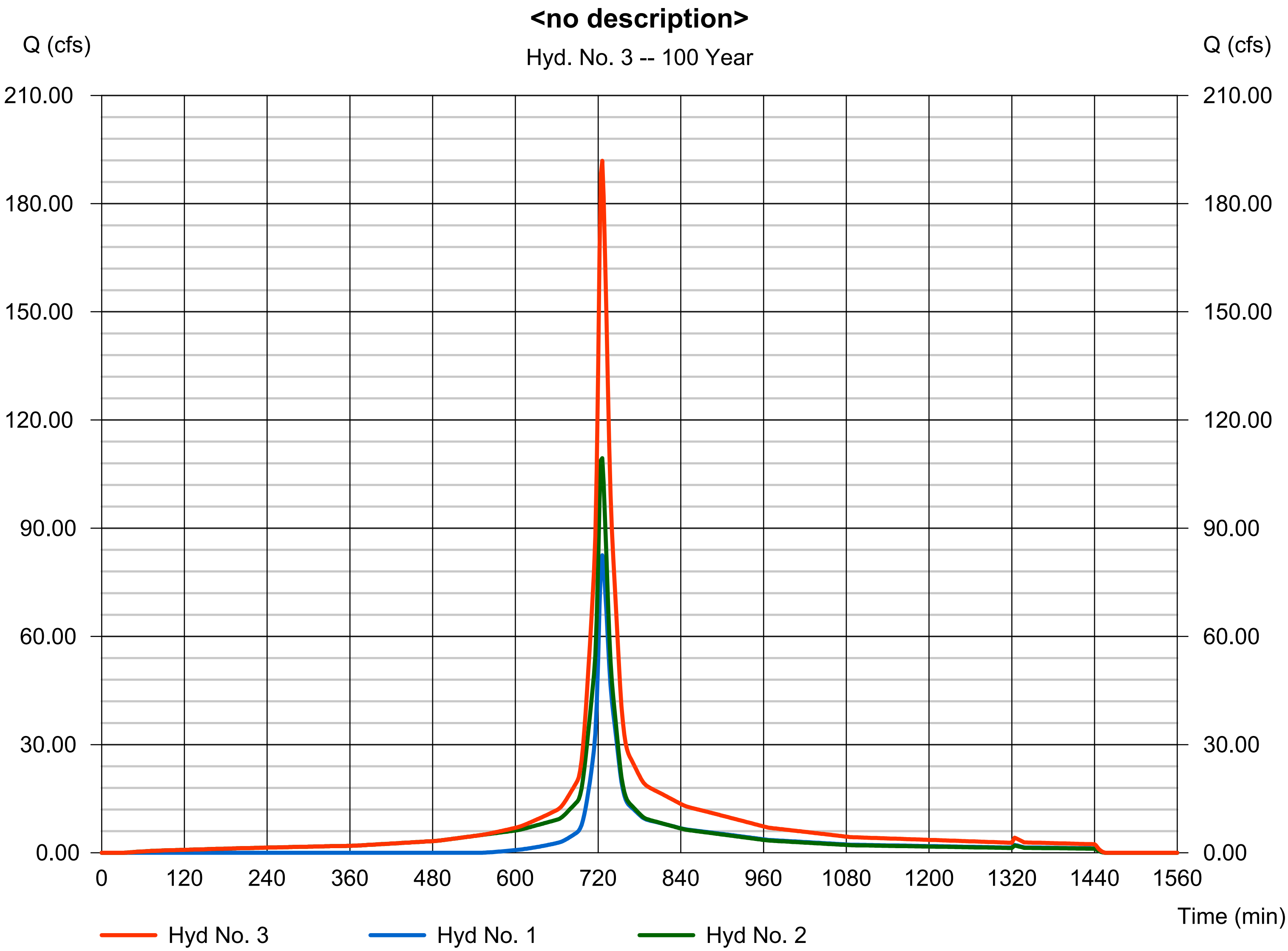


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 191.90 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 758,598 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.360 ac



Hydrograph Report

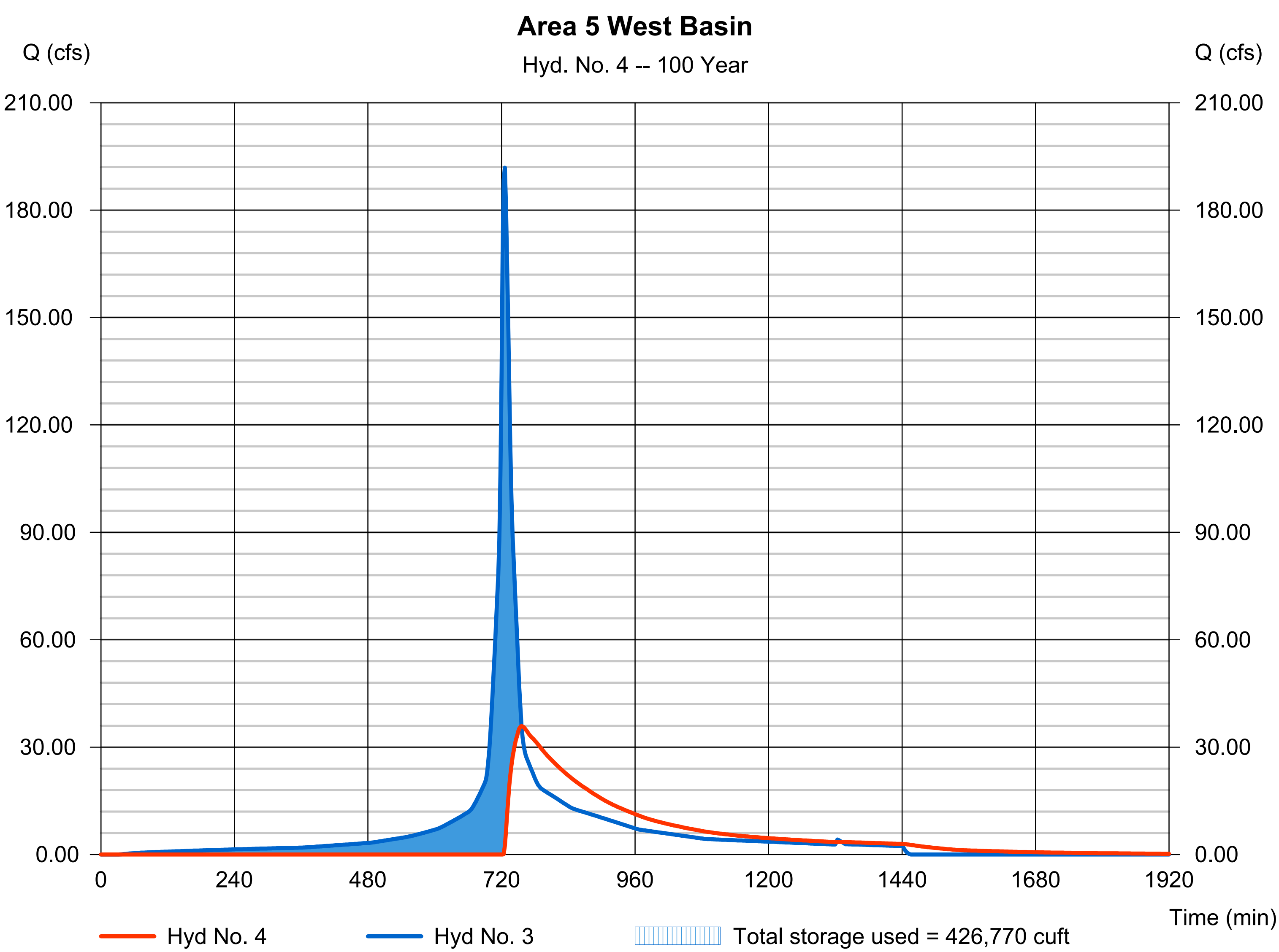
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 4

Area 5 West Basin

Hydrograph type	= Reservoir	Peak discharge	= 35.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 486,229 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 50.33 ft
Reservoir name	= Area 5 West	Max. Storage	= 426,770 cuft

Storage Indication method used.



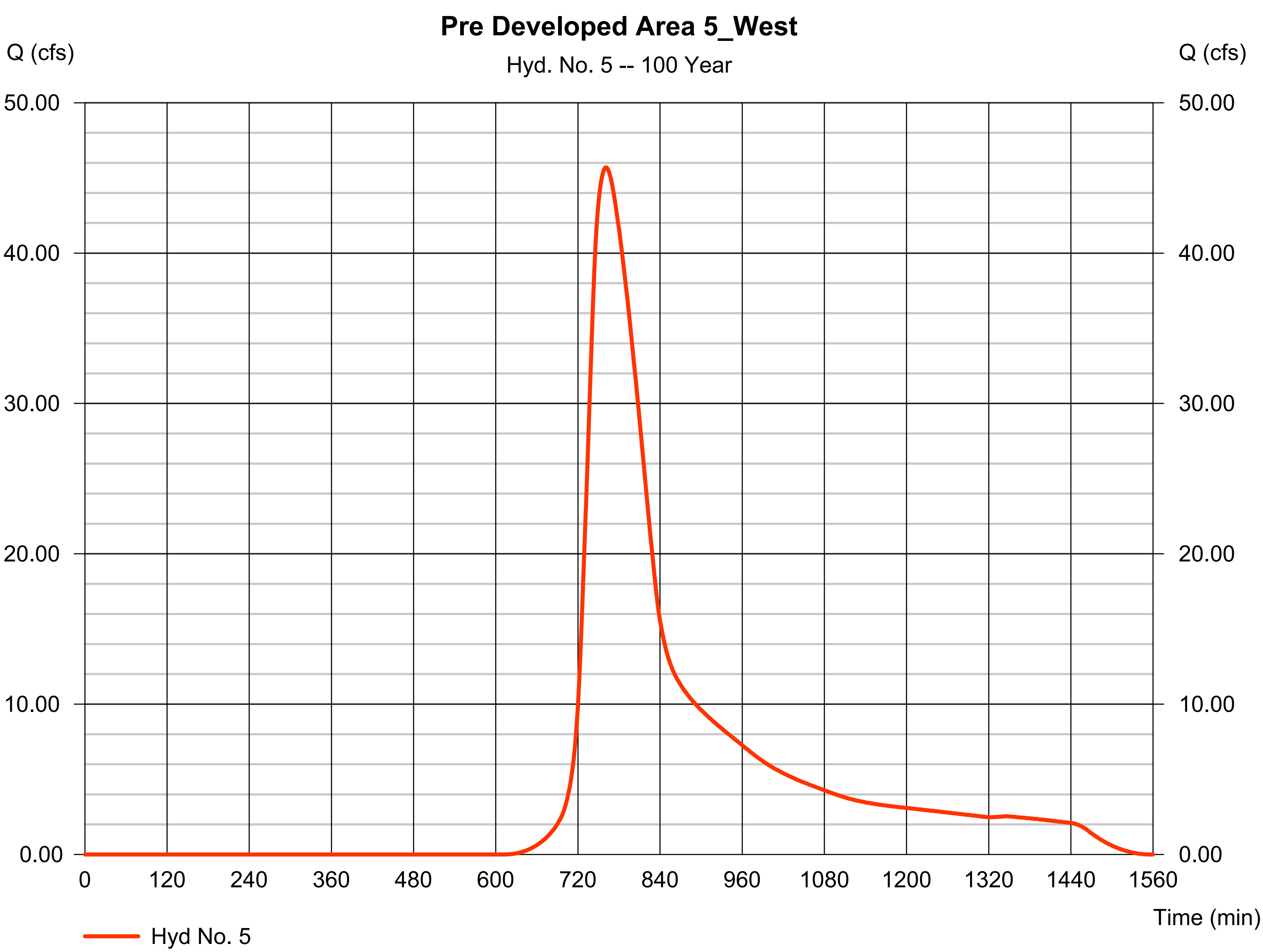
Hydrograph Report

Hyd. No. 5

Pre Developed Area 5_West

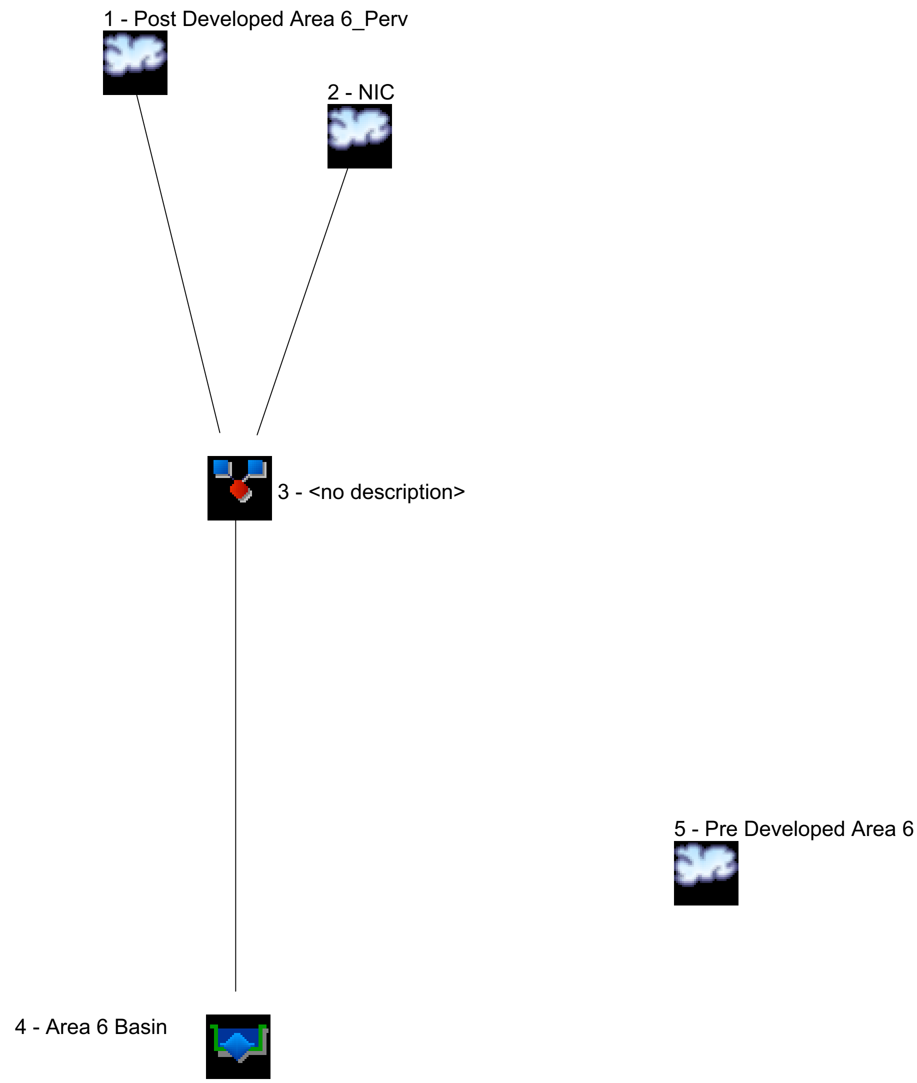
Hydrograph type	= SCS Runoff	Peak discharge	= 45.70 cfs
Storm frequency	= 100 yrs	Time to peak	= 762 min
Time interval	= 2 min	Hyd. volume	= 423,903 cuft
Drainage area	= 35.360 ac	Curve number	= 54*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.30 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.050 x 77) + (9.450 x 55) + (20.720 x 55) + (2.900 x 30) + (1.240 x 55)] / 35.360



Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 6.gpw	Thursday, Jun 17, 2010

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	5.358	2	734	35,744	----	------	------	Post Developed Area 6_Perv
2	SCS Runoff	59.92	2	726	242,506	----	------	------	NIC
3	Combine	63.98	2	726	278,250	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	52.43	278,250	Area 6 Basin
5	SCS Runoff	0.246	2	984	7,396	----	------	------	Pre Developed Area 6

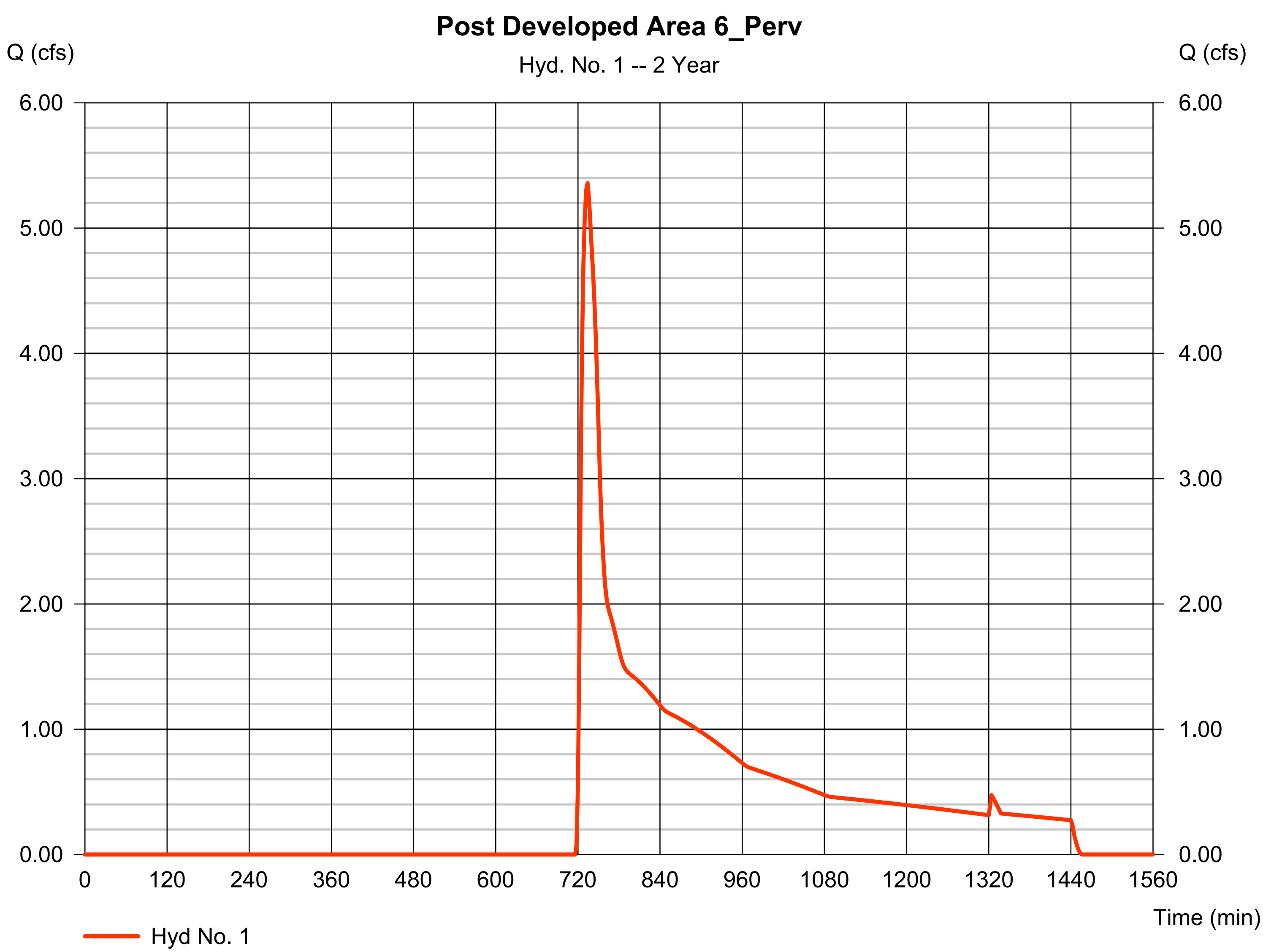
Hydrograph Report

Hyd. No. 1

Post Developed Area 6_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 5.358 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 35,744 cuft
Drainage area	= 26.280 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (6.150 x 61) + (5.460 x 39) + (2.600 x 39) + (12.070 x 70)] / 26.280



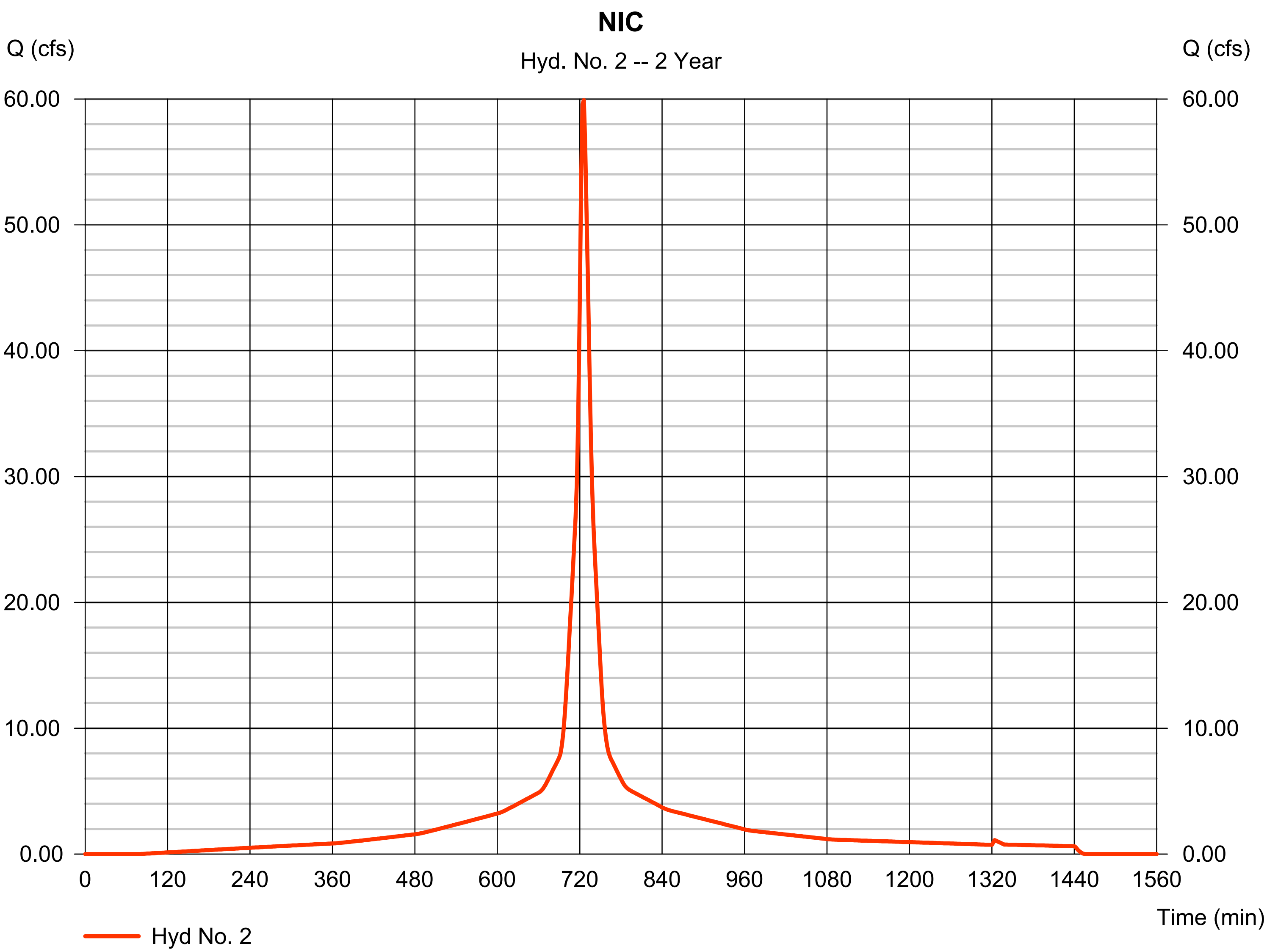
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 59.92 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 242,506 cuft
Drainage area	= 21.920 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(21.920 x 98)] / 21.920

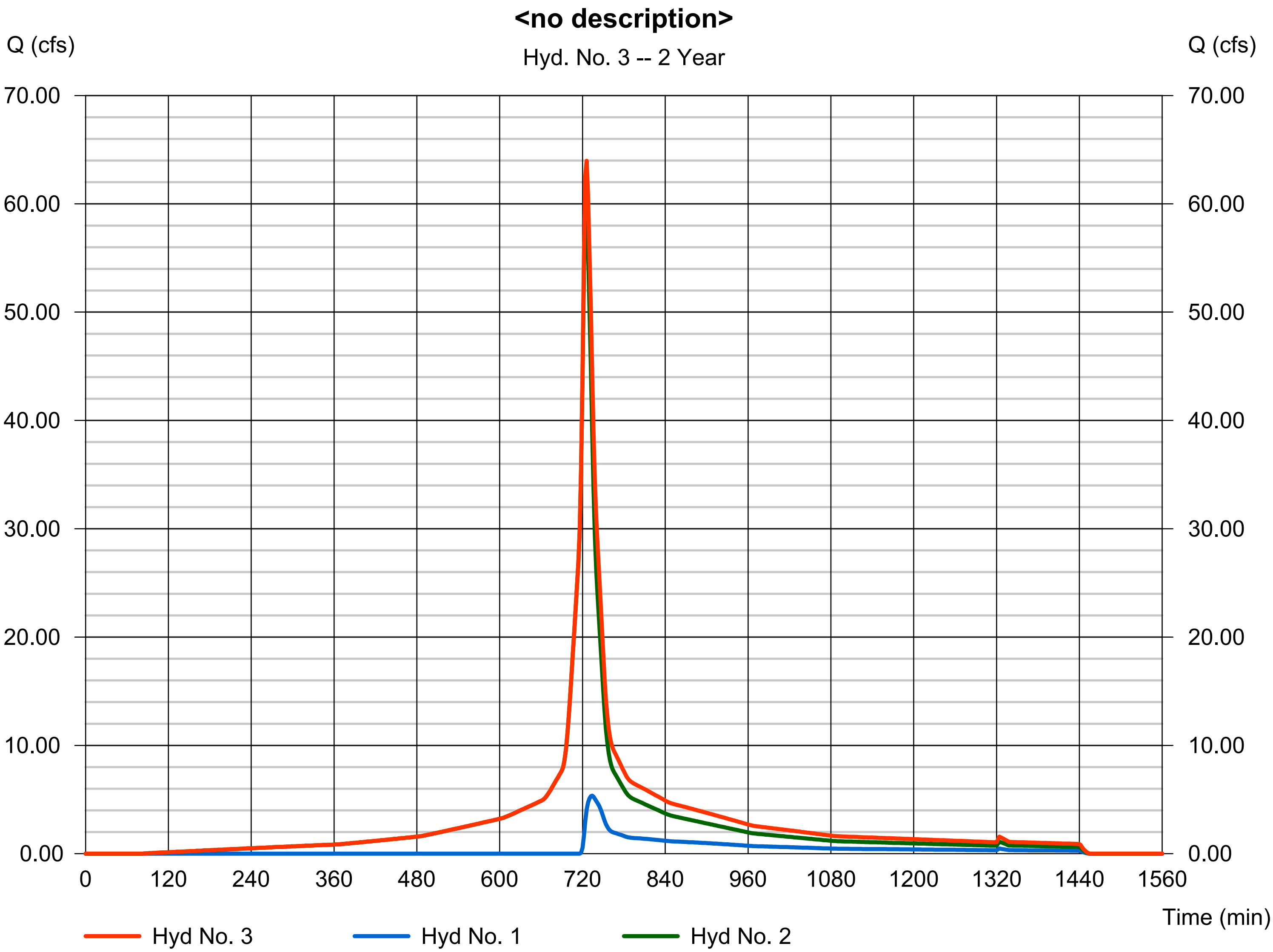


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 63.98 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 278,250 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 48.200 ac



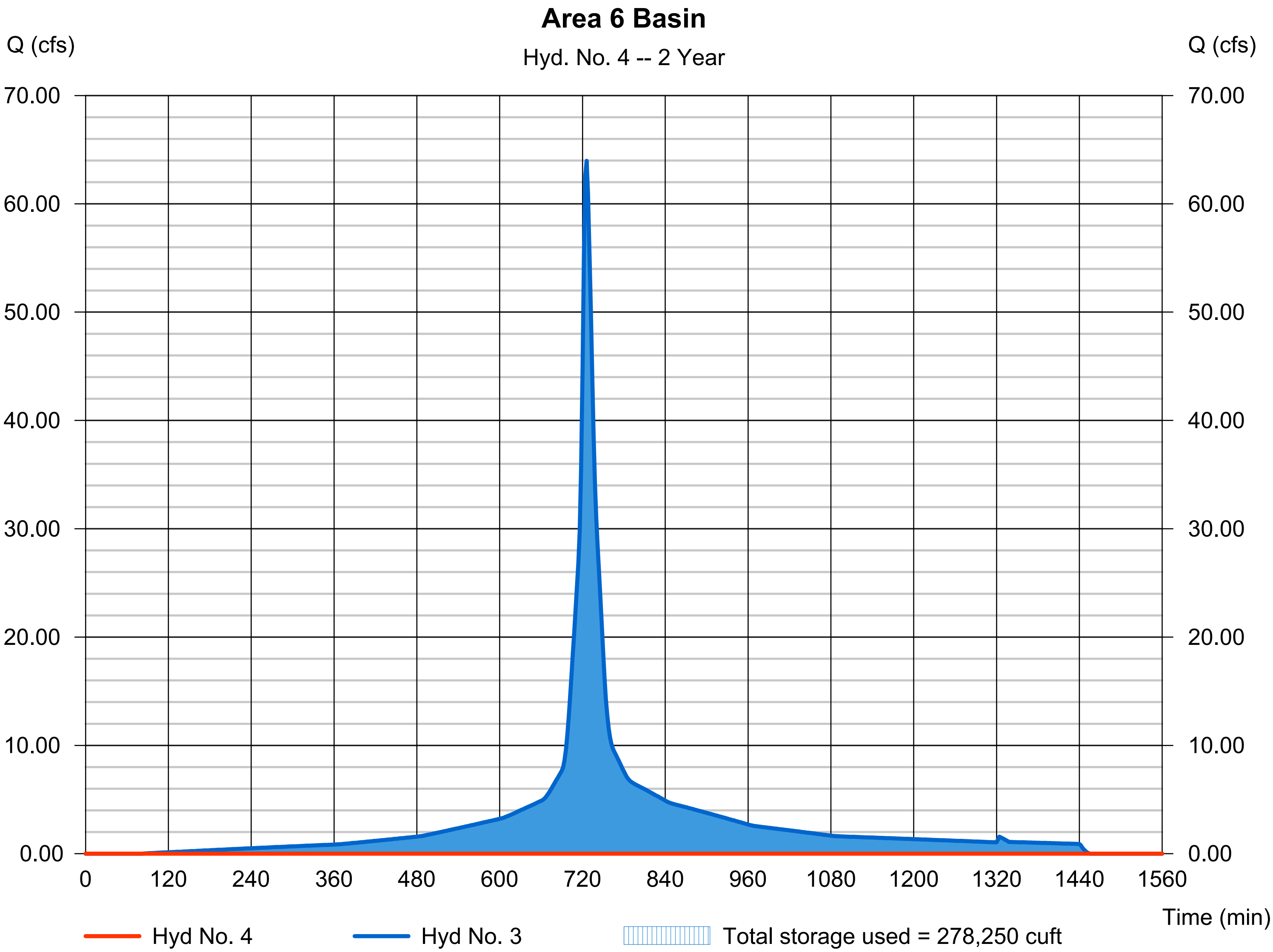
Hydrograph Report

Hyd. No. 4

Area 6 Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 52.43 ft
Reservoir name	= Area 6	Max. Storage	= 278,250 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Area 6

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 49.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	49.00	00	0	0
1.00	50.00	16,039	8,020	8,020
2.00	51.00	90,200	53,120	61,139
3.00	52.00	163,467	126,834	187,973
4.00	53.00	252,550	208,009	395,981
5.00	54.00	301,338	276,944	672,925
6.00	55.00	345,659	323,499	996,424

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

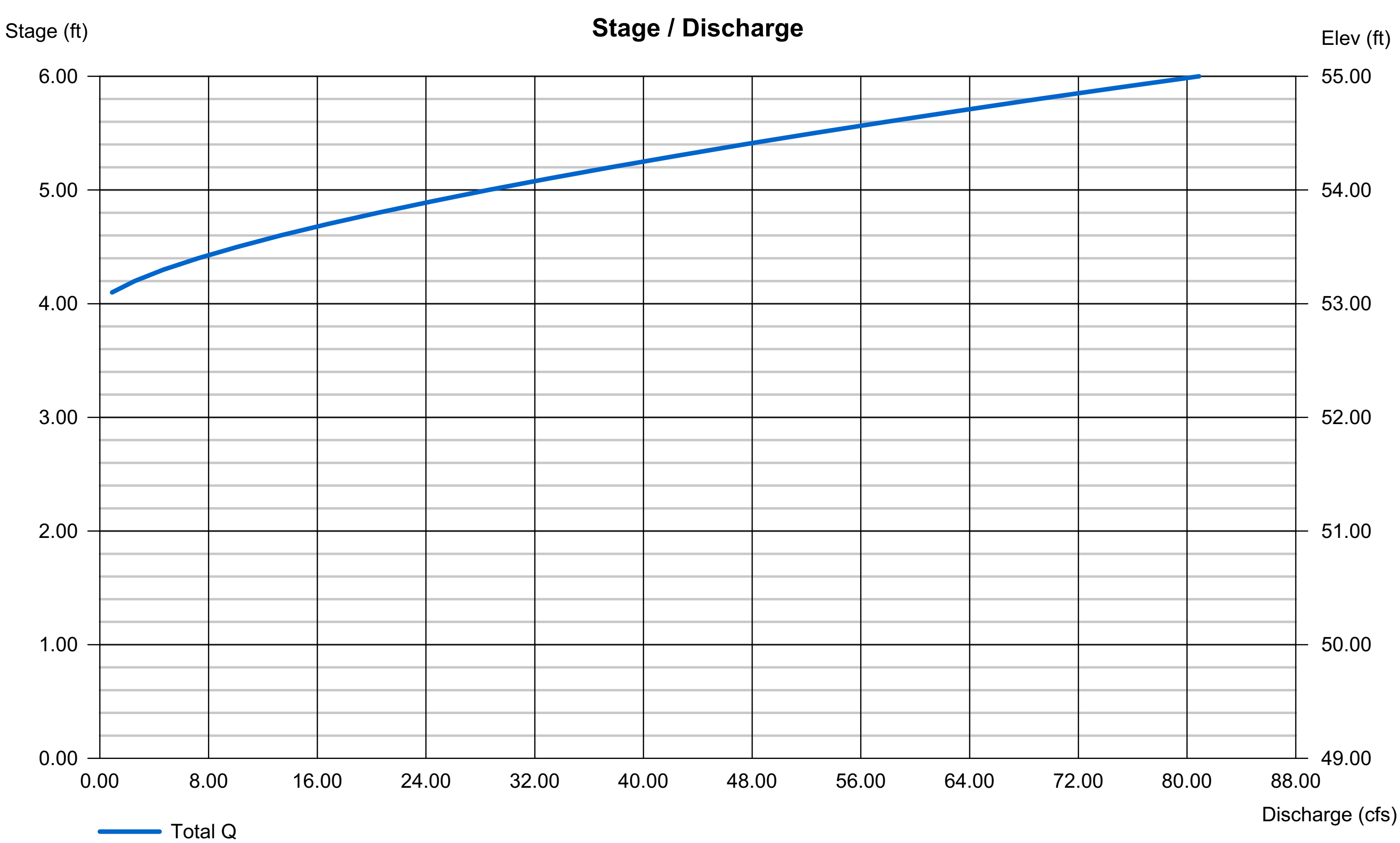
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 11.00	0.00	0.00	0.00
Crest El. (ft)	= 53.00	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 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).



Hydrograph Report

Hyd. No. 5

Pre Developed Area 6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.246 cfs
Storm frequency	= 2 yrs	Time to peak	= 984 min
Time interval	= 2 min	Hyd. volume	= 7,396 cuft
Drainage area	= 48.200 ac	Curve number	= 44*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.60 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.150 x 55) + (5.460 x 30) + (23.470 x 30) + (13.120 x 70)] / 48.200

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	29.23	2	726	121,371	----	------	------	Post Developed Area 6_Perv
2	SCS Runoff	95.11	2	726	392,395	----	------	------	NIC
3	Combine	124.34	2	726	513,766	1, 2	------	------	<no description>
4	Reservoir	2.417	2	1216	117,754	3	53.19	449,008	Area 6 Basin
5	SCS Runoff	4.427	2	802	80,196	----	------	------	Pre Developed Area 6

Area 6.gpw	Return Period: 10 Year	Thursday, Jun 17, 2010

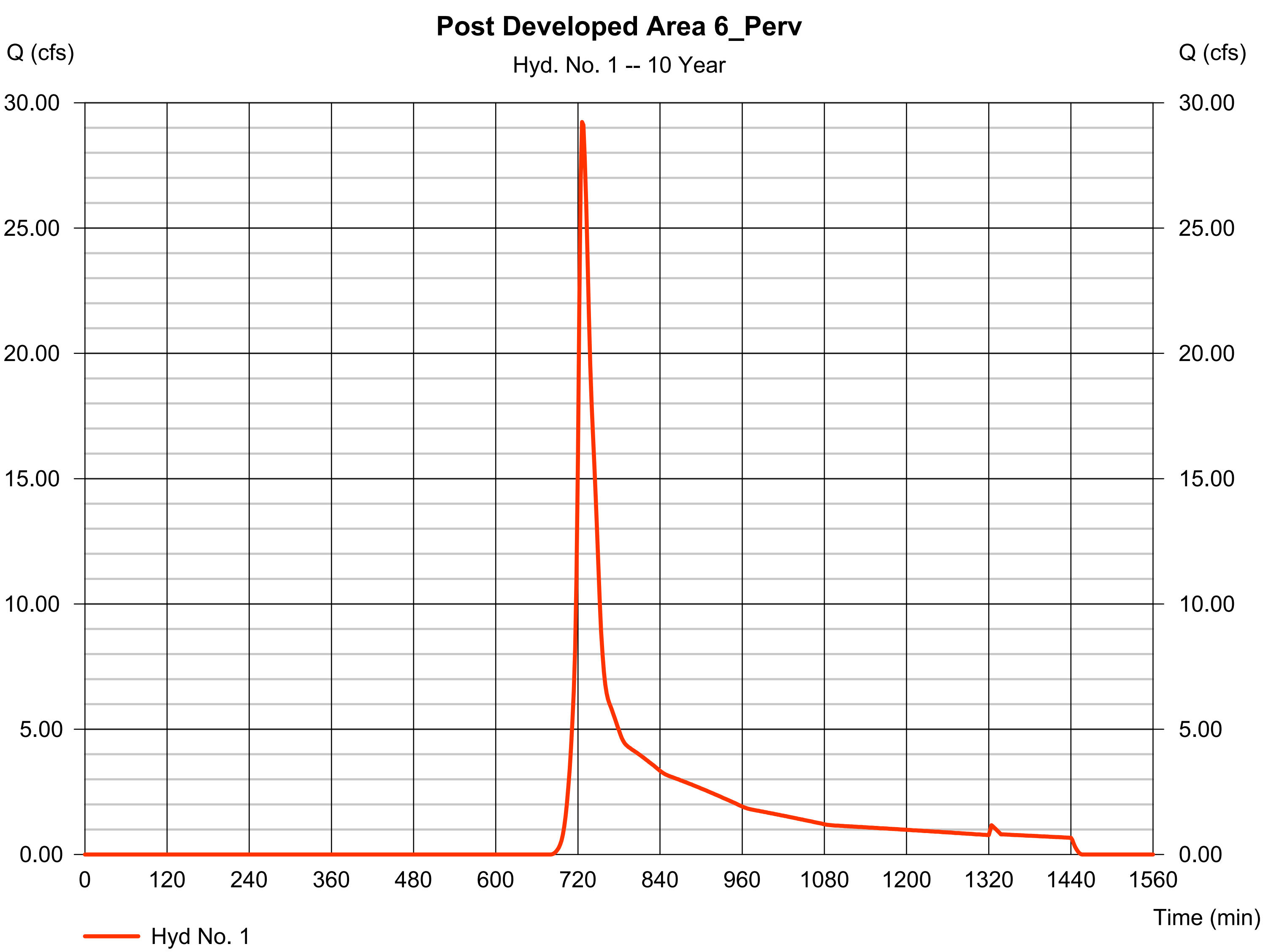
Hydrograph Report

Hyd. No. 1

Post Developed Area 6_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 29.23 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 121,371 cuft
Drainage area	= 26.280 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (6.150 x 61) + (5.460 x 39) + (2.600 x 39) + (12.070 x 70)] / 26.280



Hydrograph Report

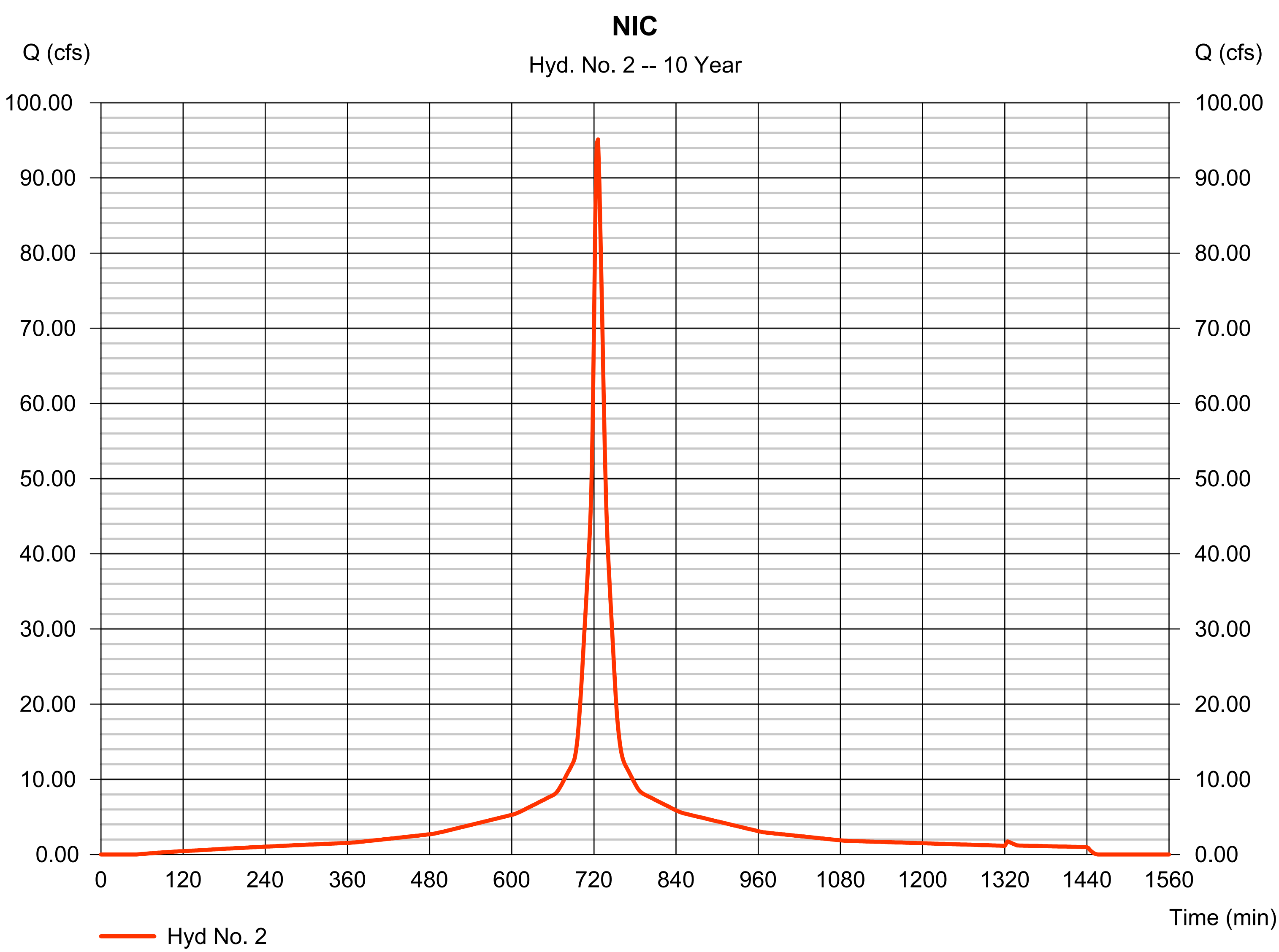
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jun 17, 2010

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 95.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 392,395 cuft
Drainage area	= 21.920 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(21.920 x 98)] / 21.920



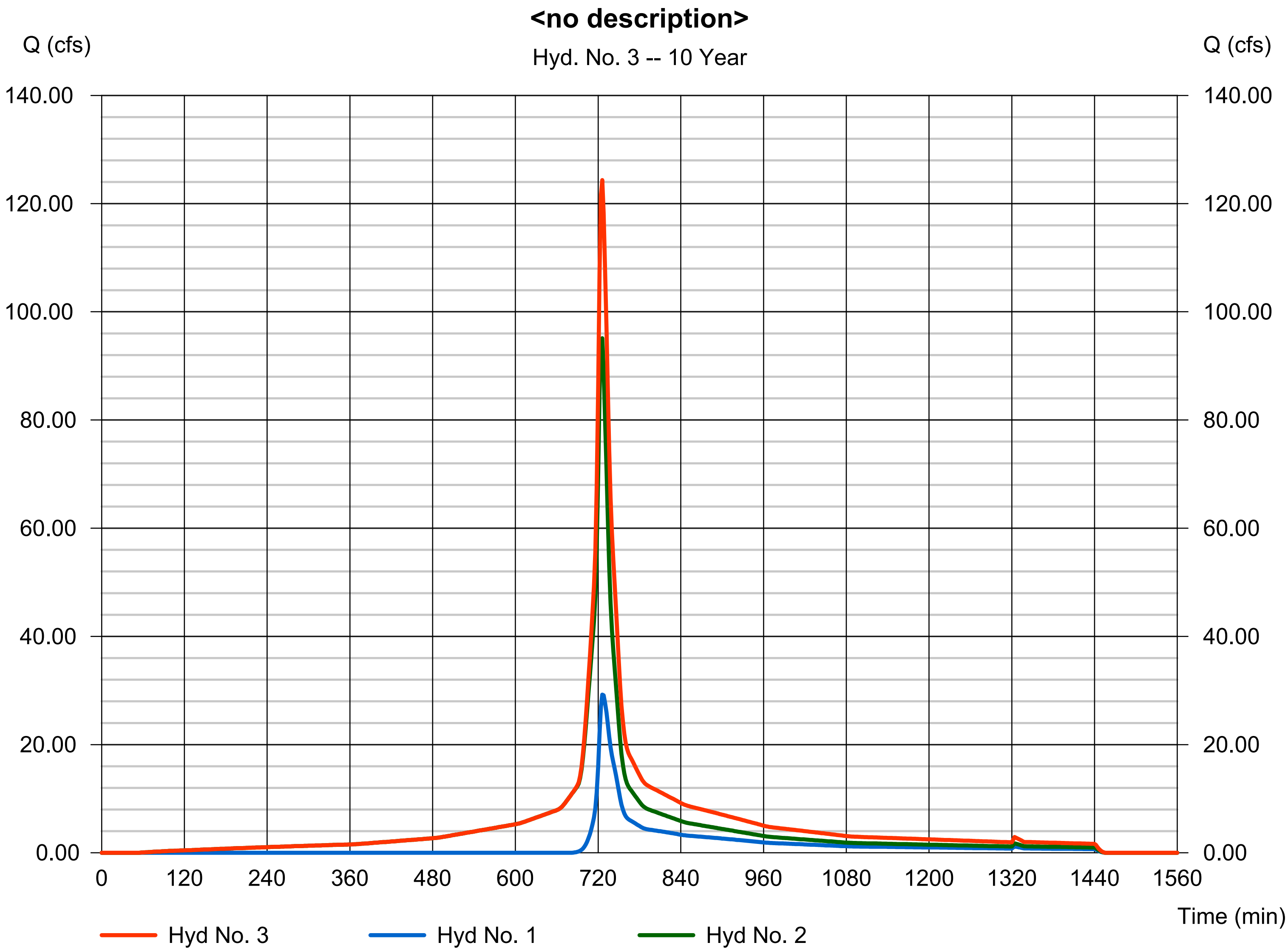
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jun 17, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 124.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 513,766 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 48.200 ac



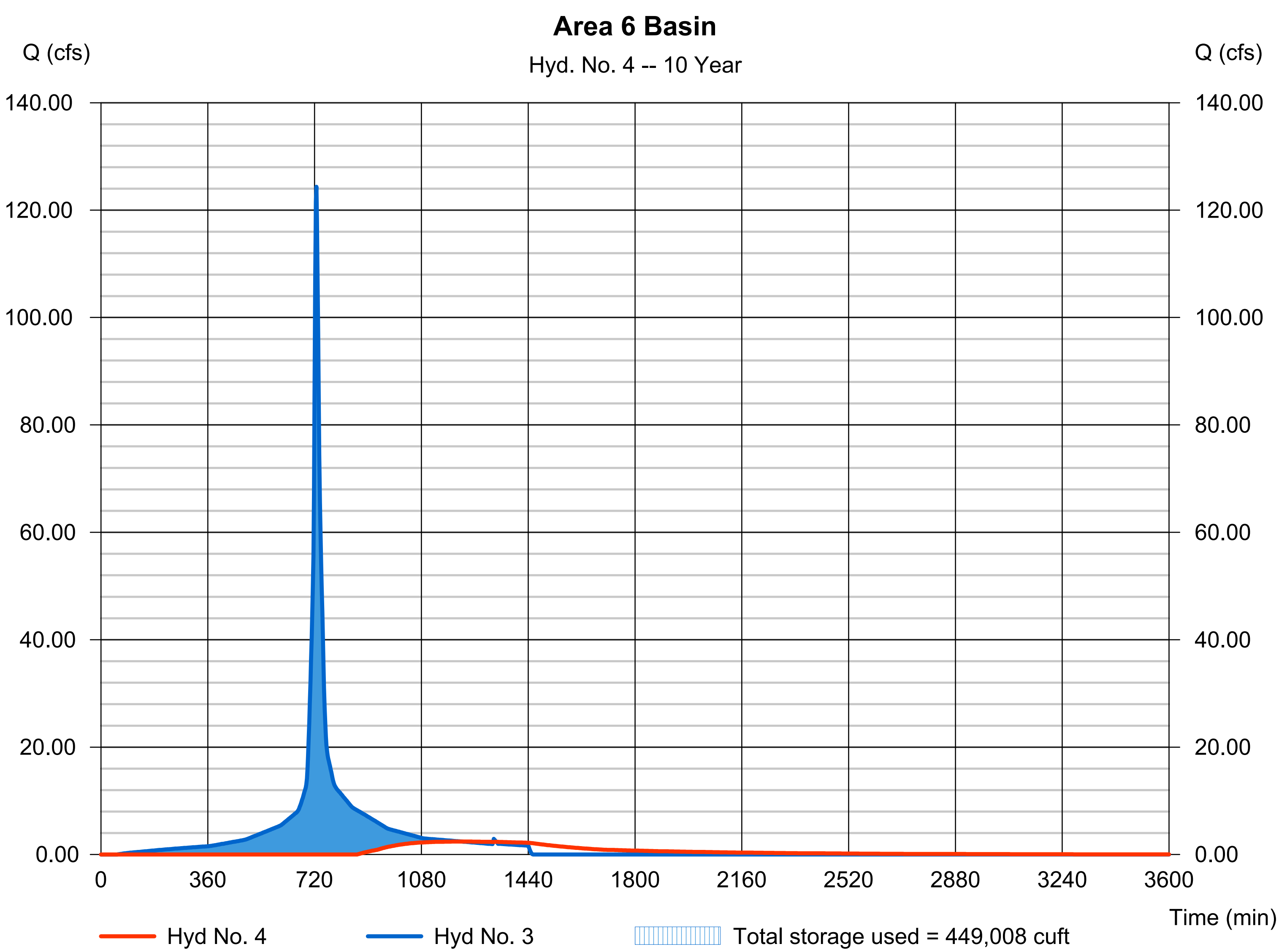
Hydrograph Report

Hyd. No. 4

Area 6 Basin

Hydrograph type	= Reservoir	Peak discharge	= 2.417 cfs
Storm frequency	= 10 yrs	Time to peak	= 1216 min
Time interval	= 2 min	Hyd. volume	= 117,754 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 53.19 ft
Reservoir name	= Area 6	Max. Storage	= 449,008 cuft

Storage Indication method used.



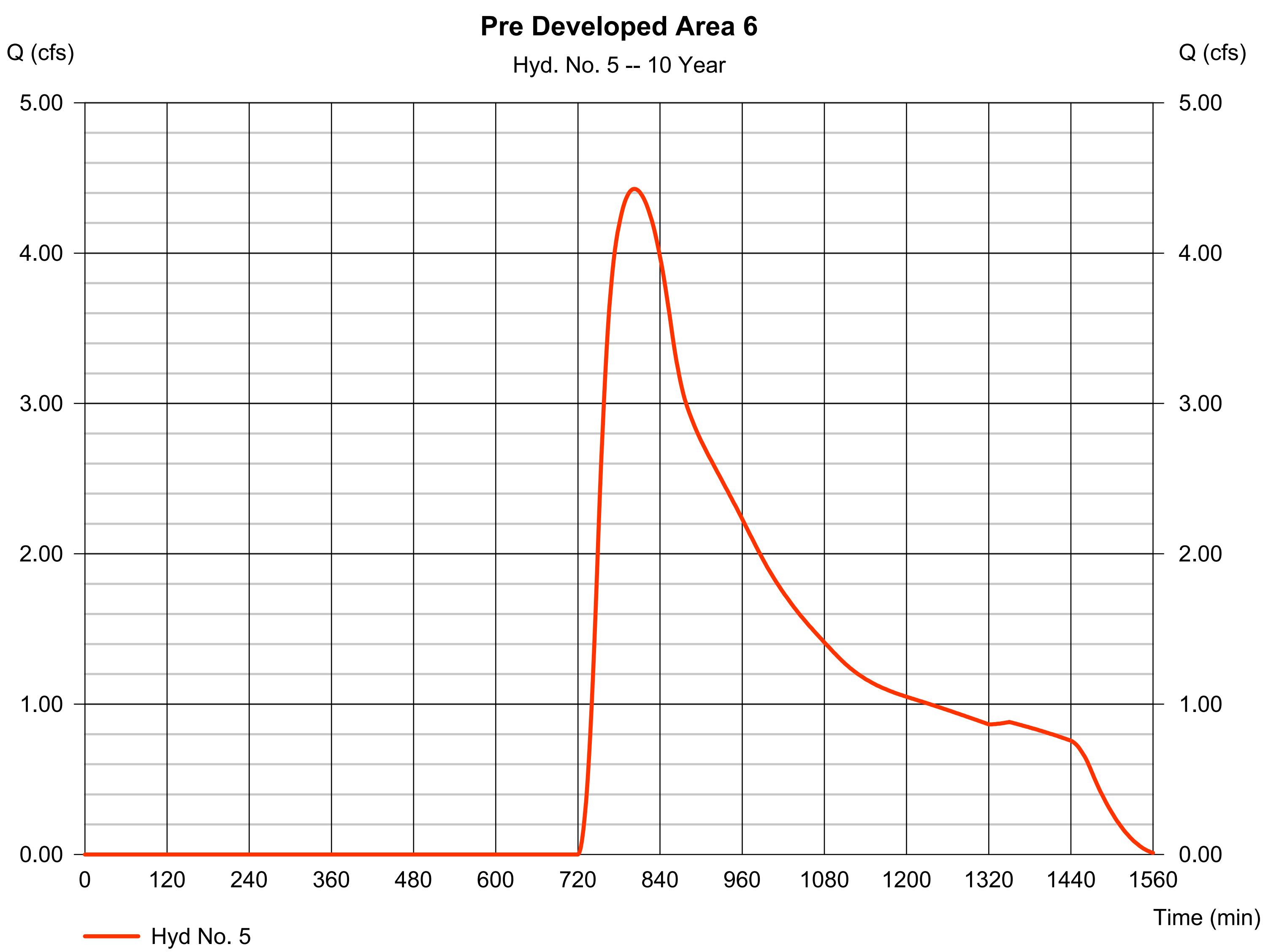
Hydrograph Report

Hyd. No. 5

Pre Developed Area 6

Hydrograph type	= SCS Runoff	Peak discharge	= 4.427 cfs
Storm frequency	= 10 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 80,196 cuft
Drainage area	= 48.200 ac	Curve number	= 44*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.60 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.150 x 55) + (5.460 x 30) + (23.470 x 30) + (13.120 x 70)] / 48.200



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	97.89	2	726	358,241	----	------	------	Post Developed Area 6_Perv
2	SCS Runoff	163.38	2	726	684,689	----	------	------	NIC
3	Combine	261.26	2	726	1,042,930	1, 2	------	------	<no description>
4	Reservoir	24.92	2	792	646,918	3	53.91	648,534	Area 6 Basin
5	SCS Runoff	32.13	2	772	370,639	----	------	------	Pre Developed Area 6

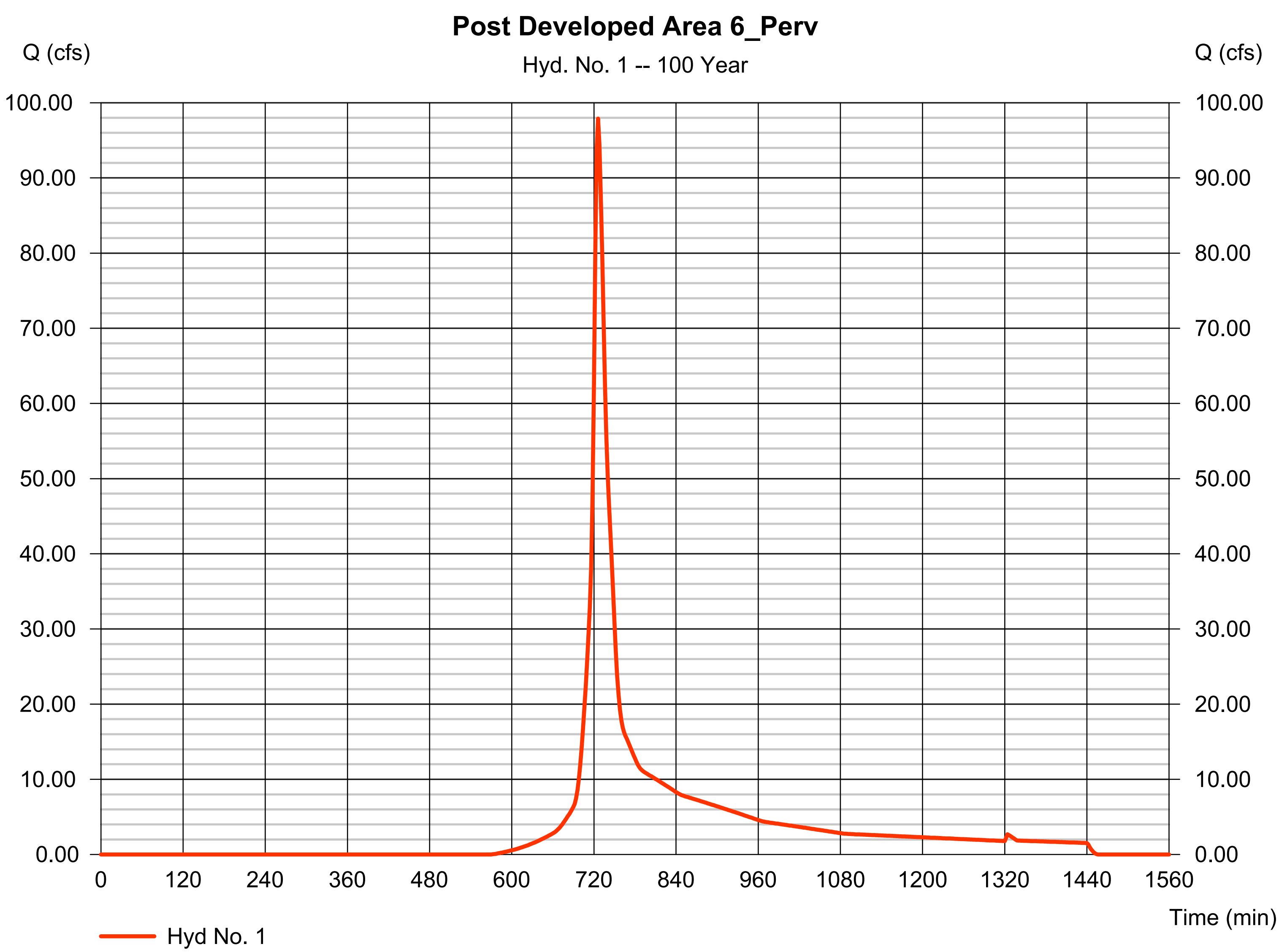
Hydrograph Report

Hyd. No. 1

Post Developed Area 6_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 97.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 358,241 cuft
Drainage area	= 26.280 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (6.150 x 61) + (5.460 x 39) + (2.600 x 39) + (12.070 x 70)] / 26.280



Hydrograph Report

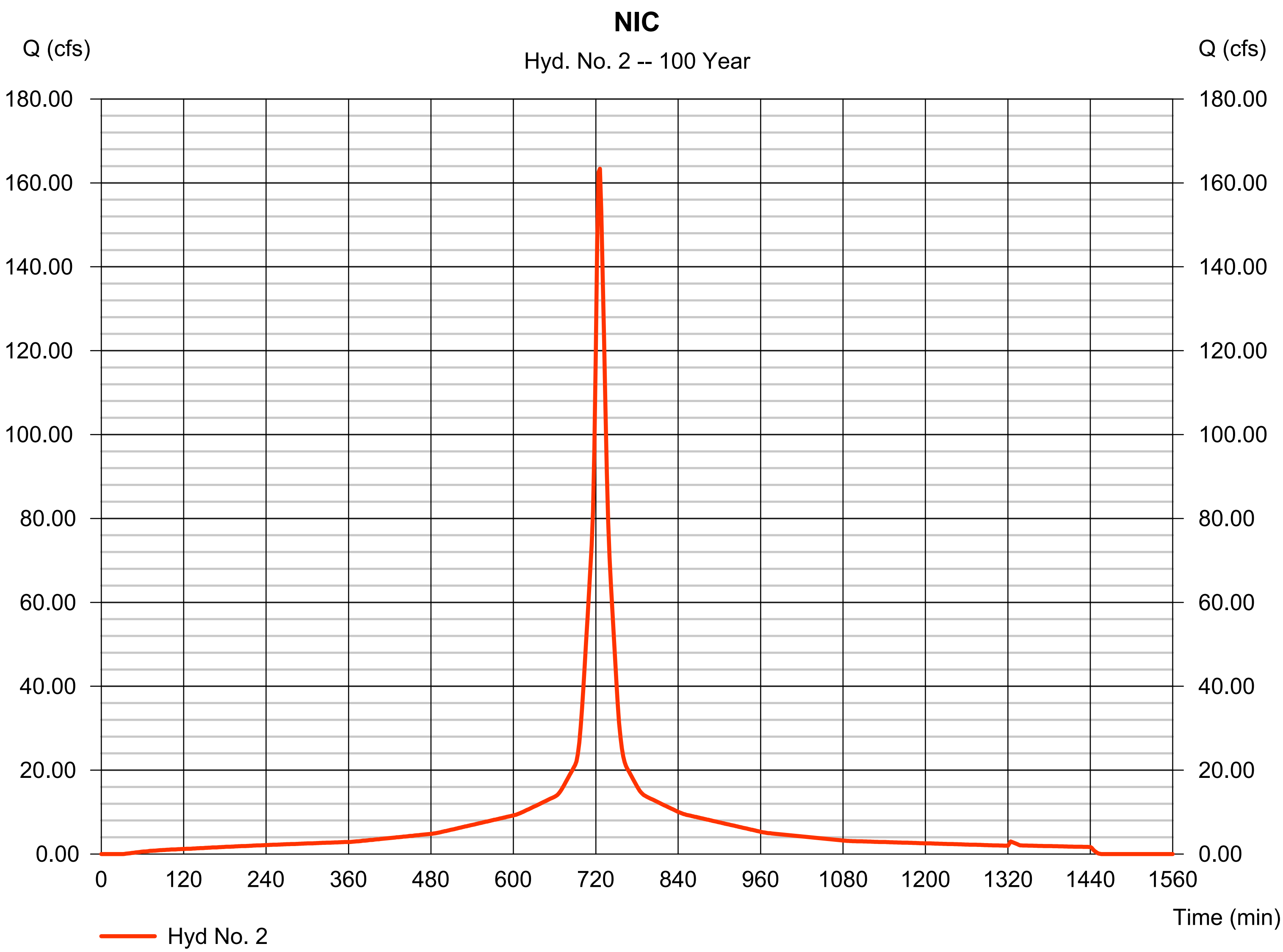
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jun 17, 2010

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 163.38 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 684,689 cuft
Drainage area	= 21.920 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(21.920 x 98)] / 21.920

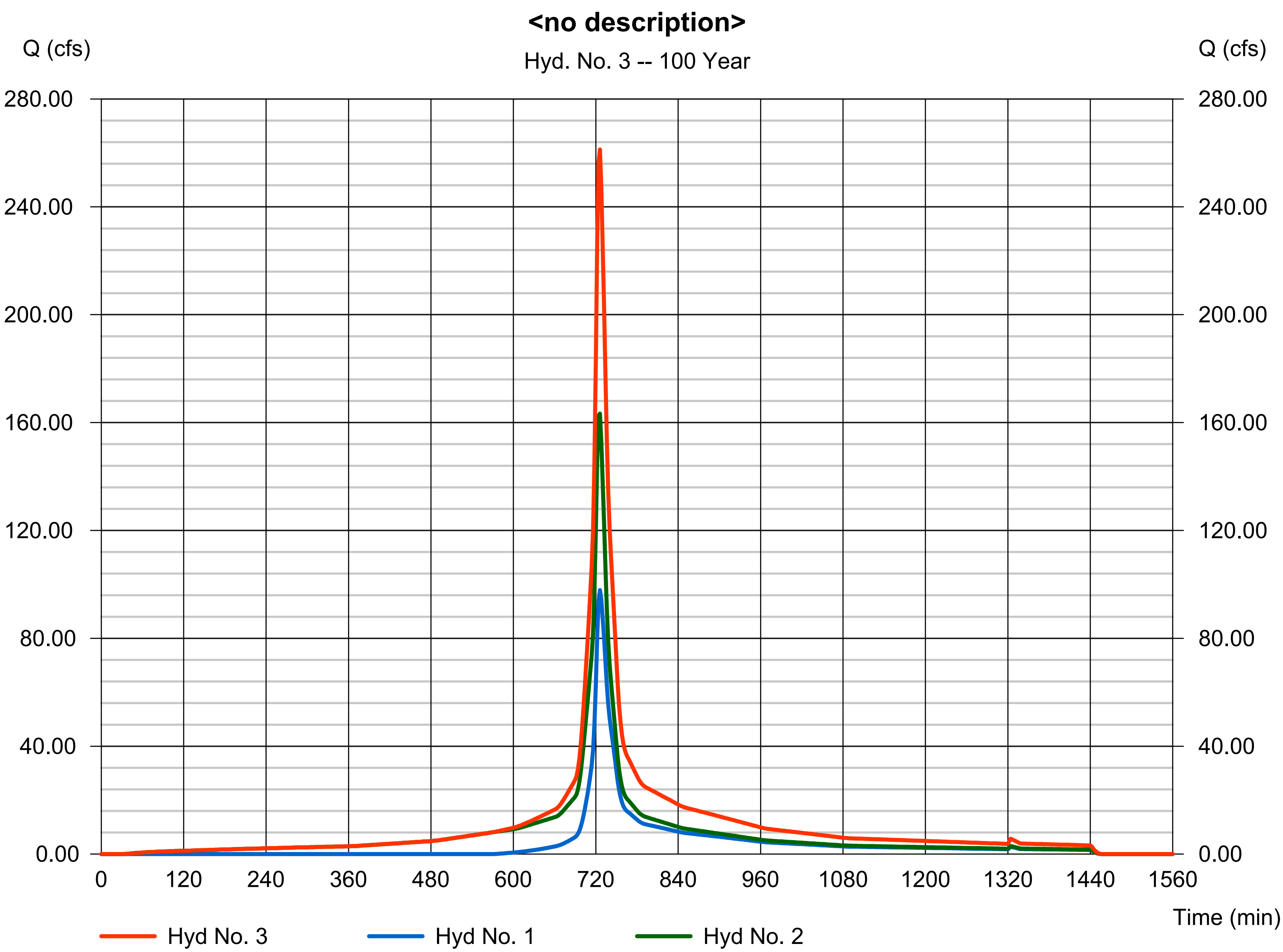


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 261.26 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,042,930 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 48.200 ac



Hydrograph Report

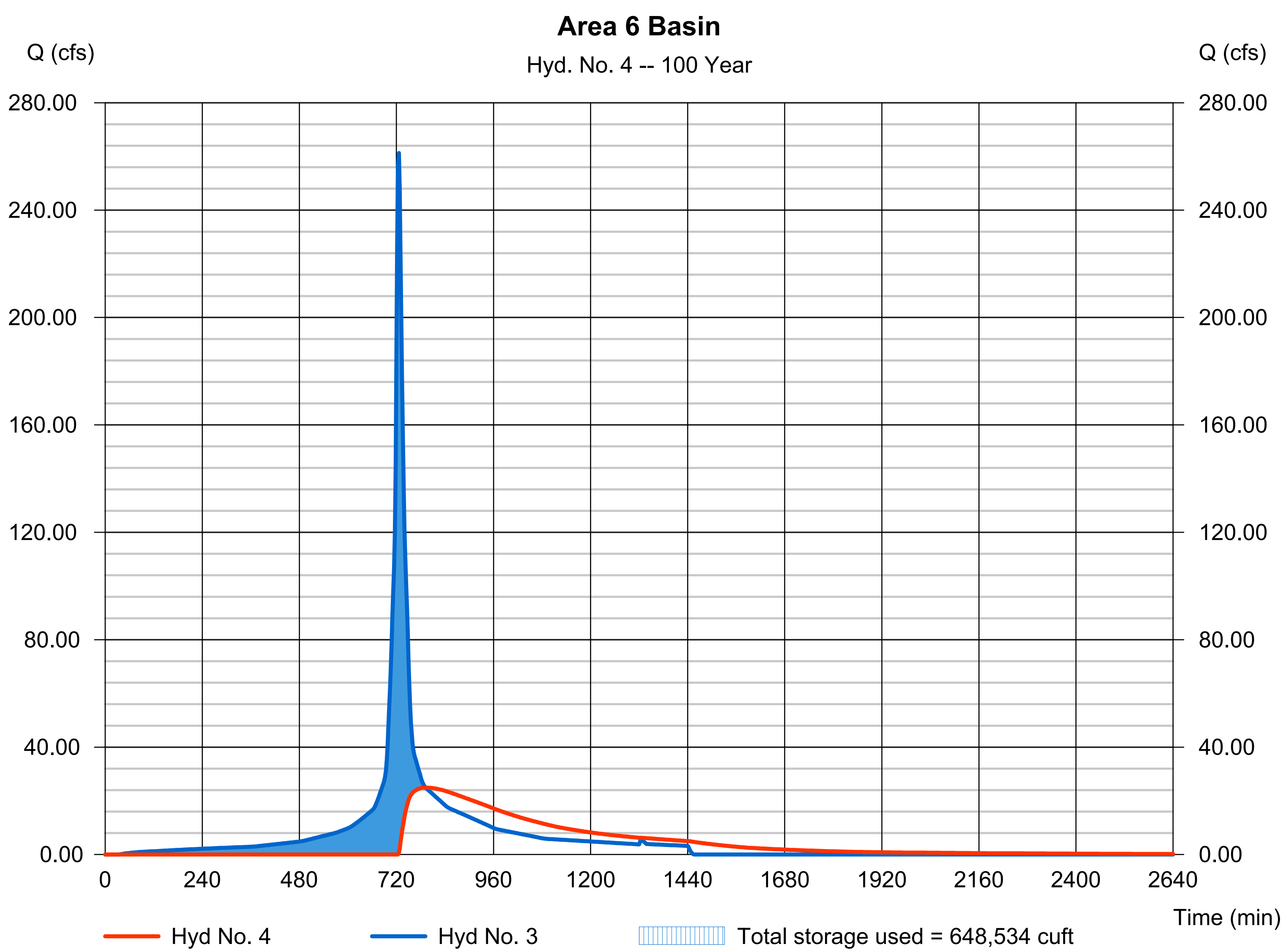
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jun 17, 2010

Hyd. No. 4

Area 6 Basin

Hydrograph type	= Reservoir	Peak discharge	= 24.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 792 min
Time interval	= 2 min	Hyd. volume	= 646,918 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 53.91 ft
Reservoir name	= Area 6	Max. Storage	= 648,534 cuft

Storage Indication method used.



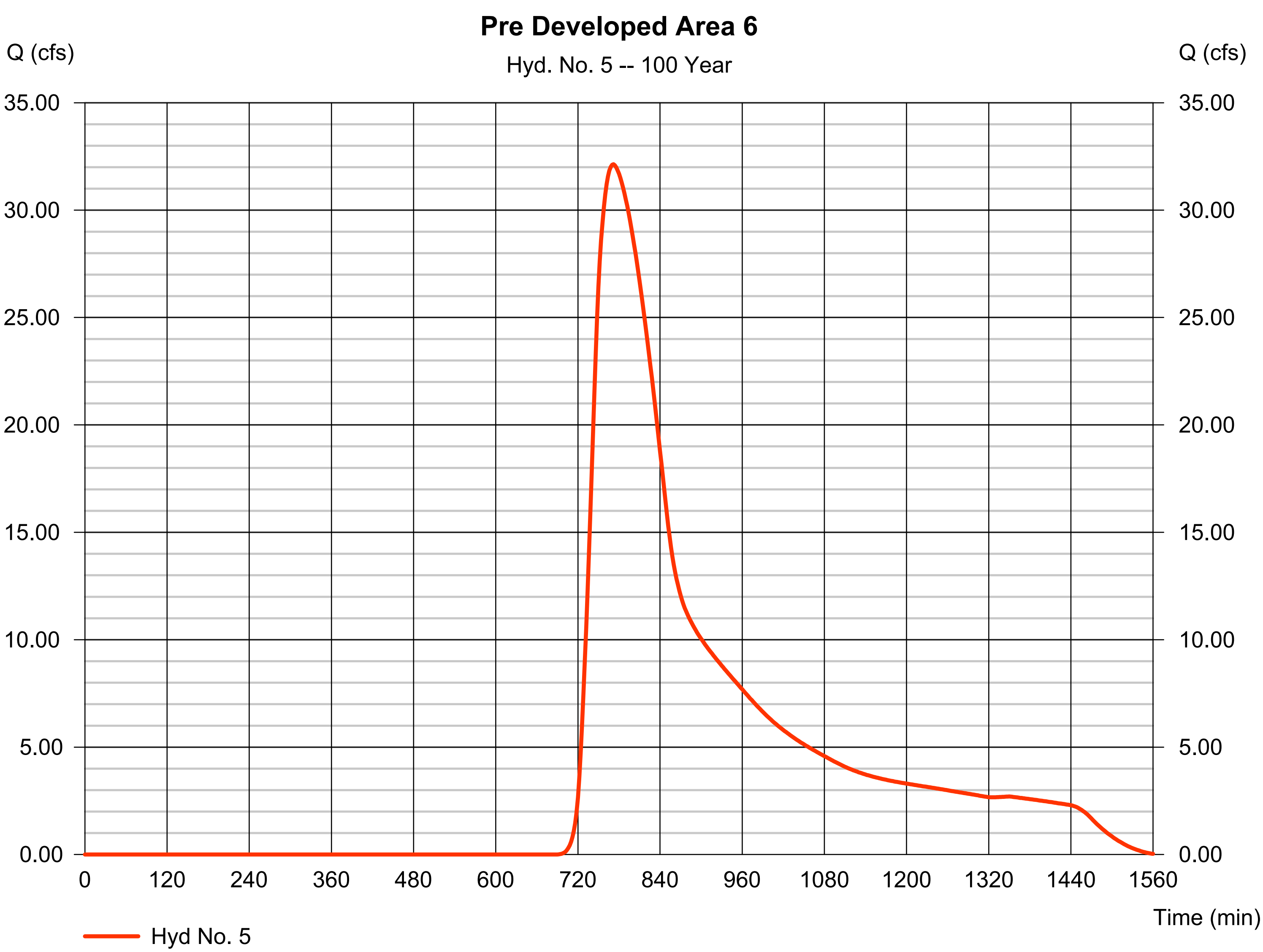
Hydrograph Report

Hyd. No. 5

Pre Developed Area 6

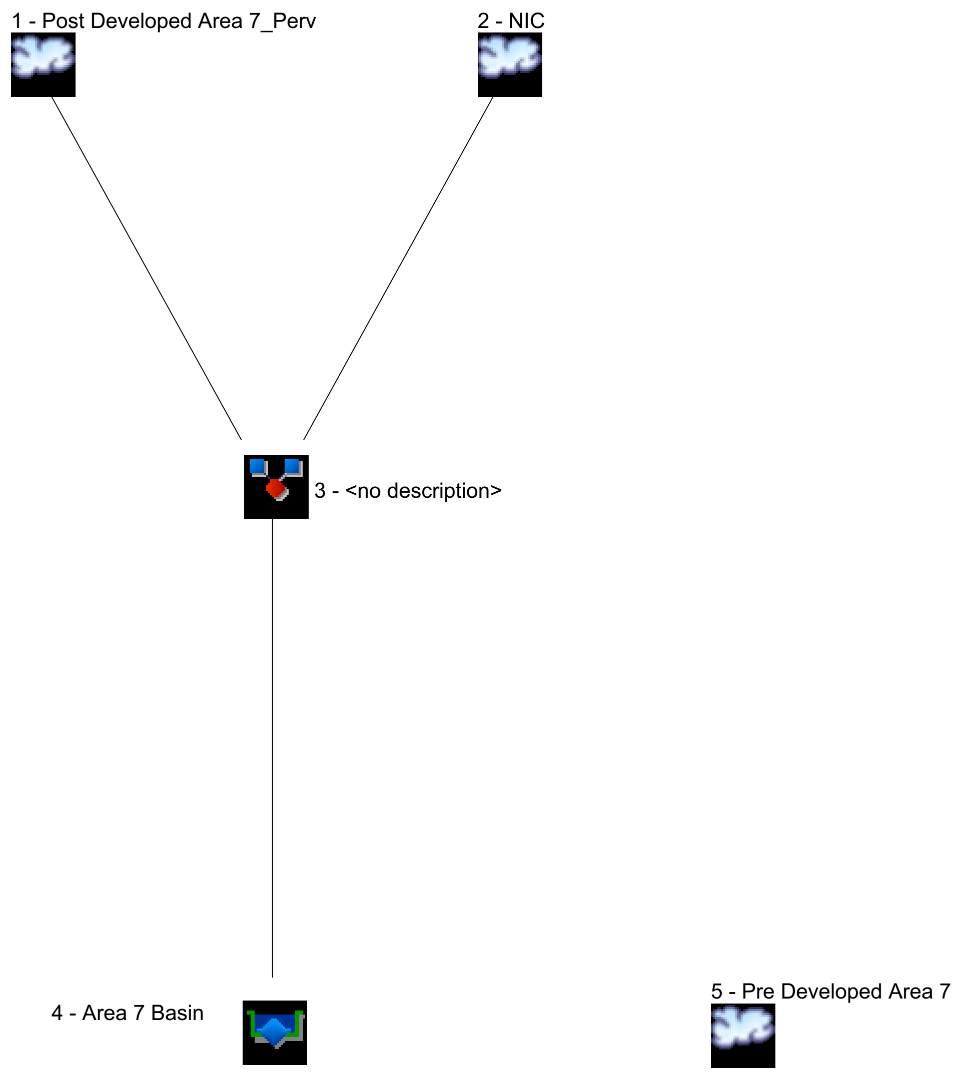
Hydrograph type	= SCS Runoff	Peak discharge	= 32.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 370,639 cuft
Drainage area	= 48.200 ac	Curve number	= 44*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.60 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.150 x 55) + (5.460 x 30) + (23.470 x 30) + (13.120 x 70)] / 48.200



Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 7.gpw	Thursday, Jul 1, 2010

Pond Report

Pond No. 1 - Area 7

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 51.60 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	51.60	00	0	0
0.40	52.00	53,912	10,782	10,782
1.40	53.00	178,444	116,178	126,960
2.40	54.00	263,172	220,808	347,768
3.40	55.00	271,849	267,511	615,279

Culvert / Orifice Structures

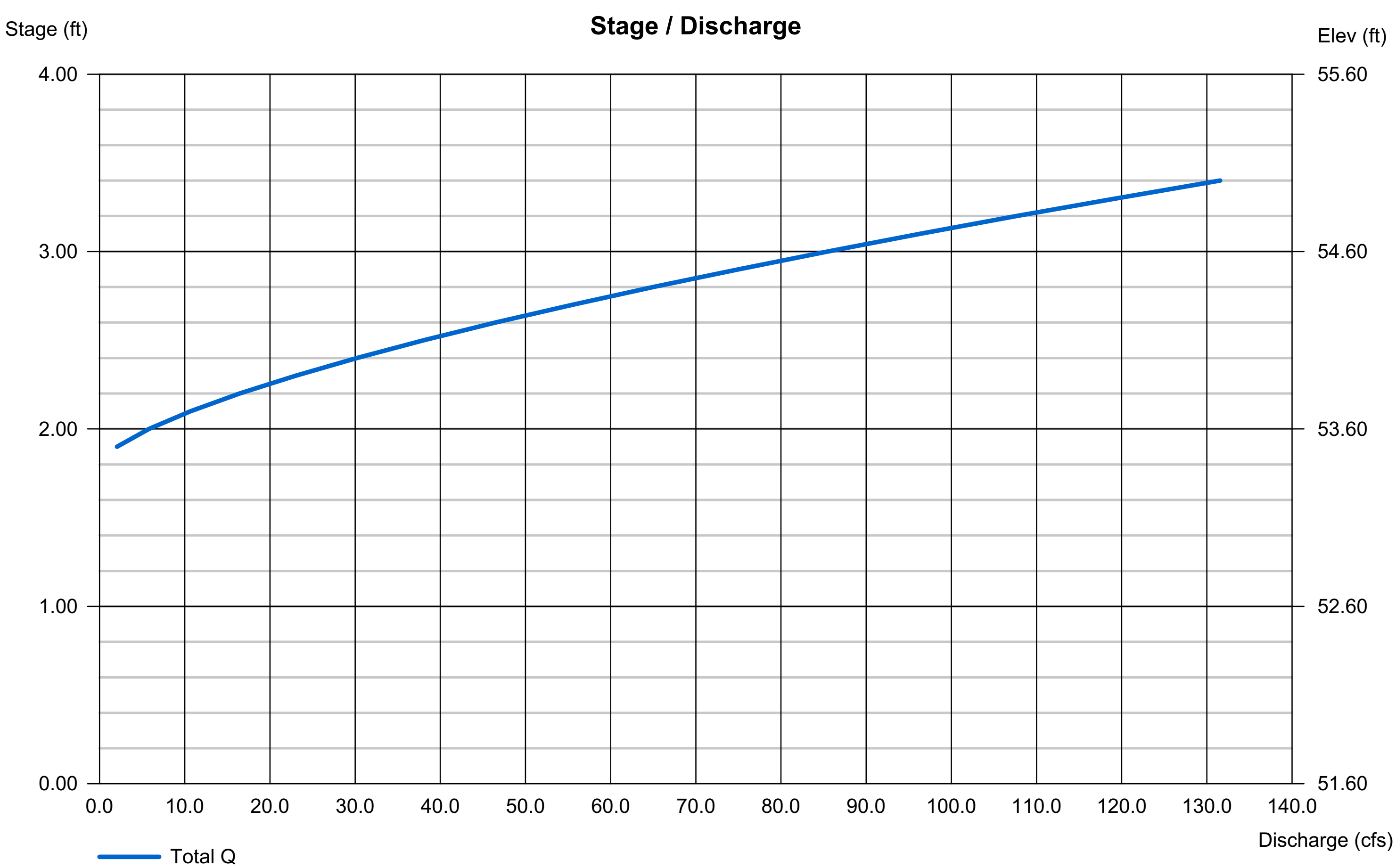
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 25.00	0.00	0.00	0.00
Crest El. (ft)	= 53.40	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 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).



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	4.999	2	734	33,350	----	------	------	Post Developed Area 7_Perv
2	SCS Runoff	53.34	2	716	124,941	----	------	------	NIC
3	Combine	53.34	2	716	158,291	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	53.14	158,291	Area 7 Basin
5	SCS Runoff	2.023	2	804	37,271	----	------	------	Pre Developed Area 7

Hydrograph Report

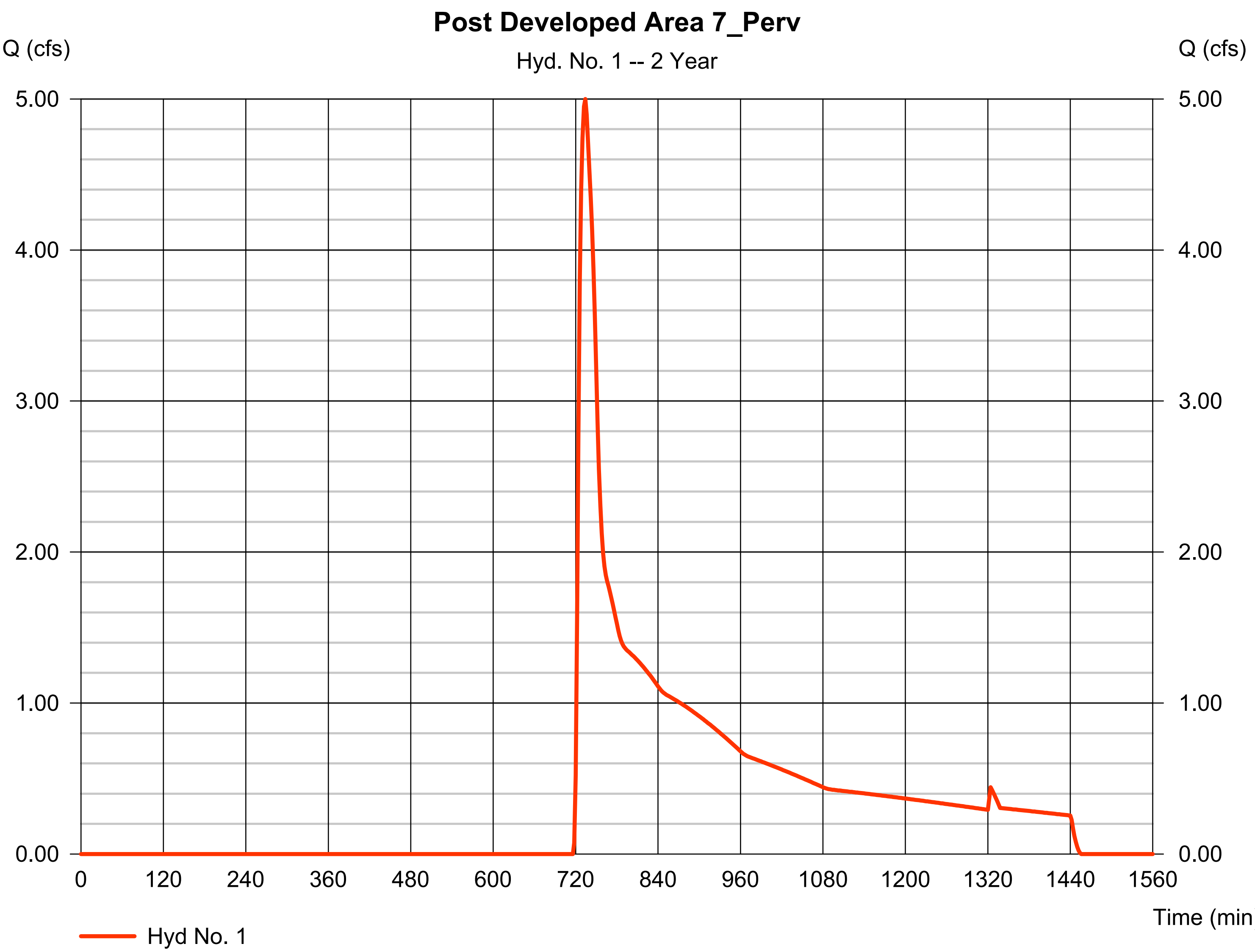
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 1

Post Developed Area 7_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 4.999 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 33,350 cuft
Drainage area	= 24.520 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.690 x 77) + (10.000 x 61) + (13.830 x 55)] / 24.520

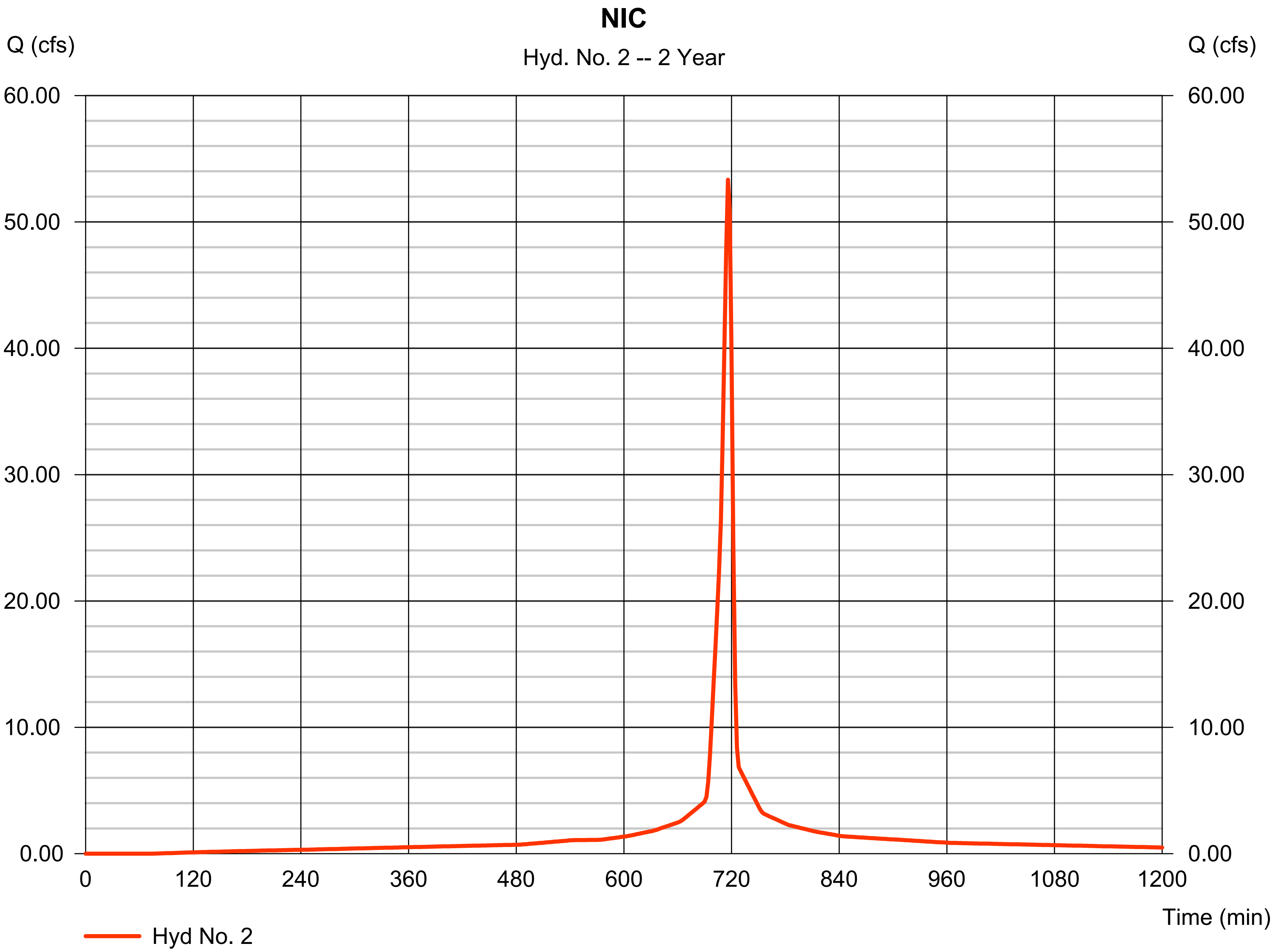


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 53.34 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 124,941 cuft
Drainage area	= 11.970 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



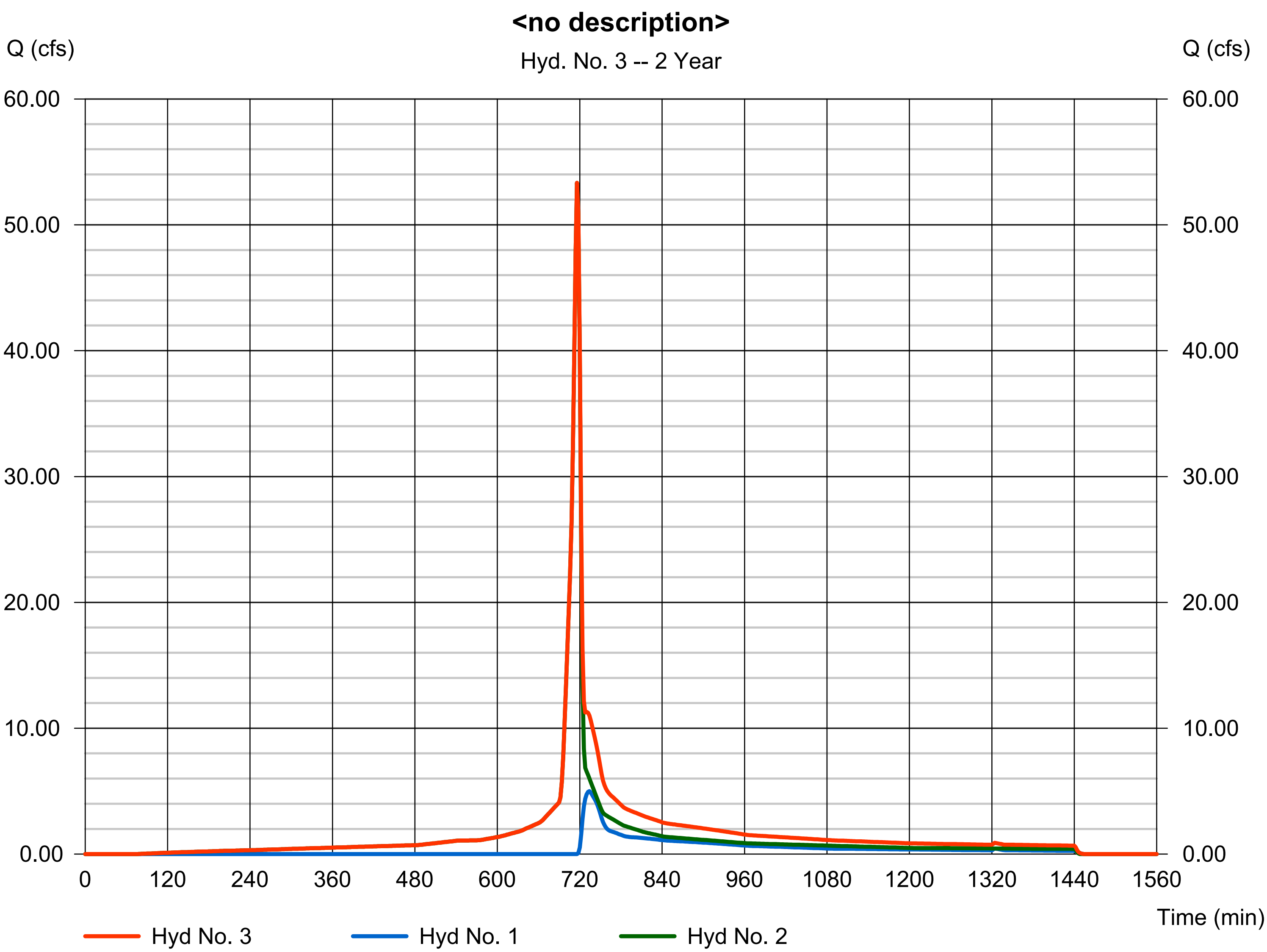
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 53.34 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 158,291 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 36.490 ac



Hydrograph Report

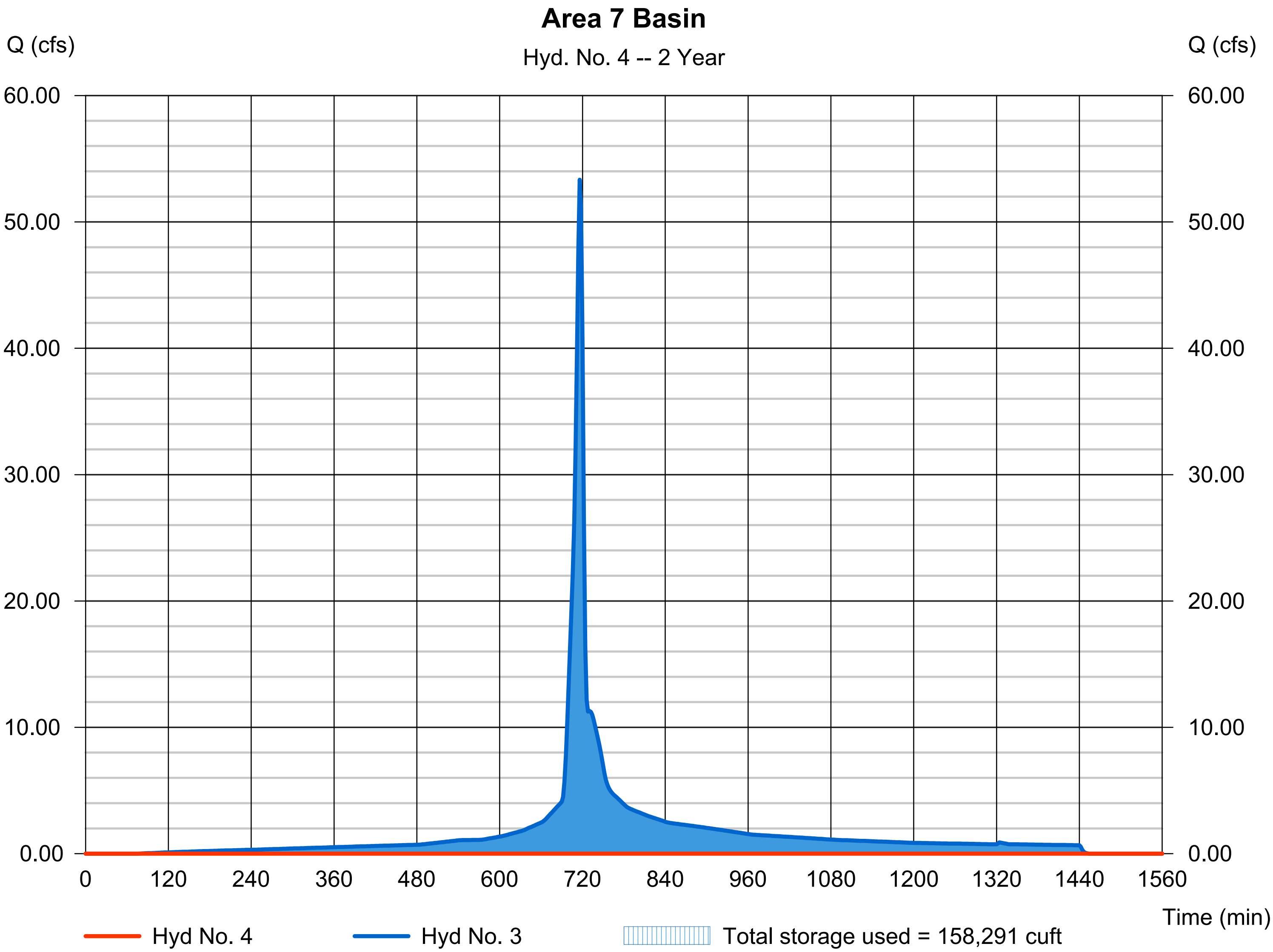
Hydraflow Hydrographs by Intelisolve v9.23 — Thursday, Jul 1, 2010

Hyd. No. 4

Area 7 Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 53.14 ft
Reservoir name	= Area 7	Max. Storage	= 158,291 cuft

Storage Indication method used.



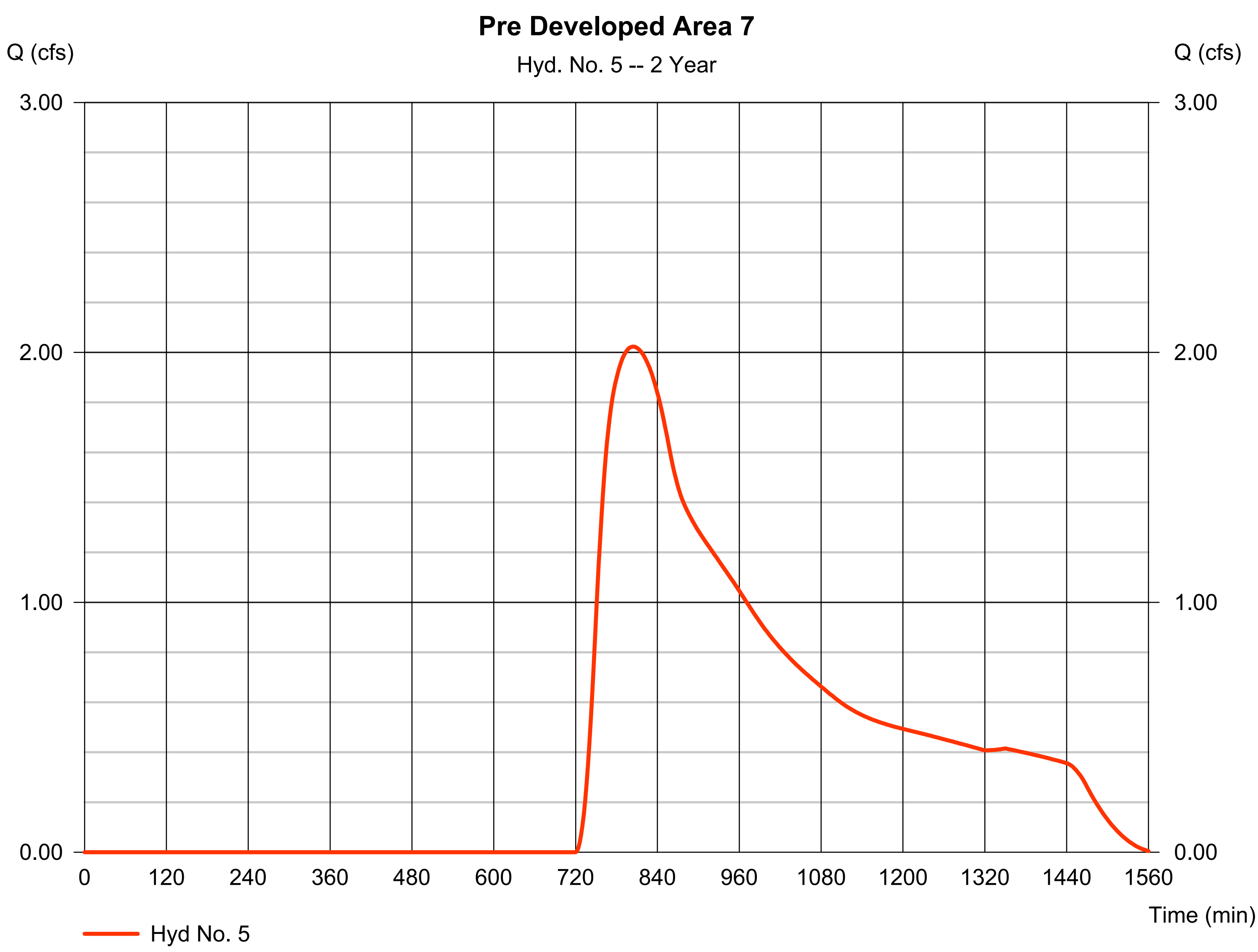
Hydrograph Report

Hyd. No. 5

Pre Developed Area 7

Hydrograph type	=	SCS Runoff
Storm frequency	=	2 yrs
Time interval	=	2 min
Drainage area	=	36.490 ac
Basin Slope	=	0.0 %
Tc method	=	TR55
Total precip.	=	3.30 in
Storm duration	=	24 hrs
Peak discharge	=	2.023 cfs
Time to peak	=	804 min
Hyd. volume	=	37,271 cuft
Curve number	=	55*
Hydraulic length	=	0 ft
Time of conc. (Tc)	=	50.00 min
Distribution	=	Type III
Shape factor	=	285

* Composite (Area/CN) = [(35.800 x 55) + (0.690 x 77)] / 36.490



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	27.27	2	726	113,243	----	------	------	Post Developed Area 7_Perv
2	SCS Runoff	84.62	2	716	202,165	----	------	------	NIC
3	Combine	92.28	2	716	315,407	1, 2	------	------	<no description>
4	Reservoir	2.972	2	978	100,113	3	53.52	242,751	Area 7 Basin
5	SCS Runoff	11.83	2	774	143,366	----	------	------	Pre Developed Area 7

Area 7.gpw	Return Period: 10 Year	Thursday, Jul 1, 2010

Hydrograph Report

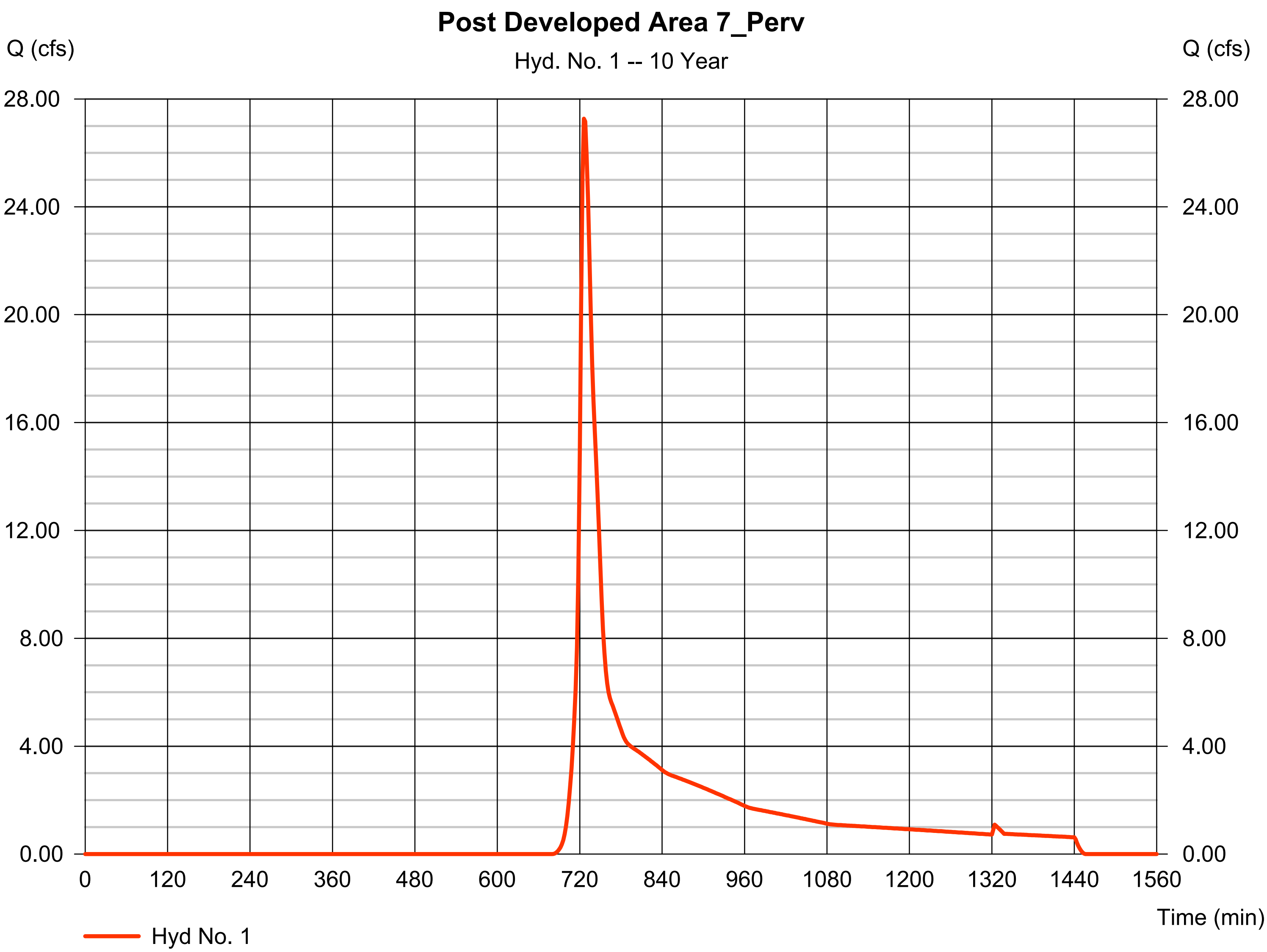
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 1

Post Developed Area 7_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 27.27 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 113,243 cuft
Drainage area	= 24.520 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.690 x 77) + (10.000 x 61) + (13.830 x 55)] / 24.520

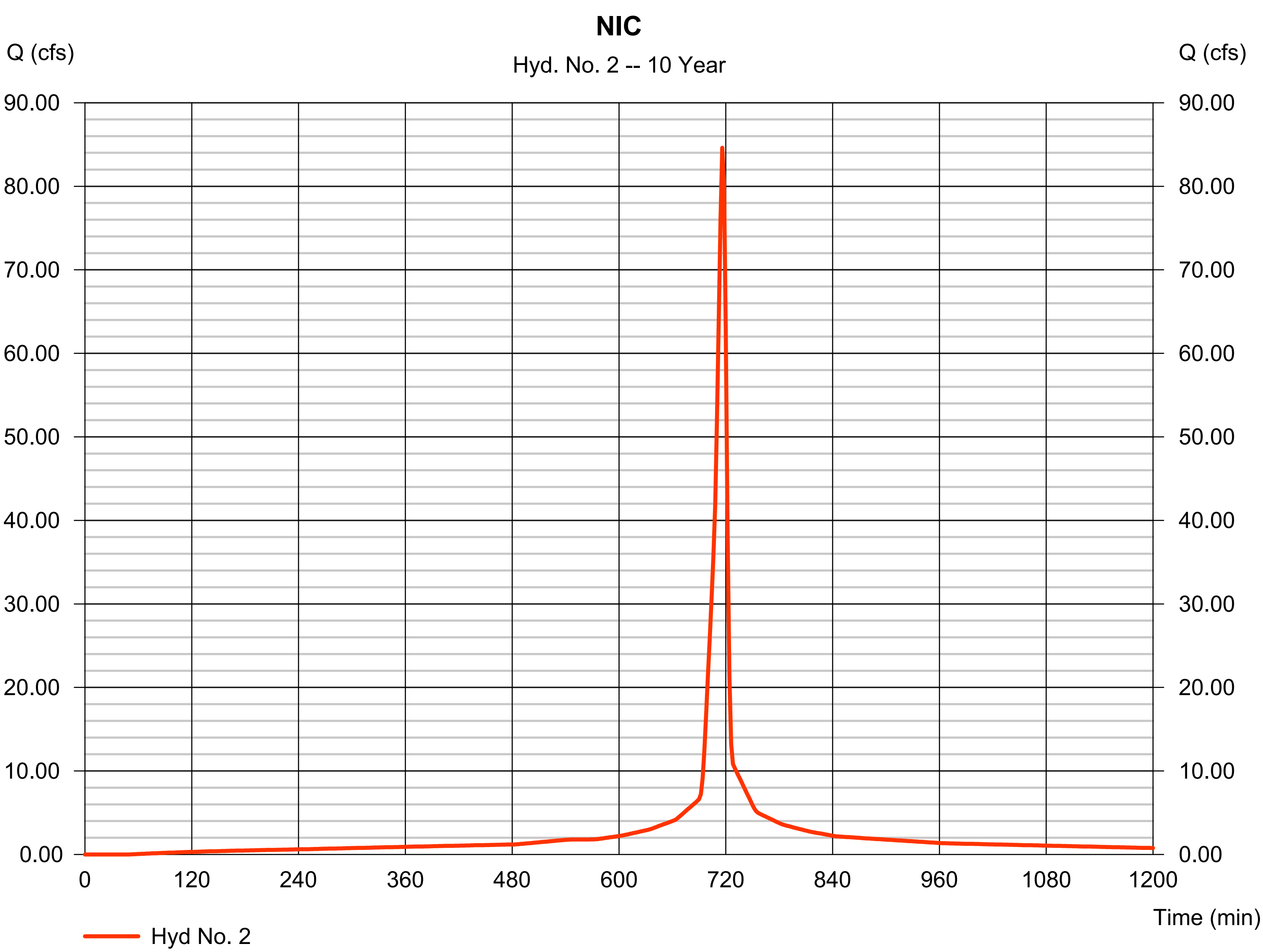


Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 84.62 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 202,165 cuft
Drainage area	= 11.970 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

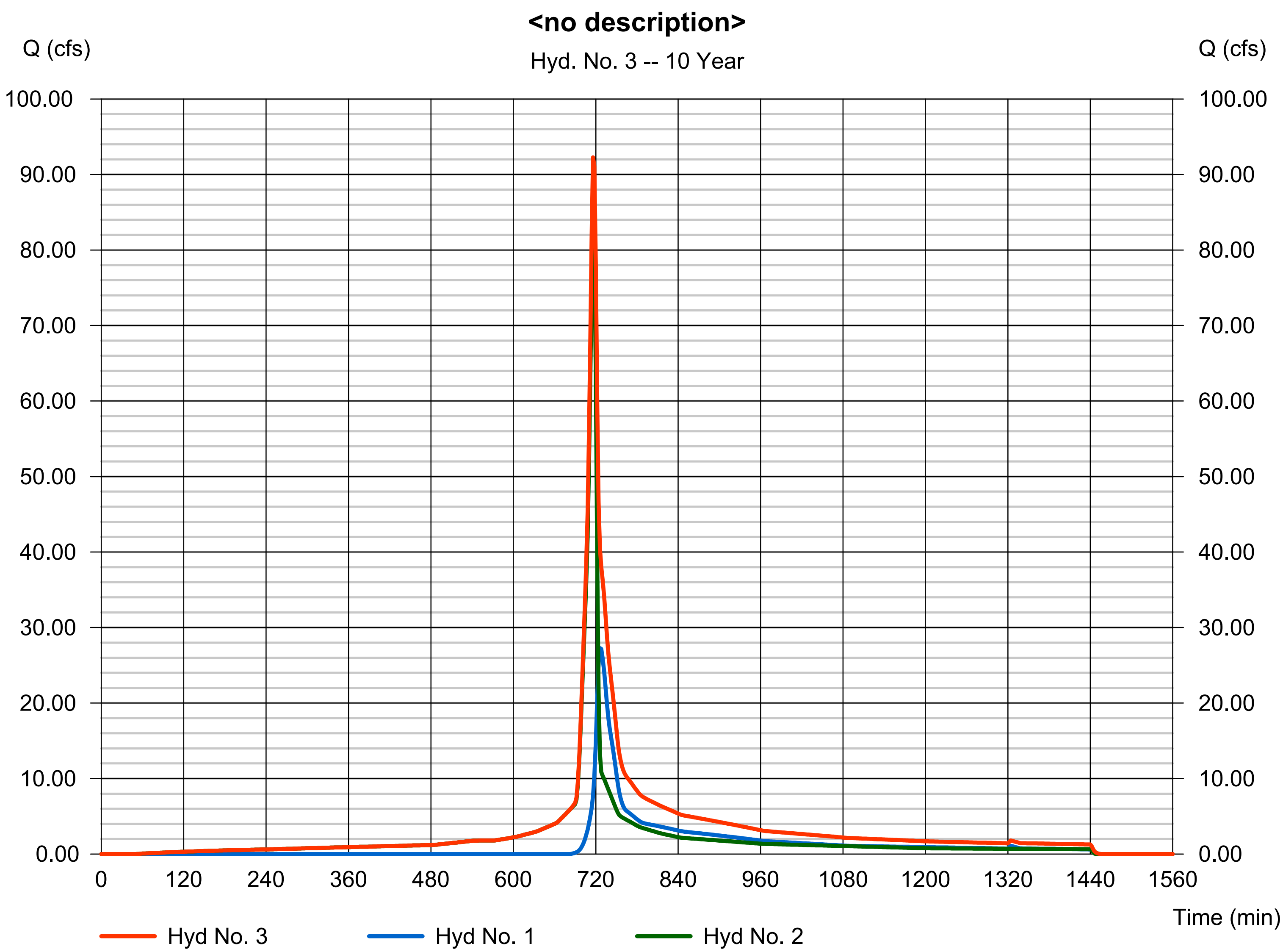


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 92.28 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 315,407 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 36.490 ac



Hydrograph Report

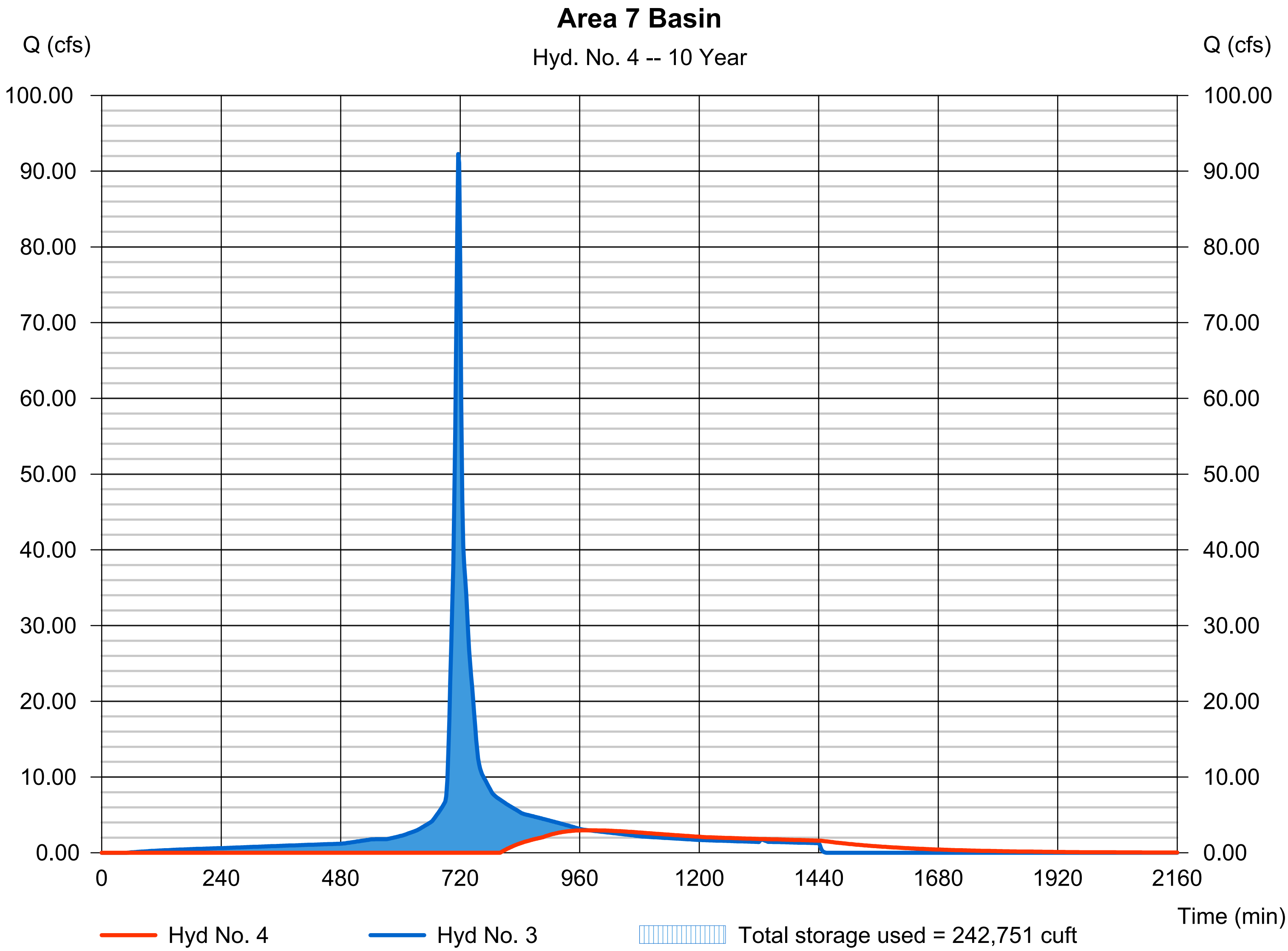
Hydraflow Hydrographs by Intelisolve v9.23 | Thursday, Jul 1, 2010

Hyd. No. 4

Area 7 Basin

Hydrograph type	= Reservoir	Peak discharge	= 2.972 cfs
Storm frequency	= 10 yrs	Time to peak	= 978 min
Time interval	= 2 min	Hyd. volume	= 100,113 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 53.52 ft
Reservoir name	= Area 7	Max. Storage	= 242,751 cuft

Storage Indication method used.



Hydrograph Report

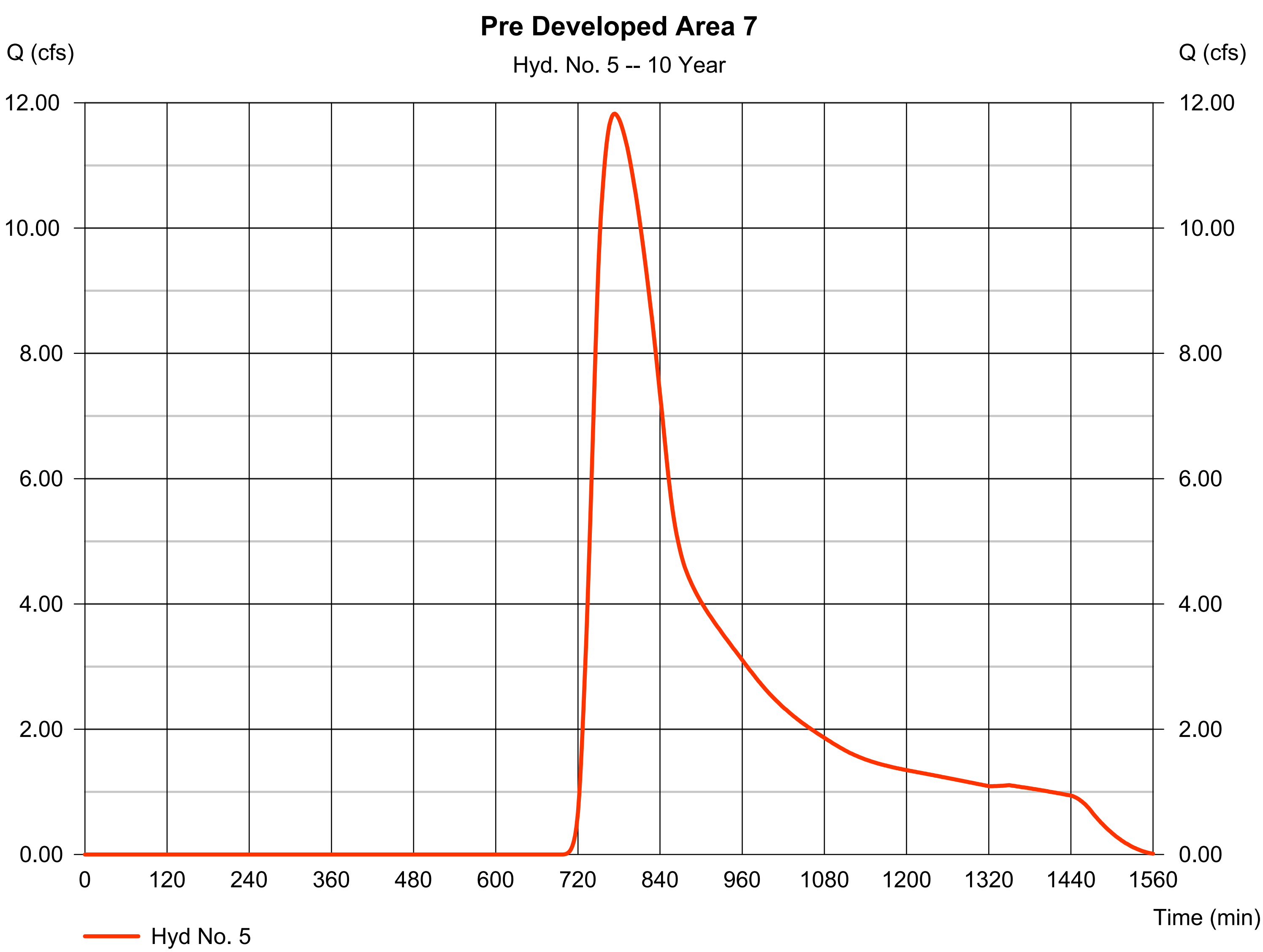
Hydraflow Hydrographs by Intelisolve v9.23 Thursday, Jul 1, 2010

Hyd. No. 5

Pre Developed Area 7

Hydrograph type	= SCS Runoff	Peak discharge	= 11.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 143,366 cuft
Drainage area	= 36.490 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 50.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(35.800 x 55) + (0.690 x 77)] / 36.490



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	91.33	2	726	334,249	----	------	------	Post Developed Area 7_Perv
2	SCS Runoff	145.29	2	716	352,756	----	------	------	NIC
3	Combine	183.05	2	718	687,005	1, 2	------	------	<no description>
4	Reservoir	35.67	2	752	471,710	3	54.07	366,361	Area 7 Basin
5	SCS Runoff	44.68	2	766	452,935	----	------	------	Pre Developed Area 7

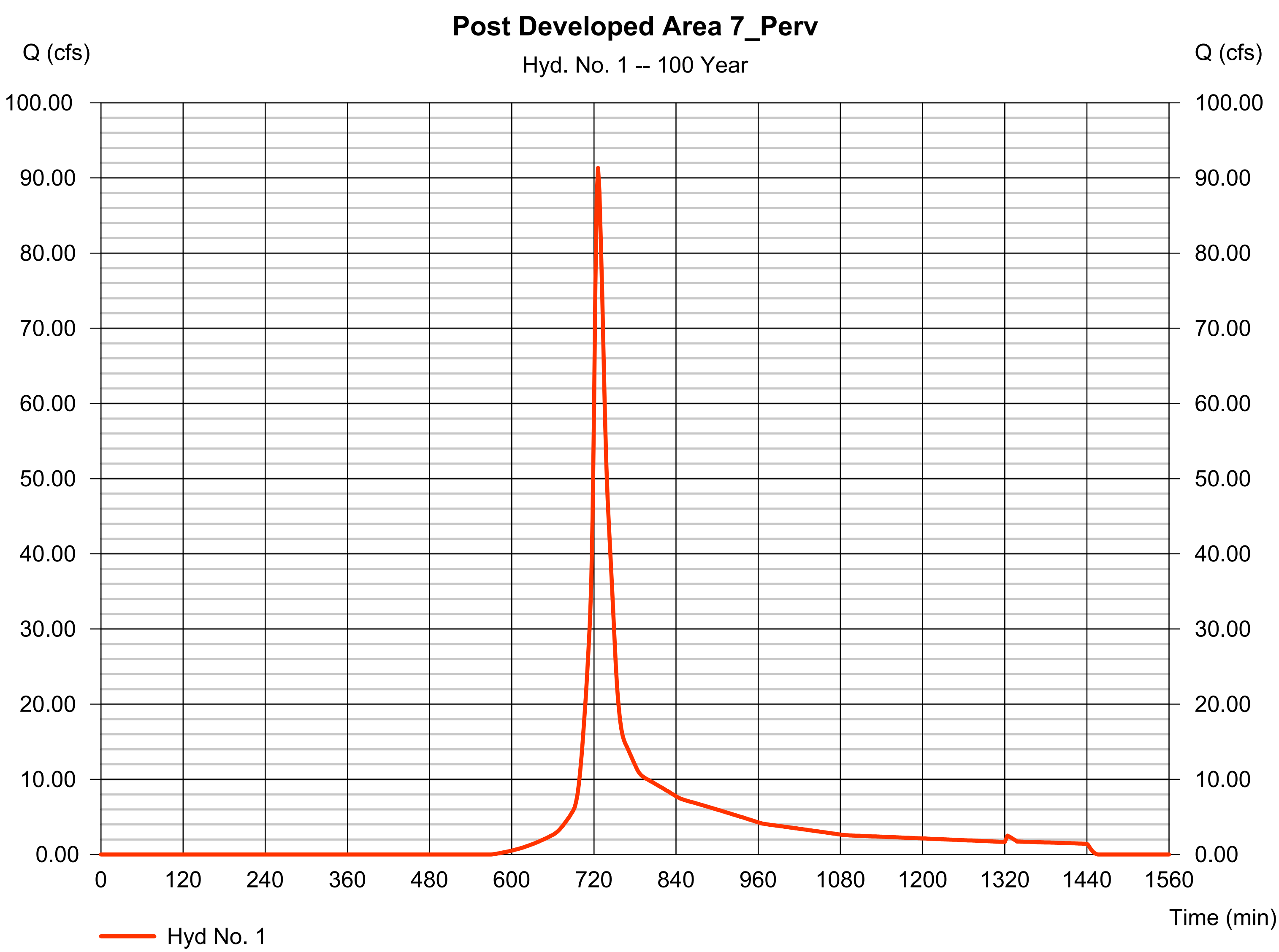
Hydrograph Report

Hyd. No. 1

Post Developed Area 7_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 91.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 334,249 cuft
Drainage area	= 24.520 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (0.690 x 77) + (10.000 x 61) + (13.830 x 55)] / 24.520



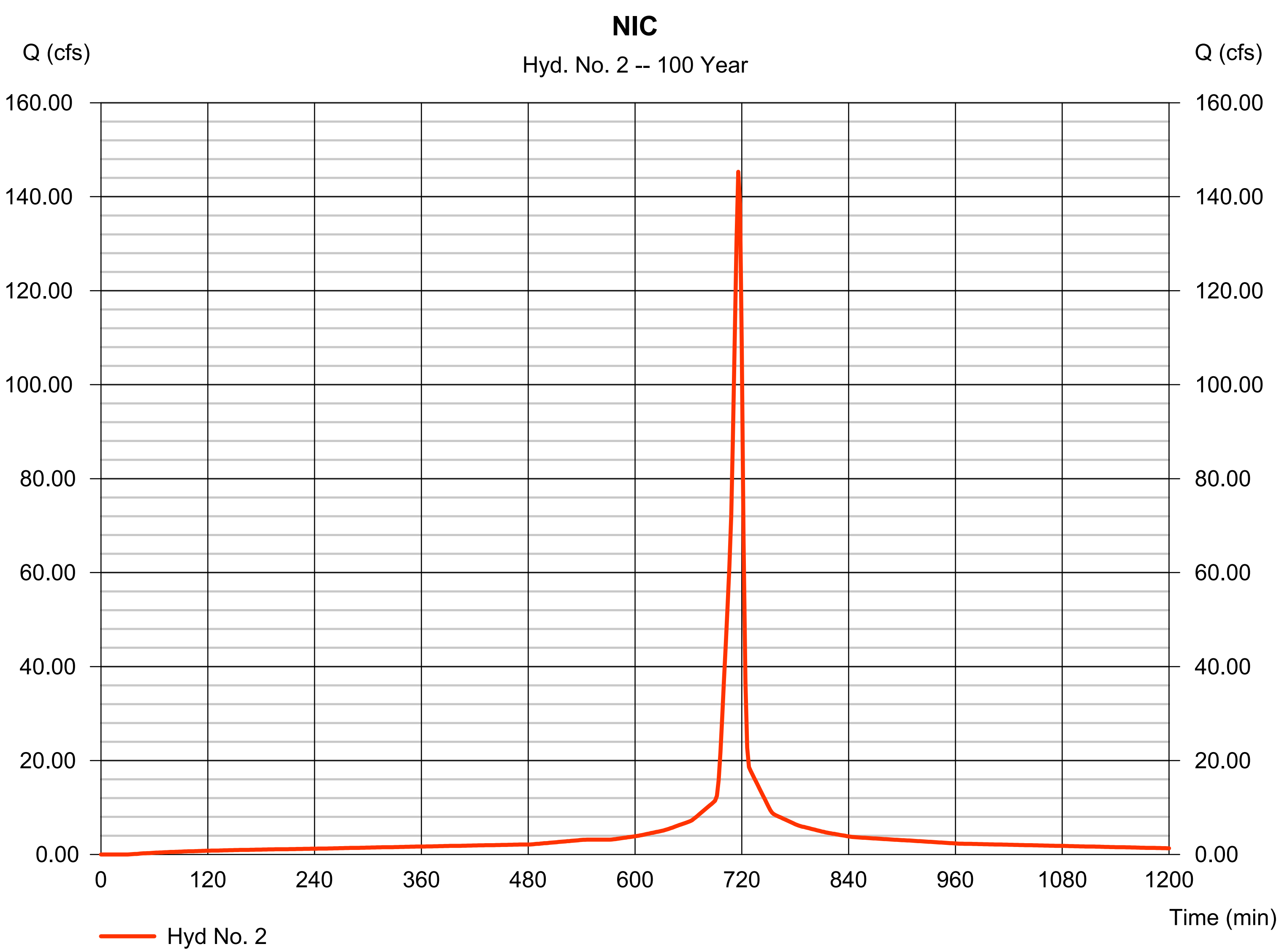
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 | Thursday, Jul 1, 2010

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 145.29 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 352,756 cuft
Drainage area	= 11.970 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

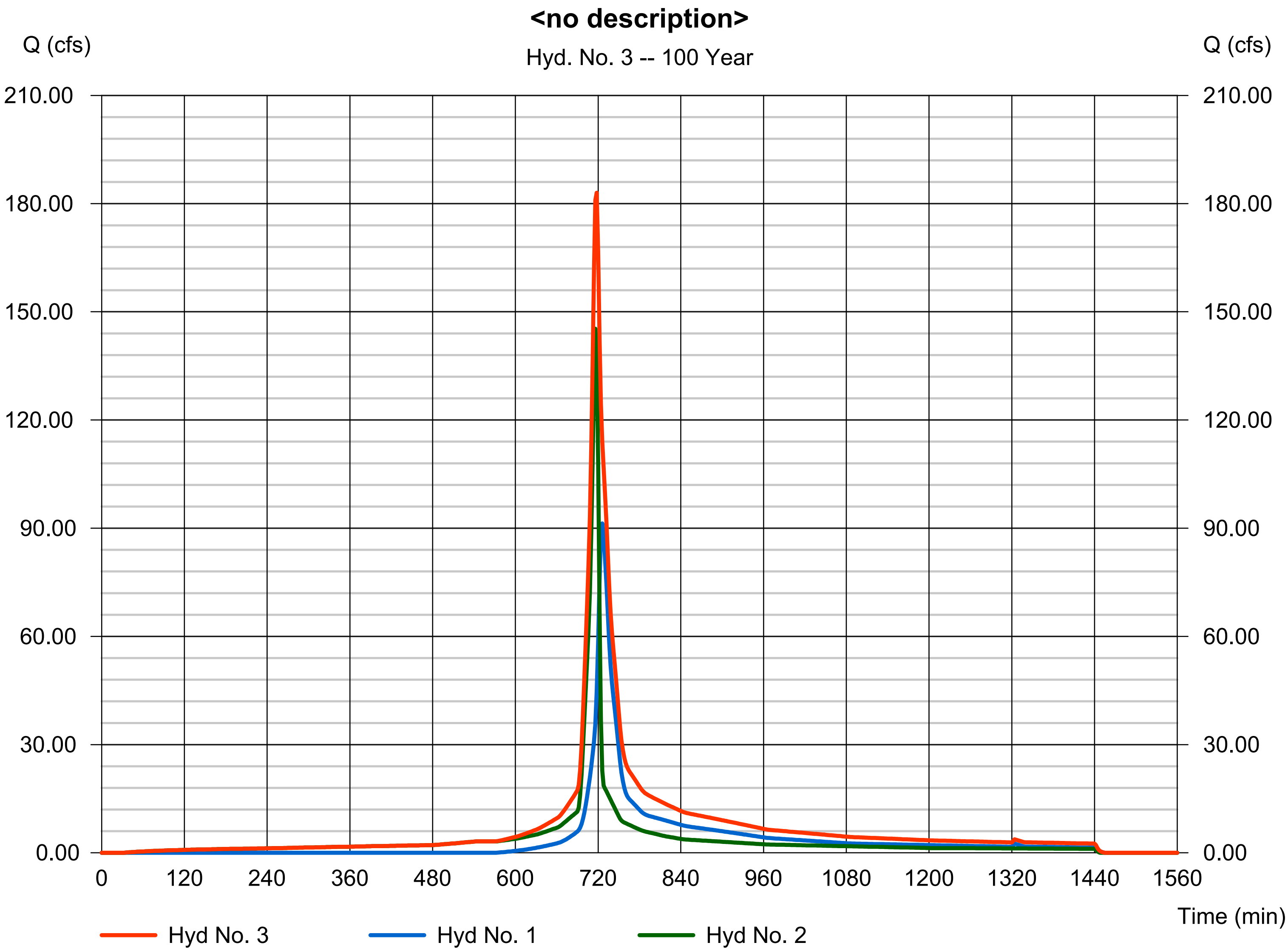


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 183.05 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 687,005 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 36.490 ac



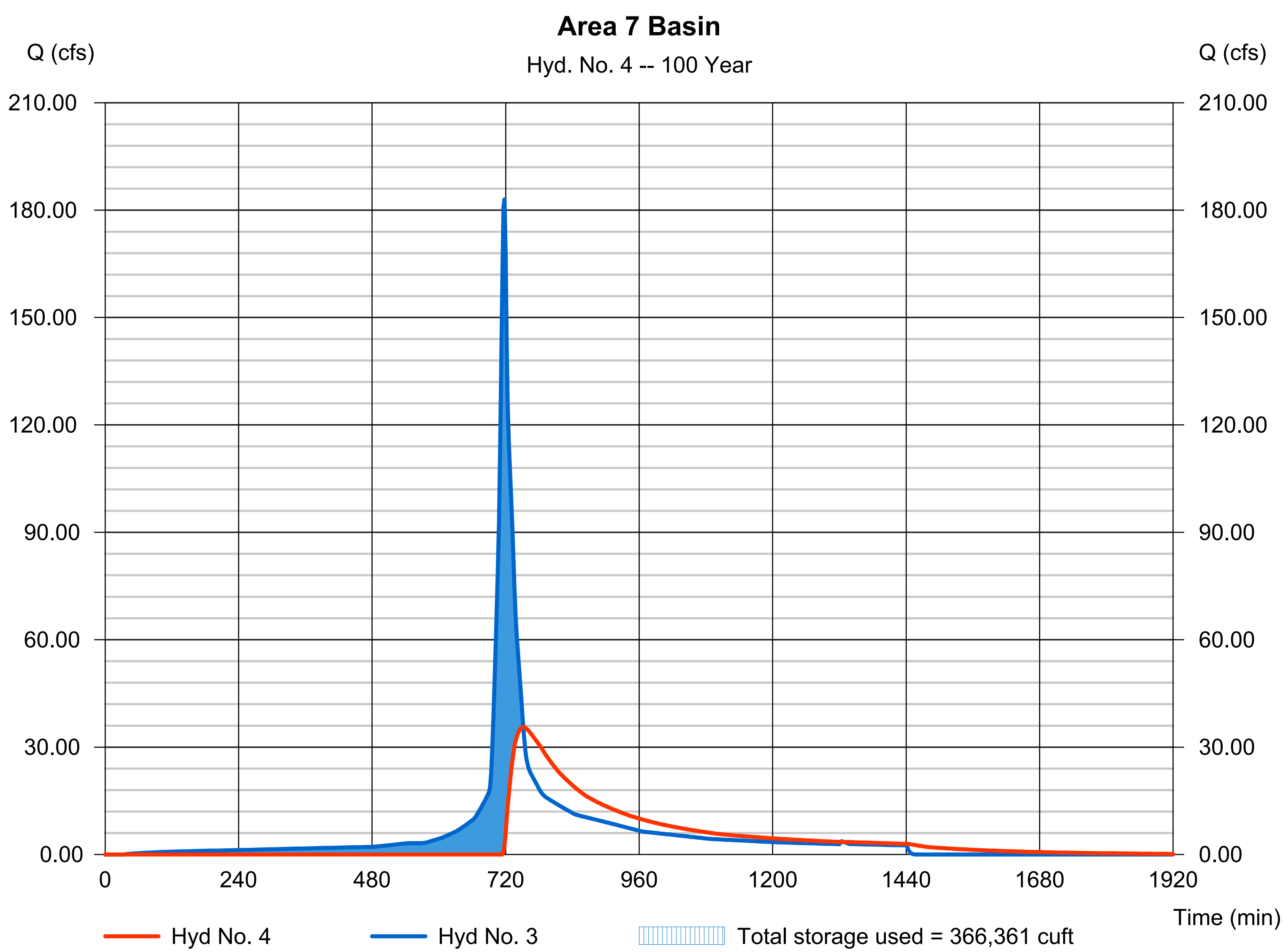
Hydrograph Report

Hyd. No. 4

Area 7 Basin

Hydrograph type	= Reservoir	Peak discharge	= 35.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 471,710 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 54.07 ft
Reservoir name	= Area 7	Max. Storage	= 366,361 cuft

Storage Indication method used.



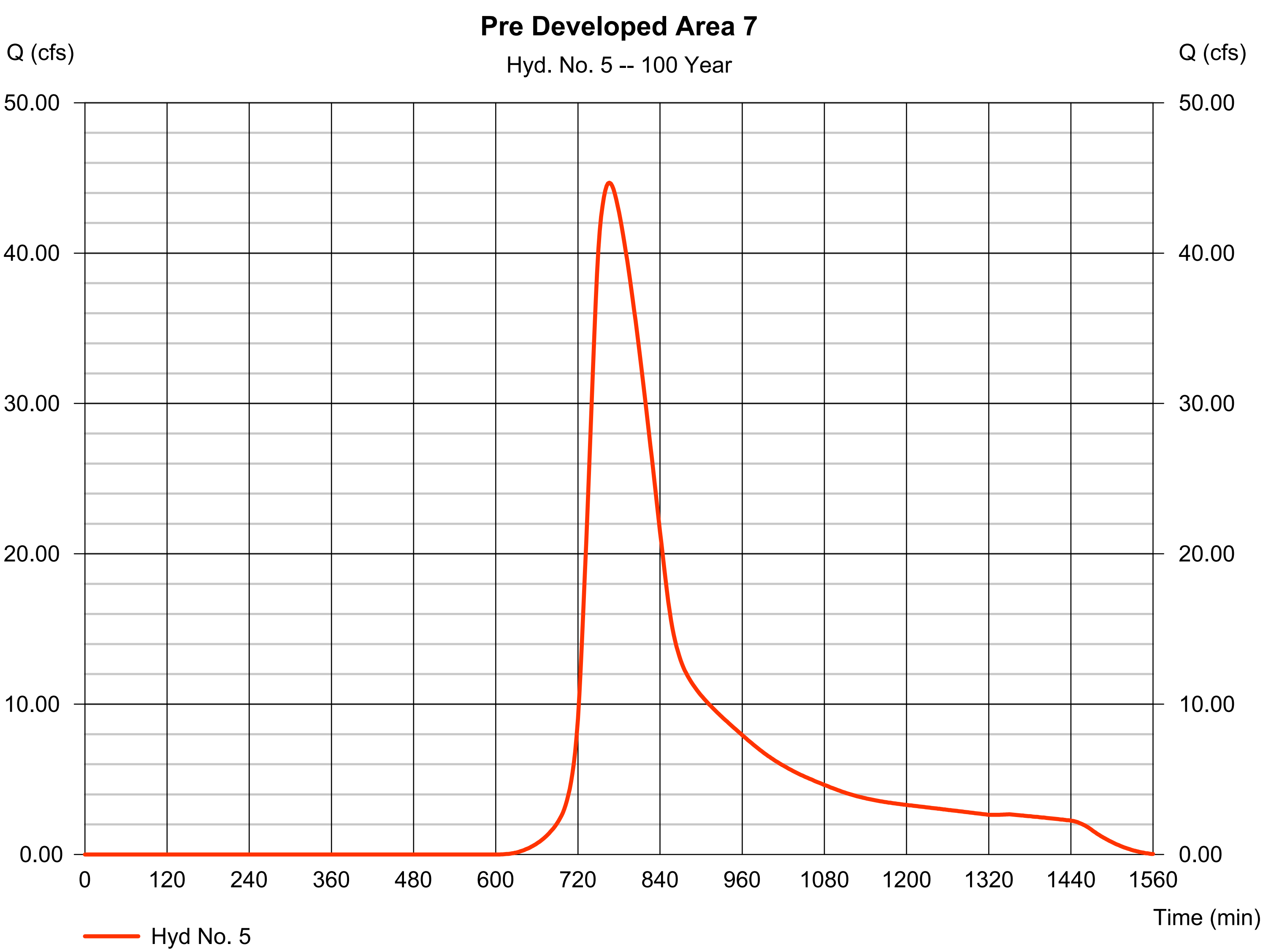
Hydrograph Report

Hyd. No. 5

Pre Developed Area 7

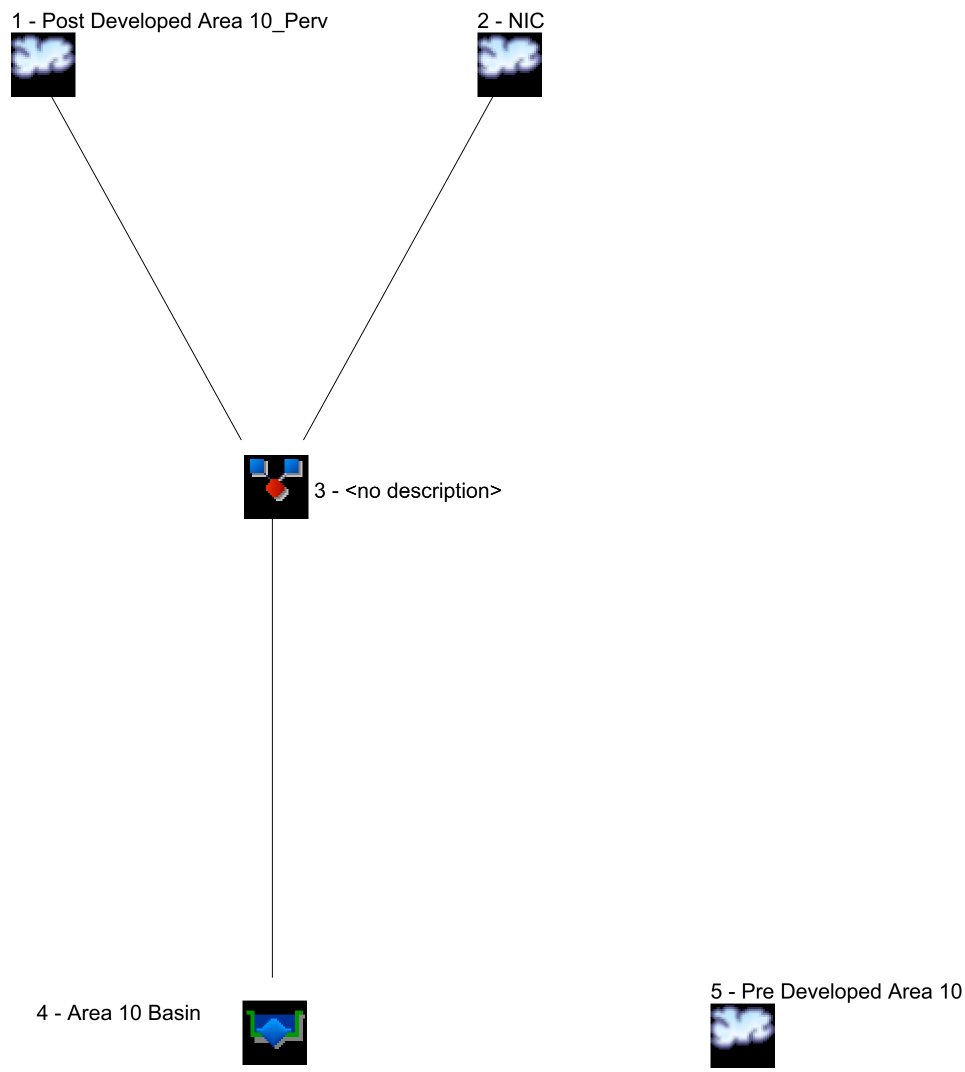
Hydrograph type	= SCS Runoff	Peak discharge	= 44.68 cfs
Storm frequency	= 100 yrs	Time to peak	= 766 min
Time interval	= 2 min	Hyd. volume	= 452,935 cuft
Drainage area	= 36.490 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 50.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(35.800 x 55) + (0.690 x 77)] / 36.490



Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Area 10.gpw	Wednesday, Jun 30, 2010

Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Jun 30, 2010

Pond No. 1 - Area 10

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 56.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	56.50	110,805	0	0
0.50	57.00	176,293	71,775	71,775
1.50	58.00	182,035	179,164	250,939
2.50	59.00	187,833	184,934	435,873

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

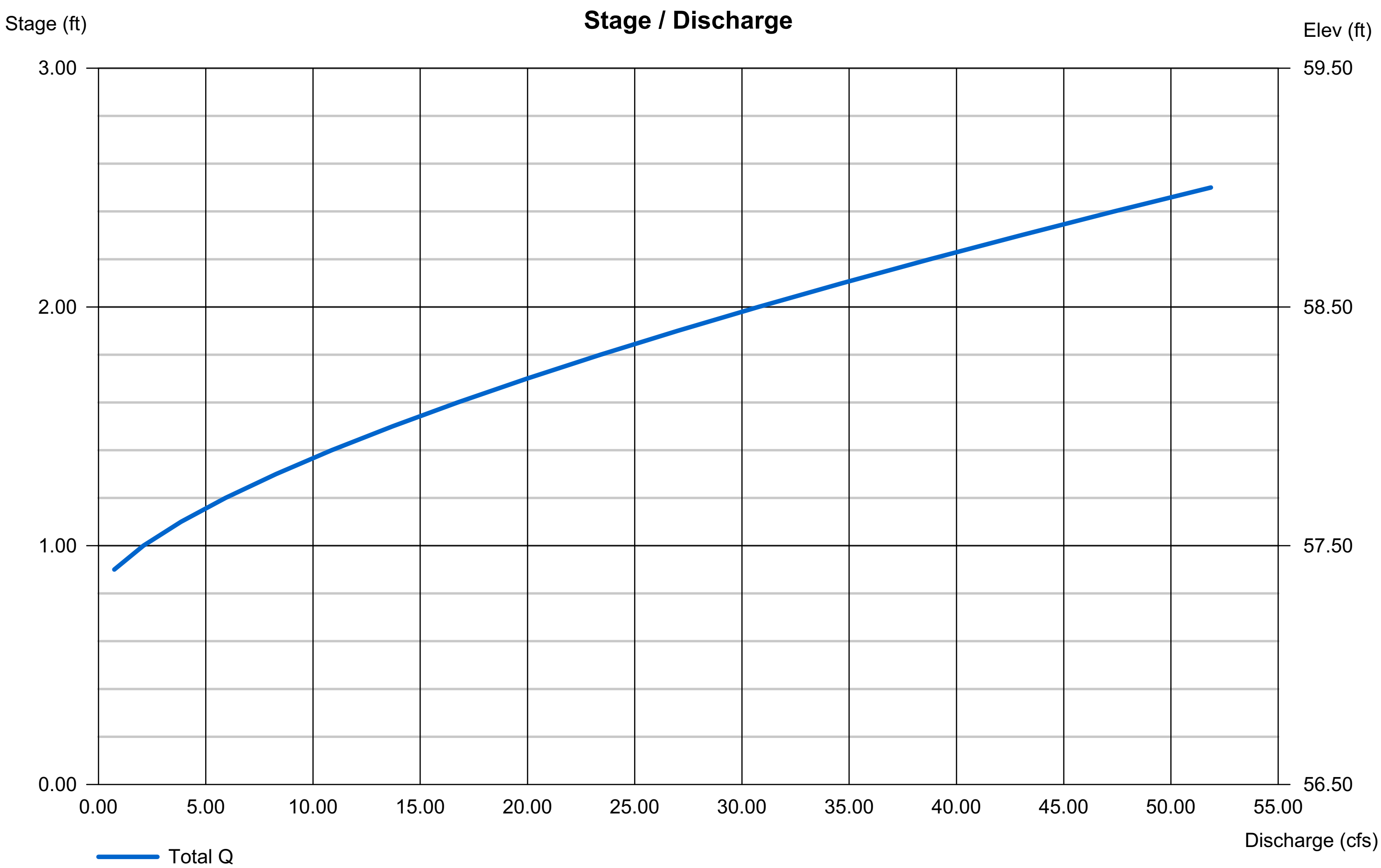
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	0.00	0.00	0.00
Crest El. (ft)	= 57.30	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 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).



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	1.216	2	734	8,763	----	------	------	Post Developed Area 10_Perv
2	SCS Runoff	17.88	2	726	72,354	----	------	------	NIC
3	Combine	25.92	2	726	111,315	1, 2	------	------	<no description>
4	Reservoir	0.000	2	n/a	0	3	57.22	111,315	Area 10 Basin
5	SCS Runoff	1.873	2	774	24,040	----	------	------	Pre Developed Area 10

Hydrograph Report

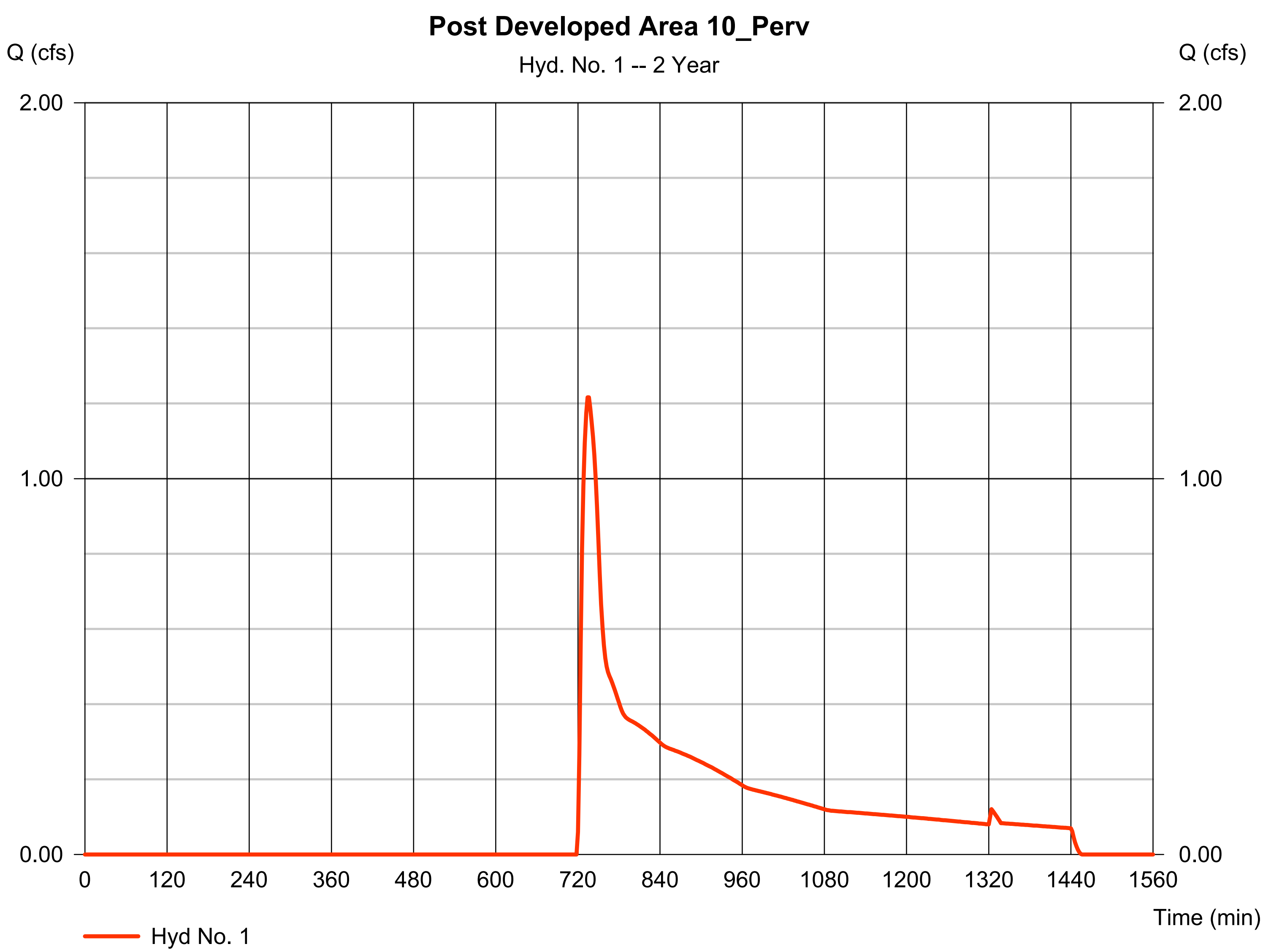
Hydraflow Hydrographs by Intelisolve v9.23 | Wednesday, Jun 30, 2010

Hyd. No. 1

Post Developed Area 10_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 1.216 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 8,763 cuft
Drainage area	= 7.070 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (4.850 x 55) + (2.220 x 61)] / 7.070



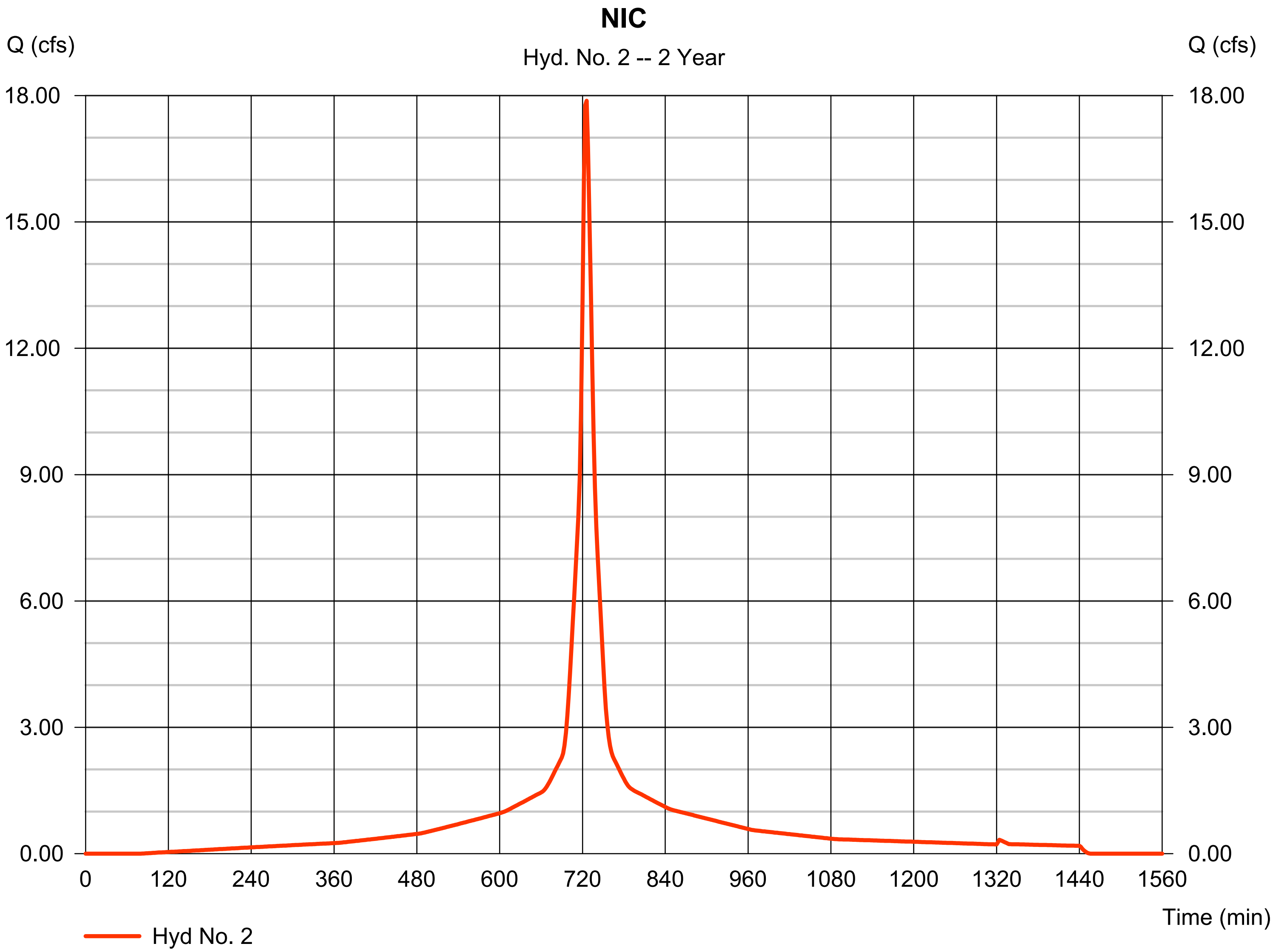
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 17.88 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 72,354 cuft
Drainage area	= 6.540 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.540 x 98)] / 6.540

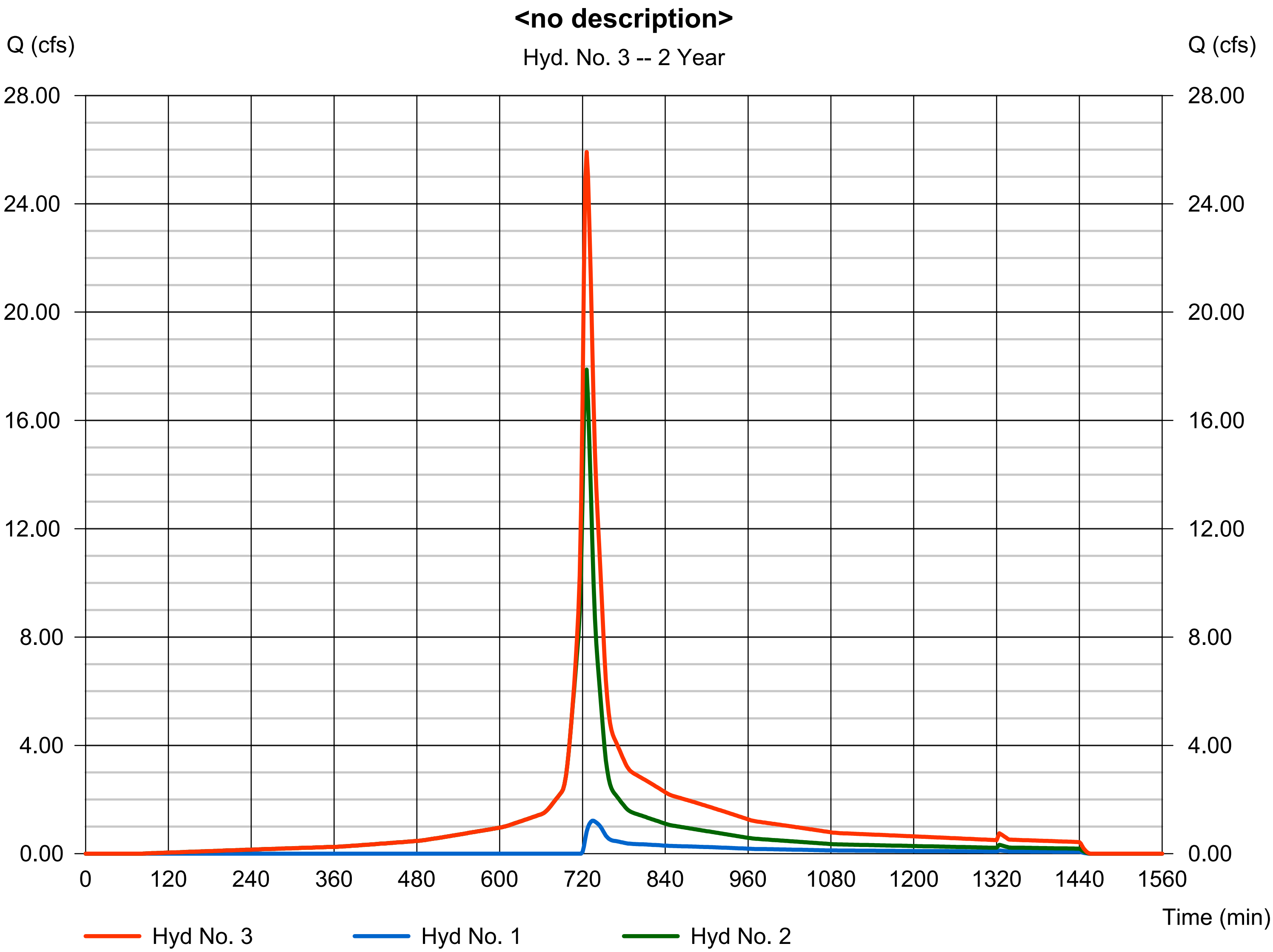


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 25.92 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 111,315 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 13.610 ac



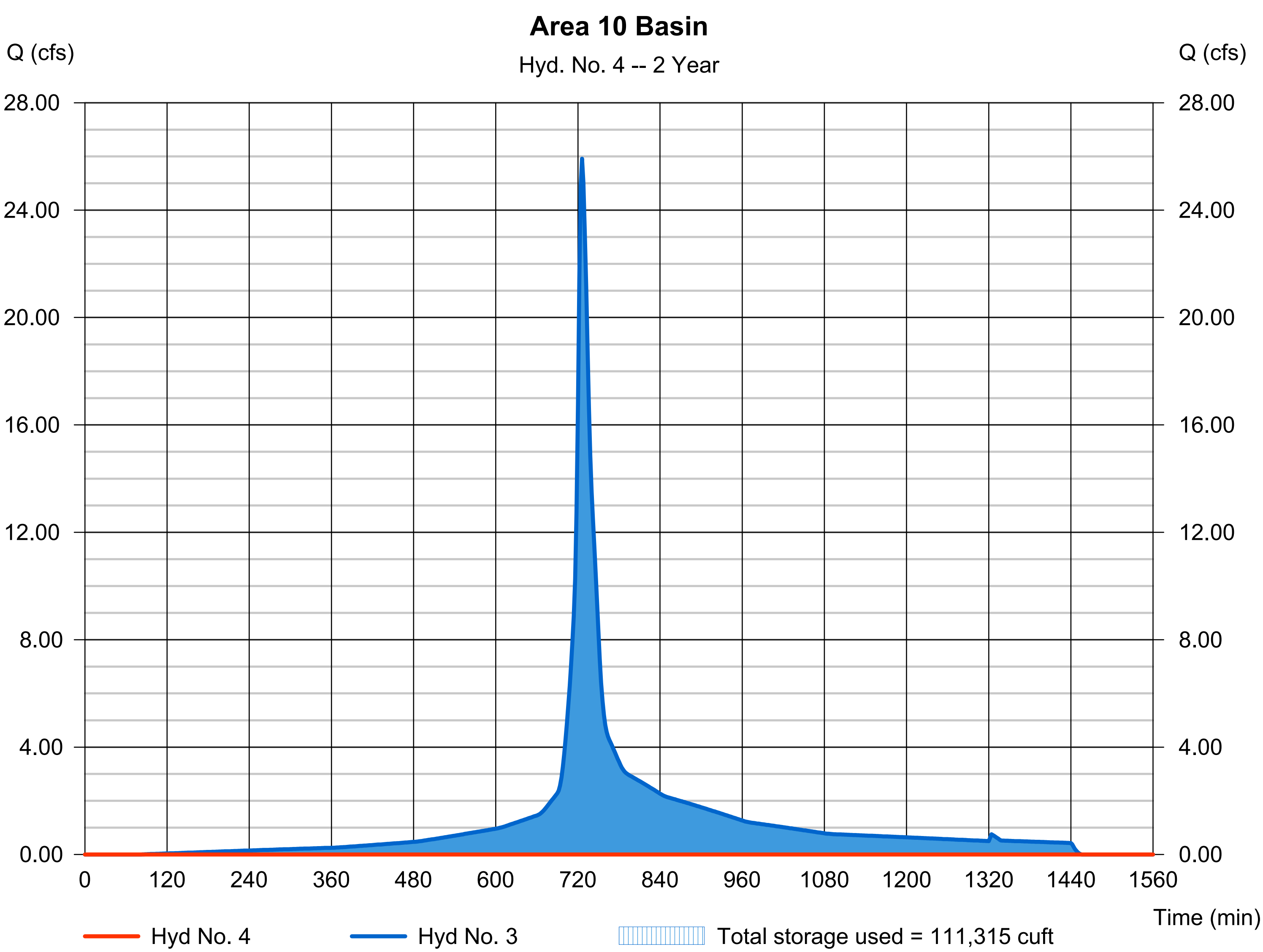
Hydrograph Report

Hyd. No. 4

Area 10 Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 57.22 ft
Reservoir name	= Area 10	Max. Storage	= 111,315 cuft

Storage Indication method used.



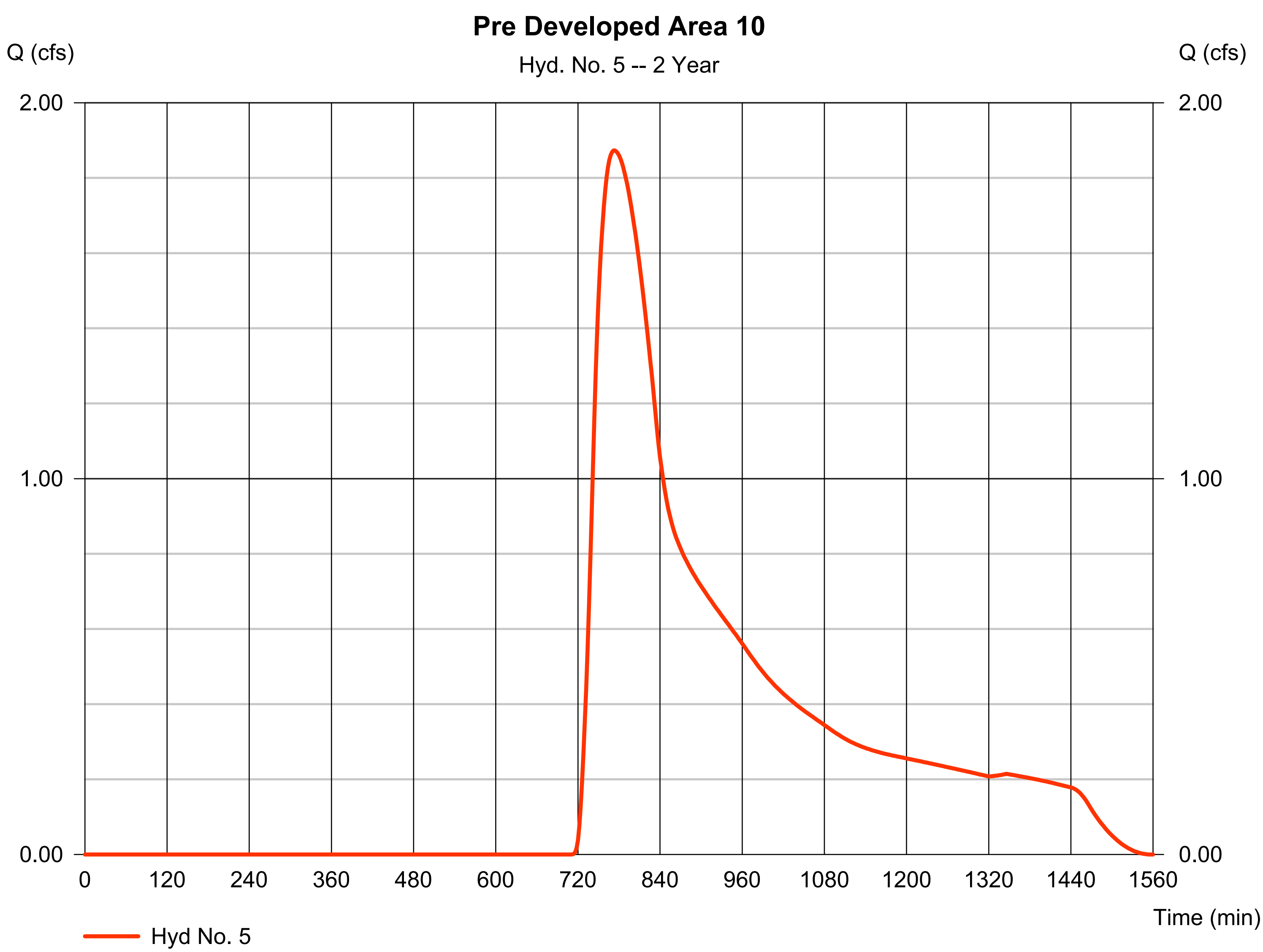
Hydrograph Report

Hyd. No. 5

Pre Developed Area 10

Hydrograph type	= SCS Runoff	Peak discharge	= 1.873 cfs
Storm frequency	= 2 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 24,040 cuft
Drainage area	= 13.610 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.120 x 55) + (5.490 x 70)] / 13.610



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	7.287	2	728	30,927	----	------	------	Post Developed Area 10_Perv
2	SCS Runoff	28.38	2	726	117,074	----	------	------	NIC
3	Combine	57.23	2	726	227,050	1, 2	------	------	<no description>
4	Reservoir	2.537	2	956	101,502	3	57.53	165,897	Area 10 Basin
5	SCS Runoff	7.498	2	764	73,809	----	------	------	Pre Developed Area 10

Hydrograph Report

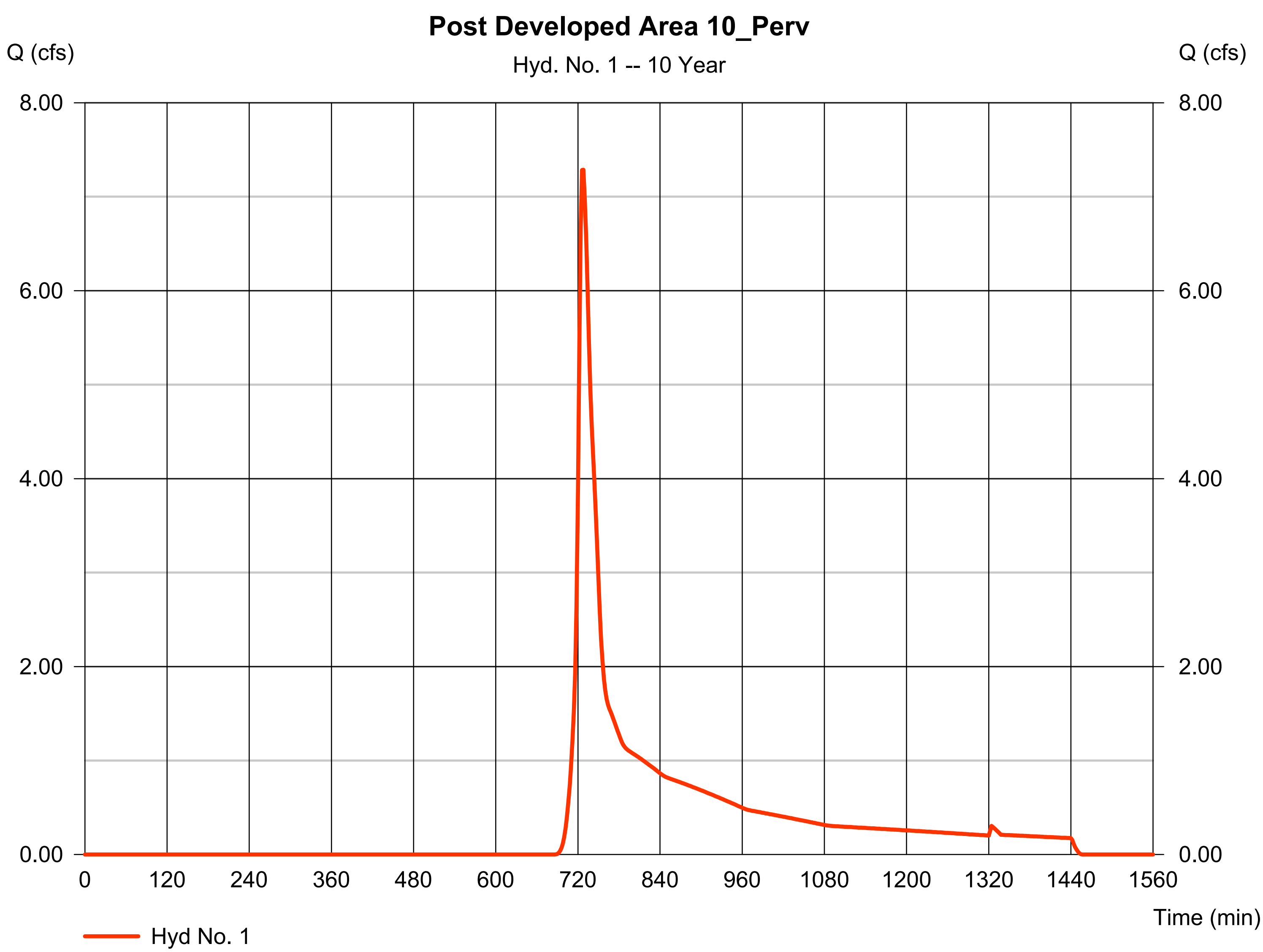
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Jun 30, 2010

Hyd. No. 1

Post Developed Area 10_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 7.287 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 30,927 cuft
Drainage area	= 7.070 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (4.850 x 55) + (2.220 x 61)] / 7.070



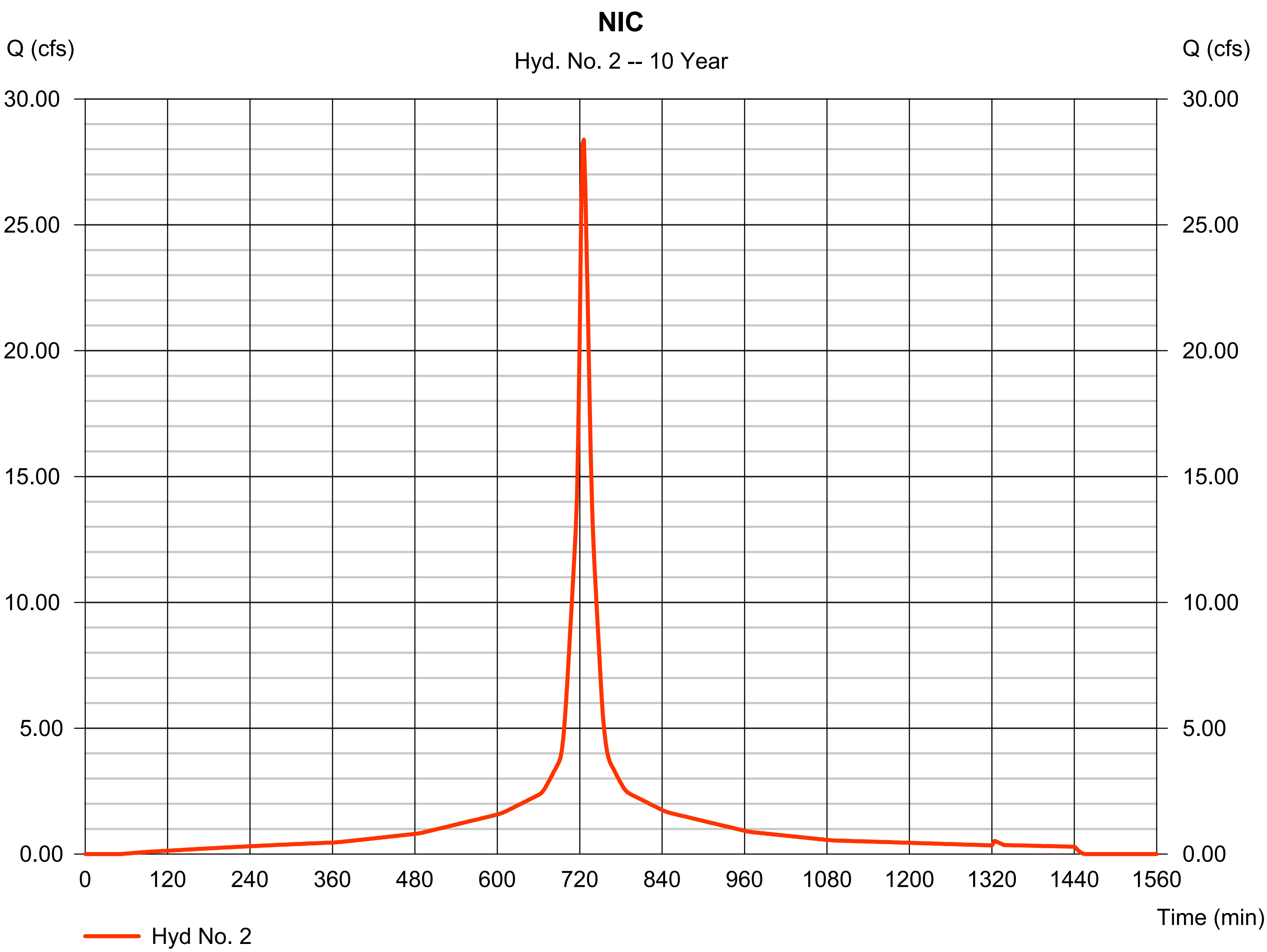
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 28.38 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 117,074 cuft
Drainage area	= 6.540 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.540 x 98)] / 6.540

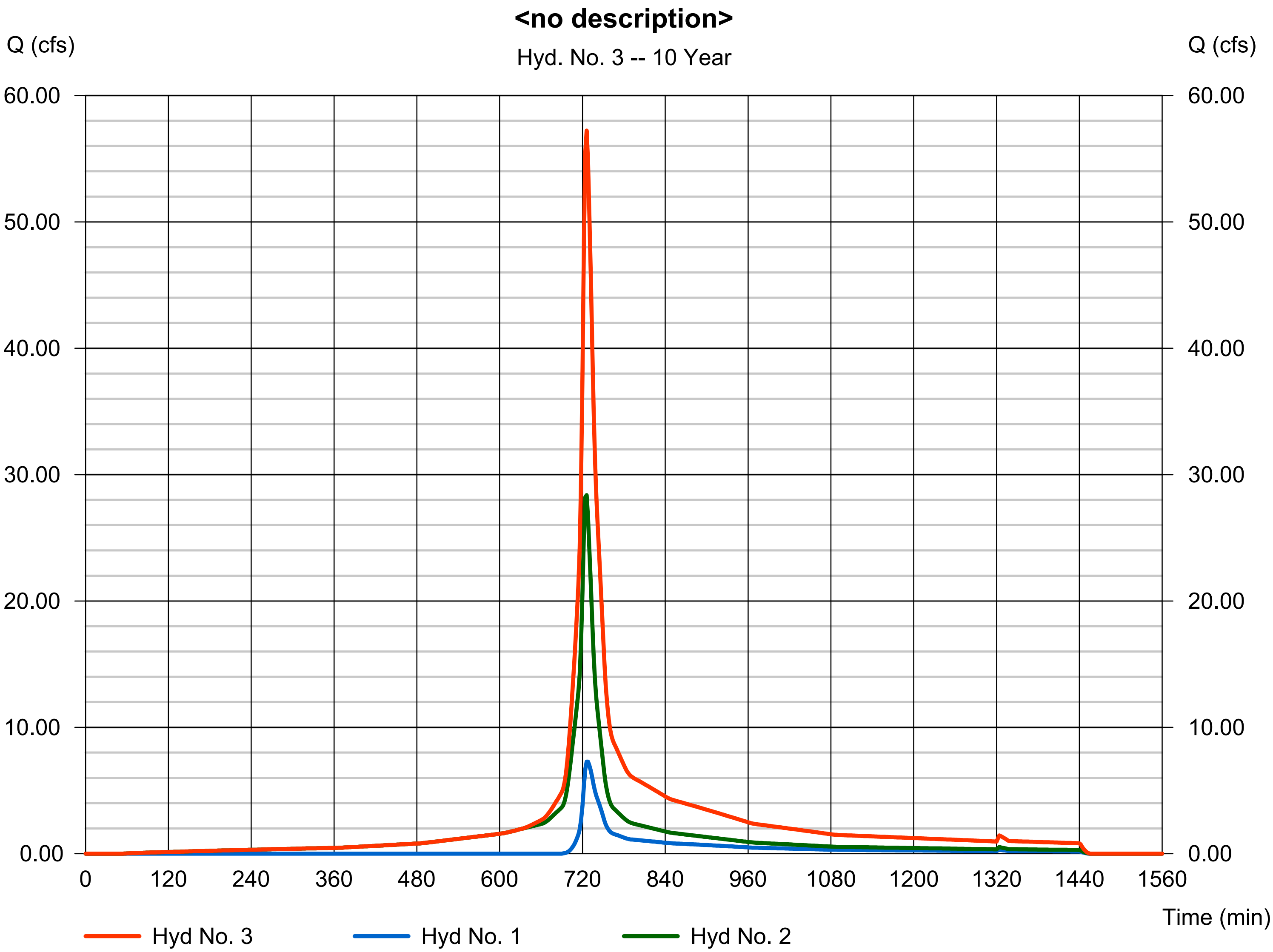


Hydrograph Report

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 57.23 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 227,050 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 13.610 ac



Hydrograph Report

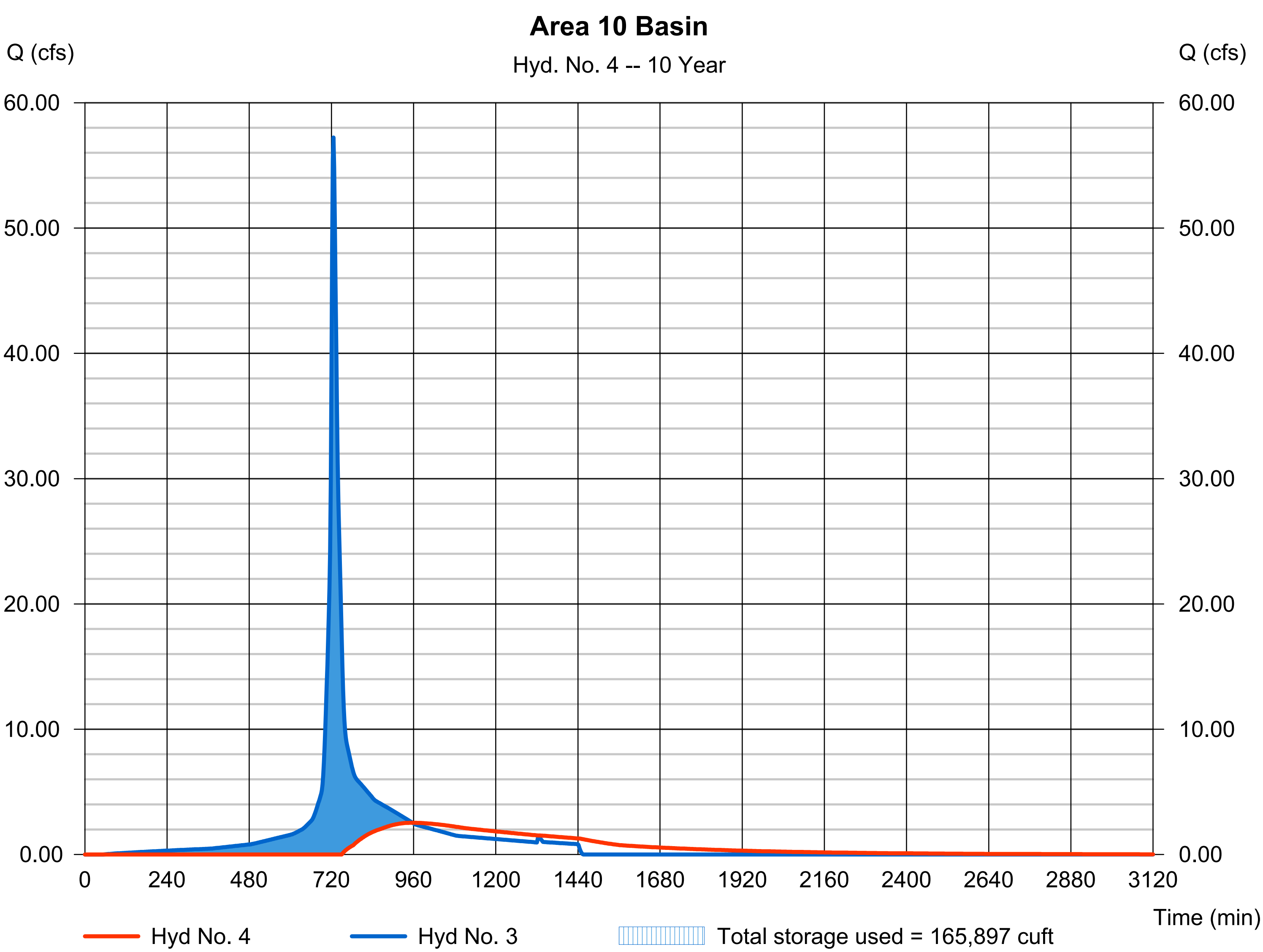
Hydraflow Hydrographs by Intelisolve v9.23 | Wednesday, Jun 30, 2010

Hyd. No. 4

Area 10 Basin

Hydrograph type	= Reservoir	Peak discharge	= 2.537 cfs
Storm frequency	= 10 yrs	Time to peak	= 956 min
Time interval	= 2 min	Hyd. volume	= 101,502 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 57.53 ft
Reservoir name	= Area 10	Max. Storage	= 165,897 cuft

Storage Indication method used.



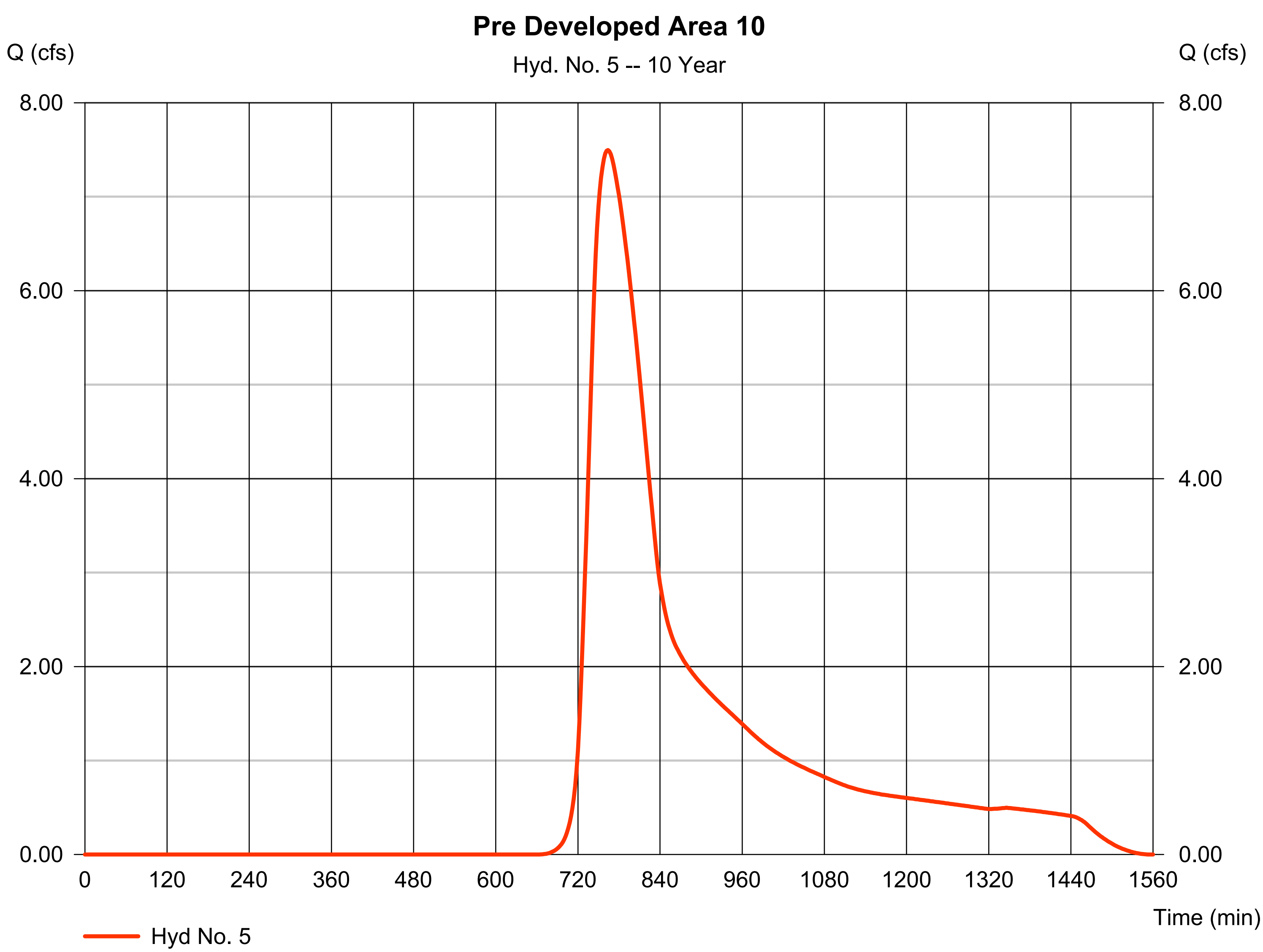
Hydrograph Report

Hyd. No. 5

Pre Developed Area 10

Hydrograph type	= SCS Runoff	Peak discharge	= 7.498 cfs
Storm frequency	= 10 yrs	Time to peak	= 764 min
Time interval	= 2 min	Hyd. volume	= 73,809 cuft
Drainage area	= 13.610 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.00 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.120 x 55) + (5.490 x 70)] / 13.610



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

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	25.39	2	726	93,281	----	------	------	Post Developed Area 10_Perv
2	SCS Runoff	48.74	2	726	204,282	----	------	------	NIC
3	Combine	128.99	2	726	494,090	1, 2	------	------	<no description>
4	Reservoir	17.81	2	768	368,542	3	58.13	275,554	Area 10 Basin
5	SCS Runoff	22.87	2	760	205,200	----	------	------	Pre Developed Area 10

Area 10.gpw	Return Period: 100 Year	Wednesday, Jun 30, 2010

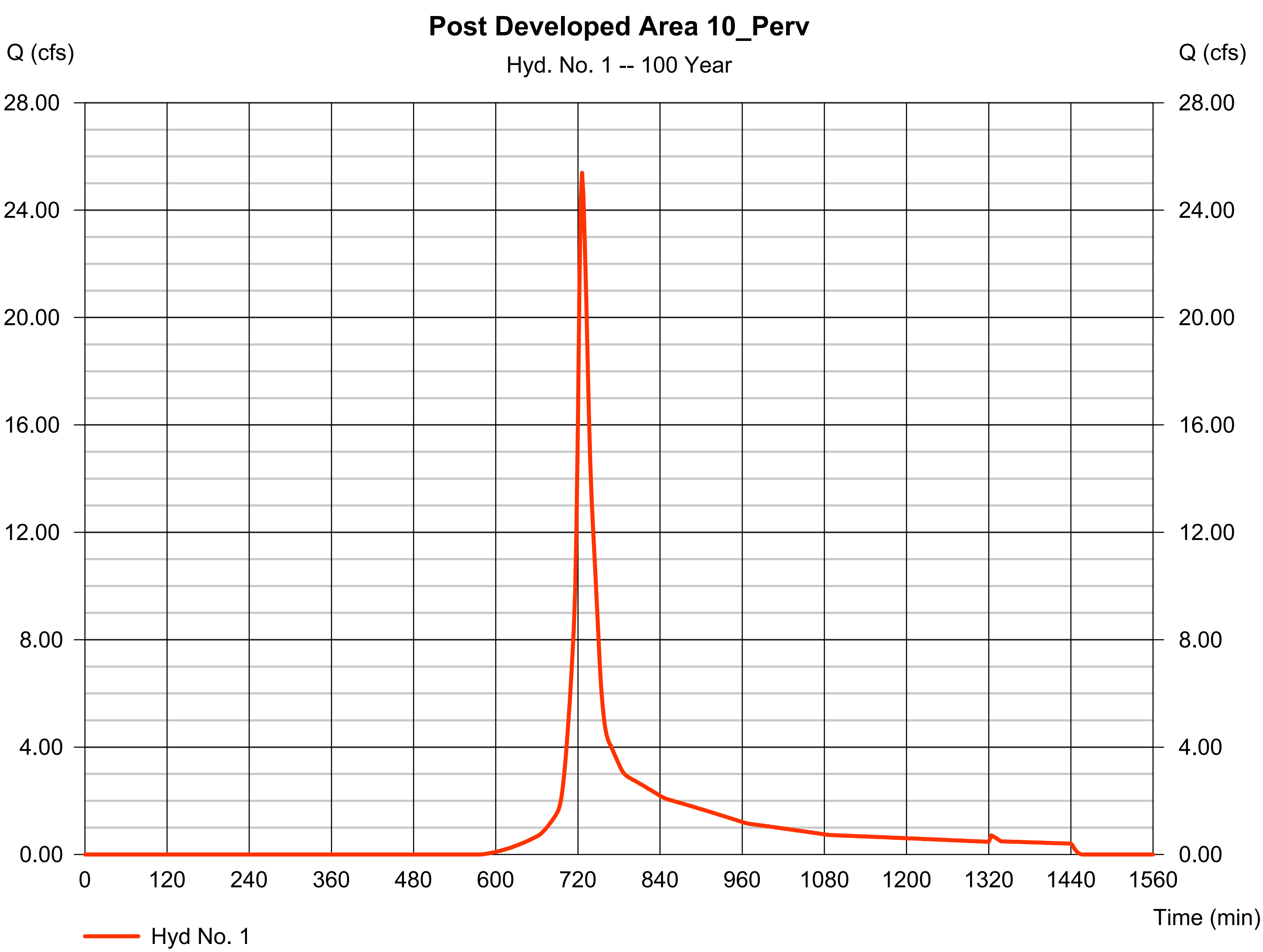
Hydrograph Report

Hyd. No. 1

Post Developed Area 10_Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 25.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 93,281 cuft
Drainage area	= 7.070 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = + (4.850 x 55) + (2.220 x 61)] / 7.070



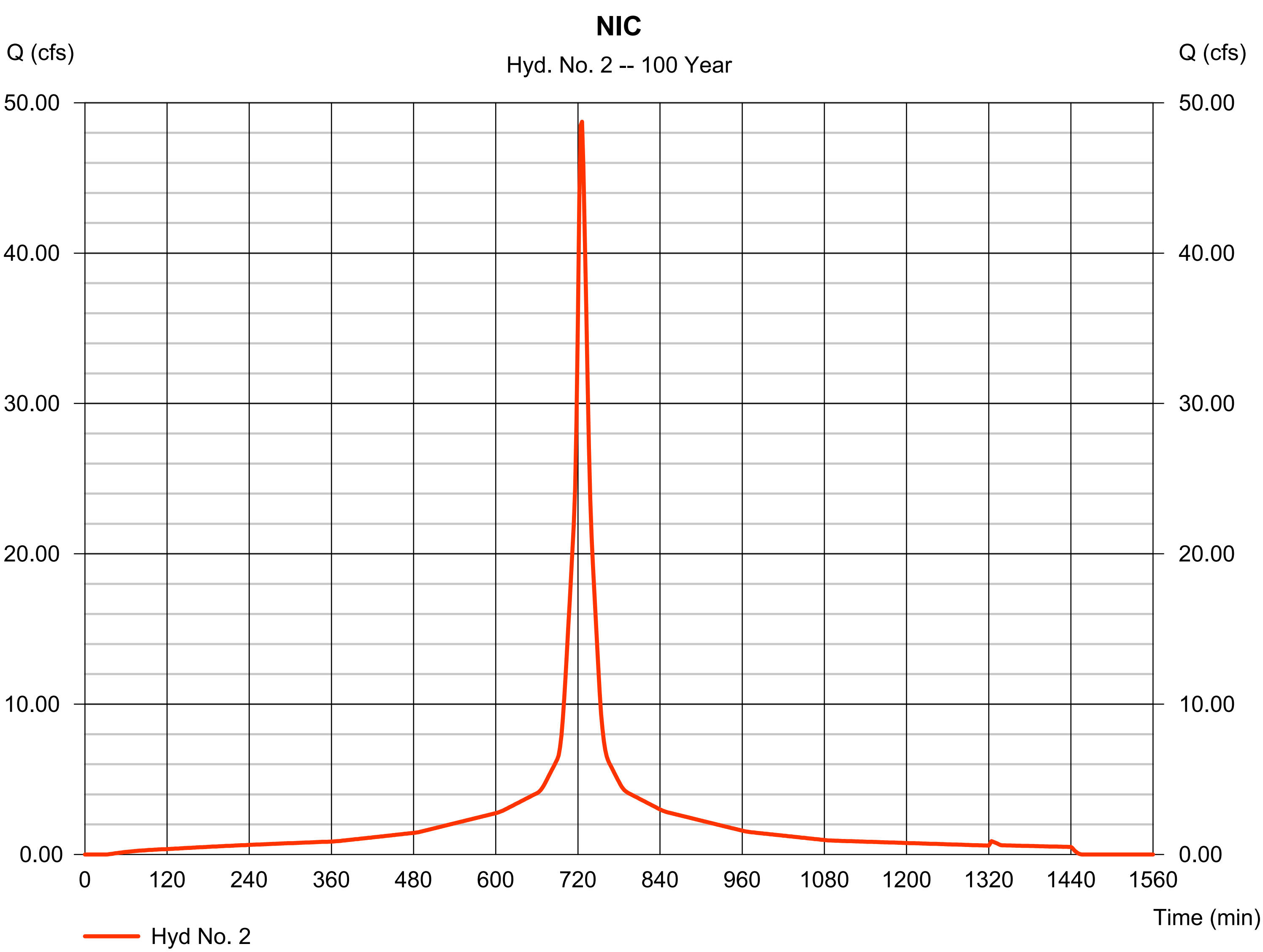
Hydrograph Report

Hyd. No. 2

NIC

Hydrograph type	= SCS Runoff	Peak discharge	= 48.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 204,282 cuft
Drainage area	= 6.540 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(6.540 x 98)] / 6.540



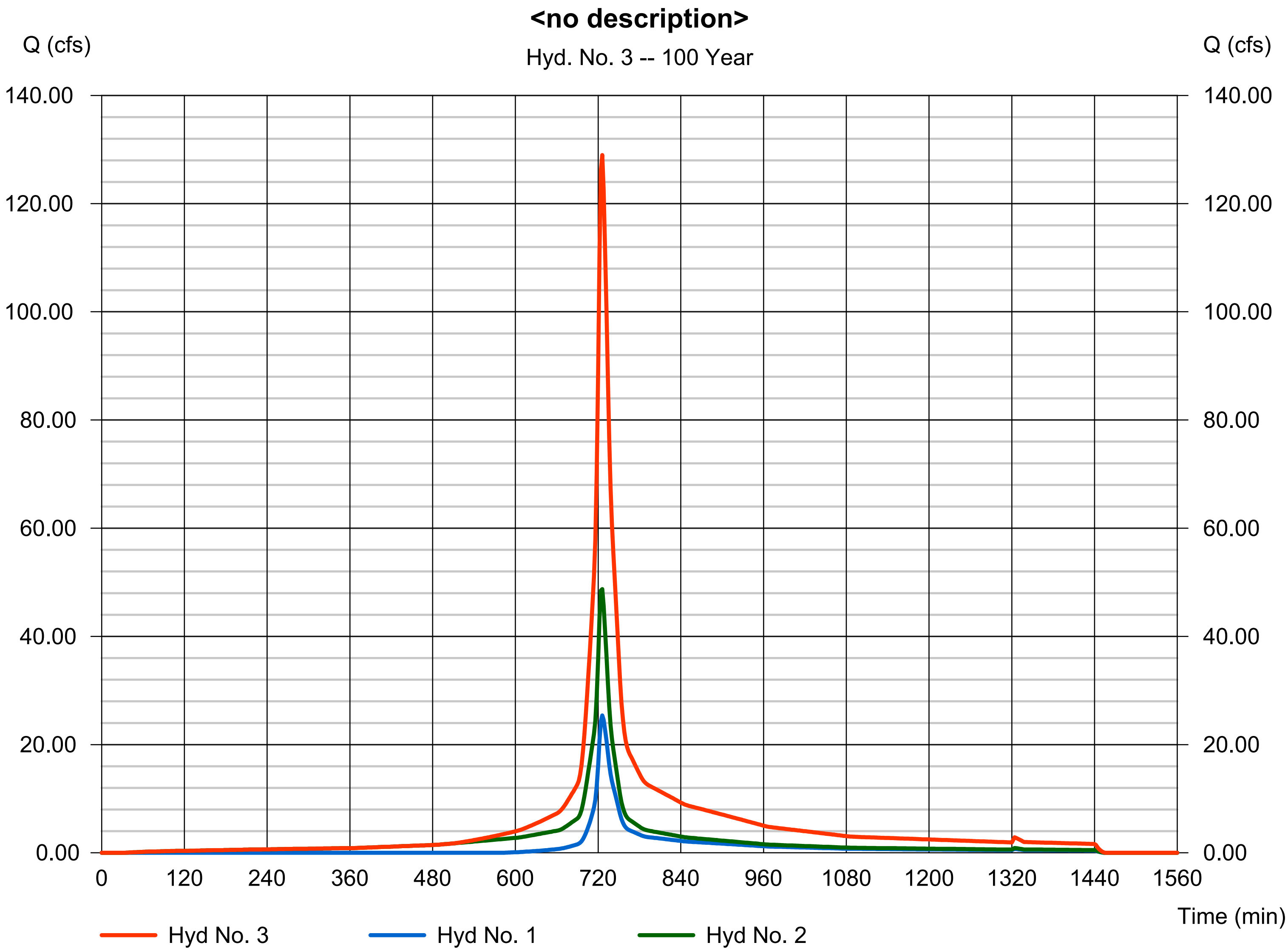
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Jun 30, 2010

Hyd. No. 3

<no description>

Hydrograph type	= Combine	Peak discharge	= 128.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 494,090 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 13.610 ac



Hydrograph Report

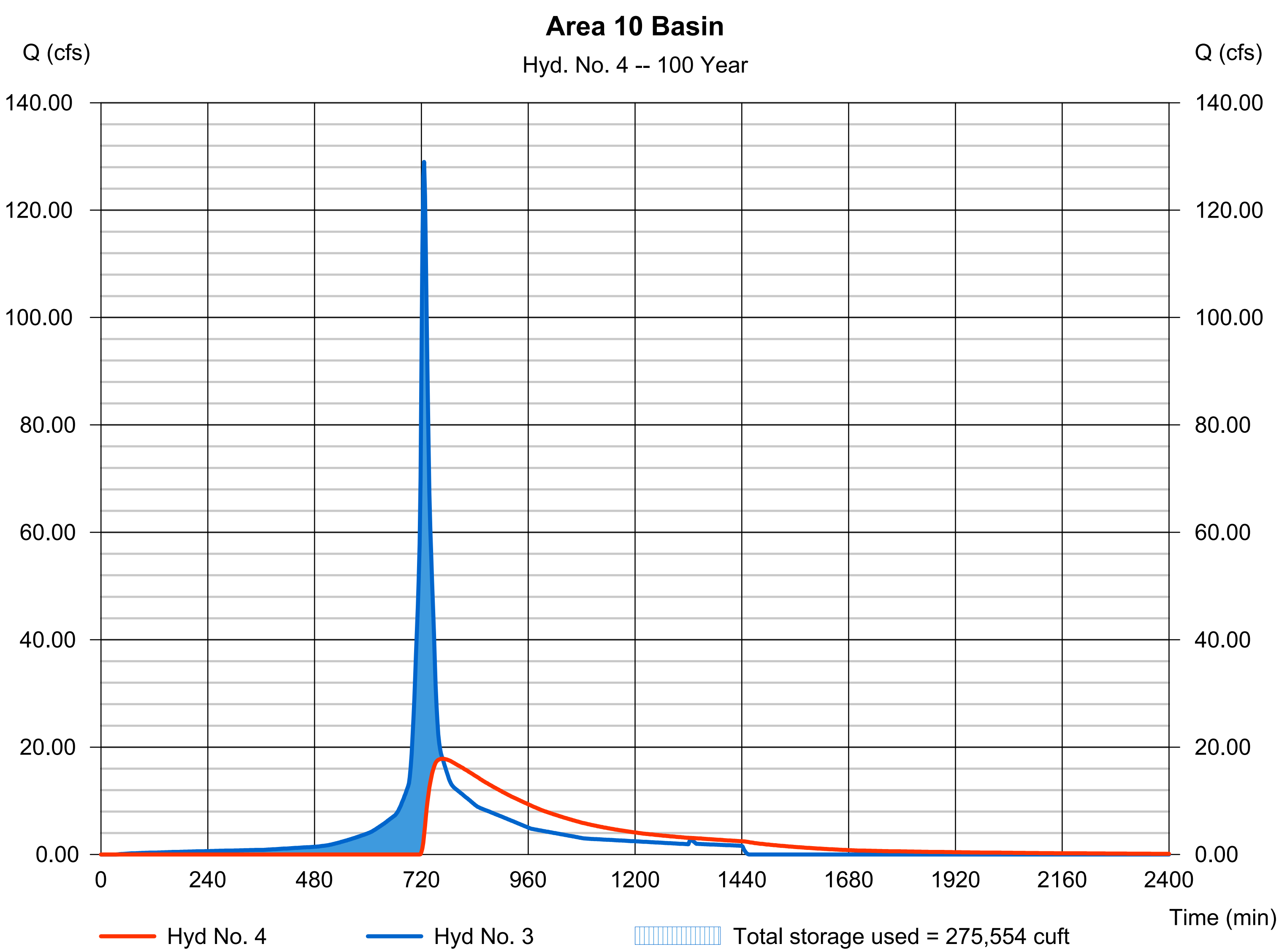
Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Jun 30, 2010

Hyd. No. 4

Area 10 Basin

Hydrograph type	= Reservoir	Peak discharge	= 17.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 368,542 cuft
Inflow hyd. No.	= 3 - <no description>	Max. Elevation	= 58.13 ft
Reservoir name	= Area 10	Max. Storage	= 275,554 cuft

Storage Indication method used.



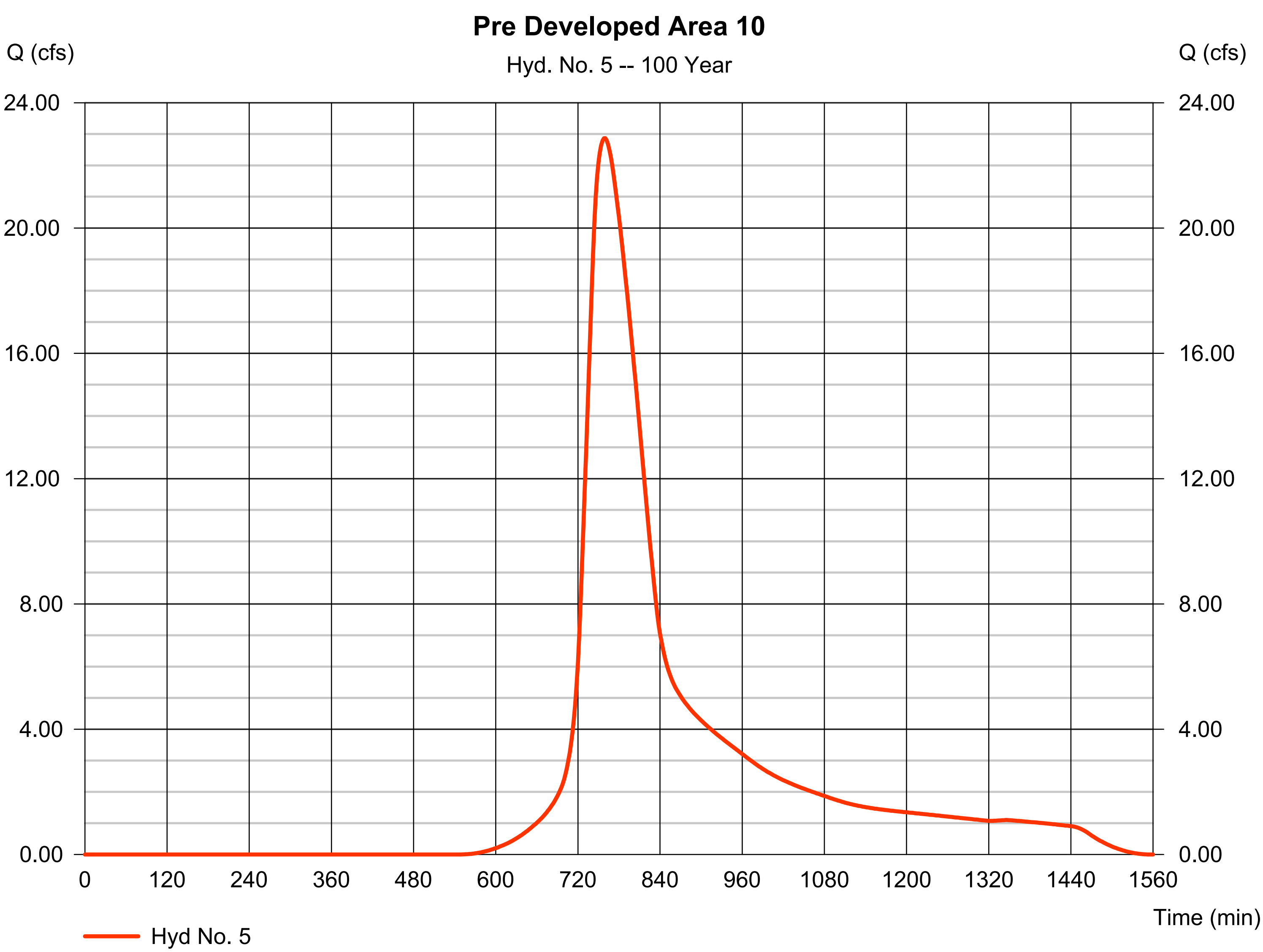
Hydrograph Report

Hyd. No. 5

Pre Developed Area 10

Hydrograph type	= SCS Runoff	Peak discharge	= 22.87 cfs
Storm frequency	= 100 yrs	Time to peak	= 760 min
Time interval	= 2 min	Hyd. volume	= 205,200 cuft
Drainage area	= 13.610 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.00 min
Total precip.	= 8.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.120 x 55) + (5.490 x 70)] / 13.610



APPENDIX D

Soil Investigation

Groundwater Mounding Analysis

RSC 011.01				Depth to Seasonal High Gound Water			Depth to Ground Water		
Test Pit ID	Date	Existing Ground Elevation (ft)	Proposed Basin Elevation (ft)	Inches below Existing Grade	Feet below Existing Grade	Elevation (ft)	Inches below Existing Grade	Feet below Existing Grade	Elevation (ft)
TP-2A	6/14/2010	47.2	47.2	35	2.92	44.3	69	5.75	41.5
TP-2B	6/14/2010	49.9	48.9	44	3.67	46.2	78	6.50	43.4
TP-2C	5/5/2010	49.9	49.4	42	3.50	46.4	42	3.50	46.4
TP-2D	6/14/2010	50.0	49.8	34	2.83	47.2	78	6.50	43.5
TP-2E	6/14/2010	50.0	49.9	41	3.42	46.6	74	6.17	43.8
TP-5A	6/22/2010	53.5	52.5	46	3.83	49.7	93	7.75	45.8
TP-5B	6/22/2010	58.5	53.2	98	8.17	50.3	132	11.00	47.5
TP-5C	5/5/2010	52.9	52.6	28	2.33	50.6	28	2.33	50.6
TP-5D	6/22/2010	51.6	51.6	25	2.08	49.5	62	5.17	46.4
TP-5E	6/22/2010	58.6	53.8	Perched - 54	4.50	54.1	124	10.33	48.3
TP-5F	6/22/2010	47.6	46.9	35	2.92	44.7	46	3.83	43.8
TP-5G	6/15/2010	52.8	48.0	Perched - 45	3.75	49.1	124	10.33	42.5
TP-5H	5/5/2010	49.5	46.8	56	4.67	44.8	56	4.67	44.8
TP-5I	6/15/2010	45.6	45.3	34	2.83	42.8	47	3.92	41.7
TP-5J	6/15/2010	52.0	49.2	62	5.17	46.8	90	7.50	44.5
TP-6A	6/15/2010	50.6	50.6	24	2.00	48.6	36	3.00	47.6
TP-6B	5/5/2010	54.0	54.0	40	3.33	50.7	40	3.33	50.7
TP-6C	6/15/2010	52.0	52.0	24	2.00	50.0	42	3.50	48.5
TP-6D	6/15/2010	50.3	50.3	35	2.92	47.4	47	3.92	46.4
TP-6E	6/15/2010	54.1	54.1	42	3.50	50.6	84	7.00	47.1
TP-7A	6/14/2010	52.5	51.6	41	3.42	49.1	63	5.25	47.3
TP-7B	6/14/2010	53.0	52.3	40	3.33	49.7	63	5.25	47.8
TP-7C	6/15/2010	54.0	53.5	52	4.33	49.7	61	5.08	48.9
TP-7D	5/5/2010	53.0	53.0	24	2.00	51.0	24	2.00	51.0
TP-7E	6/14/2010	54.1	53.9	34	2.83	51.3	66	5.50	48.6
TP-10A	6/14/2010	56.5	56.5	28	2.33	54.2	51	4.25	52.3
TP-10B	6/15/2010	57.5	57.2	43	3.58	53.9	66	5.50	52.0
TP-10C	5/5/2010	57.6	57.2	40	3.33	54.3	40	3.33	54.3
TP-10D	6/15/2010	56.5	56.5	40	3.33	53.2	70	5.83	50.7
TP-10E	6/15/2010	56.5	56.5	42	3.50	53.0	51	5.83	50.7

Date: 06/14/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0–6	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
6–23	Light yellowish-brown (10YR 6/4) loamy sand; granular structure; friable; gradual, wavy boundary	
23–35	Yellowish-brown (10YR 5/6) loamy sand; weak subangular blocky to granular structure; friable; weak clay bridging between sand grains; clear, wavy boundary	30 (G)
35–56	Pale yellow (2.5Y 7/3) sand; common medium, distinct, yellow (2.5Y 7/6) and strong brown (7.5YR 5/6) mottles; single grain; loose; 20% fine to medium rounded quartzose gravel; abrupt, wavy boundary	
56–84	Very pale brown (10YR 7/4) sandy clay loam; granular structure; friable; moist; common peds of white (10YR 8/1) clay with common coarse, prominent, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; angular blocky structure; plastic; clear, wavy boundary	72 (UD)
84–114+	Light gray (10YR 7/2) coarse sand; single grain; loose; saturated; 40% fine to medium rounded quartzose gravel	

	Depth (in) below existing grade
Seasonal High Water Table:	35
Ground Water:	69

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG** **TP-2A** Job No.: RSC 011.01

Date: 6/14/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" to 0	O-horizon (organic layer)	
0 to 2"	Dark grayish-brown (10YR 4/2) loamy sand; weak subangular blocky structure; friable; many medium roots	
2" to 6"	Light brownish-gray (10YR 6/2) loamy sand; subangular blocky structure; friable; few medium roots	
6" to 10"	Brown (10YR 5/3) loamy sand; subangular blocky structure; friable	
10" to 24"	Olive yellow (2.5Y 6/6) loamy sand; subangular blocky structure; friable; 30% rounded quartzose gravel, < 0.5" diameter	
24" to 36"	Brownish-yellow (10YR 6/6) loamy sand; subangular blocky structure; friable; 30% rounded quartzose gravel, < 0.5" diameter	
36" to 44"	Pale yellow (2.5Y 7/4) sandy loam; subangular blocky structure; friable	
44" to 62"	Variegated yellow (10YR 7/6), pale yellow (2.5Y 8/2), and yellowish-brown (10YR 5/4) loamy sand; common, medium, prominent, yellow (2.5Y 7/6) mottles; subangular blocky structure; friable	
62" to 64"	Thin bands of brownish-yellow (10YR 6/6), pale yellow (2.5Y 8/3), and yellow (10YR 7/6) silty clay; subangular blocky structure; firm-in-place	
64" to 82"	Light yellowish-brown (2.5Y 6/4) sandy clay loam; subangular blocky structure; slightly plastic; and white (2.5Y 8/1) silt loam; subangular blocky structure; friable; saturated	Two undisturbed samples taken at 66"
82" to 108"+	Variegated pale yellow (2.5Y 7/4) and yellow (10YR 7/6) loamy sand; subangular blocky structure; friable; saturated and Gray (10YR 6/1) sandy clay; subangular blocky structure; plastic saturated	

Estimated Seasonal High Water Table Observed at:
44 inches below existing grade

Ground Water Observed at:
78 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG** **TP-2B** **(Area 2 and 3 Basin)** Job No: RSC 011.01

Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

Depth	Soil Description	Remarks
+"2"	O-horizon (organic layer)	
Surface – 8"	Grayish-brown (10YR 5/2) loamy sand; subangular blocky structure; friable	
8" – 11"	Olive yellow (2.5Y 6/6) loamy sand; subangular blocky structure; friable	
11" – 17"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	
17" – 29"	Light olive brown (2.5Y 5/6) loamy sand; subangular blocky structure; friable	Two (2) undisturbed sample taken at 22" Disturbed sample taken at 22"
29" – 42"	Yellow (2.5Y 7/6) sand; single grain; loose; 20% rounded quartzose pebbles < 0.5" diameter	
42" – 72"	Pale yellow (2.5Y 8/4) coarse sand; single grain; loose; saturated	
72" – 102"+	Mixed layers of: Pale yellow (2.5Y 8/4) coarse sand; single grain; loose; saturated; and White (8/N) silt loam; many, coarse, prominent, olive yellow (2.5Y 6/6) mottles; slightly plastic; saturated	

Estimated Seasonal High Water Table Observed at:
42 inches below existing grade

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 60" due to groundwater saturation.

Estimated Ground Water Observed at:
42 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-2C** **(Area 2 and 3 Basin)** Job No: RSC 011.01

Date: 06/14/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0 – 9	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
9 – 24	Brownish-yellow (10YR 6/6) sand; single grain; loose; 10% medium rounded quartzose gravel; clear, wavy boundary	
24 – 34	Yellowish-brown (10YR 5/6) loamy sand; weak subangular blocky structure; friable; 20% fine to medium rounded quartzose gravel; clear, irregular boundary	
34 – 60	Pale yellow (2.5Y 7/3) sand; common medium, distinct, yellow (2.5Y 7/6) and strong brown (7.5YR 5/6) mottles; single grain; loose; 20% fine to medium rounded quartzose gravel; abrupt, wavy boundary	
60 – 82	Gray (10YR 6/1) loamy sand; common coarse, prominent, brownish-yellow (10YR 6/6) mottles; weak subangular blocky structure; saturated; abrupt, smooth boundary	
82 – 120+	Light gray (2.5Y 7/2) gravelly clay (90% fine rounded quartzose gravel); subangular blocky structure; firm; common peds of variegated light gray (10YR 7/1) and dark gray (10YR 4/1) clay with common medium, distinct, very pale brown (10YR 7/3) mottles; angular blocky structure; plastic; saturated	84 (UD, G)

	Depth (in) below existing grade
Seasonal High Water Table:	34
Ground Water:	78

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-2D** Job No.: RSC 011.01

Date: 6/14/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" to 0	O-horizon (organic layer)	
0 to 2"	Dark grayish-brown (10YR 4/2) loamy sand; weak subangular blocky structure; friable; many medium roots	
2" to 10"	Light brownish-gray (10YR 6/2) loamy sand; subangular blocky structure; friable; few medium roots	
10" to 12"	Brown (10YR 5/3) loamy sand; subangular blocky structure; friable	
12" to 26"	Olive yellow (2.5Y 6/6) loamy sand; subangular blocky structure; friable	
26" to 41"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	
41" to 52"	Pale yellow (2.5Y 8/2) loamy sand; common, medium, prominent, yellow (2.5Y 7/6) mottles (increasing size and density with depth); subangular blocky structure; friable	
52" to 72"	Mixed layers of: Light brownish-gray (10YR 6/2) sand; many, coarse, prominent, brownish-yellow (10YR 6/6) mottles; single grain; loose; moist; 20% rounded quartzose gravel, 0.5 to 1" diameter; and Pale yellow (2.5Y 7/4) loamy sand; many, medium, distinct, olive yellow (2.5Y 6/6) mottles; subangular blocky structure; friable; moist; 20% rounded quartzose gravel, 0.5 to 1" diameter and Pale yellow (2.5Y 7/3) sandy clay; subangular blocky structure; plastic	
72" to 96"+	Pale yellow (2.5Y 7/3) coarse sand; single grain; loose; saturated	Two undisturbed samples taken at 72"

Estimated Seasonal High Water Table Observed at:
41 inches below existing grade

Ground Water Observed at:
74 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-2E (Area 2 and 3 Basin)** Job No: RSC 011.01

Date: 06/22/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0		
10	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
34	Light yellowish-brown (2.5Y 6/4) loamy sand; weak subangular blocky structure; friable; clear, wavy boundary	
46	Brownish-yellow (10YR 6/6) loamy sand; weak subangular blocky structure; friable; clear, smooth boundary	36 (UD)
58	Variegated pale yellow (2.5Y 7/3) and yellowish-brown (10YR 5/6) sandy clay loam; subangular blocky structure; slightly plastic; gradual, irregular boundary	
71	Pale yellow (2.5Y 7/3) sandy loam; common medium, distinct, olive yellow (2.5Y 6/6) mottles; subangular blocky structure; friable; moist; clear, wavy boundary	
102	Light gray (10YR 7/2) silty clay loam; common coarse, prominent, brownish-yellow (10YR 6/6) and yellow (10YR 7/6) mottles; angular blocky structure; slightly plastic; moist; gradual, wavy boundary	
138+	Light gray (2.5Y 7/2) sand; common medium (0.5 to 1.0 inch thick) bands of brownish-yellow (10YR 6/6) sand; single grain; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	46
Ground Water:	93

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-5A** Job No.: RSC 011.01

Date: 06/22/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0 – 6	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
6 – 24	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; gradual, irregular boundary	
24 – 46	Variegated pale yellow (2.5Y 7/4), brownish-yellow (10YR 6/6), and yellowish-brown (10YR 5/4) sandy loam; weak subangular blocky structure; friable; clear, wavy boundary	
46 – 84	Yellowish-brown (10YR 5/8) sand; single grain; loose; clear, wavy boundary	
84 – 98	Brownish-yellow (10YR 6/6) sand; single grain; loose; common flecks of mica; gradual, wavy boundary	84 (UD)
98 – 156+	Light gray (2.5Y 7/2) sand; common fine, distinct, yellow (2.5Y 7/6) mottles; single grain; saturated	144 (G)

	Depth (in) below existing grade
Seasonal High Water Table:	98
Ground Water:	132

Sample codes: G = grab sample, UD = undisturbed sample

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Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

Depth	Soil Description	Samples
+"2" to Surface	O-horizon (organic layer)	
Surface to 4"	Gray (10YR 6/1) fine sand; single grain; loose	
4" to 28"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	Undisturbed sample taken at 11" Disturbed sample taken at 11"
28" to 56"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable structure; friable; 20% rounded quartzose pebbles < 0.5" diam.; saturated	
56" to 66"	Brownish-yellow (10YR 6/6) clay; subangular blocky structure; plastic	
66" to 76"	Mixed layers of: brownish-yellow (10YR 6/6) coarse sand; single grain; loose; saturated; and White (10YR 8/1) coarse sand; single grain; loose; saturated; and reddish-yellow (5YR 6/6) coarse sand; single grain; loose; saturated;	Undisturbed sample taken at 78"
76" to 86"	Pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable; saturated	
86" to 96"	Pale yellow (2.5Y 8/2) coarse sand; pale yellow (2.5Y 7/4) and brownish-yellow (10YR 6/8) striations; single grain; loose; saturated	
96" to 102"+	Light gray (2.5Y 7/2) coarse sand; single grain; loose; saturated	

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 66" due to groundwater saturation.

Seasonal High Water Table:
28 inches below existing grade

Ground Water:
28 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG** **TP-5C** **(Area 5 East Basin)** Job No: RSC 011.01

Date: 06/22/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0 – 5	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
5 – 25	Pale yellow (2.5Y 7/3) sandy loam; subangular blocky structure; friable; clear, wavy boundary	18 (UD)
25 – 99	Light gray (10YR 7/2) clay (gradual transition to sandy clay loam); common coarse, prominent, yellowish-brown (10YR 5/6) and brownish-yellow (10YR 6/6) mottles; angular blocky structure; plastic; clear, wavy boundary	
99 – 120+	Light gray (2.5Y 7/2) sand; common medium (0.5 to 1.0 inch thick) bands of brownish-yellow (10YR 6/6) sand; single grain; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	25
Ground Water:	62

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-5D** Job No.: RSC 011.01

Date: 06/22/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0		
8	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
24	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; clear, irregular boundary	
35	Variegated yellowish-brown (10YR 5/6) and light yellowish-brown (2.5Y 6/4) sandy clay loam; granular structure; friable; clear, irregular boundary	
54	Olive yellow (2.5Y 6/6) sandy clay loam; common coarse, prominent, yellowish-red (5YR 5/6) mottles; subangular blocky structure, firm in-place; granular structure, friable when removed; 20% fine rounded quartzose gravel; clear, irregular boundary	
63	Light gray (10YR 7/2) clay; common fine to medium, prominent, reddish-yellow (7.5YR 6/6) mottles; angular blocky structure; plastic; clear, irregular boundary	
91	Variegated pale yellow (2.5Y 7/4) and brownish-yellow (10YR 6/6) sandy loam; weak subangular blocky structure; friable; common peds of variegated pale yellow (2.5Y 7/4) and brownish-yellow (10YR 6/6) clay; angular blocky structure; slightly plastic; clear, smooth boundary	84 (UD)
112	Light yellowish-brown (10YR 6/4) sand; single grain; loose; abrupt, wavy boundary	
120	White (N 8/) clay; angular blocky structure; plastic; abrupt, wavy boundary	
162+	Light gray (2.5Y 7/2) sand; common fine, distinct, yellow (2.5Y 7/6) mottles; single grain; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	54 (perched)
Ground Water:	124

Sample codes: G = grab sample, UD = undisturbed sample

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Date: 06/22/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0–5	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
5–15	Light yellowish-brown (10YR 6/4) loamy sand; weak subangular blocky structure; friable; gradual, wavy boundary	
15–24	Pale yellow (2.5Y 7/3) loamy sand; weak subangular blocky structure; friable; gradual, smooth boundary	18 (UD)
24–28	Pale yellow (2.5Y 7/4) loamy sand; weak subangular blocky structure; friable; 40% medium rounded quartzose gravel; clear, smooth boundary	
28–35	Light olive brown (2.5Y 5/6) sand; single grain; loose; gradual, wavy boundary	
35–70	Light gray (10YR 7/2) sandy clay loam; common medium, distinct, yellowish-brown (10YR 5/6) mottles; subangular blocky structure; saturated; clear, irregular boundary	
70–126+	White (N 8/) sandy clay loam; common medium, prominent, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) mottles; subangular blocky structure; friable; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	35
Ground Water:	46

Sample codes: G = grab sample, UD = undisturbed sample

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Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade		Sample Depth (in)
0		
6	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
21	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; clear, wavy boundary	
34	Yellowish-brown (10YR 5/6) sandy clay; granular structure; friable; gradual, irregular boundary	
45	Brownish-yellow (10YR 6/6) sandy clay; common coarse, distinct, yellowish-red (5YR 5/6) mottles; weak subangular blocky structure, slightly firm in-place; granular structure, friable when removed; gradual, wavy boundary	
57	Variegated light yellowish-brown (2.5Y 6/4), pale yellow (2.5Y 7/3), and light reddish-brown (5YR 6/4) silty clay loam; subangular blocky structure; slightly plastic; gradual, irregular boundary	
65	Variegated pale yellow (2.5Y 7/3) and brownish-yellow (10YR 6/6) sandy loam; subangular blocky structure; friable; clear, wavy boundary	
96	Light gray (10YR 7/1) silty clay loam; common fine, prominent, brownish-yellow (10YR 6/6) mottles; subangular blocky structure; slightly plastic; gradual, irregular boundary	76 (UD)
122	Variegated white (10YR 8/1) and olive yellow (2.5Y 6/6) clay; angular blocky structure; plastic; clear, irregular boundary	
156+	Variegated white (10YR 8/1) and pale yellow (2.5Y 7/3) sand; common coarse, distinct, light gray (N 6/) mottles; single grain; saturated	150 (G)

	Depth (in) below existing grade
Seasonal High Water Table:	45 (perched)
Ground Water:	124

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-5G** Job No.: RSC 011.01

Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

Depth	Description	Samples
+"2"		
Surface	O-horizon (organic layer)	
	Pale yellow (2.5Y 8/2) loamy sand; subangular blocky structure; friable	
4"	Olive yellow (2.5Y 6/6) loamy sand; subangular blocky structure; friable; 20% rounded quartzose pebbles 0.5" - 1" diameter	Undisturbed sample taken at 11" Disturbed sample taken at 36"
48"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	Disturbed sample taken at 50"
56"	Variegated Light gray (2.5Y 7/1) and pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable; and rounded quartoze pebbles 0.5" - 1" diameter; saturated	Undisturbed sample taken at 78"
93"	Yellow (2.5Y 8/6) sandy loam; subangular blocky structure; friable; saturated	
112"	White (2.5Y 8/1) fine sand; common, medium, prominent, yellow (10YR 7/6) mottles; single grain; loose; saturated	
120"+		

Seasonal High Water Table:
56 inches below existing grade

Ground Water:
56 inches below existing grade

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 90" due to groundwater saturation.

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Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0–4	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
4–17	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; clear, wavy boundary	
17–34	Yellowish-brown (10YR 5/6) loamy sand; subangular blocky structure; friable; gradual, irregular boundary	30 (UD)
34–78	White (10YR 8/1) sandy clay loam; common coarse, prominent, brownish-yellow (10YR 6/6) and strong brown (7.5YR 5/6) mottles; subangular blocky structure; friable; saturated; clear, wavy boundary	
78–92	White (10YR 8/1) clay; many coarse, prominent, pale yellow (2.5Y 7/4) mottles; many fine, prominent, brownish-yellow (10YR 6/6) mottles; angular blocky structure; plastic; clear, smooth boundary	
92–108+	Variegated light gray (2.5Y 7/2) and brownish-yellow (10YR 6/6) coarse sand; single grain; loose; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	34
Ground Water:	47

Sample codes: G = grab sample, UD = undisturbed sample

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Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade		Sample Depth (in)
0		
8	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
22	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; clear, wavy boundary	
49	Yellowish-brown (10YR 5/6) sandy clay; granular structure; friable; gradual, wavy boundary	
62	Brownish-yellow (10YR 6/6) coarse sand; subangular blocky structure; common clay bridging between sand grains; friable; clear, wavy boundary	
84	Variegated yellow (2.5Y 7/6) and pale yellow (2.5Y 7/3) sand; single grain; loose; common thin (< 0.25 inch thick) bands of dark gray (N 4/) sand; gradual, wavy boundary	72 (UD)
120+	Variegated light gray (10YR 7/2) and brownish-yellow (10YR 6/6) coarse sand; single grain; loose; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	62
Ground Water:	90

Sample codes: G = grab sample, UD = undisturbed sample

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Date: 6/15/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" – 0	O-horizon (organic layer)	
0 – 10"	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; many fine to medium roots	
10" – 12"	Brown (10YR 4/3) loamy sand; subangular blocky structure; firm-in-place	
12" – 24"	Pale yellow (2.5Y 7/3) loamy sand; subangular blocky structure; friable	Two undisturbed samples taken at 20"
24" – 39"	Brownish-yellow (10YR 6/6) sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; single grain; loose; saturated at 36"	
39" – 96"	White (10YR 8/1) sandy clay; many, medium, prominent, pale yellow (2.5Y 7/4) mottles; subangular blocky structure; slightly plastic; saturated	
96" – 108"+	Very pale brown (10YR 7/3) sand; many, coarse, prominent, yellowish-brown (10YR 5/6) mottles; single grain; loose; saturated	

Estimated Seasonal High Water Table Observed at:
24 inches below existing grade

Ground Water Observed at:
36 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-6A** **(Area 6 Basin)** Job No: RSC 011.01

Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

Depth	Soil Description	Remarks
+"2" – Surface	O-horizon (organic layer)	
Surface – 7"	Gray (10YR 6/1) fine sand; single grain; loose	
7" – 33"	Pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable; saturated at 22"	Two (2) unisturbed sample taken at 12" Disturbed sample taken at 12"
33" – 40"	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable	
40" – 72"	Variegated Light yellowish-brown (2.5Y 6/4) and yellow (2.5Y 7/6) loamy sand; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; subangular blocky structure; friable; and 20% rounded quartzose pebbles 0.5" - 1" diameter; saturated	
72" – 90"	Variegated light gray (2.5Y 7/1) clay loam and pale yellow (2.5Y 8/2) clay loam and white (2.5Y 8/1) coarse sand; many, coarse, prominent, yellow (10YR 7/8) mottles; subangular blocky structure; slightly plastic; saturated	
90" – 96"+	White (2.5Y 8/1) silty clay; common, coarse, prominent, reddish-yellow (5YR 7/8) mottles; subangular blocky structure; plastic; saturated	

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 60" due to groundwater saturation.

Seasonal High Water Table:
40 inches below existing grade

Ground Water:
40 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey	SOIL LOG TP-6B (Area 6 Basin) Job No: RSC 011.01

Date: 6/15/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" to 0	O-horizon (organic layer)	
0 to 4"	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; many fine to medium roots	
4" to 24"	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; common fine to medium roots	
24" to 34"	Pale yellow (2.5Y 7/4) sand; common, medium, prominent, brownish-yellow (10YR 6/8) mottles; single grain; loose; 60% rounded quartzose gravel, 0.5" to 1" diameter	
34" to 40"	Light gray (10YR 7/2) sand; many, coarse, prominent, yellowish-brown (10YR 5/6) mottles; and many, coarse, distinct, light gray (2.5Y 7/2) mottles; single grain; loose	
40" to 102"	Variegated white (10YR 8/1) and brownish-yellow (10YR 6/6) sandy clay loam; subangular blocky structure; slightly plastic; 40% rounded quartzose gravel, 0.5" to 1" diameter; few white (2.5Y 8/1) sandy clay peds with many, coarse, prominent, yellow (2.5Y 7/6) mottles; slightly plastic	Two undisturbed samples taken at 44"
102" to 108"+	Very pale brown (10YR 8/2) sand; many, coarse, distinct, pale yellow (2.5Y 7/3) mottles; single grain; loose; saturated; few white (2.5Y 8/1) sandy clay peds with many, coarse, prominent, yellow (2.5Y 7/6) mottles; slightly plastic	

Estimated Seasonal High Water Table Observed at:
24 inches below existing grade

Ground Water Observed at:
42 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-6C** **(Area 6 Basin)** Job No: RSC 011.01

Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0		
12	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
15	Dark brown (10YR 3/3) loamy sand; subangular blocky structure; friable; abrupt, wavy boundary	
35	Pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable; gradual, irregular boundary	27 (UD)
48	Variegated light gray (2.5Y 7/2), pale yellow (2.5Y 7/4), and yellowish-brown (10YR 5/6) sand; single grain; loose; moist; 20% medium to coarse rounded quartzose gravel; abrupt, wavy boundary	
102	White (10YR 8/1) sandy clay; common coarse, prominent, yellowish-brown (10YR 5/6) mottles; common fine, prominent, dark yellowish-brown (10YR 4/4) mottles; subangular blocky structure; plastic; saturated; gradual, broken boundary	
114+	Variegated light gray (10YR 7/1) and brownish-yellow (10YR 6/6) coarse sand; single grain; loose; saturated; 30% coarse rounded quartzose gravel	

	Depth (in) below existing grade
Seasonal High Water Table:	35
Ground Water:	47

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-6D** Job No.: RSC 011.01

Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0 – 7	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
7 – 17	Light yellowish-brown (10YR 6/4) loamy sand; weak subangular blocky structure; friable; gradual, wavy boundary	
17 – 42	Yellowish-brown (10YR 5/6) sand; granular structure; weak clay bridging between sand grains; friable; clear, wavy boundary	
42 – 90	Light gray (2.5Y 7/2) sand; common medium, distinct, light yellowish-brown (2.5Y 6/4) mottles; single grain; loose; gradual, smooth boundary	68 (UD)
90 – 114	Pale yellow (2.5Y 7/3) sand; single grain; loose; common peds of variegated light gray (10YR 7/1) and brownish-yellow (10YR 6/6) sandy clay; angular blocky structure; slightly plastic; moist; gradual, irregular boundary	
114 – 126+	Variegated pale yellow (2.5Y 7/3) and brownish-yellow (10YR 6/6) sand; single grain; loose; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	42
Ground Water:	84

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-6E** Job No.: RSC 011.01

Date: 06/14/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0–18	Dark gray (10YR 4/1) sandy loam; subangular blocky structure; friable; mixed with trash (e.g., clam shells, bones, broken dishware, etc.); abrupt, irregular boundary	12 (G)
18–30	Light yellowish-brown (10YR 6/4) loamy sand; weak subangular blocky structure; friable; gradual, wavy boundary	
30–41	Brownish-yellow (10YR 6/6) loamy sand; weak subangular blocky structure; friable; clear, wavy boundary	30 (UD)
41–78	Light yellowish-brown (2.5Y 6/3) loamy sand; common medium, distinct, olive yellow (2.5Y 6/6) mottles; weak subangular blocky structure; moist; clear, wavy boundary	
78–120+	Light gray (2.5Y 7/2) gravelly clay (90% fine rounded quartzose gravel); subangular blocky structure; firm; common peds of variegated light gray (10YR 7/1) and dark gray (10YR 4/1) clay with common medium, distinct, very pale brown (10YR 7/3) mottles; angular blocky structure; plastic; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	41
Ground Water:	63

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-7A** Job No.: RSC 011.01

Date: 06/14/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade	Description	Sample Depth (in)
0		
5	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, irregular boundary	
28	Light yellowish-brown (10YR 6/4) loamy sand; weak subangular blocky structure; friable; gradual, wavy boundary	
37	Variegated yellow (2.5Y 7/6) and pale yellow (2.5Y 7/3) sand; single grain; loose; clear, wavy boundary	
40	Light yellowish-brown (2.5Y 6/4) sand; single grain; loose; 40% medium to coarse rounded quartzose gravel; clear, wavy boundary	
54	Light yellowish-brown (2.5Y 6/4) loamy sand; common fine, prominent, brown (7.5YR 4/4) mottles; weak subangular blocky to granular structure; friable; 20% medium rounded quartzose gravel; clear, irregular boundary	44 (UD)
75	Variegated light yellowish-brown (2.5Y 6/4), light brownish-gray (10YR 6/2), and strong brown (7.5YR 4/6) gravelly sand (60% fine to medium rounded quartzose gravel); single grain; loose; moist; abrupt, wavy boundary	
108+	Light gray (2.5Y 7/2) gravelly clay (90% fine rounded quartzose gravel); subangular blocky structure; firm; common peds of variegated light gray (10YR 7/1) and dark gray (10YR 4/1) clay with common medium, distinct, very pale brown (10YR 7/3) mottles; angular blocky structure; plastic; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	40
Ground Water:	63

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-7B** Job No.: RSC 011.01

Date: 6/14/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2"		
	O-horizon (organic layer)	
0		
	Gray (2.5Y 6/1) loamy sand; weak subangular blocky structure; friable	
4"		
	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; many fine to medium roots	
22"		
	Yellowish-brown (10YR 5/6) loamy sand; subangular blocky structure; friable; 30% rounded quartzose gravel, 0.5" to 1" diameter starting at 30"	Two undisturbed samples taken at 30"
42"		
	Olive yellow (2.5Y 6/6) coarse sand; single grain; loose; 30% rounded quartzose gravel, 0.5" to 1" diameter; moist	
50"		
	Reddish-yellow (7.5YR 6/6) coarse sand; single grain; loose; moist	
52"		
	Pale yellow (2.5Y 7/4) coarse sand; few, medium, prominent, brownish-yellow (10YR 6/6) mottles; single grain, loose; saturated; few, light gray (2.5Y 7/1) sandy clay peds with common, medium, prominent, brownish-yellow (10YR 6/6) mottles; slightly plastic	
58"		
	Variegated light gray (2.5Y 7/1) and light yellowish-brown (2.5Y 6/3) sand; single grain; loose; saturated; and gray (N 8/) silty clay; subangular blocky structure; plastic; saturated	
84"+		

Estimated Seasonal High Water Table Observed at:
52 inches below existing grade

Ground Water Observed at:
61 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey	SOIL LOG TP-7C (Area 7 Basin) Job No: RSC 011.01

Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

Depth	Soil Description	Samples
+"2" / Surface	O-horizon (organic layer)	
8"	Gray (10YR 6/1) fine sand; single grain; loose	
17"	Olive yellow (2.5Y 6/6) loamy sand; subangular blocky structure; friable	Disturbed sample taken at 12"
24"	Pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable	Two (2) undisturbed sample taken at 12" Disturbed sample taken at 20"
40"	Olive yellow (2.5Y 6/6) loamy sand; loamy sand; subangular blocky structure; friable; saturated	
96"+	Mixed layers of: Light gray (2.5Y 7/1) coarse sand; single grain; loose; 20% rounded quartzose pebbles 0.5"- 1" diameter; saturated; and Pale yellow (2.5Y 8/2) coarse sand; single grain; loose; saturated; and few, white (2.5YR 8/1) clay peds; slightly plastic; saturated; and Brownish-yellow (10YR 6/6) striations	

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 40" due to groundwater saturation.

Seasonal High Water Table:
24 inches below existing grade

Ground Water:
24 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-7D (Area 7 Basin)** Job No: RSC 011.01

Date: 6/14/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2"	O-horizon (organic layer)	
0	Gray (2.5Y 6/1) loamy sand; weak subangular blocky structure; friable	
3"	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable	
12"	Yellowish-brown (10YR 5/6) loamy sand; subangular blocky structure; friable	
24"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	
34"	Pale yellow (2.5Y 7/4) loamy sand; few, medium, faint, yellow (2.5Y 7/6) mottles; subangular blocky structure; friable	Two undisturbed samples taken at 36"
40"	Light gray (2.5Y 7/2) silt loam; common, coarse, prominent, yellow (2.5Y 7/6) mottles; subangular blocky structure; friable; saturated	
60"	Variegated light gray (2.5Y 7/1) and light yellowish-brown (2.5Y 6/3) sand; single grain; loose; saturated; and gray (N 8/) silty clay; subangular blocky structure; plastic; saturated	
90"+		

Estimated Seasonal High Water Table Observed at:
34 inches below existing grade

Ground Water Observed at:
66 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey	SOIL LOG TP-7E (Area 7 Basin) Job No: RSC 011.01

Date: 6/14/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" to 0	O-horizon (organic layer)	
0 to 12"	Gray (2.5Y 5/1) loamy sand; weak subangular blocky structure; friable	
12" to 28"	Light yellowish-brown (10YR 6/4) loamy sand; subangular blocky structure; friable; many fine to medium roots	
28" to 39"	Variegated light brownish-gray (10YR 6/2) and pale yellow (2.5Y 7/3) loamy sand; weak, subangular blocky structure	
39" to 45"	Pale brown (10YR 6/3) gravelly sand; single grain; loose; 90% medium to coarse rounded quartzose gravel	
45" to 120"+	Variegated white (10YR 8/1), light yellowish-brown (2.5Y 6/4), and yellowish-brown (10YR 5/6) sandy clay loam; subangular blocky structure; firm-in-place; 40% medium to coarse rounded quartzose gravel	Grab sample taken at 51"

Estimated Seasonal High Water Table Observed at:
28 inches below existing grade

Ground Water Observed at:
51 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey	SOIL LOG TP-10A (Area 10 Basin) Job No: RSC 011.01

Date: 06/15/10
Performed by: Don Brickner
Method: Test pit
Surroundings: Woodland

Depth (in) below existing grade		Sample Depth (in)
0		
7	Gray (10YR 5/1) loamy sand; weak subangular blocky structure; friable; abrupt, wavy boundary	
31	Light yellowish-brown (10YR 6/4) loamy sand; weak subangular blocky structure; friable; gradual, wavy boundary	
43	Brownish-yellow (10YR 6/6) sand; single grain; loose; clear, irregular boundary	
57	Variegated light yellowish-brown (2.5Y 6/3) and light gray (2.5Y 7/2) loamy sand; weak subangular blocky structure; friable; clear, wavy boundary	50 (UD)
75	Light brownish-gray (2.5Y 6/2) coarse sand; few medium, faint, light yellowish-brown (2.5Y 6/4) mottles; single grain; loose; moist; 40% fine to coarse rounded quartzose gravel; abrupt, wavy boundary	
120+	Light gray (2.5Y 7/2) gravelly clay (90% fine rounded quartzose gravel); subangular blocky structure; firm; common peds of variegated light gray (10YR 7/1) and dark gray (10YR 4/1) clay with common medium, distinct, very pale brown (10YR 7/3) mottles; angular blocky structure; plastic; saturated	

	Depth (in) below existing grade
Seasonal High Water Table:	43
Ground Water:	66

Sample codes: G = grab sample, UD = undisturbed sample

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-10B** Job No.: RSC 011.01

Date: 5/5/2010
Performed by: Christopher Andes and Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+"2" to Surface	O-horizon (organic layer)	
Surface to 10"	Gray (10YR 6/1) fine sand; single grain; loose	
10" to 17"	Yellow (2.5Y 7/6) loamy sand; subangular blocky structure; friable	Two (2) unisturbed sample taken at 10" Disturbed sample taken at 14"
17" to 38"	Pale yellow (2.5Y 7/4) loamy sand; subangular blocky structure; friable	Unisturbed sample taken at 16"
38" to 72"	Brownish-yellow (10YR 6/8) coarse sand; single grain; loose; saturated at 40"	
72" to 82"	Variegated Light gray (2.5Y 7/1) and pale yellow (2.5Y 8/2) clay loam; many, coarse, prominent, yellow (10YR 7/8) mottles; subangular blocky structure; slightly plastic; saturated	
82" to 90"	Pale yellow (2.5Y 7/4) sandy clay loam; subangular blocky structure; slightly plastly; saturated	
90" to 96"+	White (2.5Y 8/1) silty clay; common, coarse, prominent, reddish-yellow (5YR 7/8) mottles; subangular blocky structure; plastic; saturated	Disturbed sample taken at 90"

Notes: Test pit left open for approximately 30 minutes.
Test pit began collapsing at approximately 50" due to groundwater saturation.

Seasonal High Water Table:
40 inches below existing grade

Ground Water:
40 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	**Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey**	**SOIL LOG TP-10C (Area 10 Basin)** Job No: RSC 011.01

Date: 6/15/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2"	O-horizon (organic layer)	
0	Gray (2.5Y 5/1) loamy sand; weak subangular blocky structure; friable	
6"	Light yellowish-brown (2.5Y 6/4) loamy sand; subangular blocky structure; friable; many fine to medium roots	
15"	Yellowish-brown (10YR 5/4) loamy sand; subangular blocky structure; friable; many fine to medium roots; 10% fine to medium rounded quartzose gravel	
27"	Pale yellow (2.5Y 7/4) sand; single grain; loose	
40"	Light yellowish-brown (2.5Y 6/3) sand; common, medium, distinct, light gray (10YR 7/1) mottles; single grain; loose	
51"	Pale yellow (2.5Y 7/3) sandy clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) and common, coarse, prominent, white (2.5Y 8/1) mottles; subangular blocky structure; friable	
58"	Gray (10YR 6/1) sandy clay loam; common, medium, faint, gray (10YR 5/1) mottles; subangular blocky structure; friable; few, white (10YR 8/1) clay peds; subangular blocky structure; plastic	Two undisturbed samples taken at 60"
94"	White (10YR 8/1) silty clay; common, medium, prominent, pale yellow (2.5Y 7/4) and yellowish-brown (10YR 5/6) mottles; subangular blocky structure; plastic; saturated	
116"	Light yellowish-brown (2.5Y 6/4) sand; many, medium, distinct, yellow (10YR 7/6) mottles; single grain; loose; saturated; common, white (10YR 8/1) silty clay peds; common, medium, prominent, pale yellow (2.5Y 7/4) and yellowish-brown (10YR 5/6) mottles; subangular blocky structure; plastic; saturated	
130"+		

Estimated Seasonal High Water Table Observed at:
40 inches below existing grade

Ground Water Observed at:
70 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. 2922 ATLANTIC AVE., SUITE 3A ATLANTIC CITY, N.J. 08401	Stormwater Master Plan The Richard Stockton College of NJ Township of Galloway, Atlantic County, New Jersey	SOIL LOG TP-10D (Area 10 Basin) Job No: RSC 011.01

Date: 6/15/2010
Performed by: Ryan Healey
Method: Test Pit
Surroundings: Wooded Upland

+2" to 0	O-horizon (organic layer)	
0 to 4"	Gray (2.5Y 5/1) loamy sand; weak subangular blocky structure; friable	
4" to 27"	Light yellowish-brown (10YR 6/4) loamy sand; subangular blocky structure; friable; many fine to medium roots	
27" to 34"	Variegated light yellowish-brown (2.5Y 6/4) and pale yellow (2.5Y 7/3) gravelly sand; single grain; loose; 80% medium to coarse rounded quartzose gravel	
34" to 42"	Brownish-yellow (10YR 6/6) gravelly sand; single grain; loose; 70% medium to coarse rounded quartzose gravel	Two undisturbed samples taken at 36"
42" to 46"	Pale yellow (2.5Y 7/4) sand; few, medium, distinct, brownish-yellow (10YR 6/6) mottles; single grain; loose	
46" to 64"	Light gray (2.5Y 7/2) sand; few, coarse, faint, white (10YR 8/1) mottles; single grain; loose; saturated	
64" to 90"	White (10YR 8/1) coarse sand; many, medium, prominent, brownish-yellow (10YR 6/6) mottles; single grain; loose; saturated; discontinuous white (10YR 8/1) clay peds; plastic; saturated	
90" to 120"+	Light yellowish-brown (2.5Y 6/4) sand; many, medium, distinct, yellow (10YR 7/6) mottles; single grain; loose; saturated; common, white (10YR 8/1) silty clay peds; common, medium, prominent, pale yellow (2.5Y 7/4) and yellowish-brown (10YR 5/6) mottles; subangular blocky structure; plastic; saturated	

Estimated Seasonal High Water Table Observed at:
42 inches below existing grade

Ground Water Observed at:
51 inches below existing grade

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVE., SUITE 3A** **ATLANTIC CITY, N.J. 08401**	**Stormwater Master Plan** **The Richard Stockton College of NJ** **Township of Galloway,** **Atlantic County, New Jersey**	**SOIL LOG** **TP-10E** **(Area 10 Basin)** Job No: RSC 011.01

Date: 05/22/2009
Performed by: Ryan Healey
Method: hand auger
Surroundings: wooded

Depth	Description
Surface	
	Brown (10 YR 4/3) loamy sand; subangular blocky structure; friable
6"	
	Yellowish-brown (10YR 5/6) loamy sand; subangular blocky structure; friable
34"	
	Light yellowish-brown (2.5Y 6/4) sand; single grain; loose; with 10% medium rounded quartzose gravel
42"	
	Light yellowish-brown (2.5Y 6/4) sand; single grain; loose; common, coarse, distinct, brownish-yellow (10YR 6/6) mottles; saturated
62"	
	Light gray (10YR 7/2) sand; single grain; loose; saturated
68"	
	White (2.5Y 8/1) sand; single grain; loose; saturated
76"	
	Very pale brown (10YR 7/3) sandy clay; very fine granular structure, massive, firm, subangular blocky structure
80"	
	Variegated white (2.5Y 8/1) and light yellowish-brown (2.5Y 6/4) coarse sand; single grain; loose; saturated
88"+	

Seasonal High Water Table:
80 inches below existing grade

Note 1: The clay layer at 76" created a perched condition.

Ground Water:
> than 88 inches below existing grade

Note 2: Boring abandoned, could not overcome moist soil collapse.

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVENUE** **SUITE 3A** **ATLANTIC CITY, NJ 08401**	**Richard Stockton College of NJ** **Development Area 1 (Academic Core)** **Block 875.04, Lot 1.01** **Galloway Township,** **Atlantic County, New Jersey**	**SOIL LOG** **Boring 1** Job No: RSC 011.01

Date: 05/22/2009
Performed by: Ryan Healey
Method: hand auger
Surroundings: wooded

Depth	Description
Surface	
6"	Brown (10 YR 4/3) loamy sand; subangular blocky structure; friable
40"	Yellowish-brown (10YR 5/6) loamy sand; subangular blocky structure; friable
48"	Very pale brown (10YR 7/3) sand; single grain; loose
76"	Light yellowish-brown (2.5Y 5/2) sand; single grain; loose; with 20% organic root matter until 68 inches; with 10% medium rounded quartzose gravel starting at 68 inches; saturated
80"	Light yellowish-brown (2.5Y 5/2) sandy clay; very fine granular structure, massive, firm, subangular blocky structure; saturated
90"+	Pale yellow (2.5Y 7/3) coarse sand; single grain; loose; saturated

Seasonal High Water Table:
> than 90 inches below existing grade

Note 1: The clay layer at 80" created a perched condition.

Ground Water:
> than 90 inches below existing grade

Note 2: Boring abandoned, could not overcome moist soil collapse.

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC. **2922 ATLANTIC AVENUE** **SUITE 3A** **ATLANTIC CITY, NJ 08401**	**Richard Stockton College of NJ** **Development Area 1 (Academic Core)** **Block 875.04, Lot 1.01** **Galloway Township,** **Atlantic County, New Jersey**	**SOIL LOG** **Boring 2** Job No: RSC 011.01

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	3.1	cm	or	1.22	in
Length of Sample	=	12.1	cm	=	4.764	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2A REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **30 in**

3. TYPE OF SAMPLE: UNDISTURBED [ ] DISTURBED [x]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.80 cm
   At the end of each test interval, H_2 = 11.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	43.27	0.721	
0.00	44.39	0.740	
0.00	44.49	0.742	
0.00	44.70	0.745	
0.00	44.58	0.743	0.74

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 3.17 x 4.8 / 0.74 x ln (20.8 / 11.8)

   K = 11.08 in/hr | **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	3.2	cm	or	1.26	in
Length of Sample	=	12.0	cm	=	4.724	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2A REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **30 in**

3. TYPE OF SAMPLE: UNDISTURBED ☐ DISTURBED ☒

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):

   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:

   At the beginning of each test interval, H_1 = 21.10 cm

   At the end of each test interval, H_2 = 12.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	40.02	0.667	
0.00	40.55	0.676	
0.00	40.46	0.674	
0.00	40.83	0.681	
0.00	40.52	0.675	0.67

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

   = 60 min / hr x 0.16 / 3.17 x 4.7 / 0.67 x ln (21.1 / 12.1)

   K = 11.79 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ________ ________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	6.0	cm	or	2.362	in
Length of Sample	=	9.2	cm	=	3.638	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2B REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **66 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.50 cm
   At the end of each test interval, H_2 = 10.70 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	17.66	0.294	
0.00	17.53	0.292	
0.00	17.50	0.292	
0.00	17.63	0.294	
0.00	17.41	0.290	0.29

7. CALCULATION OF PERMEABILITY:

$K, (in/hr) = 60 \text{ min / hr} \times r^2 / R^2 \times L (in) / T (min) \times \ln (H_1/H_2)$

$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 3.6 / 0.29 \times \ln(19.5 / 10.7)$

K = 12.44 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ________

SIGNATURE OF SOIL EVALUATOR ________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.228	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2C REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **22 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.00 cm
   At the end of each test interval, H_2 = 10.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	96.49	1.608	
0.00	96.39	1.607	
0.00	98.42	1.640	
0.00	96.36	1.606	
0.00	97.15	1.619	1.62

7. CALCULATION OF PERMEABILITY:

$$K, \text{(in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 \;/\; 5.76 \times 4.2 \;/\; 1.62 \times \ln(20 \;/\; 10.8)$$

K = 2.69 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.213	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2C REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **22 in**

3. TYPE OF SAMPLE: UNDISTURBED ☐ DISTURBED ☒

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.60 cm
   At the end of each test interval, H_2 = 11.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	97.11	1.619	
0.00	97.93	1.632	
0.00	96.54	1.609	
0.00	98.31	1.639	
0.00	101.24	1.687	1.64

7. CALCULATION OF PERMEABILITY:

$$K,\ (\text{in/hr}) = 60\ \text{min / hr} \times r^2 / R^2 \times L\ (\text{in}) / T\ (\text{min}) \times \ln (H_1/H_2)$$
$$= 60\ \text{min / hr} \times 0.16 / 3.17 \times 4.2 / 1.64 \times \ln (20.6 / 11.4)$$

K = 4.61 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify)

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.213	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2C REPLICATE (letter) B DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **22 in**

3. TYPE OF SAMPLE: UNDISTURBED [ ] DISTURBED [x]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.80 cm
   At the end of each test interval, H_2 = 11.60 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	58.30	0.972	
0.00	58.36	0.973	
0.00	59.58	0.993	
0.00	60.62	1.010	
0.00	60.15	1.003	0.99

7. CALCULATION OF PERMEABILITY:

$$K, \text{(in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 / 3.17 \times 4.2 / 0.99 \times \ln (20.8 / 11.6)$$

K = 7.52 in/hr | **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 2E REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **72 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.80 cm
   At the end of each test interval, H_2 = 10.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	101.97	1.700	
0.00	101.27	1.688	
0.00	101.33	1.689	
0.00	99.14	1.652	
0.00	100.58	1.676	1.68

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.4 / 1.68 x ln (18.8 / 10)

   K = 2.77 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.346	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5A REPLICATE (letter) A DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.20 cm
   At the end of each test interval, H_2 = 10.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	115.40	1.923	
0.00	117.02	1.950	
0.00	116.39	1.940	
0.00	117.49	1.958	
0.00	116.92	1.949	1.94

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.3 / 1.94 x ln (19.2 / 10.4)

K = 2.28 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.4	cm	or	1.732	in
Length of Sample	=	10.8	cm	=	4.268	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5A REPLICATE (letter) B DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.10 cm
   At the end of each test interval, H_2 = 10.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	118.02	1.967	
0.00	119.18	1.986	
0.00	120.87	2.015	
0.00	120.65	2.011	
0.00	121.48	2.025	2.00

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.3 / 2.00 x ln (19.1 / 10.3)

   K = 2.20 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

   [x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
   [ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
   [ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.1	cm	or	1.614	in
Length of Sample	=	11.1	cm	=	4.386	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5B REPLICATE (letter) A DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **84 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.60 cm
   At the end of each test interval, H_2 = 9.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	31.55	0.526	
0.00	32.48	0.541	
0.00	33.25	0.554	
0.00	33.91	0.565	
0.00	30.67	0.511	0.54

7. CALCULATION OF PERMEABILITY:

$$K \text{ (in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.4 / 0.54 \times \ln (18.6 / 9.8)$$

K = 8.68 in/hr | **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.4	cm	or	2.126	in
Length of Sample	=	9.8	cm	=	3.874	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5B REPLICATE (letter) B DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **84 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.90 cm
   At the end of each test interval, H_2 = 10.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	35.30	0.588	
0.00	31.74	0.529	
0.00	32.21	0.537	
0.00	32.70	0.545	
0.00	33.01	0.550	0.55

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 3.9 / 0.55 x ln (18.9 / 10)

K = 7.47 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.2	cm	or	2.047	in
Length of Sample	=	10.0	cm	=	3.953	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5D REPLICATE (letter) A DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **18 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.20 cm
   At the end of each test interval, H_2 = 10.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	20.62	0.344	
0.00	21.65	0.361	
0.00	22.20	0.370	
0.00	21.71	0.362	
0.00	20.62	0.344	0.36

7. CALCULATION OF PERMEABILITY:

$$K, \text{(in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.0 / 0.36 \times \ln (19.2 / 10.4)$$

K = 11.35 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.1	cm	or	2.008	in
Length of Sample	=	10.1	cm	=	3.992	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5D REPLICATE (letter) B DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **18 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.10 cm
   At the end of each test interval, H_2 = 10.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	23.96	0.399	
0.00	24.24	0.404	
0.00	24.94	0.416	
0.00	23.36	0.389	
0.00	23.26	0.388	0.40

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60\ min / hr \times r^2 / R^2 \times L\ (in) / T\ (min) \times \ln (H_1/H_2)$$
$$= 60\ min / hr \times 0.16 / 5.76 \times 4.0 / 0.40 \times \ln (19.1 / 10.4)$$

K = 10.13 in/hr | **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME: Stockton College Stormwater Master Plan   NO. RSC 011.01
MUNICIPALITY: Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.228	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5E   REPLICATE (letter) A   DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL ☐   NATIVE SOIL - (indicate depth) ☒ **84 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒   DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):

   Sample Density Used: ☒ No   ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:

   At the beginning of each test interval, H_1 = 18.80 cm
   At the end of each test interval, H_2 = 9.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	1.73	0.029	
0.00	1.83	0.031	
0.00	1.79	0.030	
0.00	1.80	0.030	
0.00	1.77	0.030	0.03

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.2 / 0.03 x ln (18.8 / 9)

   K = 174.59 in/hr   **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify) ____________	

SIGNATURE OF SOIL EVALUATOR ____[signature]____   DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.228	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5E REPLICATE (letter) B DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **84 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.00 cm
   At the end of each test interval, H_2 = 9.20 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	2.00	0.033	
0.00	2.07	0.035	
0.00	2.04	0.034	
0.00	2.03	0.034	
0.00	2.04	0.034	0.03

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.2 / 0.03 x ln (19 / 9.2)

   K = 150.62 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.6	cm	or	1.417	in
Length of Sample	=	11.6	cm	=	4.583	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5F REPLICATE (letter) A DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **18 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.80 cm
   At the end of each test interval, H_2 = 11.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	77.51	1.292	
0.00	77.32	1.289	
0.00	77.66	1.294	
0.00	79.50	1.325	
0.00	78.38	1.306	1.30

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.6 / 1.30 x ln (19.8 / 11)

K = 3.45 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.1	cm	or	1.614	in
Length of Sample	=	11.1	cm	=	4.386	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5F REPLICATE (letter) B DATE COLLECTED 6/22/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **18 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.60 cm
   At the end of each test interval, H_2 = 10.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	75.21	1.254	
0.00	76.49	1.275	
0.00	77.05	1.284	
0.00	77.05	1.284	
0.00	77.94	1.299	1.28

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.4 / 1.28 x ln (19.6 / 10.8)

   K = 3.41 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ________ ________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.8	cm	or	1.496	in
Length of Sample	=	11.4	cm	=	4.504	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5G REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **76 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.80 cm
   At the end of each test interval, H_2 = 9.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	37.04	0.617	
0.00	34.07	0.568	
0.00	34.14	0.569	
0.00	33.93	0.566	
0.00	34.95	0.583	0.58

7. CALCULATION OF PERMEABILITY:

$$K, \text{(in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.5 / 0.58 \times \ln (18.8 / 9)$$

K = 9.53 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	________

SIGNATURE OF SOIL EVALUATOR ________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5G REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **76 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.10 cm
   At the end of each test interval, H_2 = 9.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	30.29	0.505	
0.00	30.19	0.503	
0.00	29.91	0.499	
0.00	29.91	0.499	
0.00	29.70	0.495	0.50

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.4 / 0.50 x ln (19.1 / 9.3)

K = 10.62 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.228	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5H REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **50 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.20 cm
   At the end of each test interval, H_2 = 10.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	53.21	0.887	
0.00	52.99	0.883	
0.00	53.24	0.887	
0.00	53.54	0.892	
0.00	53.09	0.885	0.89

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

= 60 min / hr x 0.16 / 5.76 x 4.2 / 0.89 x ln (19.2 / 10)

K = 5.18 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____ ____

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.6	cm	or	1.417	in
Length of Sample	=	11.6	cm	=	4.583	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5J REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **72 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.60 cm
   At the end of each test interval, H_2 = 10.70 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	18.61	0.310	
0.00	20.15	0.336	
0.00	19.28	0.321	
0.00	20.15	0.336	
0.00	20.81	0.347	0.33

7. CALCULATION OF PERMEABILITY:

$$K,\ (\text{in/hr}) = 60\ \text{min / hr} \times r^2 / R^2 \times L\ (\text{in}) / T\ (\text{min}) \times \ln (H_1/H_2)$$
$$= 60\ \text{min / hr} \times 0.16\ /\ 5.76\ \times 4.6\ /\ 0.33\ \times \ln(\ 19.6\ /\ 10.7\ )$$

K = 14.01 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.4	cm	or	1.732	in
Length of Sample	=	10.8	cm	=	4.268	in

TUBE PERMEAMETER TEST DATA

1. TEST # 5J REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **72 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.10 cm
   At the end of each test interval, H_2 = 9.20 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	16.23	0.271	
0.00	17.28	0.288	
0.00	17.08	0.285	
0.00	17.07	0.285	
0.00	17.25	0.288	0.28

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.3 / 0.28 x ln (18.1 / 9.2)

   K = 17.01 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6A REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **20 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.30 cm
   At the end of each test interval, H_2 = 10.50 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	108.49	1.808	
0.00	106.47	1.775	
0.00	108.92	1.815	
0.00	107.62	1.794	
0.00	106.98	1.783	1.79

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.4 / 1.79 x ln (19.3 / 10.5)

K = 2.50 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.3	cm	or	1.693	in
Length of Sample	=	10.9	cm	=	4.307	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6A REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **20 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.30 cm
   At the end of each test interval, H_2 = 10.50 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	51.89	0.865	
0.00	51.82	0.864	
0.00	52.27	0.871	
0.00	51.47	0.858	
0.00	57.48	0.958	0.88

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.3 / 0.88 x ln (19.3 / 10.5)

   K = 4.95 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.409	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6B REPLICATE (letter) B DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **12 in**

3. TYPE OF SAMPLE: UNDISTURBED [ ] DISTURBED [x]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.20 cm
   At the end of each test interval, H_2 = 11.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	139.33	2.322	
0.00	135.33	2.256	
0.00	134.96	2.249	
0.00	136.65	2.278	
0.00	137.68	2.295	2.28

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60\ min/hr \times r^2 / R^2 \times L\ (in) / T\ (min) \times \ln (H_1/H_2)$$
$$= 60\ min/hr \times 0.16 / 3.17 \times 4.4 / 2.28 \times \ln(20.2 / 11.3)$$

K = 3.40 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.331	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6B REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **12 in**

3. TYPE OF SAMPLE: UNDISTURBED [ ] DISTURBED [x]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.60 cm
   At the end of each test interval, H_2 = 11.70 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	161.33	2.689	
0.00	164.71	2.745	
0.00	163.52	2.725	
0.00	167.08	2.785	
0.00	166.31	2.772	2.74

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 3.17 x 4.3 / 2.74 x ln (20.6 / 11.7)

K = 2.70 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.8	cm	or	1.89	in
Length of Sample	=	10.4	cm	=	4.11	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6C REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
FILL ☐ NATIVE SOIL - (indicate depth) ☒ **42 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H_1 = 19.60 cm
At the end of each test interval, H_2 = 10.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	50.45	0.841	
0.00	51.58	0.860	
0.00	51.55	0.859	
0.00	52.48	0.875	
0.00	53.80	0.897	0.87

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.1 / 0.87 x ln (19.6 / 10.8)

K = 4.71 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.30	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.346	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6C REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **42 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.60 cm
   At the end of each test interval, H_2 = 10.80 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	20.17	0.336	
0.00	20.55	0.343	
0.00	20.43	0.341	
0.00	21.39	0.357	
0.00	21.58	0.360	0.35

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.29 x 4.3 / 0.35 x ln (19.6 / 10.8)

   K = 13.54 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6D REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **27 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.10 cm
   At the end of each test interval, H_2 = 10.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	69.52	1.159	
0.00	69.80	1.163	
0.00	70.24	1.171	
0.00	70.87	1.181	
0.00	71.64	1.194	1.17

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.4 / 1.17 x ln(19.1 / 10.3)

K = 3.88 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.5	cm	or	1.772	in
Length of Sample	=	10.7	cm	=	4.228	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6D REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **27 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.30 cm
   At the end of each test interval, H_2 = 10.50 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	62.80	1.047	
0.00	62.89	1.048	
0.00	63.09	1.052	
0.00	62.41	1.040	
0.00	63.55	1.059	1.05

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.2 / 1.05 \times \ln (19.3 / 10.5)$$

K = 4.09 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.0	cm	or	1.969	in
Length of Sample	=	10.2	cm	=	4.031	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6E REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **68 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.30 cm
   At the end of each test interval, H_2 = 10.50 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	3.71	0.062	
0.00	3.74	0.062	
0.00	3.79	0.063	
0.00	3.78	0.063	
0.00	3.78	0.063	0.06

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

= 60 min / hr x 0.16 / 5.76 x 4.0 / 0.06 x ln (19.3 / 10.5)

K = 65.27 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.8	cm	or	1.89	in
Length of Sample	=	10.4	cm	=	4.11	in

TUBE PERMEAMETER TEST DATA

1. TEST # 6E REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **68 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.90 cm
   At the end of each test interval, H_2 = 11.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	3.02	0.050	
0.00	2.95	0.049	
0.00	3.02	0.050	
0.00	2.96	0.049	
0.00	2.99	0.050	0.05

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

= 60 min / hr x 0.16 / 5.76 x 4.1 / 0.05 x ln (19.9 / 11.1)

K = 80.30 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.3	cm	or	2.087	in
Length of Sample	=	9.9	cm	=	3.913	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7A REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **30 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.80 cm
   At the end of each test interval, H_2 = 11.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	194.21	3.237	
0.00	185.67	3.095	
0.00	187.93	3.132	
0.00	187.30	3.122	
0.00	188.05	3.134	3.14

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 3.9 / 3.14 x ln (19.8 / 11)

K = 1.22 in/hr **Soil Permeability Class = K2**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.3	cm	or	1.693	in
Length of Sample	=	10.9	cm	=	4.307	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7A REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **30 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.40 cm
   At the end of each test interval, H_2 = 10.60 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	150.05	2.501	
0.00	157.02	2.617	
0.00	158.68	2.645	
0.00	159.89	2.665	
0.00	159.02	2.650	2.62

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

= 60 min / hr x 0.16 / 5.76 x 4.3 / 2.62 x ln (19.4 / 10.6)

K = 1.66 in/hr **Soil Permeability Class = K2**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify) ______	

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.346	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7B REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **44 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.20 cm
   At the end of each test interval, H_2 = 10.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	13.41	0.224	
0.00	13.67	0.228	
0.00	13.51	0.225	
0.00	13.97	0.233	
0.00	13.81	0.230	0.23

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.3 / 0.23 \times \ln(19.2 / 10.4)$$

K = 19.49 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7B REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **44 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.10 cm
   At the end of each test interval, H_2 = 10.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	74.42	1.240	
0.00	75.90	1.265	
0.00	76.28	1.271	
0.00	75.71	1.262	
0.00	76.04	1.267	1.26

7. CALCULATION OF PERMEABILITY:

$$K,\ (in/hr) = 60\ min/hr \times r^2 / R^2 \times L\ (in) / T\ (min) \times \ln (H_1/H_2)$$
$$= 60\ min/hr \times 0.16 / 5.76 \times 4.4 / 1.26 \times \ln (19.1 / 10.3)$$

K = 3.61 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.5	cm	or	1.378	in
Length of Sample	=	11.7	cm	=	4.622	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7C REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **30 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.60 cm
   At the end of each test interval, H_2 = 10.70 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	17.25	0.288	
0.00	17.35	0.289	
0.00	17.29	0.288	
0.00	17.32	0.289	
0.00	17.35	0.289	0.29

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.6 / 0.29 x ln (19.6 / 10.7)

K = 16.16 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify) ____________	

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.8	cm	or	1.496	in
Length of Sample	=	11.4	cm	=	4.504	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7C REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **30 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.10 cm
   At the end of each test interval, H_2 = 11.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	39.84	0.664	
0.00	37.64	0.627	
0.00	37.96	0.633	
0.00	38.58	0.643	
0.00	38.58	0.643	0.64

7. CALCULATION OF PERMEABILITY:

$$K \text{ (in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln(H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.5 / 0.64 \times \ln(20.1 / 11.3)$$

K = 6.73 in/hr **Soil Permeability Class = K4**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.346	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7D REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **18 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 21.40 cm
   At the end of each test interval, H_2 = 12.20 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	101.81	1.697	
0.00	102.69	1.712	
0.00	101.63	1.694	
0.00	101.94	1.699	
0.00	102.09	1.702	1.70

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.3 / 1.70 \times \ln (21.4 / 12.2)$$

K = 2.39 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.346	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7D REPLICATE (letter) B DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **18 in**

3. TYPE OF SAMPLE: UNDISTURBED ☒ DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 21.30 cm
   At the end of each test interval, H_2 = 12.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	99.43	1.657	
0.00	100.11	1.669	
0.00	99.45	1.658	
0.00	99.97	1.666	
0.00	100.55	1.676	1.67

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

= 60 min / hr x 0.16 / 5.76 x 4.3 / 1.67 x ln (21.3 / 12.1)

K = 2.46 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil
☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts
☐ Smearing ☐ Compaction ☐ Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.331	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7D REPLICATE (letter) B DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **20 in**

3. TYPE OF SAMPLE: UNDISTURBED ☐ DISTURBED ☒

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):

   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:

   At the beginning of each test interval, H_1 = 21.30 cm

   At the end of each test interval, H_2 = 12.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	99.43	1.657	
0.00	100.11	1.669	
0.00	99.45	1.658	
0.00	99.97	1.666	
0.00	100.55	1.676	1.67

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

   = 60 min / hr x 0.16 / 3.17 x 4.3 / 1.67 x ln (21.3 / 12.1)

   K = 4.45 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	4.2	cm	or	1.654	in
Length of Sample	=	11.0	cm	=	4.331	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7D REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **20 in**

3. TYPE OF SAMPLE: UNDISTURBED [ ] DISTURBED [x]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 21.40 cm
   At the end of each test interval, H_2 = 12.20 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	101.81	1.697	
0.00	102.69	1.712	
0.00	101.63	1.694	
0.00	101.94	1.699	
0.00	102.09	1.702	1.70

7. CALCULATION OF PERMEABILITY:

$$K, \text{(in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 / 3.17 \times 4.3 / 1.70 \times \ln (21.4 / 12.2)$$

K = 4.33 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.0	cm	or	1.181	in
Length of Sample	=	12.2	cm	=	4.819	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7E REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.00 cm
   At the end of each test interval, H_2 = 10.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	16.06	0.268	
0.00	15.26	0.254	
0.00	16.06	0.268	
0.00	15.92	0.265	
0.00	16.13	0.269	0.26

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.8 / 0.26 x ln (20 / 10.1)

K = 20.72 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify)

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.30	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.5	cm	or	1.378	in
Length of Sample	=	11.7	cm	=	4.622	in

TUBE PERMEAMETER TEST DATA

1. TEST # 7E REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.80 cm
   At the end of each test interval, H_2 = 11.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	9.27	0.155	
0.00	9.52	0.159	
0.00	9.47	0.158	
0.00	9.38	0.156	
0.00	9.51	0.159	0.16

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.29 x 4.6 / 0.16 x ln (19.8 / 11)

K = 31.37 in/hr | **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	3.5	cm	or	1.378	in
Length of Sample	=	11.7	cm	=	4.606	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10A REPLICATE (letter) A DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **51 in**

3. TYPE OF SAMPLE: UNDISTURBED ☐ DISTURBED ☒

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):

   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:

   At the beginning of each test interval, $H_1 =$ 21.10 cm
   At the end of each test interval, $H_2 =$ 12.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	109.98	1.833	
0.00	109.30	1.822	
0.00	109.47	1.825	
0.00	110.06	1.834	
0.00	109.34	1.822	1.83

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 3.17 x 4.6 / 1.83 x ln (21.1 / 12.1)

   K = 4.25 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

☒ None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01

MUNICIPALITY Township of Galloway, Atlantic County, New Jersey

BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	1.78	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	5.984	in
Height of Tube After Sample is Added	=	3.8	cm	or	1.496	in
Length of Sample	=	11.4	cm	=	4.488	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10A REPLICATE (letter) B DATE COLLECTED 6/14/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) ☒ **51 in**

3. TYPE OF SAMPLE: UNDISTURBED ☐ DISTURBED ☒

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):

   Sample Density Used: ☒ No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:

   At the beginning of each test interval, H_1 = 21.30 cm

   At the end of each test interval, H_2 = 12.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	102.20	1.703	
0.00	102.90	1.715	
0.00	103.18	1.720	
0.00	102.99	1.717	
0.00	102.43	1.707	1.71

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)

   = 60 min / hr x 0.16 / 3.17 x 4.5 / 1.71 x ln (21.3 / 12.3)

   K = 4.36 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

   ☒ None ☐ Cracks ☐ Worm Channels ☐ Dry Soil

   ☐ Root Channels ☐ Large Gravel ☐ Large Roots ☐ Soil / Tube Contacts

   ☐ Smearing ☐ Compaction ☐ Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR ______ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.2	cm	or	2.047	in
Length of Sample	=	10.0	cm	=	3.953	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10B REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **50 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.00 cm
   At the end of each test interval, H_2 = 11.20 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	60.21	1.004	
0.00	59.80	0.997	
0.00	60.02	1.000	
0.00	60.42	1.007	
0.00	61.05	1.018	1.01

7. CALCULATION OF PERMEABILITY:

   K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
   = 60 min / hr x 0.16 / 5.76 x 4.0 / 1.01 x ln (20 / 11.2)

   K = 3.80 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.30	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	5.8	cm	or	2.283	in
Length of Sample	=	9.4	cm	=	3.717	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10B REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **50 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.90 cm
   At the end of each test interval, H_2 = 11.10 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	47.52	0.792	
0.00	45.68	0.761	
0.00	47.95	0.799	
0.00	46.27	0.771	
0.00	46.67	0.778	0.78

7. CALCULATION OF PERMEABILITY:

$$K\text{, (in/hr)} = 60 \text{ min / hr} \times r^2 / R^2 \times L \text{ (in)} / T \text{ (min)} \times \ln (H_1/H_2)$$

$$= 60 \text{ min / hr} \times 0.16 / 5.29 \times 3.7 / 0.78 \times \ln(19.9 / 11.1)$$

K = 5.05 in/hr **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify) ____________	

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10C REPLICATE (letter) A DATE COLLECTED 5/5/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **16 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 20.00 cm
   At the end of each test interval, H_2 = 11.40 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	100.58	1.676	
0.00	99.58	1.660	
0.00	103.88	1.731	
0.00	103.95	1.733	
0.00	101.24	1.687	1.70

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.4 / 1.70 x ln (20 / 11.4)

K = 2.44 in/hr | **Soil Permeability Class = K3**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ______ ______

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	3.2	cm	or	1.26	in
Length of Sample	=	12.0	cm	=	4.74	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10D REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL ☐ NATIVE SOIL - (indicate depth) [x] **60 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED ☐

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No ☐ Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 18.80 cm
   At the end of each test interval, H_2 = 10.00 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	5.88	0.098	
0.00	5.87	0.098	
0.00	5.95	0.099	
0.00	6.13	0.102	
0.00	5.91	0.099	0.10

7. CALCULATION OF PERMEABILITY:

K, (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.76 x 4.7 / 0.10 x ln (18.8 / 10)

K = 50.31 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	☐ Cracks	☐ Worm Channels	☐ Dry Soil
☐ Root Channels	☐ Large Gravel	☐ Large Roots	☐ Soil / Tube Contacts
☐ Smearing	☐ Compaction	☐ Other (Specify)	______

SIGNATURE OF SOIL EVALUATOR [signature] DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME **Stockton College Stormwater Master Plan** NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.40	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.0	cm	or	1.575	in
Length of Sample	=	11.2	cm	=	4.425	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10E REPLICATE (letter) A DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, $H_1 =$ 20.10 cm
   At the end of each test interval, $H_2 =$ 11.30 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	7.55	0.126	
0.00	7.34	0.122	
0.00	7.46	0.124	
0.00	7.42	0.124	
0.00	7.46	0.124	0.12

7. CALCULATION OF PERMEABILITY:

$$K, (in/hr) = 60 \text{ min / hr} \times r^2 / R^2 \times L (in) / T (min) \times \ln (H_1/H_2)$$
$$= 60 \text{ min / hr} \times 0.16 / 5.76 \times 4.4 / 0.12 \times \ln (20.1 / 11.3)$$

K = 34.23 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None	[ ] Cracks	[ ] Worm Channels	[ ] Dry Soil
[ ] Root Channels	[ ] Large Gravel	[ ] Large Roots	[ ] Soil / Tube Contacts
[ ] Smearing	[ ] Compaction	[ ] Other (Specify)	____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

PERMEABILITY TEST RESULTS

PROJECT NAME Stockton College Stormwater Master Plan NO. RSC 011.01
MUNICIPALITY Township of Galloway, Atlantic County, New Jersey
BLOCK ____________ ____________

SAMPLE AND EQUIPMENT DATA

Radius of Permeameter Tube	=	0.40	cm			
Radius of Thin Walled Sample Tube	=	2.30	cm			
Height of Tube Before Sample is Added	=	15.2	cm	or	6.00	in
Height of Tube After Sample is Added	=	4.1	cm	or	1.614	in
Length of Sample	=	11.1	cm	=	4.386	in

TUBE PERMEAMETER TEST DATA

1. TEST # 10E REPLICATE (letter) B DATE COLLECTED 6/15/2010

2. MATERIAL TESTED
   FILL [ ] NATIVE SOIL - (indicate depth) [x] **36 in**

3. TYPE OF SAMPLE: UNDISTURBED [x] DISTURBED [ ]

4. BULK DENSITY DETERMINATION (Disturbed Samples Only):
   Sample Density Used: [x] No [ ] Yes

5. HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
   At the beginning of each test interval, H_1 = 19.70 cm
   At the end of each test interval, H_2 = 10.90 cm

6. RATE OF WATER LEVEL DROP:

TIME T_1 (start of test interval)	TIME T_2 (end of test interval)	TIME T_3 (interval in minutes)	AVERAGE T (minutes)
0.00	8.84	0.147	
0.00	8.77	0.146	
0.00	9.05	0.151	
0.00	8.93	0.149	
0.00	8.96	0.149	0.15

7. CALCULATION OF PERMEABILITY:

K_i (in/hr) = 60 min / hr x r^2 / R^2 x L (in) / T (min) x ln (H_1/H_2)
= 60 min / hr x 0.16 / 5.29 x 4.4 / 0.15 x ln (19.7 / 10.9)

K = 31.72 in/hr **Soil Permeability Class = K5**

8. DEFECTS IN THE SAMPLE (Check the appropriate items)

[x] None [ ] Cracks [ ] Worm Channels [ ] Dry Soil
[ ] Root Channels [ ] Large Gravel [ ] Large Roots [ ] Soil / Tube Contacts
[ ] Smearing [ ] Compaction [ ] Other (Specify) ____________

SIGNATURE OF SOIL EVALUATOR ____________ DATE 7/12/2010

MARATHON ENGINEERING & ENVIRONMENTAL SERVICES, INC.

GROUNDWATER MOUNDING ANALYSIS

Marathon completed a groundwater mounding analysis of the largest design volumes proposed for infiltration in the proposed stormwater management infiltration basins for the Richard Stockton College of New Jersey 2010 Stormwater Master Plan using the computer model found in Ground Water, Volume 22, Number 1, published by Molden, Sunada and Warner. For this analysis, Marathon utilized the volume below the basin spillways calculated in Appendix B of the Stormwater Compliance Statement. The volume of runoff was then divided by the area of the bottom of the infiltration basin over the required infiltration time of 72 hours to determine the recharge rate as given in the table below:

Basin Description	Maximum 100-year design volume (cubic feet)	Basin bottom area (square feet)	Recharge rate (ft/day)
Basin 2	195,075	248,747	0.26
Basin 5 East	391,517	261,467	0.50
Basin 5 West	264,621	147,243	0.60
Basin 6	395,981	252,550	0.52
Basin 7	205,116	212,335	0.32
Basin 10	124,920	178,015	0.23

Marathon determined the aquifer thickness to be 200 feet beneath the Subject Property through a review of well logs for Well 01-180 identified as USGS Oceanville 1 located in Galloway Township, Atlantic County, New Jersey. The well log was presented in the report entitled "Hydrogeologic Framework of the New Jersey Coastal Plain, United States Geological Survey Open File Report 84-730." Marathon used the average tested permeability rate for the soil to remain in the basin footprint, as provided in the stormwater report referenced above, as the hydraulic conductivity. Transmissivity was calculated by multiplying the tested hydraulic conductivity by the aquifer thickness for a value in the basin footprint as given in the table below:

Basin Description	Average Tested Hydraulic Conductivity		Transmissivity (square ft/day)
	(in/hr)	(ft/day)	
Basin 2	7.56	15.11	3023
Basin 5 East	7.02	14.04	2807
Basin 5 West	9.03	18.06	3612
Basin 6	4.97	9.94	1989
Basin 7	6.25	12.50	2500
Basin 10	3.98	7.96	1592

Utilizing the values obtained and the program described above, groundwater mounding for the maximum volume retained and infiltrated in the stormwater management basins was determined to not cause stormwater or groundwater to breakout to the land surface or cause adverse impacts to adjacent water bodies, wetlands, or subsurface structures.

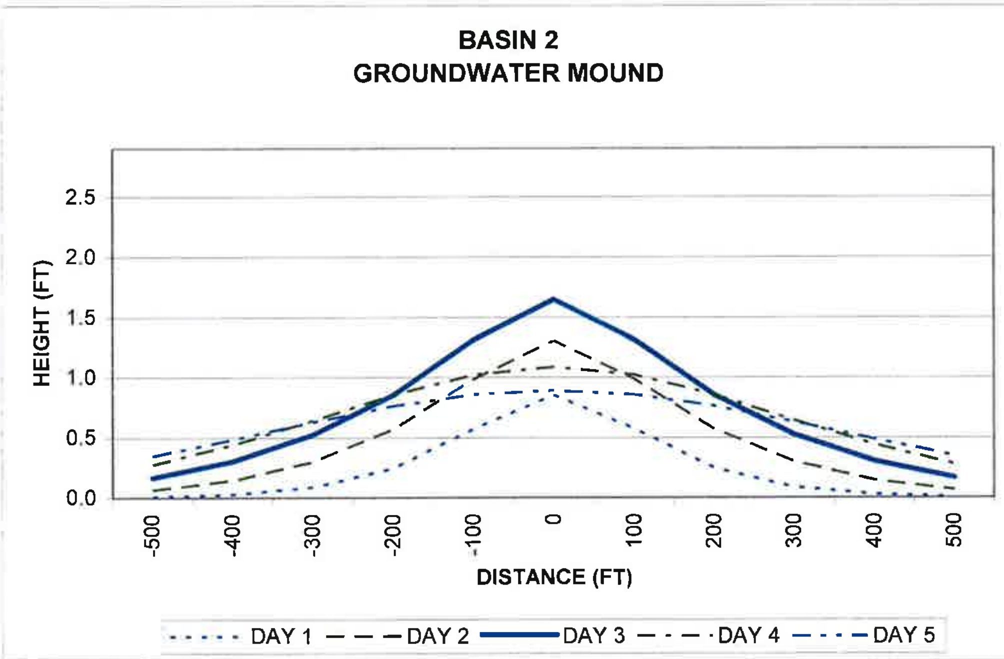
GROUNDWATER MOUNDING ANALYSIS

The following tables and graphs depict the results of the calculations for the groundwater mounding associated with the infiltration volume in the basin. Please note that the height of the groundwater mound is assumed to start at the estimated seasonal high water table elevation, as provided in the stormwater report referenced above, and the center of the subject basin. Both points are assigned a value of zero (0):

VARIABLE		BASIN 2	BASIN 5E	BASIN 5W	BASIN 6	BASIN 7	BASIN 10
RECHARGE RATE	(FT/DAY)	0.26	0.21	0.26	0.16	0.32	0.23
TRANSMISSIVITY	(SF/DAY)	3023	2807	3612	1989	2500	1592
SPECIFIC YIELD		0.15	0.15	0.15	0.15	0.15	0.15
BEGINNING TIME	(DAY)	1	1	1	1	1	1
FINAL TIME	(DAYS)	5	9	9	12	5	5
TIME INCREMENT	(DAY)	1	1	1	1	1	1
END OF RECHARGE TIME	(DAYS)	3	7	7	10	3	3
BEGINNING DISTANCE	(FT)	0	0	0	0	0	0
FINAL DISTANCE	(FT)	500	500	500	500	500	500
DISTANCE INCREMENT	(FT)	100	100	100	100	100	100
AVG DEPTH TO ESHWT	(FT)	2.90	2.50	2.30	2.80	2.70	3.10
BASIN WIDTH	(FT)	160	350	200	400	200	230
BASIN LENGTH	(FT)	2000	700	740	850	1300	800

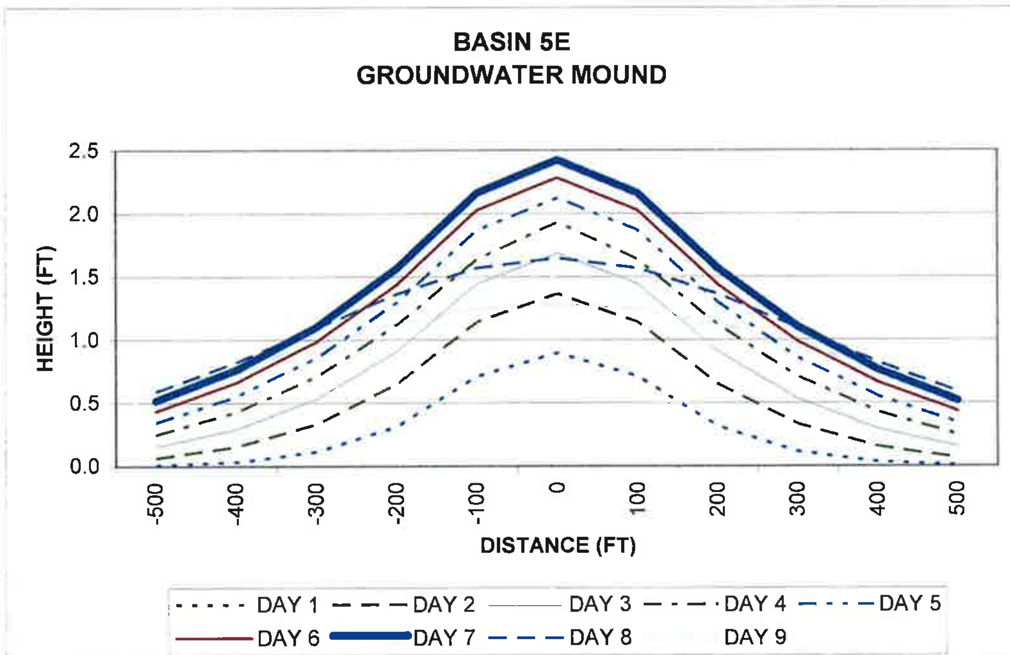
GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 2**				
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
0	0.851	1.299	1.645	1.085	0.891
100	0.573	0.985	1.314	1.022	0.857
200	0.250	0.570	0.854	0.857	0.764
300	0.091	0.303	0.525	0.646	0.632
400	0.028	0.148	0.305	0.443	0.487
500	0.007	0.066	0.167	0.281	0.350



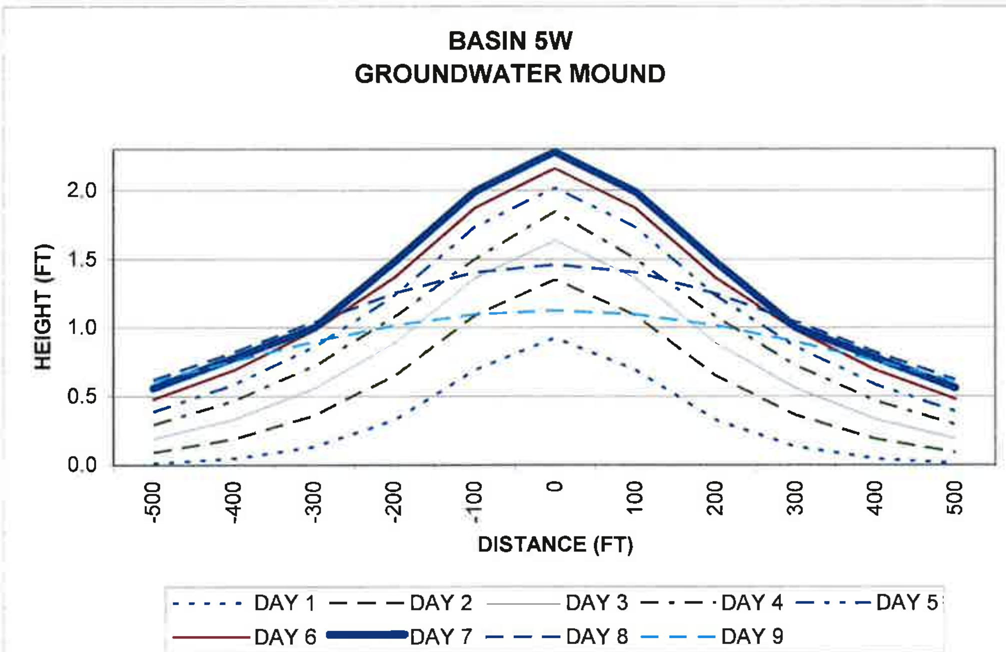
GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 5E**								
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	DAY 8	DAY 9
0	0.897	1.367	1.686	1.927	2.121	2.283	2.422	1.647	1.287
100	0.711	1.142	1.445	1.637	1.866	2.024	2.161	1.570	1.246
200	0.317	0.651	0.910	1.118	1.297	1.438	1.567	1.364	1.132
300	0.116	0.334	0.535	0.708	0.857	0.988	1.104	1.093	0.969
400	0.035	0.157	0.297	0.431	0.553	0.664	0.764	0.822	0.785
500	0.009	0.067	0.156	0.251	0.345	0.435	0.519	0.589	0.605



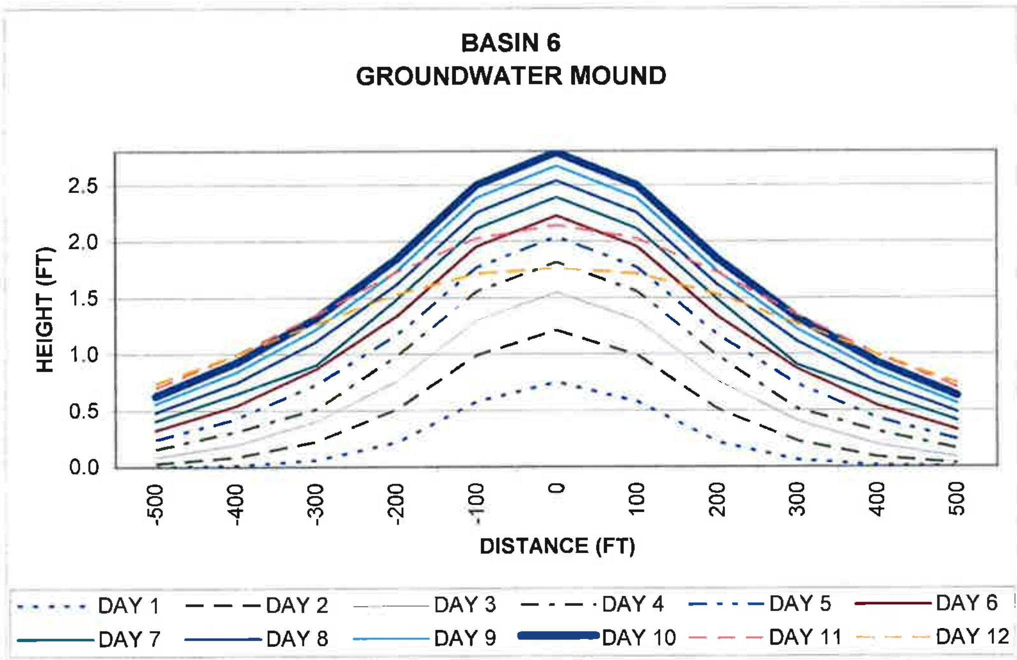
GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 5W**								
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	DAY 8	DAY 9
0	0.924	1.351	1.634	1.846	2.016	2.157	2.278	1.460	1.127
100	0.691	1.089	1.365	1.500	1.732	1.871	1.990	1.403	1.099
200	0.328	0.650	0.890	1.079	1.234	1.365	1.478	1.251	1.018
300	0.136	0.364	0.559	0.722	0.860	0.979	1.000	1.042	0.898
400	0.048	0.190	0.336	0.469	0.586	0.691	0.781	0.822	0.758
500	0.015	0.092	0.194	0.295	0.391	0.480	0.561	0.621	0.613



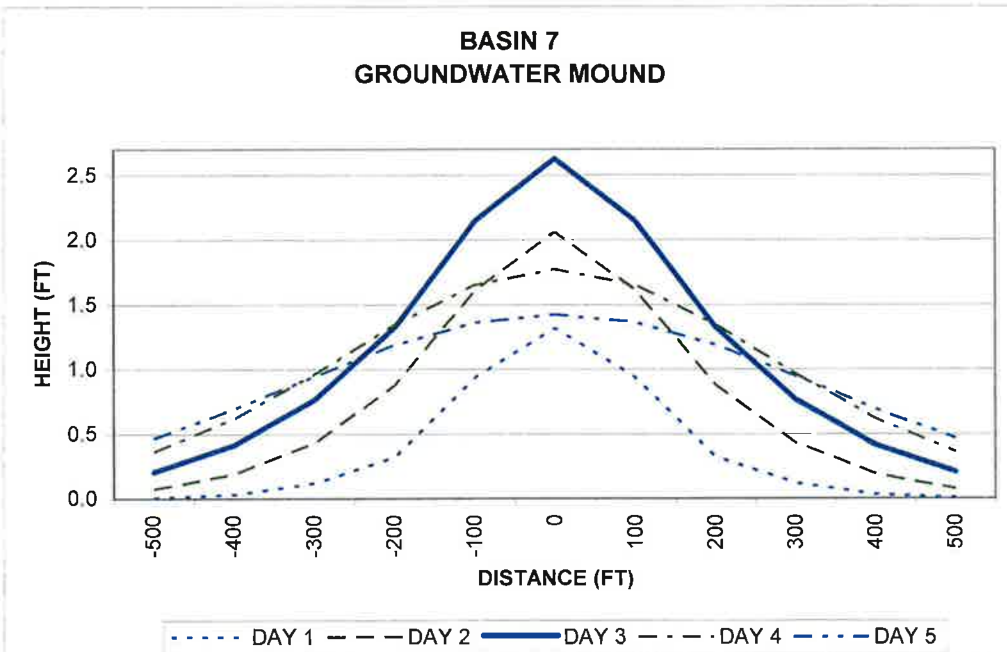
GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 6**											
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	DAY 8	DAY 9	DAY 10	DAY 11	DAY 12
0	0.752	1.210	1.548	1.815	2.037	2.225	2.390	2.536	2.666	2.785	2.142	1.763
100	0.579	0.988	1.302	1.556	1.769	1.952	2.111	2.254	2.382	2.498	2.026	1.715
200	0.219	0.509	0.763	0.981	1.169	1.335	1.482	1.614	1.734	1.843	1.725	1.529
300	0.063	0.227	0.406	0.514	0.728	0.868	0.900	1.112	1.220	1.319	1.349	1.271
400	0.014	0.089	0.198	0.315	0.432	0.542	0.647	0.746	0.838	0.925	0.993	0.995
500	0.002	0.030	0.088	0.162	0.243	0.326	0.407	0.486	0.562	0.630	0.702	0.741



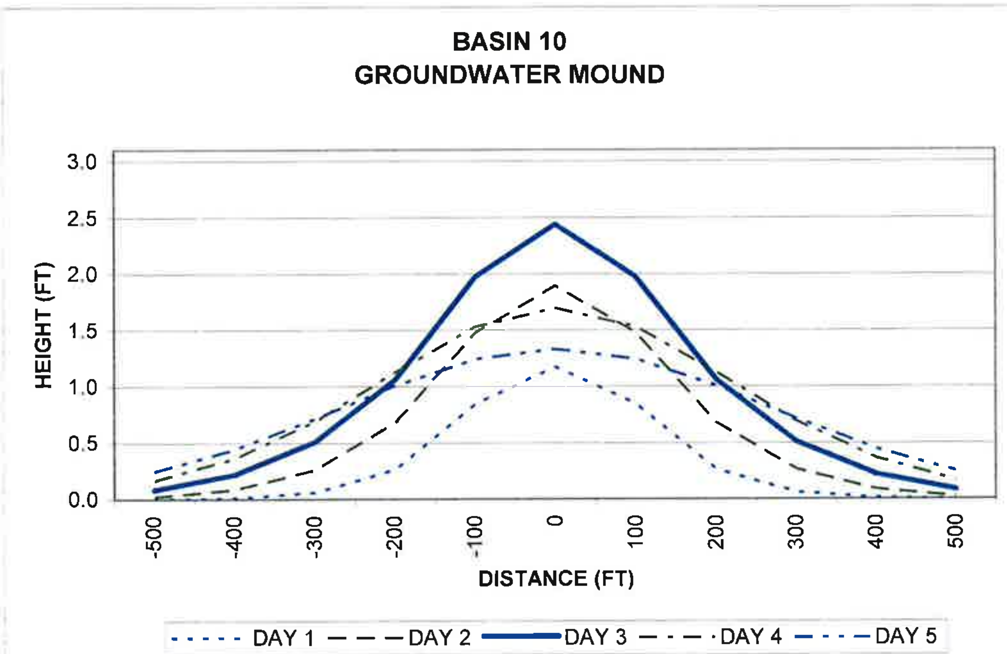
GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 7**				
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
0	1.317	2.060	2.627	1.774	1.426
100	0.937	1.610	2.144	1.653	1.362
200	0.324	0.877	1.325	1.343	1.187
300	0.123	0.433	0.767	0.963	0.947
400	0.032	0.192	0.415	0.619	0.693
500	0.007	0.076	0.208	0.364	0.469



GROUNDWATER MOUNDING ANALYSIS

DISTANCE FROM CENTER OF BASIN (FT)	HEIGHT OF MOUND (FT) - **BASIN 10**				
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
0	1.170	1.896	2.437	1.698	1.331
100	0.846	1.476	1.971	1.530	1.241
200	0.268	0.680	1.060	1.126	1.007
300	0.061	0.266	0.510	0.692	0.716
400	0.010	0.088	0.221	0.366	0.448
500	0.001	0.024	0.085	0.171	0.250



APPENDIX E

Pinelands Stormwater Checklist

STORMWATER CHECKLIST
(Part 1)

Stormwater Management Information Required to Be Submitted to Commission and Municipality for Review

The following checklist identifies the stormwater management standards that an applicant must address to complete an application with the Pinelands Commission and the concerned municipality (each "Item #" is cross-referenced in the attached Reference Guide).

Note that the stormwater management standards need not be addressed if either:

- The proposed development is minor residential development, resulting in less than five lots or dwelling units, *and* the development does not involve the construction of any new roads; *OR*
- The development proposed is minor non-residential development, *and* the development does not involve the grading, clearing or disturbance of an area in excess of 5,000 square feet within any five-year period.

Item #	Addressed	Description
1.	☑	**Calculations demonstrating that the proposed development meets one of the following three stormwater runoff rate standards:**
	☑	Post-development hydrographs for the 2, 10 and 100-year storms of 24-hour duration will not exceed the predevelopment runoff hydrographs at any point in time [N.J.A.C. 7:50-6.84(a)6ii(1)].
	☐	No increase in pre-development rates from the 2, 10 and 100 year storms will occur. In addition, any increase in stormwater volume for these storms will not increase flood damage at or downstream of the parcel [N.J.A.C. 7:50-6.84(a)6ii(2)].
	☑	The peak post-development runoff from the 2, 10 and 100-year storms will be 50%, 75% and 80% respectively of the pre-development peak rates for the same storms [N.J.A.C. 7:50-6.84(a)6ii(3)].
2.	☑	**Calculations demonstrating that the total runoff volume generated from the net increase in impervious surfaces by a 10-year storm of 24-hour duration will be retained and infiltrated on site.**
3.	☑	**Information (soil logs) demonstrating that the lowest point of infiltration of each structural stormwater management measure (e.g. swales, basins, drywells) will meet the two foot separation to**

Item #	**Addressed**	**Description**
	☑	**the seasonal high water table (SHWT) standard.**
4.	☑	**Information demonstrating that the proposed stormwater design will meet the wetland, required buffer to wetlands and surface water protection standards.**
5.	☑	**Information demonstrating that the soil suitability (permeability rate) standard will be met for all stormwater infiltration facilities (e.g. swales, basins, drywells).**
6.	☐ NA	**If the development includes High Pollutant Loading Areas (HPLAs) such as gas stations or vehicle maintenance facilities, information which demonstrates that the HPLA standards will be met is submitted.**
7.	☑	**The groundwater mounding standards will be met.**
8.	☑	**Information demonstrating that all of the following low impact stormwater design standards will be met (as applicable – see Reference Guide):**
	☑	Pretreatment of stormwater, prior to entering infiltration measures, has been incorporated into the design.
	☑	The design utilizes multiple, smaller stormwater management measures dispersed spatially throughout the site.
	☑	The design incorporates non-structural stormwater management strategies identified in the NJDEP stormwater regulations to the maximum extent practical. A written description of each of these strategies must be provided. Alternatively, the results of the NJDEP's NSPS Spreadsheet or Low Impact Design (LID) Checklist may be submitted.

STORMWATER CHECKLIST
(PART 2)

Additional Stormwater Management Information Required to Be Submitted to Municipality for Review

The following checklist identifies certain stormwater management standards that an applicant must address with the municipality (each "Item #" is cross-referenced in the attached Reference Guide). Note that there may be additional information that is required by a municipal ordinance that is not identified in this Pinelands Commission Checklist and Reference Guide.

Item #	Addressed	Description
9.	☑	**No direct discharge of stormwater to farm fields will occur to the maximum extent practical.**
10.	☑	**The Total Suspended Solids (TSS) load in the stormwater will be reduced by 80%.**
11.	☑	**Stormwater management measures have been designed to reduce the nutrient load in the stormwater runoff from the post-developed site to the maximum extent practical.**
12.	☑	**The development will meet the groundwater recharge standards.**
13.	☑	**The stormwater management plan addresses stormwater facilities construction and as-built requirement standards.**
14.	☑	**The proposed stormwater management measures meet structural design standards.**
15.	☑	**The development meets stormwater facility safety standards.**
16.	☑	**A stormwater facilities maintenance plan is provided.**

APPENDIX F

Stormwater Management Facility Maintenance Manual

STORMWATER MANAGEMENT FACILITY MAINTENANCE MANUAL

for

The Richard Stockton College of New Jersey
Block 875.04, Lots 1.01 - 1.08
Galloway Township, Atlantic County, New Jersey

July 2010

Prepared for:
The Richard Stockton College of New Jersey
P.O. Box 195
Pomona, New Jersey 08240

Prepared by:
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RSC 011.01

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INSPECTION, MAINTENANCE AND REPAIR PLAN

A. PROJECT INFORMATION

I. DRAWINGS OF STORMWATER MANAGEMENT MEASURES:

The project's Stormwater Management Plans are included in the plan set **"Stockton College Stormwater Master Plan**, Block 875.04, Lots 1.01 – 1.08, Galloway Township, Atlantic County, New Jersey" prepared by Marathon Engineering & Environmental Services, Inc. and are included herein by reference.

II. LOCATION OF STORMWATER MANAGEMENT MEASURES BY MEANS OF LATITIUDE AND LONGITUDE AND BLOCK AND LOT:

The site's BMPs (Stormwater Management Facilities) are located at various sites within the College Campus in the Township of Galloway, Atlantic County, New Jersey. The center of the site is approximately LAT: 39º 29' 28" N LONG: 74º 31' 49" W.

III. PREVENTATIVE CORRECTIVE MAINTENANCE TASKS AND SCHEDULES:

Refer to SECTION B.III for Summary of Maintenance Procedures.

IV. COST ESTIMATE:

Because this Maintenance Manual is prepared as a general overview of possible tasks for the various SWMFs, a specific cost estimate cannot be prepared at this time. Because the Richard Stockton State College (the "Colllege") is a state entity, no payment of fees to the municipality for maintenance of the stormwater management facilities is required and a maintenance bond is not required for activities performed by the College. Refer to SECTION B.VIII, Cost of SWMF Maintenance Tasks for a generalized cost list.

V. NAME OF PERSON RESPONSIBLE FOR INSPECTIONS AND MAINTENANCE:

The stormwater management system within the Campus Development Zone will consist of a variety of underground storm sewer pipe, inlets, manholes, flared end sections, stormwater management infiltration basins and underground infiltration trenches. The maintenance of all of the stormwater management components and facilities (SWMFs) shall be the responsibility of the College Facilities Maintenance Department. It shall be the responsibility of the contractor, during construction, to maintain these facilities until final acceptance by the College is assumed.

During Construction:

Company / Individual:	Construction Contractor
ADDRESS:	To be provided
	To be provided
PHONE:	To be provided

Upon Acceptance of the facilities by the College:

Company / Individual:	The Richard Stockton College of New Jersey (the "College")
	P.O. Box 195

ADDRESS: Pomona, New Jersey 08240
PHONE: (609) 626-6052

The title and date on the maintenance plan and the name, address, and telephone number of the person with stormwater management measure maintenance responsibility as specified, will be recorded on the deed of the property on which the measure is located. Any change in the information due to change in property ownership will be recorded on the deed.

The person with maintenance responsibility will be required to perform the following:

1. Maintain records of all maintenance related work orders.
2. Evaluate the effectiveness of the maintenance plan at least once a year and adjust the plan and deed as necessary.
3. Retain and make available the maintenance plan and associated documentation to any requesting administrative, health, environmental or safety agency having authority over the site.
4. Because the College is a state entity, in lieu of submitting the documents to the Township, submit annual copies of these documents to the College's Engineer for their records.

Maintenance training will be required and instruction given by the person with the maintenance responsibility. A basic description of the purpose and function of the overall stormwater management measures and their major components such as, but not limited to, sedimentation accumulation around drainage structures, pruning and general clean-up procedures, maintenance of lawns and vegetation management, will be outlined. Maintenance personnel will also receive training in specialized inspection and maintenance tasks and/or the operation and care of specialized maintenance equipment. Training will be provided in the need for, and use of, all required safety equipment and procedures.

B. PREVENTATIVE MAINTENANCE PROCEDURES

I. OBJECTIVES:

The purpose of preventative maintenance is to assure that the Stormwater Management Facilities (SWMFs) remain operational and safe at all times, while minimizing the need for emergency or corrective procedures.

II. OVERVIEW:

A comprehensive SWMF maintenance program is comprised of several related requirements including:

A. Providing adequate funding, staffing, equipment, and materials
B. Performing routine maintenance procedures on a regular basis
C. Performing emergency maintenance procedures and repairs in a timely manner

D. Conducting SWMF inspections to determine the need for and effectiveness of maintenance work

E. Providing training and instruction to maintenance personnel and inspections

F. Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance programs and the need for revised or additional maintenance procedures, personnel, and equipment

G. Instilling pride of workmanship and a commitment to excellence in program personnel

III. SUMMARY OF GENERAL MAINTENANCE PROCEDURES

The following are general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

A. PREVENTATIVE MAINTENANCE PROCEDURES:

1. Grass Cutting

A regularly scheduled program of mowing and trimming of grass at SWMFs during the growing season will help to maintain a tightly knit turf and will also help to prevent diseases, pests, and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, grass should not be allowed to grow more than 1 to 2 inches between cuttings, or shall be mowed at least once a month during the growing season. Allowing the grass to grow more than this amount prior to cutting it may result in damage to the grades growing points and limit its continued healthy growth. Agencies such as the local Soil Conservation District can provide valuable assistance in determining optimum mowing requirements.

2. Grass Maintenance

Grassed areas require periodic fertilizing, de-thatching, and soil conditioning in order to maintain healthy growth. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, storm water flow, or other causes. Agencies such as the local Soil Conservation District can provide valuable assistance in establishing a suitable grass maintenance program. All vegetation deficiencies should be addressed without the use of fertilizers or pesticides whenever possible.

3. Vegetative Cover

Trees, shrubs, and ground cover require periodic maintenance, including fertilizing, pruning, and pest control in order to maintain healthy growth. Agencies such as the local Soil Conservation District can be of assistance in establishing a preventative maintenance program. Inspection of the vegetative components shall be performed at least annually for unwanted growth. When establishing or restoring vegetation, biweekly inspections of vegetative health should be performed during the first growing season or until the vegetation is established. Once established, inspections of vegetation health, density, and diversity should be performed at least twice annually during both the growing and non-growing seasons.

4. Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal from SWMFs will reduce the chance of outlet structures, trash racks, and other components becoming clogged and inoperable during storm events. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized. Agencies such as the Division of Solid Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

5. Sediment Removals and Disposal

Accumulated sediment should be removed before it threatens the operation or storage volume of a SWMF. Typically, sediment shall be removed every 5-10 years, or when the sediment accumulation is more than 6” – 12”. Disposal of sediment must comply with all local, county, state, and federal regulations. Only suitable disposal sites should be utilized. The sediment removal program in infiltration facilities must also include provisions for monitoring the porosity of the sub-base, and replacement or cleansing of the pervious materials as necessary. Agencies such at the Division of Solid Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

6. Mechanical Components

All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually. SWMF components, such as valves, sluice gates, pumps, fence gates, locks, and access hatches should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufacturers’ recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

7. Elimination of Potential Mosquito Breading Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and the source of a large mosquito population. Ponded water in areas such as open cans and bottles, debris and sediment accumulations, and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to controlling the health and nuisance effects of flying mosquitoes. The local Mosquito Control Commission can provide valuable information on establishing this maintenance program.

8. Pond Maintenance

Water quality, including suitable oxygen levels, should be maintained through continuous recharge with fresh water from either surface or subsurface sources. Where adequate oxygen levels cannot be assured through inflow, mechanical aeration such as a solar powered aerator or fountain, shall be provided. A program of monitoring the aquatic environment of a permanent pond should be established. Although the complex environment of a healthy aquatic ecosystem will require little maintenance, water quality, aeration, vegetative growth, and animal populations should be monitored on a regular basis. The timely correction of an imbalance in the ecosystem can prevent more serious problems form occurring. Additional information on pond maintenance can be obtained through agencies such as the U.S. Fish and Wildlife Service.

Provisions to drain a permanent pool are necessary for maintenance and safety. If a gravity drain is not feasible, suitable pumps and both primary and backup power sources shall be provided.

9. Pervious Pavement Maintenance

The surface of all pervious paving must be inspected for cracking, subsidence, spalling, deterioration, erosion, and the growth of unwanted vegetation at least once a year. Remedial measures must be taken as soon as practical. Care must be taken when removing snow from pervious pavement. Routine sweeping or vacuuming at least four times a year, or more often if required, will reduce the possibility of clogging. If mud or sediment is tracked onto the surface course of a pervious paving system, it must be removed as soon as possible. Removal should take place when the surface course is thoroughly dry. Disposal of debris, trash, sediment, and other waste matter removed from pervious paving surface courses should be done at a suitable disposal/recycling site and in compliance with local, state, and federal waste regulations.

9. Inspection

Regularly scheduled inspections of the SWMFs should be performed by qualified inspectors. The primary purpose of the inspections is to ascertain the operational condition of embankments, outlet structures, and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled preventative and aesthetic maintenance procedures and will help to identify where changes are warranted. Finally, the SWMF inspections should be used to determine the need for and timing of corrective maintenance procedures. In addition to regularly scheduled inspections, an informal inspection should be performed during every visit to a SWMF by maintenance or supervisory personnel. An inspection checklist is included as part of this maintenance plan.

10. Reporting

The recording of all maintenance work and inspections provide valuable data on the SWMF condition. Along with the written reports, a chain of command for reporting and solving maintenance problems and addressing maintenance needs should be established.

B. CORRECTIVE MAINTENANCE PROCEDURES

The following are general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

1. Removal of Debris and Sediment

Sediment, debris, and trash should be removed immediately and properly disposed of in a timely manner. All disposal of materials should be done at suitable disposal /recycling sites and in compliance with all applicable local, state, and federal waste regulations. Equipment and personnel must be available to perform the removal work on short notice. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites may be utilized if necessary.

2. Structural Repairs

Structural damage to outlet and inlet structures, trash racks, and headwalls or flared end sections from vandalism, flood events, or other causes must be repaired promptly. Equipment, material, and personnel must be available to perform these repairs on short notice. The analysis of structural damage and the design and performance of structural repairs shall only be undertaken by qualified personnel.

3. Wall, Embankment, and Slope Repairs

Damage to walls, embankments, and side slopes must be repaired promptly. Typical problems include settlement, scouring, cracking, sloughing, seepage, and rutting. Equipment, materials, and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel. Repair of wall systems shall be per the manufacturer's specifications.

4. Dewatering

It may be necessary to remove ponded water from within a SWMF for maintenance and repair. If a gravity drain is not feasible, portable pumps may be necessary to remove ponded water.

5. Pond Maintenance

Water quality, including suitable oxygen levels, should be maintained through continuous recharge with fresh water from either surface or subsurface sources. Where adequate oxygen levels cannot be assured through inflow, mechanical aeration such as a solar powered aerator or fountain, shall be provided. A program of monitoring the aquatic environment of a permanent pond should be established. Although the complex environment of a healthy aquatic ecosystem will require little maintenance, water quality, aeration, vegetative growth, and animal populations should be monitored on a regular basis. The timely correction of an imbalance in the ecosystem can prevent more serious problems form occurring. Problems such as algae growth, excessive siltation, and mosquito breeding, should be addressed and corrected in a timely manner. The sooner the problem is corrected, the easier it will be to restore a balanced environment in the pond. Due to the complex environment in a pond, it is recommended agencies such as the U.S. Fish and Wildlife Service be consulted for corrective maintenance procedures and additional information on pond maintenance.

6. Extermination of Mosquitoes

If neglected, a SWMF can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of an expert, such as the local Mosquito Commission. Proper procedures carried out be trained personnel can control the mosquitoes with a minimum of damage or disturbance to the environment. If mosquito control in a facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

7. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils, to erosion, corrective steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including riprap, gabion lining, sod, seeding, concrete lining, and re-grading. The local Conservation District can provide assistance in recommending materials and methodologies to control erosion.

8. Vegetative Cover Repair

The vegetative cover should be maintained at 85 percent. If vegetation has greater than 50 percent damage, the area should be reestablished in accordance with the original specifications. Fertilization of vegetation surrounding the pond area should be avoided except in special cases. Overfertilization can contribute to excess algae growth in the pone. As a general rule, the nutrient needs of the vegetation surrounding the pond should be evaluated by testing the pH and nutrient content of the soil prior to fertilization. The adjustment of pH may be necessary to maintain vegetation. Fertilization of all turf areas should occur in the fall.

9. Fence Repair

Where fences are provided, they may be damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site.

10. Elimination of Trees, Brush, Roots, and Animal Burrows

Large roots can impair the stability of dams, embankments, and side slopes. Animal burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from dams and embankments to prevent their destabilization and the creation of seepage routes. Roots should also be completely removed to prevent their decomposition within the dam or embankment. Rood voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete, or other material. If plugging of the burrows does not discourage the animals form returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them.

11. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of a SWMF, particularly at inlets, outlets, and emergency spillways. Providing the equipment, materials, and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months. Care must be taken when removing snow from pervious pavement surfaces or stabilized lawn areas which can be damaged by snow plows or loader buckets. Sand, grit, or cinders should not be used on pervious paving surfaces or stabilized lawn areas for snow or ice control.

12. Pervious Pavement

Routine sweeping or vacuuming at least annually, or more often if required, will reduce the possibility of clogging of pervious pavement surfaces. Remedial measures must be taken as soon as practical. Pressure washing will restore porosity of clogged pervious pavement to nearly new conditions.

13. Stabilized Lawn

Should potholes occur, or if three or more adjacent rings area broken or damaged, the sections shall be removed and replaced per manufacturer's specifications. Vegetation shall be re-established.

C. AESTHETIC GENERAL MAINTENANCE PROCEDURES

The following are general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

1. Graffiti Removal

The timely removal of this eyesore will restore the aesthetic quality of a SWMF. Removal can be accomplished by painting or otherwise covering it, or removing it with scrapers, solvents, or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

2. Grass Trimming

Trimming of grass edges around structures and fences will provide for a neat and attractive appearance of the facility.

3. Control of Weeds

Although a regular grass maintenance program will keep weed intrusion to a minimum, some weeds will appear. Periodic weeding, either chemically or mechanically, will not only help to maintain a healthy turf, but will also keep grassed areas attractive. The use of chemicals should be limited in areas adjacent to the SWMFs.

4. Details

Careful, meticulous, and frequent attention to the performance of maintenance items such as painting, tree pruning, leaf collection, debris removal, and grass cutting will result in a SWMF that remains both functional and attractive.

D. MAINTENANCE DURING CONSTRUCTION

The following are general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

1. The contractor shall stage his activity during construction to limit the amount of exposed soil on the site in an effort to reduce erosion and silt and sediment accumulation. Soil erosion and sediment control structures shall be placed as indicated on the Soil Erosion and Sediment Control Plan. These structures shall include, but not be limited to, stabilized construction entrances, hay bales, silt fences, inlet protection, and swale and slope protection blankets.

2. The contractor shall grade all swales as per the engineering documents to ensure positive flow patterns. Any low points within the swales that create standing water shall be regraded so that positive flow patterns are achieved. The elimination of standing water will eliminate possible mosquito breeding habitats.

3. Following each significant rainfall event (1” of rainfall or greater), the contractor shall perform the following inspection and clean-up:
    a. All swales shall be inspected and all accumulated silt and sediment shall be removed and redistributed on the site.

b. All erosion activities that might have occurred within the swales shall be regraded, retopsoiled, refertilized, and reseeded.

c. Swale and slope blankets that have been exposed or torn and damaged shall be removed and replaced with new material.

d. Inlet protection shall be inspected, and if damaged, shall be replaced.

e. All debris within swales such as tree limbs, excessive leaves, or trash shall be removed and disposed of legally. These materials shall not be placed back on the site.

f. All inlets and outlet structures shall be inspected and all debris, silt, sediment, trash, excessive leaves, and tree limbs shall be removed and disposed of legally. These materials shall not be placed back on the site.

g. All signs of erosion around inlets and outlet structures shall be regraded, retopsoiled, refertilized, and reseeded.

h. Should excessive accumulation of sediment be present within the inlets and storm sewer pipe, reverse flushing and vacuuming will be required.

i. Infiltration basins shall be inspected for erosion damage and accumulated debris, trash, leaves, and tree limbs. Eroded areas shall immediately be regraded, retopsoiled, refertilized, and reseeded and all debris, trash, leaves, and tree limbs shall be removed. All debris, trash, leaves, and tree limbs shall be disposed of legally and shall not be placed back on the site or buried on site.

j. Undesirable plant growth such as woody vegetation and weeds, etc. shall be removed.

k. Damage from rodents and loss of basin freeboard shall be repaired immediately.

l. The contractor shall inspect the spillways for damage and repair any damage.

m. The contractor shall inspect the sand bottom in infiltration basins. Washed away sand shall be replaced as needed. A 6 inch sand bottom consisting of K5 material, certified by a Professional Engineer licensed in New Jersey, must be maintained in a basin at all times. Accumulated debris, trash, leaves, and tree limbs shall be removed from the basin along with accumulated sediment. All material must be disposed of legally and shall not be placed back on the site or buried on site. Infiltration basins must drain within the required 72 hour period. After rainfall events the contractor shall keep records to ensure that the basin drains within 72 hours. Should permeability of a basin become a problem, the basin shall be drained manually by pumping. The basin shall be inspected for damage to the sand layer or excessive silt and sediment. Should basin permeability remain a problem, a licensed professional engineer shall be consulted to make an inspection and render a solution. Basin bottoms shall remain as level as possible to ensure uniform distribution of runoff. Soil compaction under the basins shall be prohibited. All excavation must be performed by equipment placed outside of the basin area. Infiltration basins shall not be put into operation until all upland areas are stabilized. During construction the basin areas can be utilized as sediment basins which will be cleaned and the final sand bottom placed.

n. Prior to basin construction, the contractor shall cordon off the area required for the infiltration basin to prevent construction equipment and stockpiled materials from compacting the subgrade soils. During construction, precautions shall be taken to prevent the subgrade from being compacted and the area contaminated with sediment. All excavation should be performed with the lightest practical excavation equipment. All excavation equipment should be placed or stored outside of the limits of the infiltration basin. The contractor is directed to the Soil Erosion and Sediment Control Plans for additional requirements regarding basin construction.

o. Basin spillways should also be checked for damage or silt and sediment buildup. Accumulated silt and sediment shall be removed after each storm event if necessary.

4. As a minimum, if no significant rainfall event occurs, all SWMF system components shall be inspected weekly and procedures specified under item B of this report shall be followed should deficiencies be discovered.

5. During construction, the College’s consulting engineer shall inspect the SWMFs on a monthly basis. A written report shall be filed with the College and the contractor. Remedial action to correct any damages on site shall be performed immediately and conform to item B. of this report. The written engineer’s report shall contain the following:

   a. Date and time of the inspection.
   b. Damages and deficiencies encountered.
   c. Action to be taken to correct damages and deficiencies.
   d. Date and time that the damages and deficiencies were corrected.
   e. A copy of any work order shall also be attached to the maintenance log.

E. MAINTENANCE BY THE COLLEGE

The following are general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

1. After each significant rainfall event (1" of rainfall or greater) or once every month the College shall be responsible for the inspection of the related SWMFs and to remediate any damage or deficiencies found on site. The SWMFs shall be checked for debris and trash build-up, sediment accumulation, erosion damage, standing water, rodent or animal damage and unwanted vegetative growth. The items of inspection shall include the following:
    a. Infiltration basin side slope, basin bottom and spillway.
    b. Stormwater conveyance systems including inlets, manholes, headwalls, endwalls, and piping in roads, on the site, and in the SWMFs.
    c. The inlets along underground infiltration trenches to determine if the trenches are functioning properly.
    d. Open space swales directing runoff toward the infiltration basins.

2. Written inspection logs shall be kept by the College for each inspection. The inspection logs shall contain the following information:
    a. Date and time of the inspection.
    b. Deficiencies or damages encountered
    c. Actions taken to correct damages or deficiencies
    d. Date and time that the damage or deficiencies were corrected.
    e. Copies of work orders shall be attached to the inspection logs.

3. Actions to remediate damage or deficiencies to the SWMFs shall include the following:
    a. The flared end section or headwall entrances to basins shall be inspected for debris, trash, leaves, and tree limbs, and if found, shall be removed and disposed of legally. These items shall not be placed back on the site or be buried on the site. Should excessive silt, sediment, debris or trash be found within inlets and the storm sewer system, the College shall be made aware of the conditions and will be responsible for cleaning and repairing the system.
    b. Any sign of erosion around the flared end sections or headwalls shall immediately be regraded, retopsoiled, reseeded and refertilized.
    c. Infiltration basins shall be inspected for erosion damage and for accumulated debris, trash, and sediment build-up. All debris, trash, tree limbs, and leaves shall be removed from the basins and disposed of legally and shall not be placed back on the site or buried on the site. All sediment accumulation shall be removed from basins. Backhoes or heavy equipment shall not be permitted into infiltration basins so as not to damage the six (6) inch sand layer or to create compaction of the sand layer. Sediment shall be removed by hand with the aid of wheel barrows and shovels. Sediment shall be disposed of legally and shall not be placed back on the site. Should the sand bottom of an infiltration basin become damaged or eroded it shall be replaced with sand of a K5 material, certified by a Professional Engineer licensed in New Jersey. The sand bottom of the basin shall at all times remain at a

depth of six (6) inches. All grass clippings from mowing operations shall be bagged and disposed of legally and shall not be placed back on the site. Freeboard in the basins must be maintained and the spillways must be kept free of all debris and trash. A good grass cover must be maintained for the spillways and side slopes. Iinfiltration basins shall be monitored after major rain events to observe the permeability of the basin. Should permeability of the basin become a problem, the basin shall be drained manually by pumping. Basins shall be inspected for damage to the sand layer or excessive silt and sediment. Should basin permeability remain a problem, a licensed professional engineer shall be consulted to make an inspection and render a solution. The basin bottom shall remain as level as possible to ensure uniform distribution of runoff.

d. Basin spillways shall be checked for damage or silt and sediment buildup.

e. All undesirable plant growth such as woody vegetation, weeds, etc. shall be removed and disposed of legally and shall not be placed back on the site or buried on the site. All vegetation shall be pruned and trimmed to help keep the access to the basin free and clear.

f. Rodent and animal damage shall be corrected immediately.

g. All landscaped plant material shall be pruned to remove damaged, diseased or dead vegetation and limbs. All material shall be disposed of legally and shall not be placed back on the site or buried on site.

F. CHECKLISTS AND LOGS

Included in this report are Tables and Sample Checklists and Logs regarding various aspects of SWMF maintenance and inspection. They contain a list of general procedures and not all measures may be applicable to the individual SWMF. Maintenance for the individual SWMFs shall be applied or adapted as necessary on a case by case basis.

IV. MAINTENANCE EQUIPMENT AND MATERIALS

Equipment required for the maintenance of the SWMFs may include, but shall not be limited to, one or all of the following:

A. GRASS MAINTENANCE EQUIPMENT

1. Tractor-Mounted Mowers
2. Riding Mowers
3. Hand Mowers
4. Gas Powered Trimmers
5. Gas Powered Edgers
6. Gas Powered Air Blowers
7. Seed Spreaders
8. Fertilizer Spreaders
9. De-Thatching Equipment

10. Pesticide and Herbicide Application Equipment
11. Grass Clipping and Leaf Collection Equipment

B. VEGETATIVE COVER MAINTENANCE EQUIPMENT

1. Saws
2. Chain Saw
3. Mulcher
4. Pruning Shears
5. Hedge Trimmers
6. Wood Chippers

C. TRANSPORTATION EQUIPMENT

1. Trucks for Transportation of Materials
2. Trucks for Transportation of Equipment
3. Vehicles for Transportation of Personnel

D. DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT

1. Loader
2. Backhoe
3. Grader

E. MISCELLANEOUS EQUIPMENT

1. Shovels
2. Rakes
3. Pruning tools
4. Brooms
5. Picks
6. Wheelbarrows
7. Fence Repair Tools
8. Painting Equipment
9. Gloves
10. Standard Mechanics Tools
11. Tools for Maintenance of Equipment
12. Office Space
13. Office Equipment
14. Telephones
15. Safety Equipment
16. Camera or Video (to record events)
17. Tools for Concrete Work (Mixers, Form Materials, etc.)
18. Welding Equipment (for Repair of Trash Racks, etc.)

F. MATERIALS

1. Topsoil
2. Fill
3. Seed
4. Soil Amenities (Fertilizer, Lime, etc.)

5. Chemicals (Pesticides, Herbicides, etc.)
6. Mulch
7. Paint
8. Paint Removers (for Graffiti)
9. Spare Parts for Equipment
10. Oil and Grease for Equipment and SWMF Components
11. Concrete

G. INSTRUCTIONS AND WARRANTIES

All manufacturers' repair and replacement instructions, along with manufacturers' product instructions and user manuals shall be kept on file. Original copies of the manufacturers' warranties shall also be kept on file.

H. ENGINEERING PLANS

A set of approved Engineering Plans shall be kept on file, along with approved test boring results, and all other copies of municipal or state approvals granted for the site development.

I. DISPOSAL AND RECYCLING SITES

The inspection and maintenance personnel shall have at their disposal, the recycling sites within Galloway Township or Atlantic County which shall include addresses, phone numbers, and names of personnel in charge, at the disposal or recycling sites.

V. SAFETY

Procedures and equipment required to protect the safety of inspection and maintenance personnel shall be, but not limited to, the following:

A. SAFETY EQUIPMENT

Safety equipment shall be worn during all inspection and repair operations. Equipment shall be, but not limited to, the following:

1. Safety Helmets
2. Safety Glasses
3. Protective Clothing Including Shoes and Gloves
4. First Aid Kit
5. Cell Phone with Emergency Numbers

B. STANDARD PROCEDURE

Standard procedure shall be that a minimum of two (2) persons shall perform inspections in the event of injury or disability during the inspection and remediation operations

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VI. SWMF MAINTENANCE EQUIPMENT AND MATERIAL COSTS

This estimate is taken from NJDEP Stormwater Management Facilities Manual Table 6-

1 and adjusted for 2010 costs. It is provided herein to present a general idea of the cost of various maintenance equipment that might be required.

GRASS MAINTENANCE EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Hand Mower	300 - 500	25 - 40
Riding Mower	3,000 - 5,000	75 - 100
Tractor Mower	15,000 - 20,000	100 - 300
Trimmer / Edger	200 - 500	25 - 35
Spreader	100 - 200	20 - 30
Chemical Sprayer	200 - 500	25 - 40

VEGETATIVE COVER MAINTENANCE EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Hand Saw	15	5
Chain Saw	300 - 500	15 - 35
Pruning Shears	25	5
Shrub Trimmer	200	25 - 35
Brush Chipper	1,000 - 5,000	50 - 150

TRANSPORTATION EQUIPMENT

	Purchase (dollars)	Lease (per month) (dollars)	Rent (per day) (dollars)
Van	10,000 - 15,000	400	50 - 70
Pickup Truck	10,000 - 15,000	400	50 - 70
Dump Truck	30,000 - 50,000	1,200	75 - 150
Light Duty Trailer	3,000 - 5,000	150	30 - 50
Heavy Duty Trailer	10,000 - 20,000	500	100 - 200

DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT

	Purchase (dollars)	Lease (per month) (dollars)	Rent (per day) (dollars)
Front End Loader	50,000 - 100,000	1,500 - 2,000	200 - 400
Backhoe	30,000 - 50,000	1,200	150 - 300
Excavator	100,000+	2,000	400 - 1,000
Grader	100,000+	2,000	400 - 1,000

MISCELLANEOUS EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Shovel	15	5
Leaf Rake	15	5
Soil Rake	15	5

Pick	15	5
Wheelbarrow	100 - 200	10
Gloves	5	N /A
Portable Compressor	500 - 1,000	50 - 100
Portable Generator	500 - 1,000	50 - 100
Concrete Mixer	500 - 1,000	25 - 50
Welding Equipment	500 - 1,500	35 - 70

MATERIALS

	Purchase (dollars)
Topsoil	35 / cubic yard
Fill Soil	15 / cubic yard
Grass Seed	5 / pound
Soil Amenities (Fertilizer, Lime, etc)	0.05 / sq ft
Chemicals (Pesticides, Herbicides, etc)	10 / gallon
Mulch	25 / cubic yard
Paint	20 / gallon
Paint Remover	10 / gallon
Machine / Motor Lubricants	5 / gallon
Dry Mortar Mix	4 / 50 pound bag
Concrete Delivered to Site	60 – 100 / cubic yard

Notes:
1. These estimates are approximation of the probable construction costs in 2008 dollars and are based upon previous construction experience and should be used as an approximate budget figure only
2. Estimated equipment costs are based upon Industrial / Commercial grade equipment.

VII. COST OF SWMF MAINTENANCE TASKS

Taken from NJDEP Stormwater Management Facilities Manual Table 6-2

PREVENTATIVE MAINTENANCE TASKS

	Small Facility (Man-Hours)	**Large Facility (Man-Hours)**
Grass Cutting	1	1 - 2
Grass Maintenance	0.5	1
Trash & Debris Removal	0.5	1
Sediment Removal	4	8
Mobilization	1	1
Inspection & Reporting	1	2

CORRECTIVE MAINTENANCE TASKS

	Small Facility	**Large Facility**

	(Man-Hours)	(Man-Hours)
Trash & Debris Removal	4	8
Structural Repairs	2-4	40
Dewatering	4	8
Mosquito Extermination	1	2-4
Erosion Repair	4	8
Fence Repair	2-4	4-8
Snow & Ice Removal	1	2
Mobilization	2	2

AESTHETIC MAINTENANCE TASKS

	Small Facility (Man-Hours)	Large Facility (Man-Hours)
Grass Trimming	0.5	2
Weed Control	0.5	2
Landscape Maintenance	1 - 2	2 - 4
Graffiti Removal	2 - 4	4 - 8

Notes:

1. This estimate is an approximation of the man-hours as provided in the NJDEP Stormwater Facility Maintenance Manual. It is based upon previous construction experience and should be used as an approximate budget figure only.
2. Cost estimates are presented in terms of man-hours. These values should be used in conjunction with applicable personnel rates to determine labor costs for a specific program or facility.
3. Facility size definitions:

   Small Facility: Total SWMF Site Area ¼ Acre

   Large Facility: Total SWMF Site Area 1 Acre

Appropriate adjustments to the estimates presented should be made as necessary to account for actual SWMF size.

X. MAINTENANCE AND INSPECTION LOGS AND CHECKLISTS

Maintenance Work Order and Checklist
For Stormwater Management Facilities

SWM Maintenance List
Page 1 of 4

Name of Facility: ______________________________
Location: ______________________________ **Date:** ____________

Crew:			**Work Started:**		**Time:**	
Equipment:			**Work Completed:**		**Time:**	
Weather:			**Total Man-hours for Work::**			

A. Preventative Maintenance

1. Grass Cutting	Items Required √	Items Done √	Comments and Special Instructions
A. Embankments and Side Slopes			
B. Perimeter Areas			
C. Access Areas and Roads			
D. Other:			

2. Grass Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A. Fertilizing			
B. Re-Seeding			
C. De-Thatching			
D. Pest Control			
E. Other:			

3. Vegetative Cover Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A. Fertilizing			
B. Pruning			
C. Pest Control			
D. Other:			

SWM Maintenance List
Page 2 of 4

5. Trash and Debris Removal	Items Required √	Items Done √	Comments and Special Instructions
A. Pond Bottom			
B. Embankments and Side Slopes			
C. Perimeter Areas			
D. Access Areas and Roads			
E. Inlets			
F. Outlets and Trash Racks			
G. Other			
H. Other:			

6. Sediment Removal	Items Required √	Items Done √	Comments and Special Instructions
A. Inlets			
B. Outlets and Trash Racks			
C. Basin Bottoms			
D. Underground Recharge Trenches			
E. Other			

7. Mechanical Components	Items Required √	Items Done √	Comments and Special Instructions
A. Valves			
B. Sluice Gates			
C. Pumps			
D. Fence Gates			
E. Locks			
F. Access Hatches			
G. Other:			

8. Pond Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A. Aeration Equipment			
B. Debris & Trash Removal			
C. Weed Removal			
D. Vegetation Maintenance			
E. Dewatering			
F. Other			

9. Elimination of Potential Mosquito Breeding Habitats	Items Required √	Items Done √	Comments and Special Instructions
A.			
B.			
C.			
D.			

SWM Maintenance List
Page 3 of 4

10. Other Preventative Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A.			
B.			
C.			
D.			

B. Corrective Maintenance

	Items Required √	Items Done √	Location, Comments, and Special Instructions
1. Debris and Sediment Removal			
2. Structural Repairs			
3. Wall, Embankment, and Slope Repairs			
4. Dewatering			
5. Pond Maintenance			
6. Control of Mosquitoes			
7. Erosion Repair			
8. Vegetative Cover Repair			
9. Fence Repair			
10. Elimination of Trees, Brush, Roots and Animal Burrows			
11. Snow and Ice Removal			
12. Other			
13. Other			

C. Aesthetic Maintenance

	Items Required √	Items Done √	Location, Comments, and Special Instructions
1. Graffiti Removal			
2. Grass Trimming			
3. Weeding			
4. Maintenance Details			
5. Other			
6.			
7.			
8.			

SWM Maintenance List
Page 4 of 4

Remarks: (Refer to Item No, If Applicable)

`

Work Order Prepared By: ______________________________

Work Completed By: ______________________________

SWM Maintenance Log
Page 1 of 4

Name of Facility: ____________________
Location: ____________________ **Date:** __________

A. Preventative Maintenance

Date:										

Work Item (√) Completed

1. Grass Cutting

A. Embankments and Side Slopes										
B. Perimeter Areas										
C. Access Areas and Roads										
D. Other:										

2. Grass Maintenance

A. Fertilizing										
B. Re-Seeding										
C. De-Thatching										
D. Pest Control										
E. Other:										

3. Vegetative Cover

A. Fertilizing										
B. Pruning										
C. Pest Control										
D. Other:										

4. Trash and Debris Removal

A. Bottoms										
B. Embankments and Side Slopes										
C. Perimeter Areas										
D. Access Areas and Roads										
E. Inlets:										
F. Outlets and Trash Racks										
G. Pervious Pavement Areas:										
H. Other:										

5. Sediment Removal

A. Inlets										
B. Outlets and Trash Racks										
C. Bottoms										
D. Underground Trenches										
E. Other:										

SWM Maintenance Log
Page 2 of 4

Date:										

Work Item (√) Completed

6. Mechanical Components

A. Valves										
B. Sluice Gates										
C. Pumps										
D. Fence Gates										
E. Locks										
F. Access Hatches										
G. Other										

7. Pond Maintenance

A. Aeration Equipment										
B. Debris & Trash Removal										
C. Weed Removal										
D. Vegetation Maintenance										
E. Dewatering										
F. Other										

8. Elimination of Potential Mosquito Breeding Habits

A.										
B.										
C.										
D.										

9. Other Preventative Maintenance

A.										
B.										
C.										
D.										

SWM Maintenance Log
Page 3 of 4

B. Corrective Maintenance

Date:										

Work Item	(√) Completed									
1. Debris and Sediment Removal										
2. Structural Repairs										
3. Wall, Embankment, and Slope Repairs										
4. Dewatering										
5. Pond Maintenance										
6. Control of Mosquitoes										
7. Erosion Repair										
8. Vegetative Cover Repair										
9. Fence Repair										
10. Elimination of Trees, Brush, Roots and Animal Burrows										
11. Snow and Ice Removal										
12. Underground Trench										
13. Other										
14. Other										
15.										
16.										

C. Aesthetic Maintenance

Date:										

Work Item	(√) Completed									
1. Graffiti Removal										
2. Grass Trimming										
3. Weeding										
4. Maintenance Details										
5. Other										
6.										
7.										
8.										

SWM Maintenance Log
Page 4 of 4

Remarks: (Refer to Item No, If Applicable)

Work Order Prepared By: ______________________________

Work Completed By: ______________________________

SWM Inspection Checklist
Page 1 of 4

Name of Facility: ______________________________

Location: ______________________________ **Date:** ____________

Weather: ______________________________ **Date:** ____________

1. Embankments and Side Slopes

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Sloughing				
F. Trash and Debris				
G. Seepage				
H. Aesthetics				
I. Other:				

2. Bottoms (Detention and Infiltration)

A. Vegetation				
B. Erosion				
C. Standing Water				
D. Settlement				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other:				

3. Low Flow Channels (Detention)

A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Standing Water				
F. Trash and Debris				
G. Sediment				
H. Other:				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SWM Inspection List
Page 2 of 4

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
4. Ponds (Retention)				
A. Vegetation				
B. Shoreline Erosion				
C. Aeration Equipment				
D. Trash and Debris				
E. Sediment				
F. Water Quality				
G. Other:				

5. Inlet Structure

A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Aesthetics				
F. Other:				

6. Outlet Structure (Detention & Retention)

A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Mechanical Components				
F. Aesthetics				
G. Other:				

7. Emergency Spillway

A. Vegetation				
B. Lining				
C. Erosion				
D. Trash & Debris				
E. Other:				

8. Perimeter

A. Vegetation				
B. Erosion				
C. Trash & Debris				
D. Fences & Gates				
E. Aesthetics				
F. Other:				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SWM Inspection List
Page 3 of 4

9. Access Roads

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
A. Vegetation				
B. Road Surface				
C. Fences & Gates				
D. Erosion				
E. Aesthetics				
F. Other:				

10. Underground Trenches

A. Sediment				
B. Standing Water				
C. Settlement				
D. Other				
E. Other				

11. Miscellaneous

A. Effectiveness of Exist. Maintenance Program				
B. Potential Mosquito Habitats				
C. Mosquitoes				
D. Other:				
E.				
F.				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SWM Inspection List
Page 4 of 4

Remarks: (Refer to Item No, If Applicable)

Inspector: ______________________________

Attachment No. 4

Exhibit C

Executive Director's Report on
The Richard Stockton College
April 2010 Master Plan

An area for storage, staging, stockpiling, and similar activities (not to exceed 20 acres) may be excluded from the deed-restricted lands in this approximate location.*

Approximately 9 acres may be excluded from the deed-restricted lands to accommodate a proposed Garden State Parkway exit ramp and improvements ancillary thereto in this approximate location.*

Exhibit C. – Sensitive Lands to be Deed Restricted (amended from Exhibit 7 of the Richard Stockton College of New Jersey April 2010 Master Plan)

* Area not drawn to scale

ATTACHMENT 5: Supplemental Background and Details from the April 2010 Master Plan

1. The wetlands buffer requirements applicable to the Designated Development Areas of the College are depicted in the 2010 Master Plan. The required buffer is generally 300 feet, except around the central core (Area 1) where it is 175 feet. Where existing development within a Designated Development Area is closer than 175 feet from wetlands, the buffer for adjacent new development shall be no greater than the existing buffer.

2. Notwithstanding the provisions of Paragraph IV above, the following provisions from prior MOAs remain valid. Additionally, regardless of where such activities are conducted, the following shall not constitute development for purposes of this MOA and shall not require Commission approval prior to the commencement thereof:

    a) the resurfacing of a right-of-way, access road or driveway constructed of an impervious material which will not result in an increase in the width of the existing impervious surface;

    b) the installation of scientific monitoring and research equipment such as weather and temperature monitoring equipment, water quality monitoring equipment and other similar scientific devices;

    c) the installation of lighting and electrical utilities along existing walkways, pathways, roadways and parking lots;

    d) the maintenance of the surface of existing parking areas which does not result in an expansion of the parking area and which does not result in a change in the composition of the parking surface;

    e) the replacement and installation of directional signs, facility identification signs parking lot directory signs, ADA signs and traffic signs;

    f) the installation of fencing, provided that no more than 1,500 square feet of clearing will occur, and that said clearing does not exceed the clearing limits established for any applicable Designated Development Area;

    g) the development of a trail or pathway in existing cleared areas provided that the width does not exceed four feet;

    h) clearing of areas along roads and at the edges of existing recreational fields, provided that the clearing does not exceed 5,000 square feet and that said clearing does not exceed the clearing limits established for any applicable Designated Development Area;

    i) the installation of equipment storage sheds and maintenance sheds, provided the area of disturbance does not exceed 1,500 square feet and that any associated

j) clearing does not exceed the clearing limits established for any applicable Designated Development Area ;

k) the installation of satellite dishes and antennas, provided that the area of disturbance does not exceed 1,500 square feet, that any associated clearing does not exceed the clearing limits established for any applicable Designated Development Area, and that the antennas are located within a Pinelands Regional Growth Area;

l) the repair, renovation, or rehabilitation of existing culverts, stormwater inlets, and stormwater piping;

m) the installation of an underground storage tank or an above ground storage tank, provided that said installation does not result in the disturbance of greater than 1,500 square feet, and that any associated clearing does not exceed the clearing limits established for any applicable Designated Development Area; and, all other activities enumerated in N.J.A.C. 7:50-4.1(a)1.-21.

3. The College may, instead of using the process delineated in this MOA, file a complete public development application seeking formal Commission approval for any proposed development project either (1) within any Designated Development Area, which exceeds the maximum impervious coverage ratio or the total area of disturbance identified within the Stormwater Plan; or, (2) anywhere else on its campus not within a Designated Development Area. Development projects satisfying either of these criteria are not subject to the terms of this MOA, however, they are subject to the Master Plan and its DCR and alternative submission does not guarantee approval.