

Wayland Town Center

Public Hearing . 15 October 2007
Revisions to the Master Special Permit submission








Key Discussion Items

- Summarize Preferred Plan
- Irrigation Demand
- Rt 27 Roadway Improvements
- Signage
- Site Plan Permitting

Irrigation Program

- Many Meetings and Opinions
  - Irrigate, Harvest Rain, or Organic
  - “Town Green” Area Evaluation
  - No Cistern – No Irrigation
- No Irrigation
  - Buffer Area, Municipal Lot, Parking Lot Islands
- Irrigation
  - Residential Areas
  - Hardscape and Around Buildings
  - Rain Gardens

Irrigation Demand

- 31% Decrease in Seasonal High Demand (25,000 gpd to 17,300 gpd)
- Comply With Irrigation Bylaw
- Avg. Irrigation Demand – 3,000 gpd

Rt 27 Roadway Improvements

- Save the Hitching Posts !
- BORC and TEC Review
- PB Recommendations to BORC

Signage & Site Plan Permitting

- Monument Sign Reductions
- Respect the MSP Basis of Design

Revisions to the original MSP submission

- Site Plan evolution
- Residential over retail
- Site plan guidelines / flexibility
- Residential elevations on the green
- Way-finding: Rt. 20 / 27 entry monument signs



Concept Plan

August 2006

Original MSP Submission plan

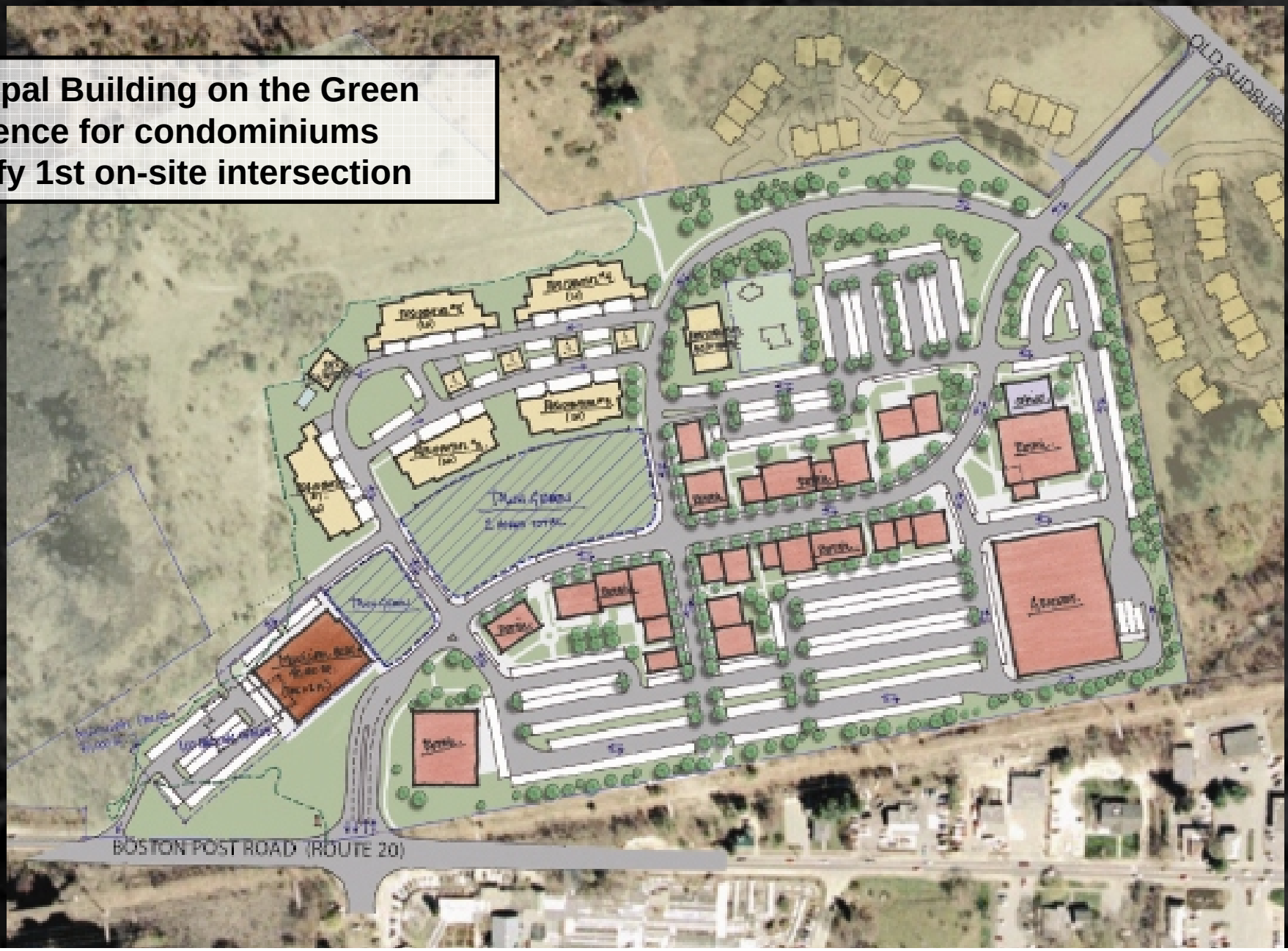
10 May 2007



“Preferred” MSP Plan

11 July 2007

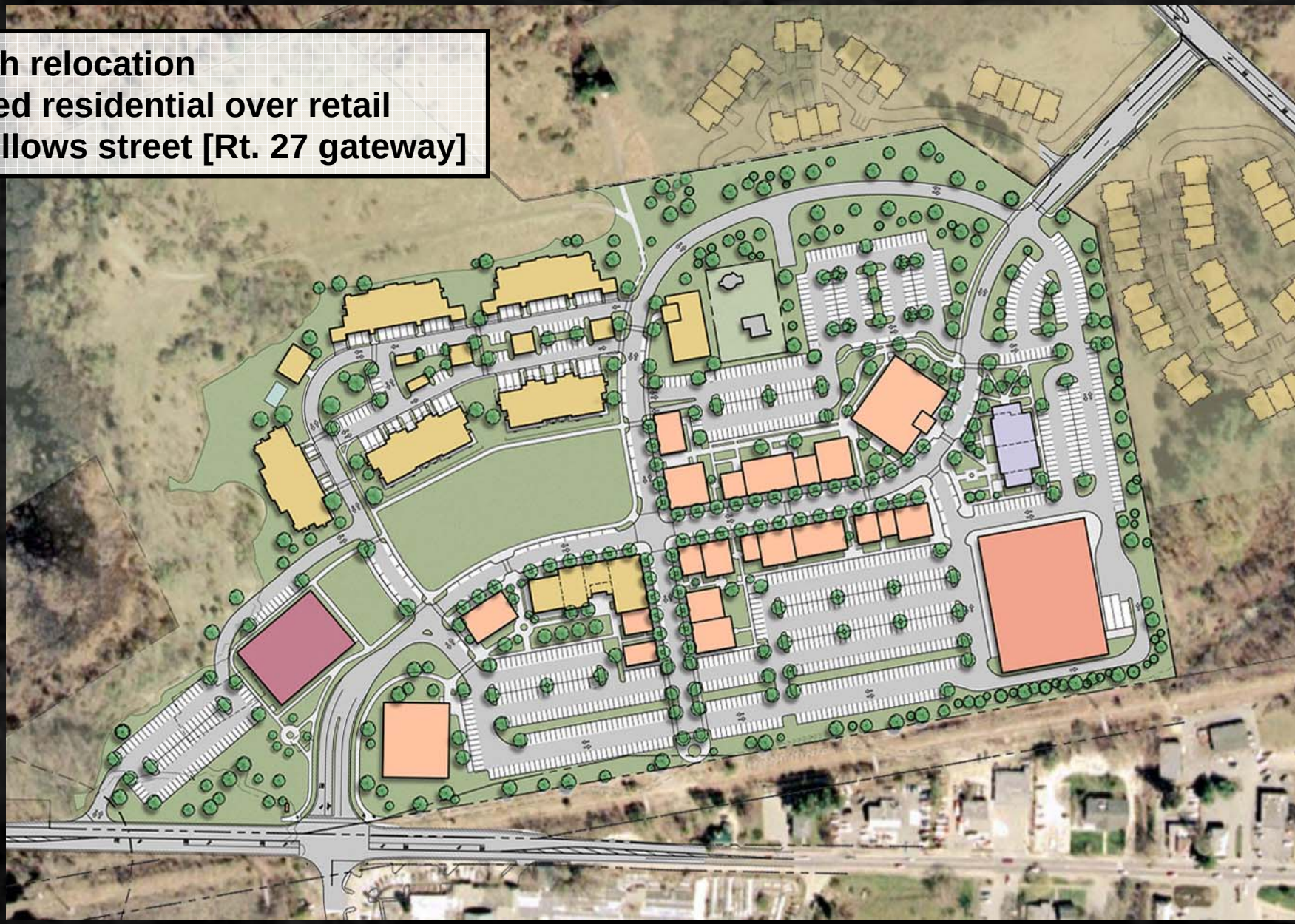
- **Municipal Building on the Green**
- **Preference for condominiums**
- **Simplify 1st on-site intersection**



Revised MSP Submission Plan

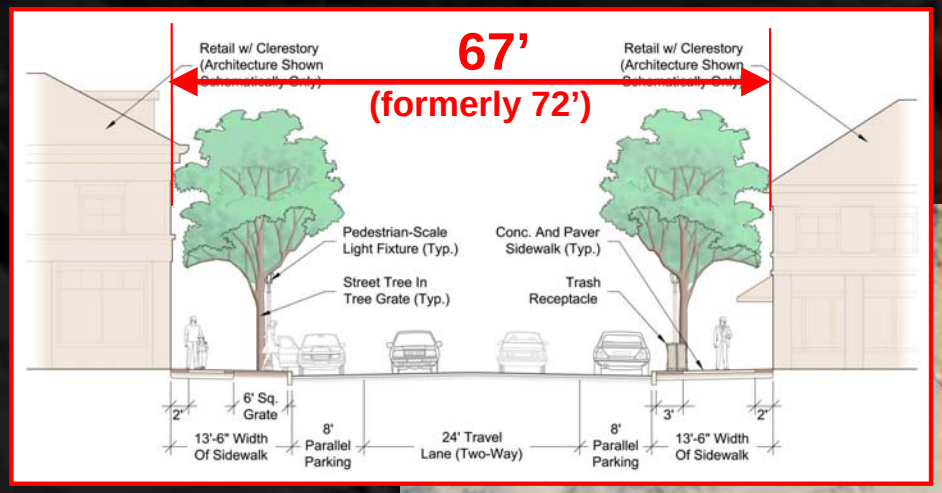
5 October 2007

- **Bike path relocation**
- **Integrated residential over retail**
- **Retail follows street [Rt. 27 gateway]**

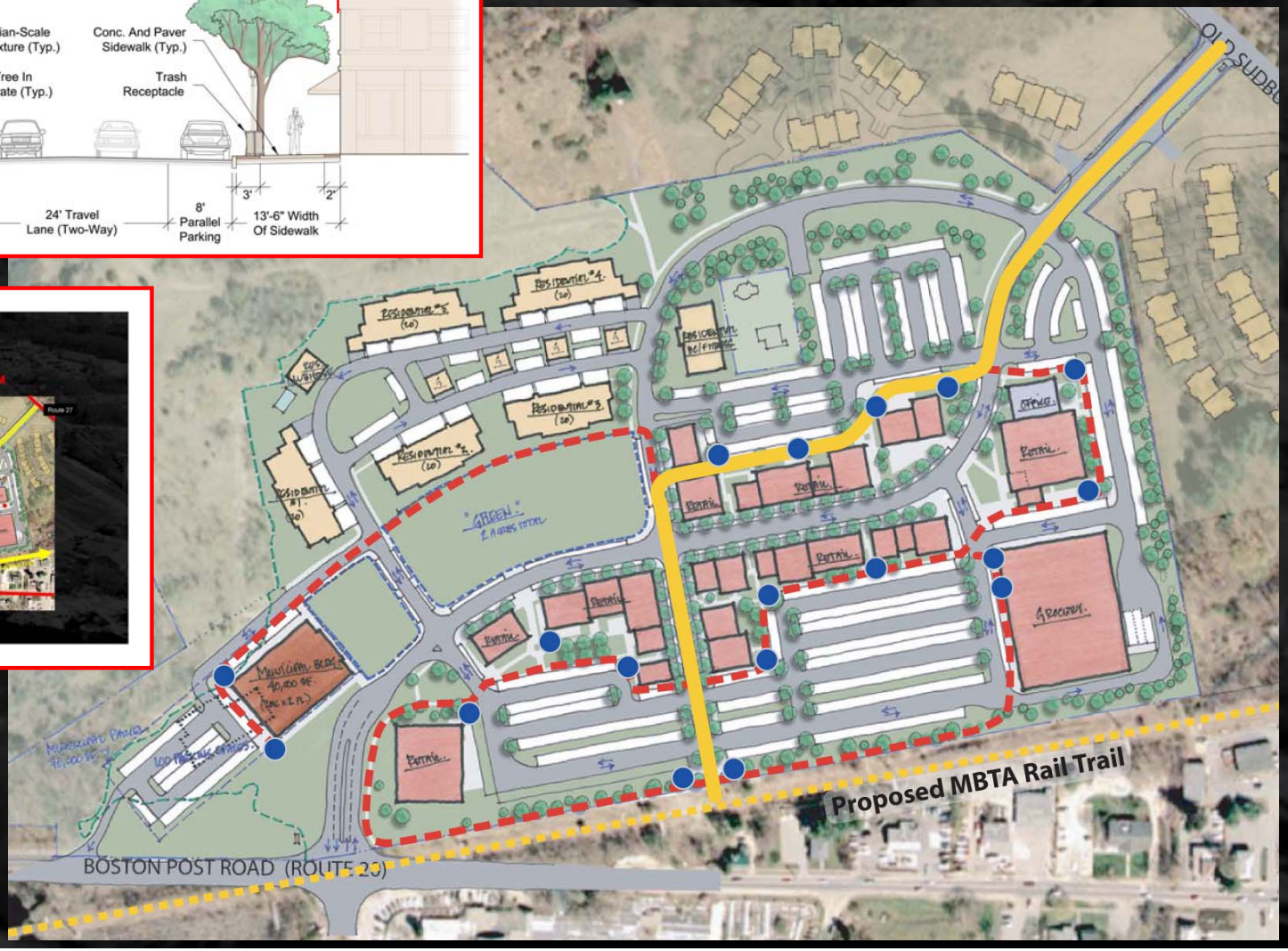


Revised MSP Submission Plan

Bike Path Relocation

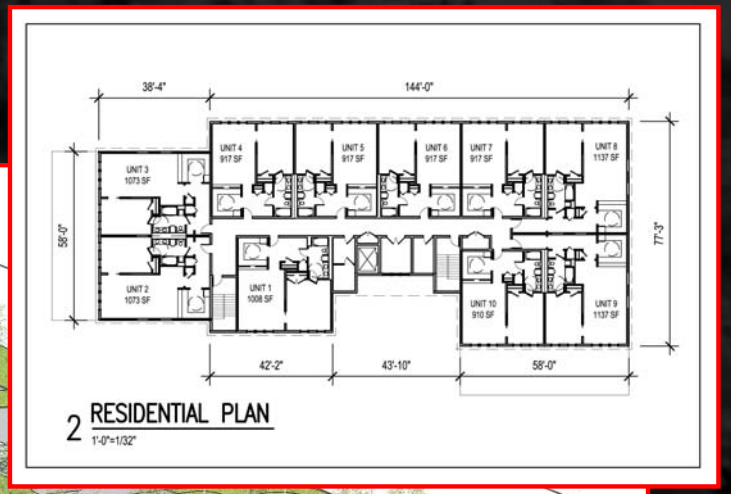






Revised MSP Submission Plan

Revised Residential over Retail



Revised MSP Submission Plan

Revised Residential over Retail





Residential Elevations

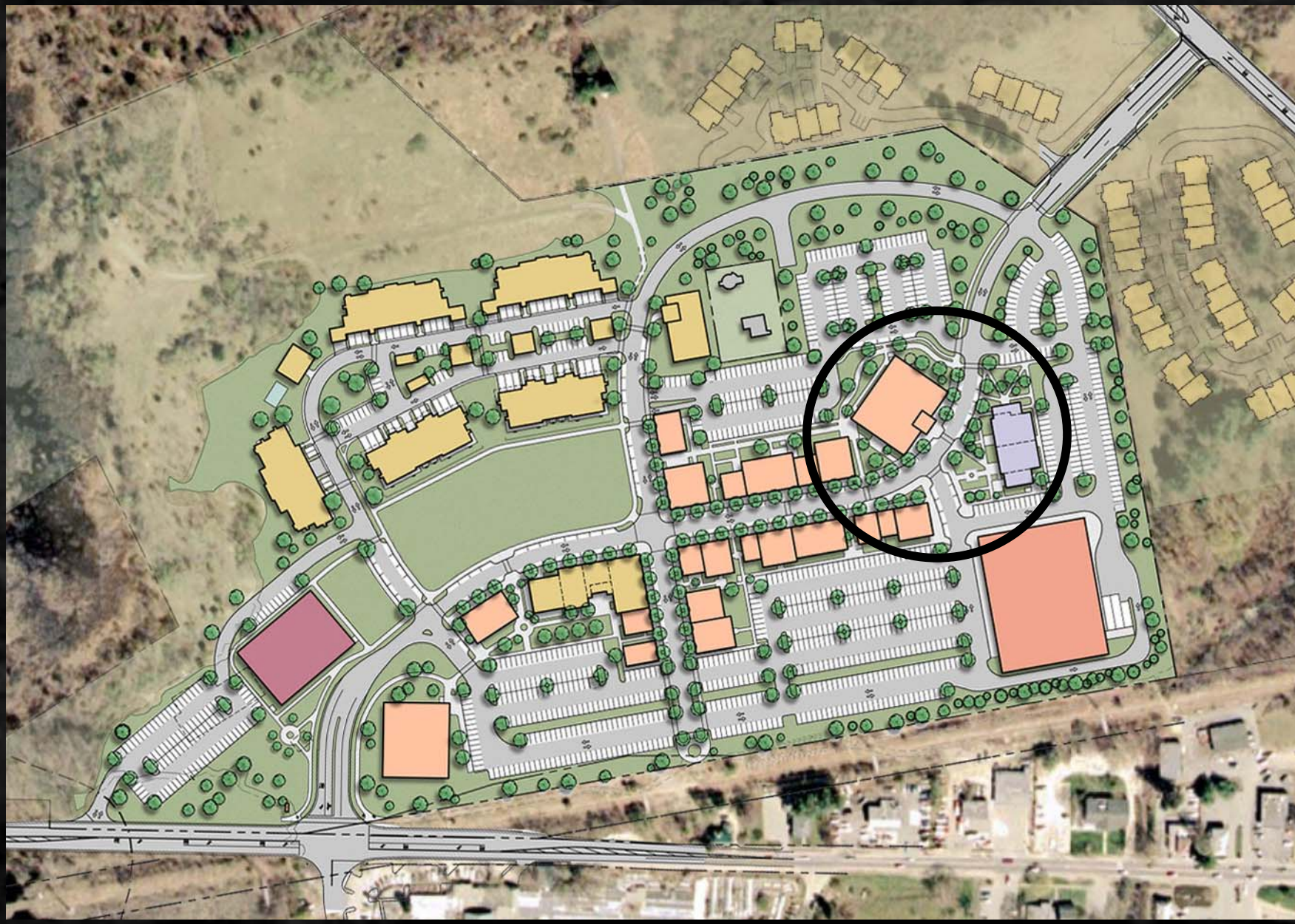
Defining the Green





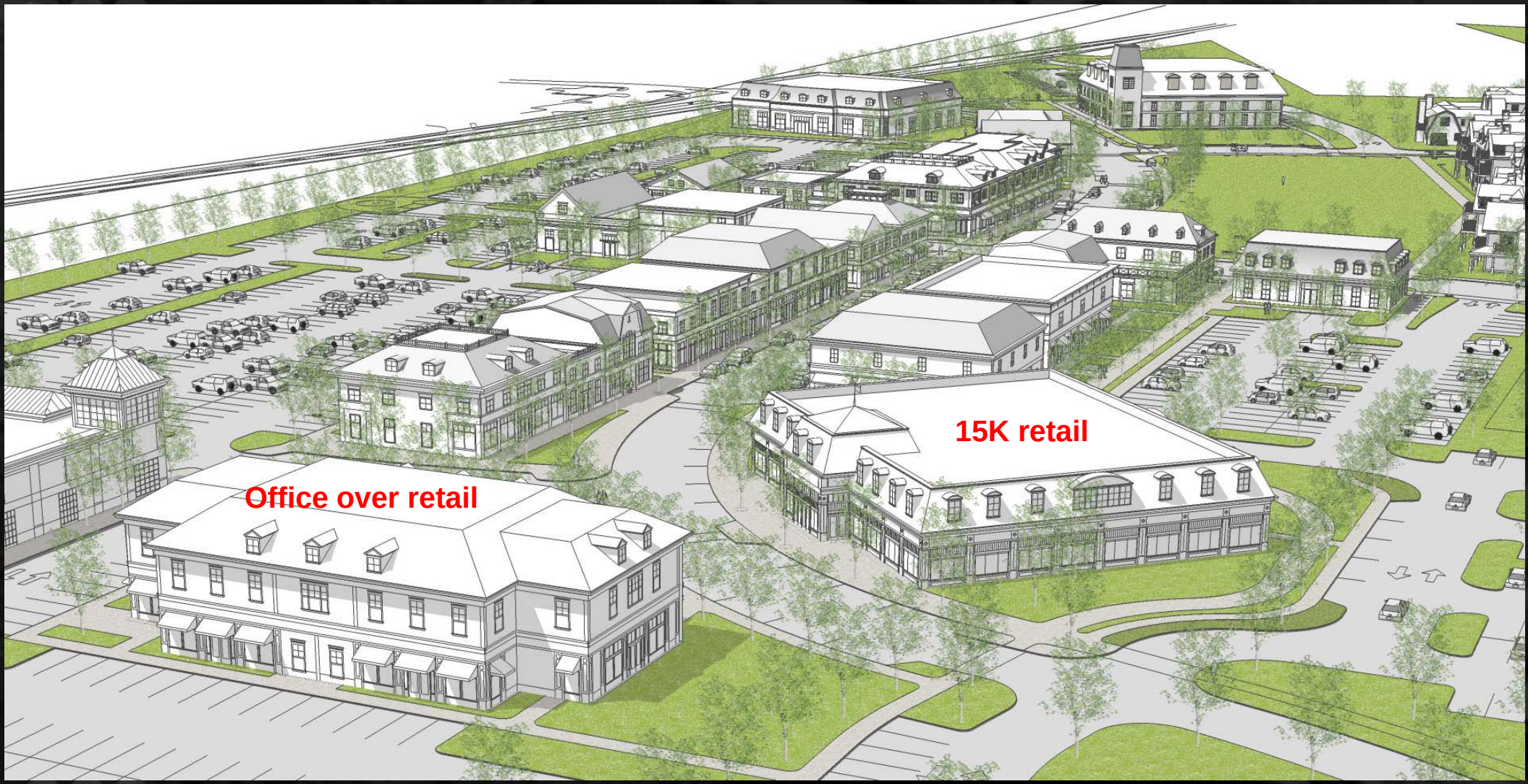
Revised MSP Submission Plan

Retail follows street [Rt. 27 gateway]



Revised MSP Submission Plan

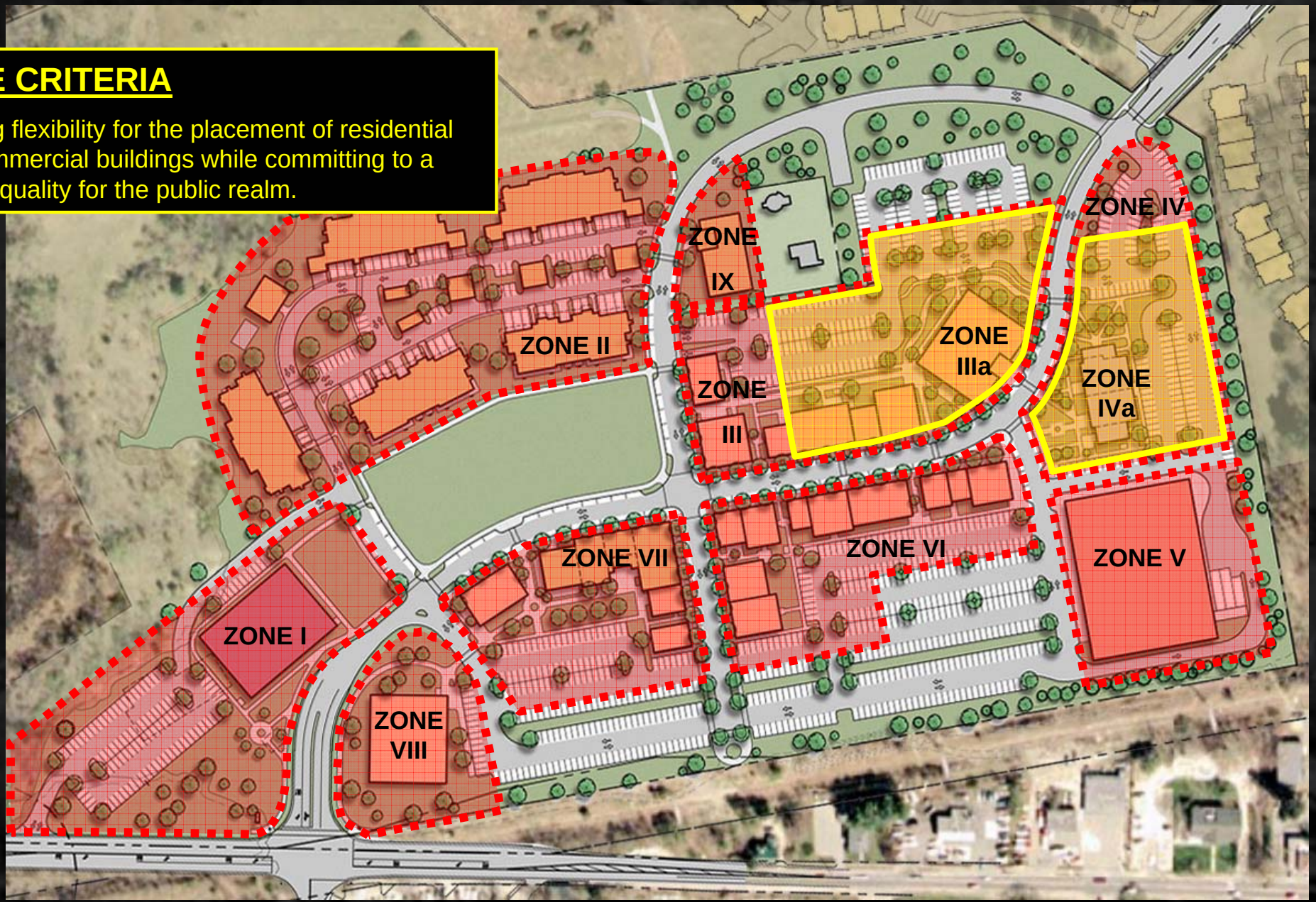
Retail follows street [Rt. 27 gateway]



Site Plan Parameters

ZONE CRITERIA

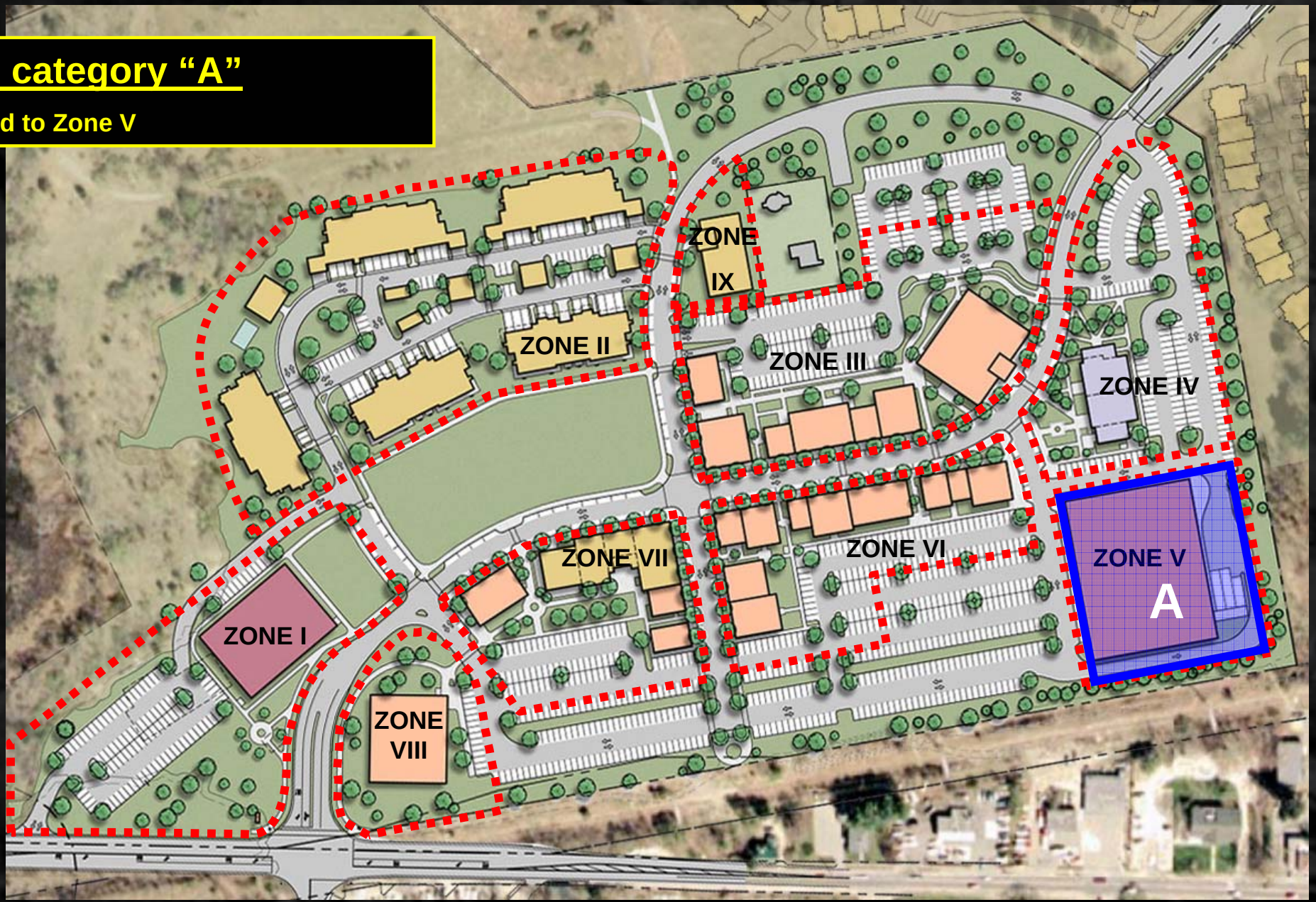
Defining flexibility for the placement of residential and commercial buildings while committing to a level of quality for the public realm.



Site Plan Parameters

Size category "A"

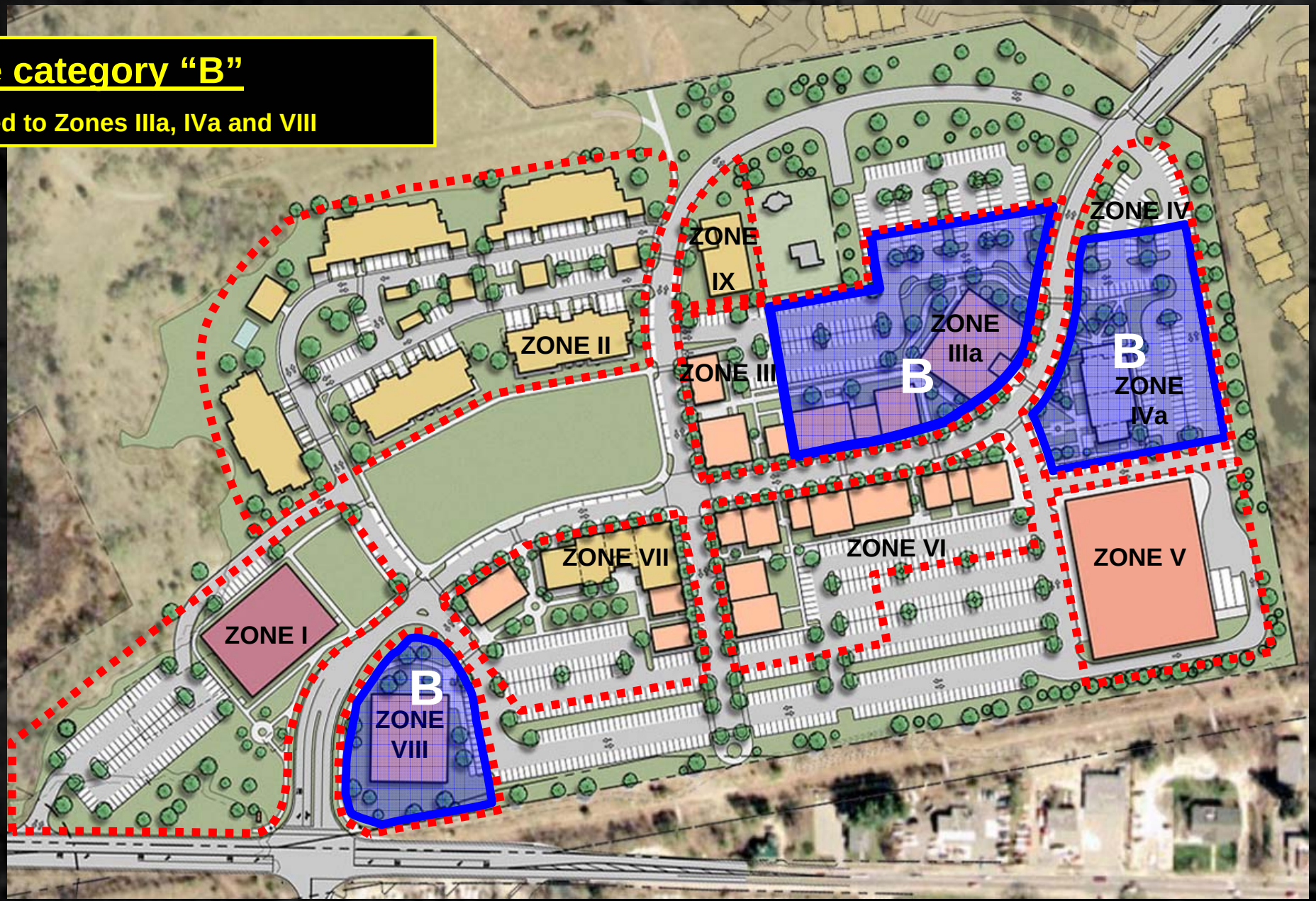
Limited to Zone V



Site Plan Parameters

Size category "B"

Limited to Zones IIIa, IVa and VIII



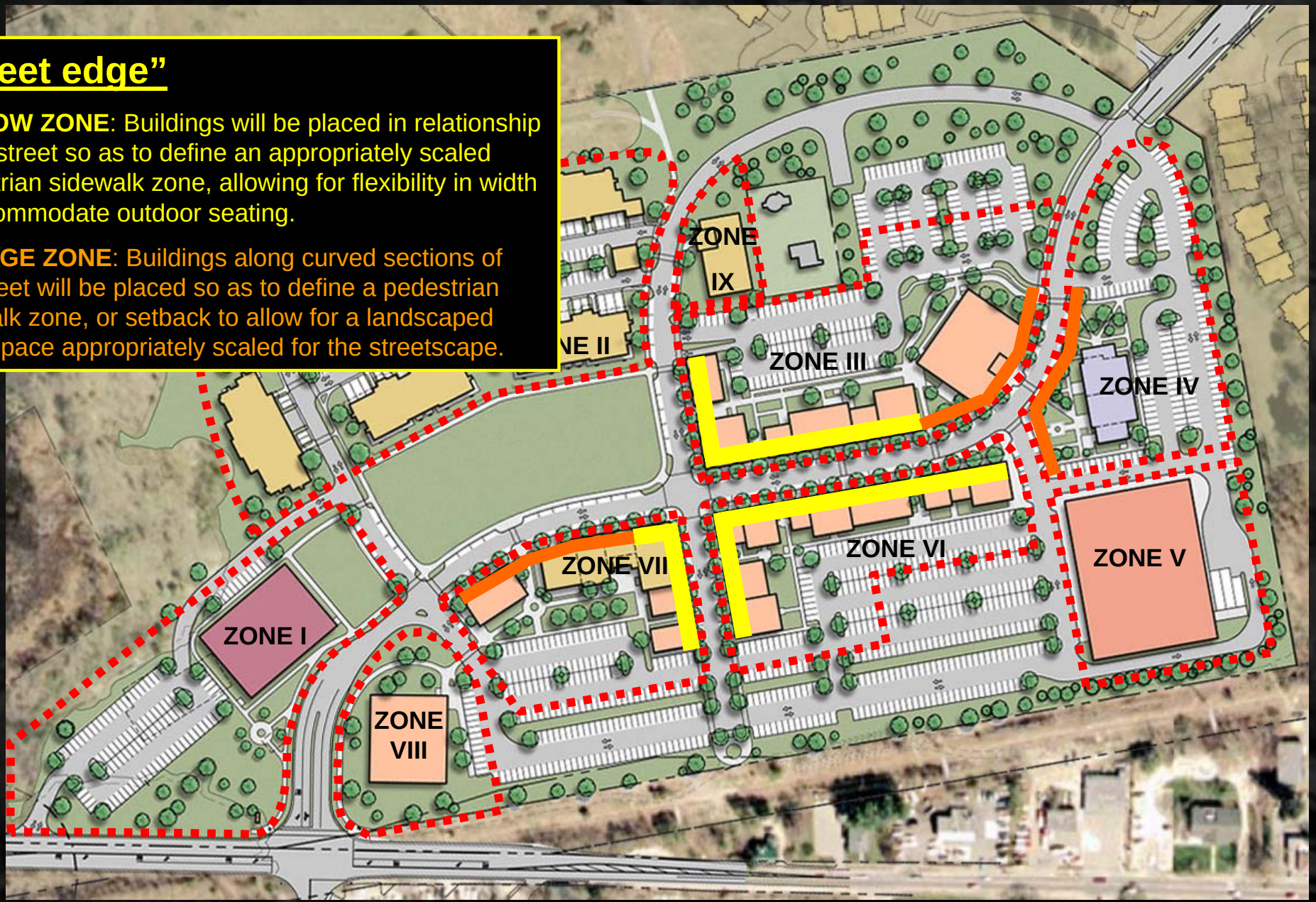
Site Plan Parameters

"Defining the street"

"Street edge"

YELLOW ZONE: Buildings will be placed in relationship to the street so as to define an appropriately scaled pedestrian sidewalk zone, allowing for flexibility in width to accommodate outdoor seating.

ORANGE ZONE: Buildings along curved sections of the street will be placed so as to define a pedestrian sidewalk zone, or setback to allow for a landscaped open space appropriately scaled for the streetscape.

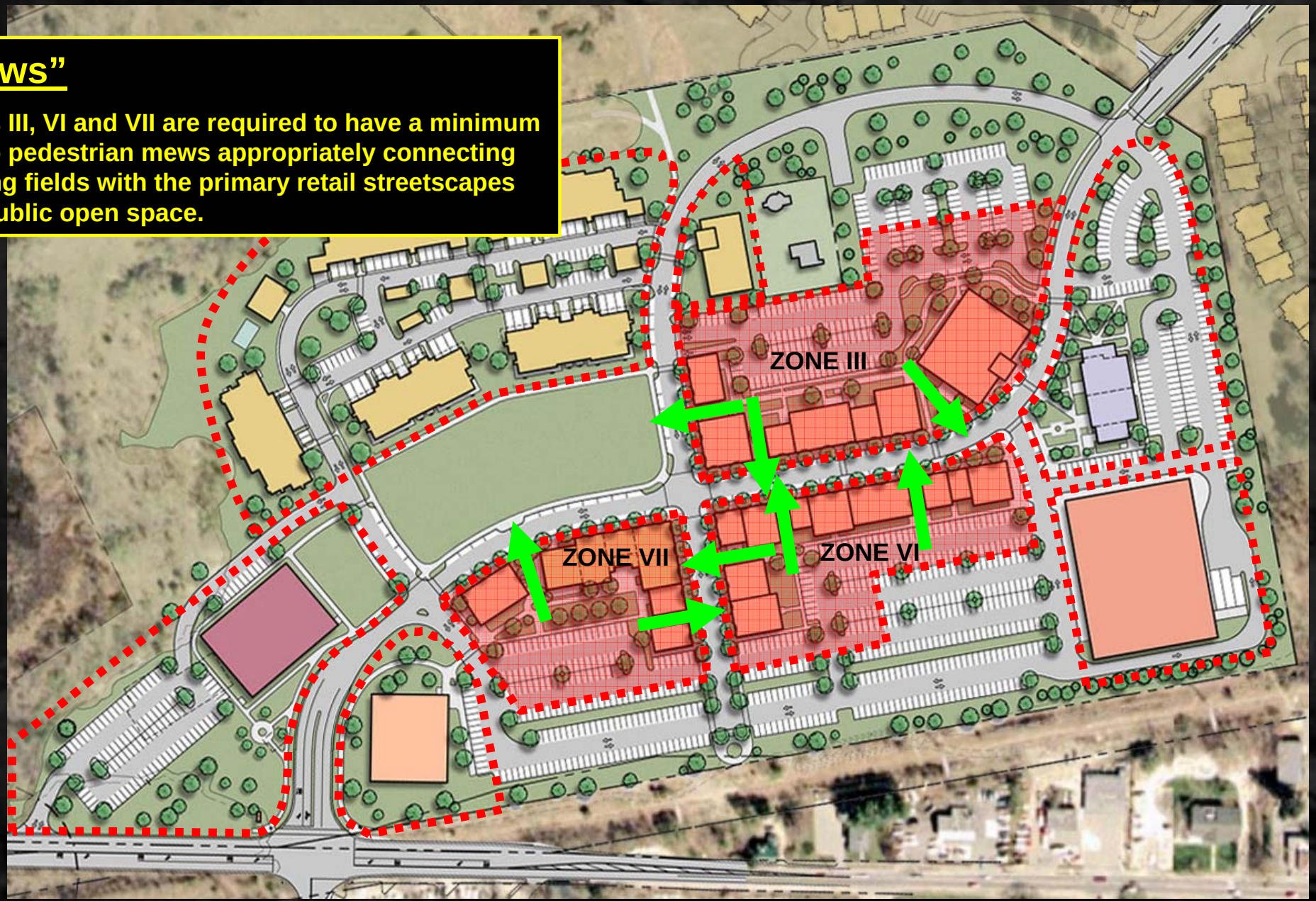


Site Plan Parameters

Pedestrian Connections

“Mews”

Zones III, VI and VII are required to have a minimum of two pedestrian mews appropriately connecting parking fields with the primary retail streetscapes and public open space.

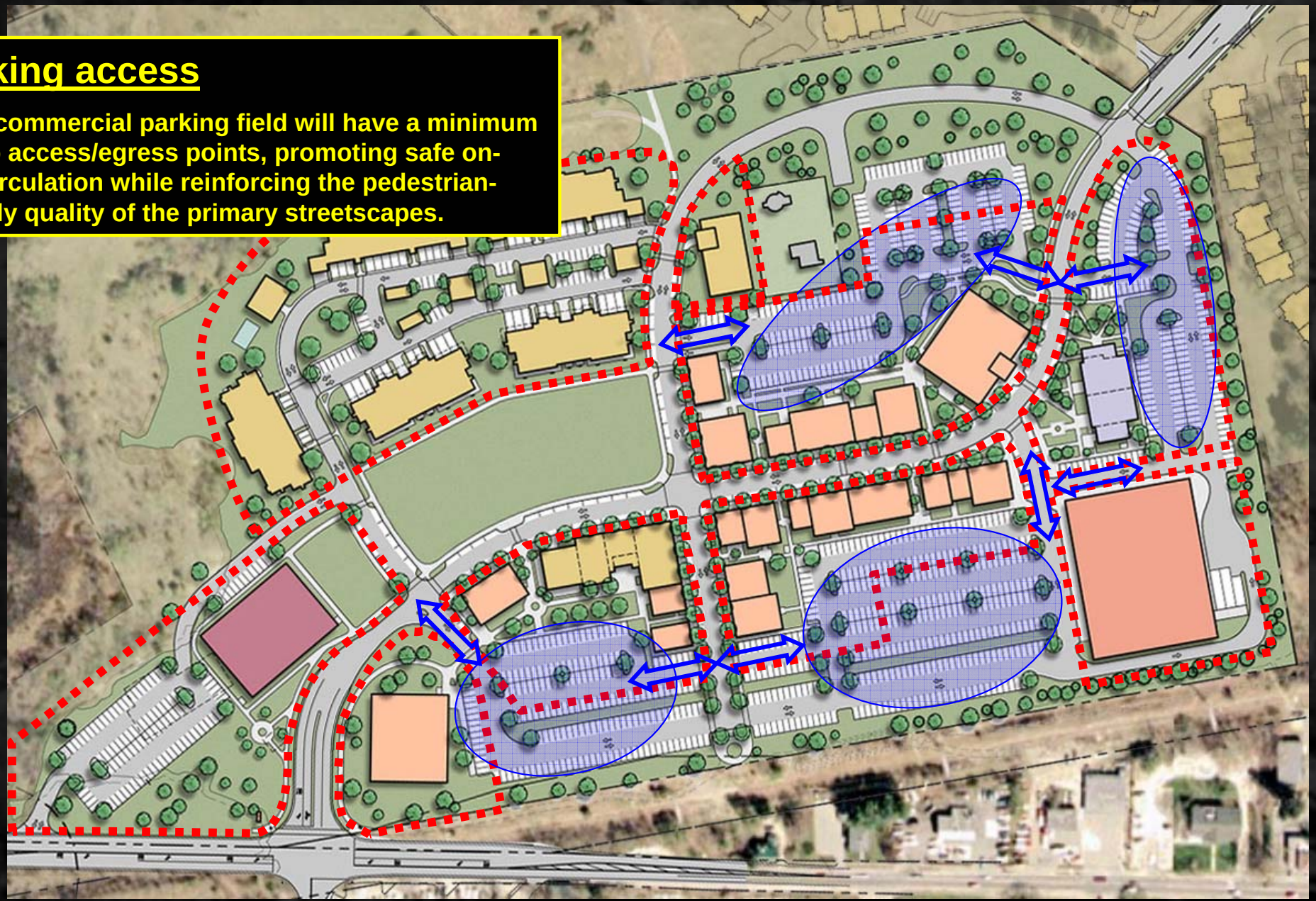


Site Plan Parameters

Vehicular Circulation

Parking access

Each commercial parking field will have a minimum of two access/egress points, promoting safe on-site circulation while reinforcing the pedestrian-friendly quality of the primary streetscapes.



Site Plan Parameters

Bike Path Location



Bike path flexibility

Bike path has been relocated off of "Street A" and will be accommodated in Zone III, either at the back edge of the retail tenants [as previously presented], or along the northern edge of the Zone.



Residential Elevations

Defining the northern edge of the Green



Residential Elevations

Defining the Green



10 - Unit Residential Building - SOUTH ELEVATION
1/16" = 1'-0"

10 May 2007



BUILDING R-2 SOUTH ELEVATION 16 - Unit
1/16" = 1'-0"
ALL 2-BEDROOM UNITS



BUILDING R-3 SOUTH ELEVATION 18 - Unit
1/16" = 1'-0"
ALL 2-BEDROOM UNITS

12 September 2007

Residential Precedents

Natick, MA



Residential Precedents

Newton, MA









Residential Precedents

Multi-family buildings

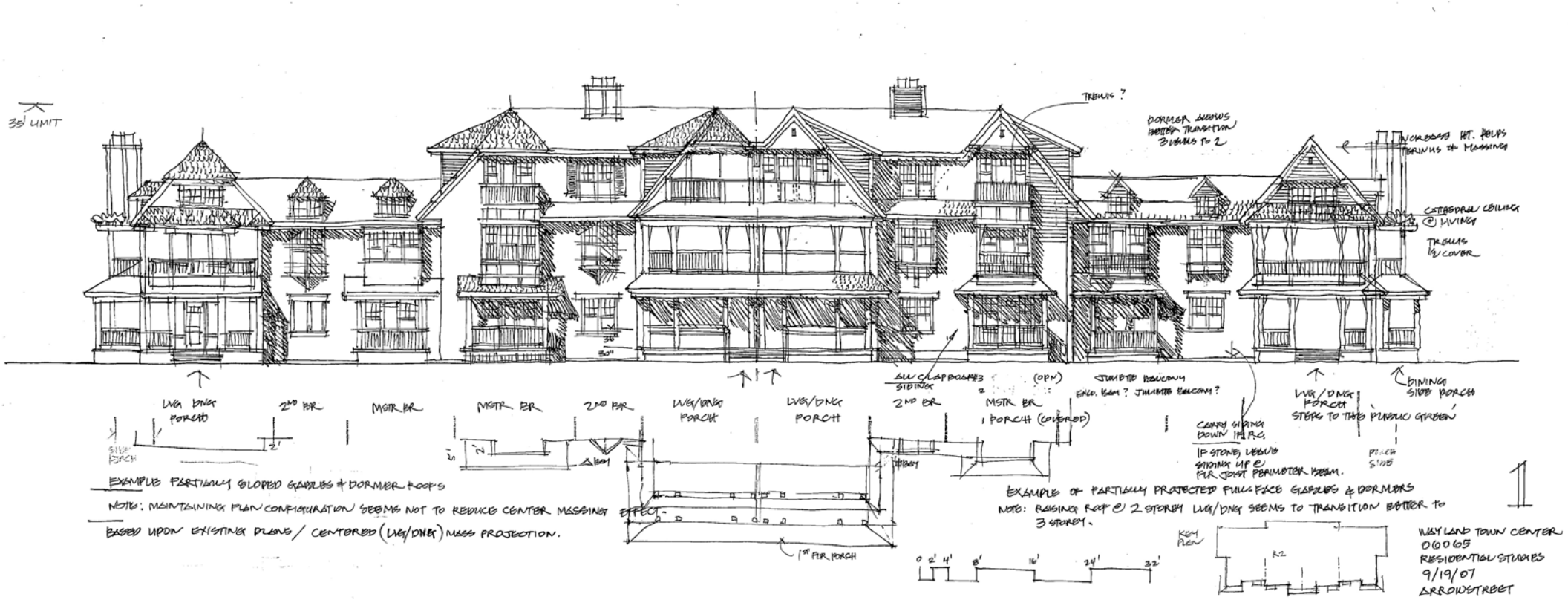




Residential Elevations

Defining the Green





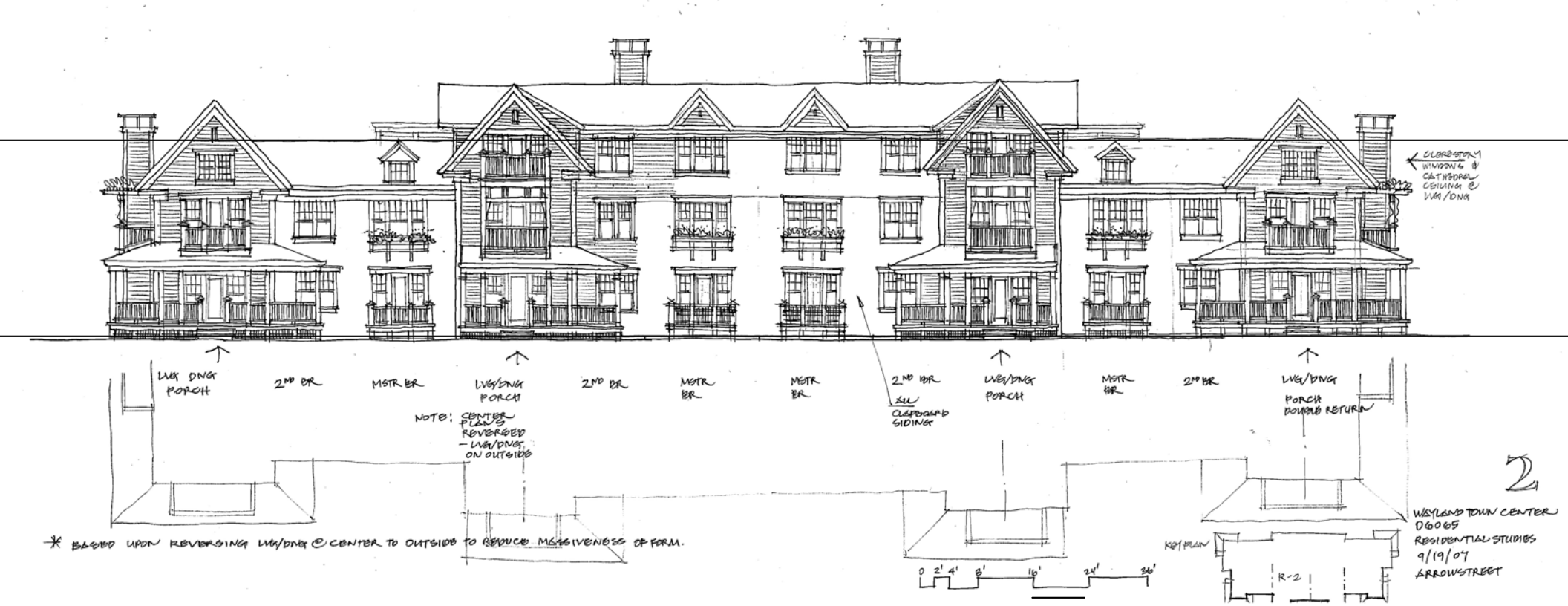
Step 1: ARTICULATION

Porches / Gables / Dormers / Trellis / Juliette Balconies

Residential Elevations

Defining the Green





Step 2: SCALE

Flipping the units to decentralize focus

Residential Elevations

Defining the Green





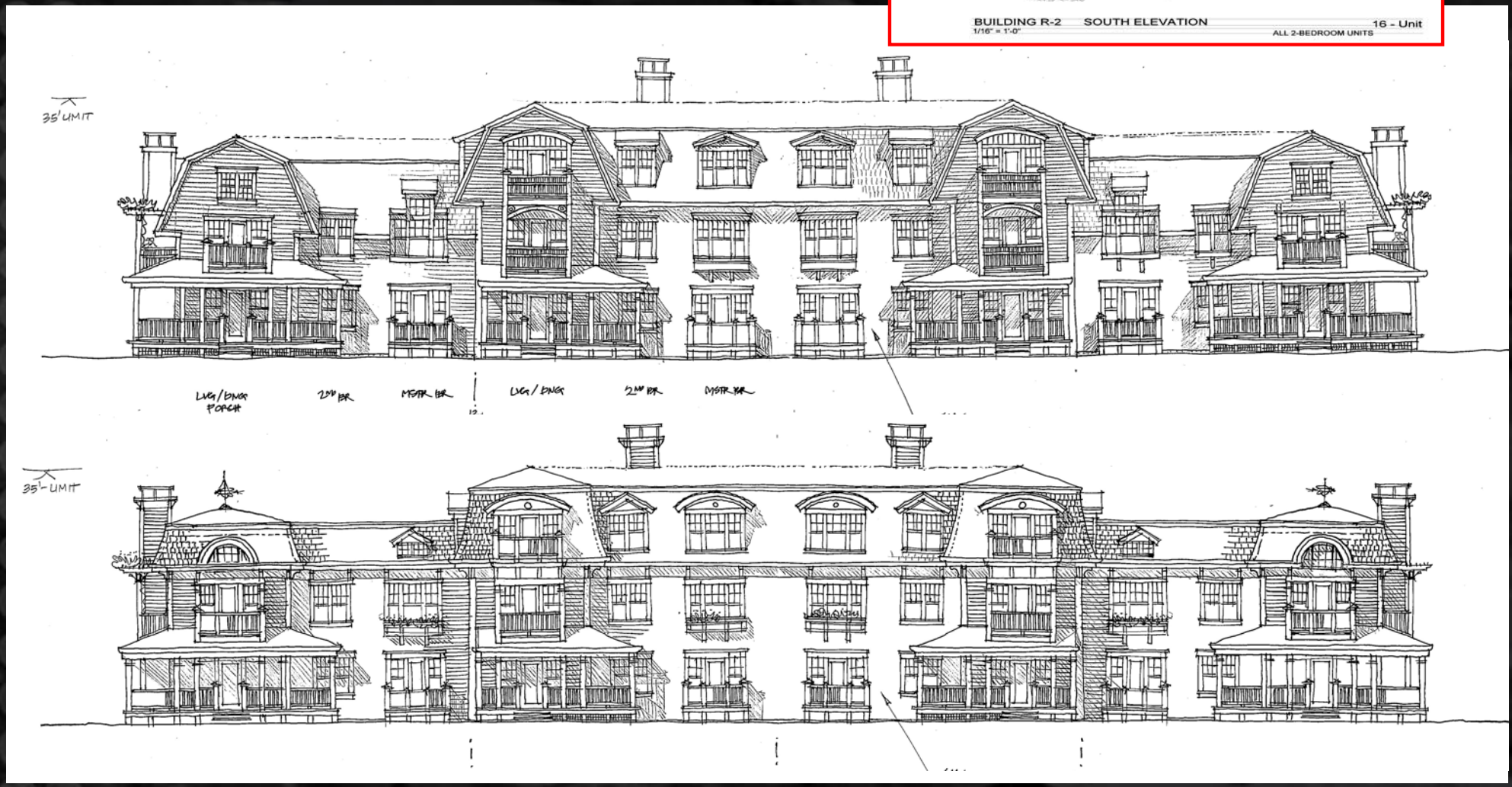
Step 2: SCALE

Roof profile: Mansard-like approach to 3rd floor

Residential Elevations

Defining the Green





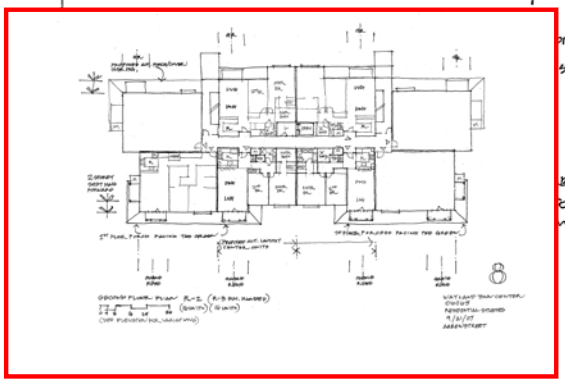
Step 4 & 5: STYLE
Variations

Residential Elevations

Defining the Green







Step 6: CONNECTING THE MASSES

Plan shift allows porches to connect and wrap

Residential Elevations

Defining the Green



RESIDENTIAL BUILDING R-2 (16 UNITS)

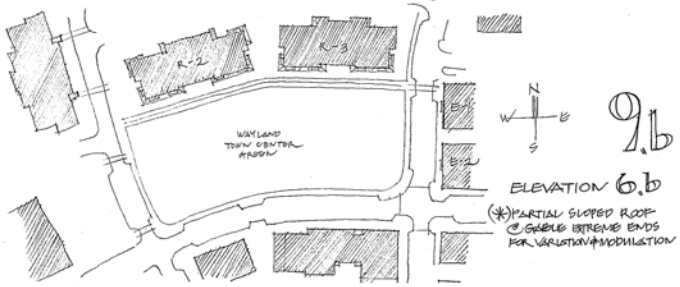
SOUTH ELEVATION — FACING WAYLAND TOWN CENTER GREEN

(SEE SKETCH PLAN FOR SUGGESTED LAYOUT)

RESIDENTIAL BUILDING R-3 (SHOWN WITH 16 UNITS — REDUCED 600'± 2 UNITS FOR MASSING AREA CONCAVE).

NOTE: ELEVATION OF R-3 PROPOSES 2 STORY MASSING @ EAST END IN ORDER SO AS NOT TO OVERPOWER BUILDINGS B-1 & B-2 AT THE EAST SIDE OF THE GREEN."

KEY PLAN:



9.b

ELEVATION 6.b

(*) PARTIAL SLOPED ROOF @ GABLE EXTREME ENDS FOR VARIATION & MODULATION

WAYLAND TOWN CENTER
060065
RESIDENTIAL STUDIES
9/21/07
ARROWSTREET



Residential Elevations

Defining the Green

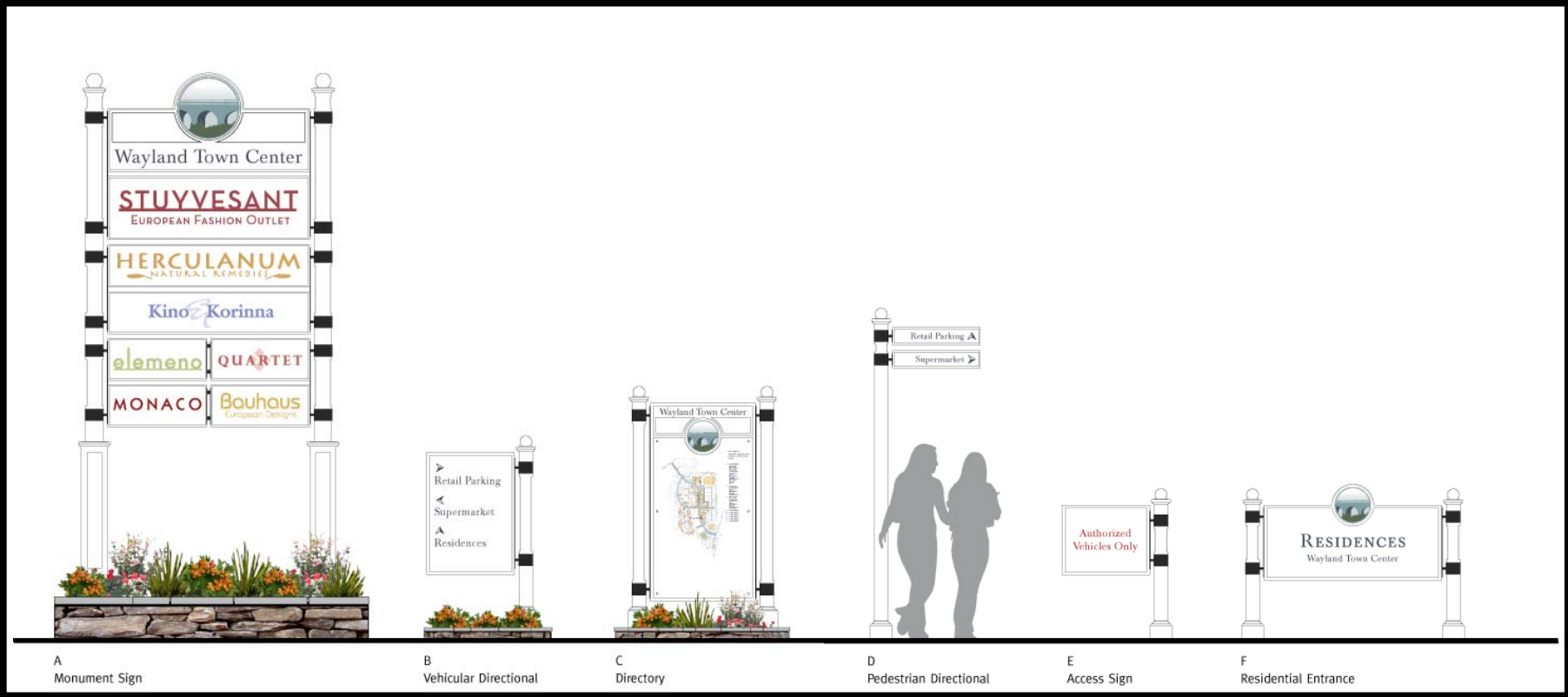


Site Identification and Way-finding



Site Identification and Way-finding

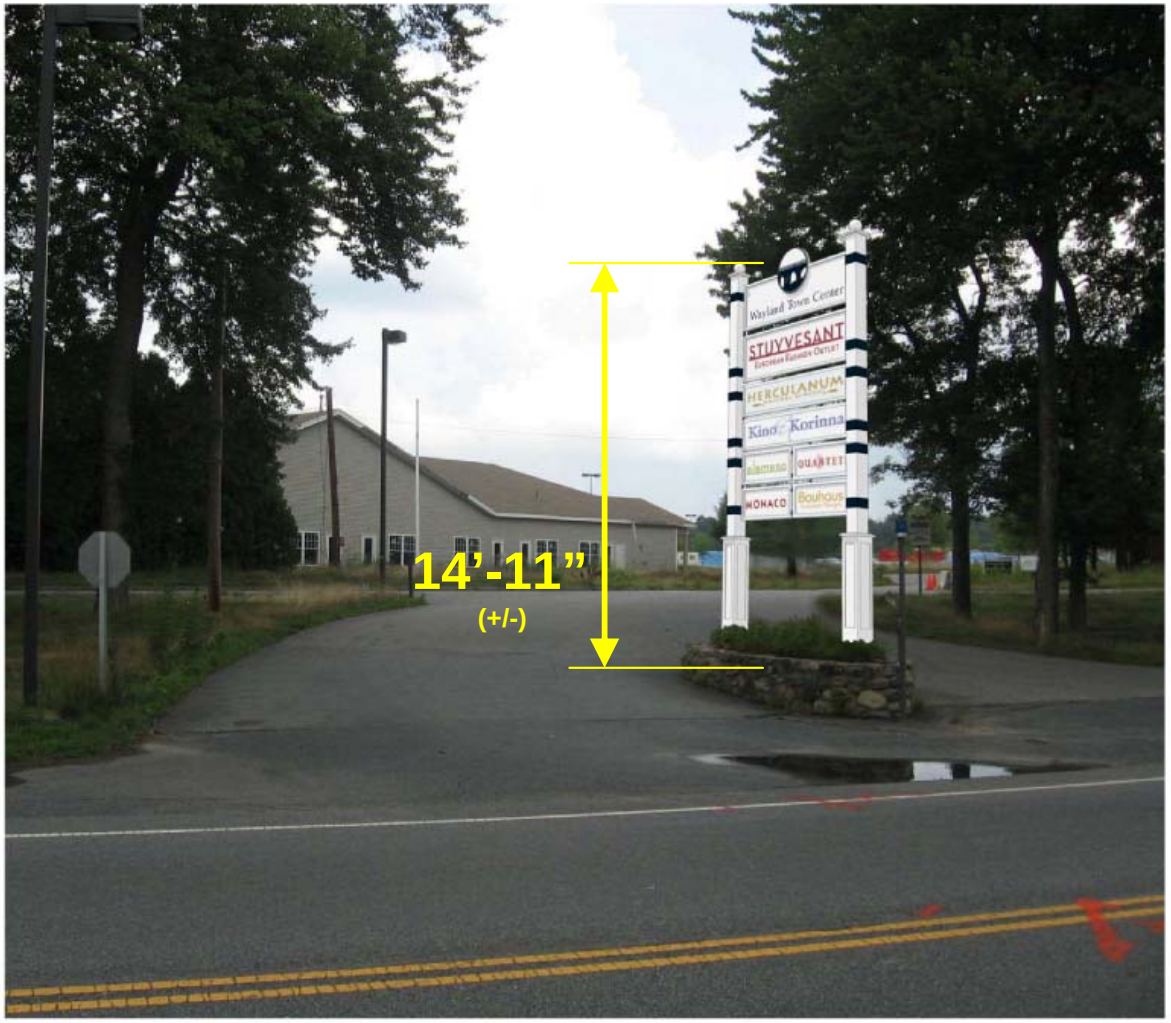
"A comprehensive sign program for way-finding… to establish a uniform theme and a common style…"



SIGNAGE FAMILY

Site Identification and Way-finding

Context Elevation



Wayland
Town Center

Site Identification and Wayfinding Program

ARROWSTREET
GRAPHIC
DESIGN

ARROWSTREET INC.
212 ELM STREET
SOMERVILLE MA 02144
617.623.5555
FAX 617.625.4646

DRAFT

DATE
September 12, 2007

TITLE
Monument Sign

SHEET
6

Site Identification and Way-finding





Site Identification and Way-finding



23’
(+/-)

20’
(+/-)



14’

Site Identification and Way-finding

Monument Signs

Monument

Notes:

Option 1: Carved wood sign posts in white with carved wood sign panels and wrought iron bracket connections. Mounted on stone base. Externally illuminated.

Option 2: Same construction as Option 1 but without stone base.



Wayland
Town Center

Site Identification and Wayfinding Program

ARROWSTREET
GRAPHIC
DESIGN

ARROWSTREET INC.
212 ELM STREET
SOMERVILLE MA 02144
617.623.5555
FAX 617.625.4646

DRAFT

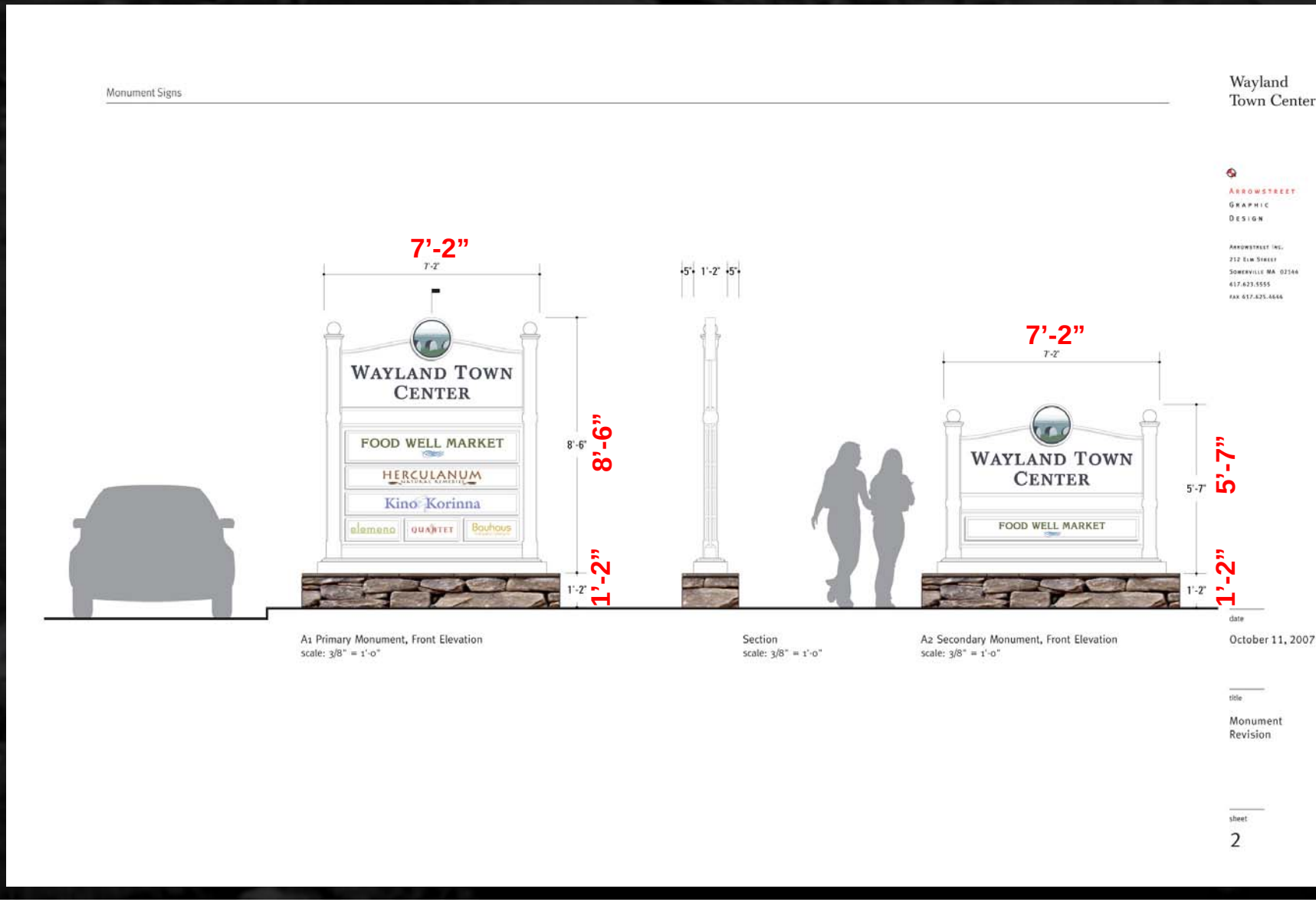
DATE
September 12, 2007

TITLE
Monument Sign
scale: 1/4" = 1'-0"

SHEET
5

Site Identification and Way-finding

Revised Monument Signs



Site Identification and Way-finding

Existing Condition: Route 20 Entrance



Site Identification and Way-finding

Monument Sign: Route 20 Entrance



Site Identification and Way-finding

Existing Condition: Route 27 Entrance



Site Identification and Way-finding

Monument Sign: Route 27 Entrance



Revised MSP Submission Plan

5 October 2007



65 Glenn Street | Lawrence, MA 01843
tel 978.794.1792 | fax 978.794.1793
www.tecmass.com

MEMORANDUM

TO: Joseph Laydon
Town Planner
Wayland Town Building
41 Cochituate Road
Wayland, MA 01778

DATE: October 15, 2007

FROM: Kevin R. Dandrade, PE, PTOE
Principal / Senior Engineer

PROJECT NO.: T0124.02

RE: Response to Recent Traffic Engineering Questions
Wayland Town Center Project – Twenty Wayland, LLC

This memorandum was prepared in response to questions and concerns regarding traffic engineering for the Town Center Project as raised within the e-mails from Mr. David Bernstein (provided to TEC by the Planning Department), to discuss confirmatory analyses provided by Vanasse & Associates, Inc. (VAI), and to provide comments on the recently submitted site plans from Arrowstreet / RJ O'Connell & Associates, Inc.

E-mails from Resident: Mr. Bernstein – 25 Glezen Lane

TEC reviewed the technical comments and analyses provided by Mr. David Bernstein within his e-mails to you and Planning Board representatives dated October 2, 9, and 10 concerning traffic introduced to Glezen Lane as part of the Wayland Town Center Project.

Mr. Bernstein provided his estimates for the increase in traffic traveling through the Routes 20/27/126 intersection. His projections show alarming increases of 50% to 68% increases in traffic, but these are not the increases directly associated with the Wayland Town Center proposal. The analysis incorrectly compares the "Build" condition (existing traffic + background growth + Project traffic) to the Existing condition rather than the "No-Build" (existing traffic + background growth + office re-occupancy traffic). However, the increase in traffic under both the No-Build and Build conditions is indeed significant and substantiates the need for additional capacity at this important intersection, as currently proposed by the Applicant.

As stated within our recent memorandum dated September 5, 2007, we identified that Mr. Bernstein was incorrectly drawing a direct relationship between the peak hour impacts and the daily impacts for the project. As a matter of practice, our profession routinely assesses the impacts of a project during the one highest peak hour (4 successive 15-minute intervals) for the adjacent street system (during Weekdays 7-9 AM & 4-6 PM, Saturday 11 AM- 2 PM, etc.) to analyze the worst case. This is based on trip generation data and methodologies substantiated by the Institute of Transportation Engineers (ITE). It is during these peak hours that there are noticeable capacity constraints along Route 20 that cause traffic to operate at or above capacity. During other "off-peak" time periods, there is available capacity to retain traffic on the arterials roadways. This is based on numerous site visits and available data from the Applicant and MassHighway.

Mr. Bernstein provided a spreadsheet with two separate tabs used to calculate the percentage of traffic expected to use Glezen Lane during the established peak hours and the estimated daily increases in traffic. Within the "Peak Hour" tab, he correctly extracted the traffic volumes from

the Traffic Impact and Access Study submitted as part of the Master Special Permit package in May 2007 and the Response to Comments issued by VAI on August 6, 2007 as a point of comparison. The noted change in traffic projections between these two documents was performed based on TEC's comments from January 8, 2007 and represents a *conservative* estimate of the potential cut-through traffic to/from both Routes 20 and 126 ***if left unmitigated***. This analysis provided by Mr. Bernstein is in line with our estimates for the project and does not represent new information. The refinement of traffic analyses is a normal element of the peer review process for Planning Board applications as the technical information is reviewed and edited to better reflect the estimated operating parameters for traffic within the study area.

The second tab, named "Daily Impact", provides Mr. Bernstein's estimate for the daily traffic increases along Glezen Lane associated with the project. The basis for his estimate is the assumption that the cut-through traffic during "off-peak" periods will be 90% of that associated with the peak hours. We do not agree with this assumption because of the reserve capacity afforded during these hours on the arterials streets. The increase in daily site-generated traffic along Glezen Lane is likely to be between 500 - 600 vehicles per day (vpd) during an average weekday ***if left unmitigated***. This would represent a daily increase of approximately 26%.

However, there are mitigation measures that will be put into place to deter a significant portion of this traffic and options for the Planning Board by securing conditions of approval that can further mitigate the impacts. TEC's recommendations for mitigation items were noted within the August 30, 2007 peer review letter. As mentioned in recent hearings, the Planning Board can also consider a condition whereby the Route 27 driveway exit can be limited to right-turn-only if there are cut-thru traffic volumes in excess of what was estimated as part of these record analyses. I recommend this measure only after other neighborhood traffic diversion options have been eliminated.

As the Planning Board has been made aware, TEC previously recommended the removal of several traffic mitigation measures for the neighborhood streets from further consideration because they would either relocate a significant volume of traffic to a different neighborhood street and/or were not directly associated with the mitigation of traffic volumes from the project. We believe that the measures recommended within our August 30, 2007 letter will reasonably mitigate the impacts associated with the Wayland Town Center Project.

MassHighway - Recommended Capacity Analysis

In a recent meeting between project representatives, Town staff, TEC, and MassHighway (District 3 Office), the District Traffic Engineer suggested that VAI supply a confirmatory analysis of the short processing lanes at the intersection of Routes 20/27/126. This involves some slightly different adjustment factors for flow rates and an assumption for single-lane traffic flow following an initial period with a two-lane operation for Route 20 eastbound. These analyses were provided to TEC electronically on October 1, 2007. The results of the analyses are comparable to those provided within TEC's peer review letter dated August 30, 2007. The results continue to show a significant improvement over the No-Build condition. (See the attached capacity analysis summary provided by VAI for delays and level of service by movement.)

Wayland Town Center Site Plan Comments

TEC reviewed the updated site plans as submitted with a revision date of October 5, 2007. Our review was limited to the Parking & Traffic Control plan as it relates to the on-site traffic engineering elements of the project. The following comments should be considered by the Applicant and the Wayland Planning Board:

1. The plan should include street names or stationing to clarify the location of site features.
2. The sidewalk entering the site from Route 20 bends to the southeast to cross the access way to the large parking field (between Buildings B-2 and E-24). This crosswalk is in a location at the end of a curve where there is a potential for higher speed turning movements. We recommend moving the crosswalk to the north, adjacent to the main aisle, to improve visibility of pedestrians. The small traffic island may be a refuge point for pedestrians as long as it is greater than 60 square feet in size.
3. The raised intersection should have different pavement treatments between the crosswalk areas and the middle of the intersection. Painted white lines should be used to clearly mark the crosswalk lanes. A detail of the raised intersection should be provided, including the approach grades.
4. We recommend a sidewalk on one side of the loop road in the northeast corner of the site (near the wastewater treatment plant) to create a "circuit" for recreational walking for the residential component.
5. We recommend a short section of sidewalk to provide a walking connection to the northerly portion of the Wayland Commons 40B development.
6. The sidewalk located along the easterly portion of Street "A" requires pedestrians from Route 27 and/or the southerly portion of the Wayland Commons 40B development to cross this roadway twice if destined for the retail stores on the south side of the roadway. We recommend the construction of the sidewalk on the southeast side of Street "A" to reduce the level of vehicle and pedestrian conflict. This has negligible impacts to the planned bicycle route. Crosswalk should be added wherever the sidewalk / bike route crosses major parking aisles.
7. The Applicant should review the accessibility of the proposed dumpster pads on the plan. Several are in places that will not likely be accessible by a typical refuse truck, most notably the units near Buildings E-18, E-19, and R-11.
8. There are no dumpster locations adjacent to the residential buildings. The Applicant should define a dumpster location, if applicable for this use.
9. Stop signs (R1-1) should be placed at more significant internal intersections within the site. We recommend placement of stop signs at the following locations in addition to the ones already listed on the plans:
    a. For the eastbound approach of Street "C" as it intersects Street "B"
    b. For the eastbound approach of Street "B" as it intersects Street "A"
    c. For the eastbound approach of the exit from the municipal building as it intersects Street "C".
    d. Both driveway approaches to Street "A" from the Wayland Commons 40B development.
10. Street "A" should have a double-yellow centerline to clearly mark the travel lanes.
11. We recommend the use of 12" painted stop lines placed adjacent to noted stop sign locations and 4 feet in advance of any crosswalk lines.
12. The plan should depict the arrow and "only" markings for the separate left and right turn lanes on Street "A" as it approaches Route 27.
13. Other detailed traffic signs, including those used for loading zones, no parking zones, speed limit zones, and pedestrian warning signs, should be included on the future plans submitted for Site Plan Review.

Please call me immediately with any questions regarding this memorandum or any other traffic engineering questions in advance of the scheduled public hearing tonight. You can reach me at the office at (978) 794-1792 or on my mobile phone at (603) 361-2312.

Attachment: Table 1: Capacity Analysis Summary – Route 20 at Route 27/126 – Synchro 6 (from Vanasse & Associates, Inc. (VAI) 10/15/2007)

cc (by e-mail): Bill Steinberg
Fred Turkington
Steven Kadlik
Eric Knapp
Kenneth Cram
Frank Dougherty
Mark MacRae

The Cecil Group
Planning and Design

MEMORANDUM

Date: October 15, 2007

To: Wayland Planning Board

From: Kenneth Buckland, AICP LEED AP, The Cecil Group

RE: Report on Remaining Issues

Copies: David O'Connor ASLA, Brian Groth

The following is a list of the remaining issues and conclusions for the MUOD Master Special Permit. The three previous Cecil Group memos, the Design Principles, and the Zoning Bylaw were considered in preparing this list.

Site Plan and Massing

Overall the residential and commercial massing seems to be an appropriate scale for the size of the site and the character of the main streets. Substantial changes have been made to improve the building designs and placements across the site. However, additional definition is suggested for this decision to allow the requested flexibility in future Site Plan Reviews but to also better define the approved plan. This has been requested from the applicant.

Noting that buildings will be visible from the Sudbury River, we recommend controlling façade treatments, using subdued colors and materials, and landscaping to minimize visibility and mitigate the visual impact.

Building Orientation

The revised configuration provides an appropriate orientation of buildings along the main and cross streets, and provides appropriate connections within the area and subareas. Although requested in the Concept Plan decision, the office space will not be located closer to the municipal building. However, upper story residential units have been maintained in the plan across from the public green, which provides a similar activity level appropriate to the location.

Residential Buildings

Changes to the residential units have improved the subarea and its connections to streets and open spaces. The additional articulation proposed in the residential unit facades will provide an appropriate presentation of the project to the public open space. Specification of the materials and colors will confirm this compatibility.

Municipal Building Pad

The potential impacts of the municipal building on the environmental resource areas, including its visibility from the Sudbury River, remain as concerns. While, the

31 St. James Avenue
Boston, MA 02116
tel: 617.426.5050
fax: 617.426.5051

overall layout and organization of the site shows improvement, the municipal building may need to be accommodated in other ways on the site to meet the standard of the zoning bylaw; i.e., the pad must be provided.

Design/Programming of the Public Open Spaces

The proposal provides two acres of public space divided into a large green space of 1.68 acres (Sheet C-5) and another of 0.32 acres in front of the municipal pad. The 1.68 acre contiguous open space is acceptable with the provision that both spaces are maintained within the plan.

At this time, the programming for the Public Green is incomplete. A plan for operation and maintenance will be required.

Landscaping

The plan does not currently indicate in great detail the form and location of the plantings. It has been assumed that the landscape plans for the site buffers will be provided during the Site Plan Review of the buildings closest to those buffers. However, this should be clarified. In addition, an approved shrub list has been requested.

A rough calculation of the landscaping within the large (>50 spaces) parking lots did not indicate that the 10% interior landscape requirement has been met. Details of the calculation should be reviewed with the site designers.

Lighting

Lighting fixtures are described in the plans (ES sheets) and in the Tenant Sign Design Criteria. The details for pedestrian/walkway edge lighting, if any, have not been indicated on those plans. Additional building lighting would increase the light intensity. The criteria to maintain should be the maximum limits at the site boundaries, and to request a control system to reduce lighting during low-use periods.

Signage

Signage criteria have been well developed. However, additional clarity is needed for section 2309.4.3. "For Size Category B, the allowed aggregate area of an establishment's main signs on the primary wall can be up to 90 sq. ft." to determine its application to the project. This is important because the October 5, 2007 submittal suggests that the major and minor signs together would exceed this standard.

Other

The other issues raised in the previous memos and documentation have been addressed for the most part. The Cecil Group will prepare a suggested list of conditions for the Board and Applicant to consider by October 22, after review of the new information provided by the Applicant.

Marchionda
& Associates, L.P.

Engineering and
Planning Consultants

October 12, 2007

Mr. Joseph Laydon, Town Planner
Town of Wayland Planning Department
Town Building
41 Cochituate Rd.
Wayland, MA 01778

RE: Master Special Permit Application
Town Center Project
400 Boston Post Road

Dear Mr. Laydon:

The following are preliminary comments based upon a review of the revised (10/5/07) Master Permit Submission plans and Stormwater Management Study, our technical coordination meeting and soil testing results as furnished by R J O'Connell on this date.

I have not completed a review of the Stormwater Management Study for which I anticipate comments by Wednesday of next week.

1. **Stormwater Management:** The revised Study does include infiltration rates consistent with the soil characteristics conforming to the Hydrology Handbook for Conservation Commissioners. These rates are most likely conservative considering the soil test results from areas in the vicinity of the basins. Final site plan designs should be based upon specific testing done in the actual basin locations to verify seasonal high water table and soil characteristics.
2. **Snow Storage:** The plans do not yet indicate the location of the snow storage area. It is preferred that this feature be identified. I have heard an oral description from the proponent that I believe will meet the intent of DEP policy. However it is desirable to include this intent on the plans.
3. **Project Details:** The civil details have yet to be specified as to where they are to be applied. There needs to be some means to identify the general intent as to what kind of surfaces and finishes will be expected in the future site plan submissions conforming to the intent of MUOD regulations (304-10(2)a.11). Some of this appears to be included in the Landscaped plans but these are limited to specific areas and not the entire site. I understand that these are permit plans and are subject to change during future review processes, however, the intent should be better defined.

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& Associates, L.P.

Engineering and
Planning Consultants

4. **Erosion Control:** The plans have a set of General notes that will form a good framework for future NPDES Stormwater Pollution Prevention Plans (SWPPP) that will be developed with the construction plans. However, the developers need to recognize the special characteristics of this site regarding dust control and the unique topography and wind conditions that prevail. Specifically Note 23 on Sheet C-0 is inadequate and I recommend for the developers to give special consideration to this potential problem.

Sincerely,
Marchionda & Associates, L.P.

Clifford E. Carlson, PE
Project Manager

Copy: Francis X. Dougherty, Twenty Wayland, LLC
Charles A. Doherty, R J O'Connell & Associates., Inc

Vanasse & Associates, Inc.
Transportation Engineers & Planners

10 New England Business Center Drive
Suite 314
Andover, MA 01810-1066
Office 978-474-8800
Fax 978-688-6508

Ref: 5139

October 4, 2007

William Steinberg, Chair
Town of Wayland Planning Board
41 Cochituate Road
Wayland MA 01778-2614

Re: Proposed Wayland Town Center (WTC) Project
MassHighway – Route 20/Route 27 Intersection
Wayland, Massachusetts

Dear Chairman Steinberg:

We have spoken to and met with MassHighway District 3 in Worcester regarding the above-referenced project concerning their latest requests and comments on the design of the Route 27/Route 20 intersection. We have specifically met with Mr. Waruzila, District Highway Director, and Barry Lorion, District Operations Engineer, and I have been authorized by Mr. Lorion to relate the following:

- There is absolutely no change in the position of MassHighway regarding the Wayland Town Center Project and the Route 20/Route 27 intersection design. MassHighway remains satisfied and is in support of the intersection project, as currently configured, as well as the mitigation proposed by the proponent along Route 20 and Route 27.

- MassHighway understands the intersection, with the project fully developed and the total mitigation in place in the horizon year, *will provide better conditions than what exists today.*

- The most recent request to modify the "lane volume distributions" on certain approaches is nothing more than a "tweaking and technical refinement" - in the ongoing detailed technical analysis to test whether or not the Proponent and MassHighway can achieve even better results in the operation or the signal phasing and timing at the intersection, further minimize vehicle delays, lessen red-light queues during the peak hours, and promote smoother flow through the intersection.

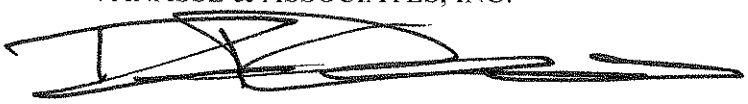
- Vanasse & Associates, Inc. (VAI) is processing this routine request as a part of the on-going technical documents being generated to complete the standard procedures of the State's review and approval process.

- There is absolutely no change in the State's position of support of the design and continued efforts to provide the Town with the best Traffic Signal Operations possible, given the geometry and lane usage, ROW availability, and both current and projected traffic volumes along Route 20.

All of the above has been discussed in the presence of the Town's Consultant, TEC Engineering of Lawrence, MA, and may be verified by direct contact with Mr. Barry Lorion at the MassHighway District 3 offices in Worcester, MA at 508-754-7204. Mr. Lorion has indicated to me he is available and willing to confirm the above.

Sincerely,

VANASSE & ASSOCIATES, INC.



Robert D. Vanasse, P.E.
President

RDV/mef

cc: T. Waruzila, B. Lorion – MassHighway, District 3
K. Dandrade – TEC
M. McCrae, D. Stratouly – The Congress Group
C. Irving, F. Dougherty – KGI Properties
RDV, KPC, SMB, File

TWENTY WAYLAND, LLC
c/o KGI Properties, LLC
4th Floor – 45 Broad Street
Boston, MA 02109

October 5, 2007

Wayland Planning Board
Wayland Town Building
41 Cochituate Road
Wayland, MA 01778-2614
Attention: Joseph Laydon, Town Planner

Re: Updated Documents
Master Special Permit Application
Town Center Project
400 Boston Post Road
Wayland, MA

Dear Mr. Laydon;

This letter transmits the following information for the referenced Master Special Permit Application as requested by the Wayland Planning Board:

1. Thirty-Five (35) copies of the updated design drawings. The drawings have been modified to incorporate specific Planning Board and public comments during our public hearings over the last four months. Attachment 1 provides the updated drawing list which should replace the drawing list in the May 18, 2007 submittal;

2. Thirty-Five (35) copies of the Site Identification and Wayfinding Program / Tenant Sign Design Criteria book dated October 5, 2007, prepared by Arrowstreet Graphics. The book should replace the signage criteria book in Attachment 10 in the May 18, 2007 submittal; and

3. Thirty Five (35) copies of the Storm water Report, entitled:" Storm water Management Report" prepared by RJ O'Connell" and dated October 5, 2007. This document should replace the storm water study provided in Attachment 12 in the May 18, 2007 submittal.

As requested by the Planning Board during our October 2, 2007 public hearing, we have transmitted one copy of the above documents and this letter separately to the following town technical consultants: TEC, The Cecil Group, and Marchianda Associates.

All streets within the MUOD will remain private and maintained by the applicant or their agents. Therefore pursuant to § 2309.6.2 we are hereby requesting a waiver from the Planning Board's Rules and Regulations governing the streets within the Mixed Use Overlay District (MUOD).

All streets within the MUOD will remain private and maintained by the applicant or their agents. Therefore pursuant to § 2309.6.2 we are hereby requesting a waiver from the Planning Board's Rules and Regulations governing the streets within the Mixed Use Overlay District (MUOD).

In addition to the above, the following is provided for the board's consideration. Some of the information is summarized below with detailed descriptions provided in attachments as noted.

SEPTIC SYSTEM LOCATIONS (§2304.3.2.2)

The following clarification should be considered by the Planning Board

"The project design is considering two locations for the septic system. The primary location is beneath the eastern side of the proposed "Town Green". The secondary location may be east the existing wastewater treatment plant. The ultimate location of the septic system will be determined based on the ongoing assessments by Raytheon, Raytheon's environmental consultants, and our consultants. Ultimately we will need approval from the Wayland Board of Health.

The location of the septic system in either location will not impact the site programming. The "Town Green" can be used for the active and passive recreational activities if the septic system is beneath that area. The areas east of the wastewater treatment plant, which is planned to be a combination of parking lots and landscaped areas, will not be impacted by the septic system siting.

We expect that the Phase I Site Plan application will include the final septic system location."

MASTER SPECIAL PERMIT DESIGN COMPLIANCE (§2309)

The MUOD zoning bylaw provides design standards that the Master Special Permit application must be compared against. Table 8A, provided in Attachment 8, compares the design standards against the application. This information should be included in Attachment 8 of the May 18, 2007 application.

SIGNAGE INFORMATION (§2309.4)

The project's signage information is updated as noted on the October 5, 2007 drawings, the Site Identification and Wayfinding Program / Tenant Sign Design Criteria book dated October 5, 2007, and the following signage summaries as required by zoning. All sign sizes are for the sign panel area only. Structural supports, stone bases, and connections are not included in the sign area calculations.

Aggregate Signage For Size Categories (§2309.4.4). The total building signage that could be utilized under the development program allowed per zoning in §2308.3 considering the signage criteria in §2309.4 and the Signage Criteria Book is 6,860 SF. This total excludes code required signage (such as "emergency exit," "sprinkler room," etc) as not within zoning regulation. The

actual proposed signage will be specified in our applications for Site Plan Review. For purposes of the MSP, the individual maximum total per Size Category is:

Size Category A: 568 SF
Size Category B: 540 SF (2 @270SF)
Size Category C: 504 SF (3 @168SF)
Size Category D: 840 SF (5 @168SF)
Size Category E: 6,384 SF (38@168SF)

These numbers are generated using the per establishment counts set forth below. The number of establishments is not determined and the sum of all categories exceeds the contemplated maximum of 6,860 SF in building signage because having more establishments in one category will reduce the number in others.

Size Category A Establishment (568 SF):
1 Major sign at 120sf [on primary wall]
5 Minor Signs at 60sf each = 300sf [on primary and/or secondary walls]
4 Blade Signs @ 16sf each = 64sf [8 SF/side]
8 Awning Signs @ 8sf each = 64sf
2 ID/Hours/Misc. Signs @ 5sf each = 10sf

Size Category B Establishments (270 SF each):
1 Major sign at 60sf [on primary wall]
3 Minor Signs at 40sf each = 120sf [on primary and/or secondary walls]
2 Blade Signs @ 16sf each = 16sf [8sf/side]
6 Awning Signs @ 8sf each = 48sf
2 ID/Hours/Misc. Signs @ 5sf each = 10sf

Size Category C, D, or E Establishments (168 SF each):
1 Major sign at 40sf [on primary wall]
3 Minor Signs at 25sf each = 75sf [on primary and/or secondary walls]
1 Blade Sign @ 16 SF/each = 16 SF [8 SF/side]
4 Awning Signs @ 8sf each = 32sf
1 ID/Hours/Misc. Signs @ 5sf

Project Aggregate Signage (§2309.4.6). The project signage, excluding signage required by code or site traffic control design, that could be utilized for the project is a maximum of 8,010 SF as summarized below:

Retail Building Signage: 6,860 SF [see §2309.4.4 summary]
Monument Signs: 55 SF/side x 2 sides/sign x 2 signs = 220 SF
Vehicular Directional Signs: 9 SF/side x 2 sides/panel x 25 panels = 450 SF
Directory Signs: 15 SF/side x 2 sides/sign x 6 signs = 180 SF
Pedestrian Directory: 2 SF/side x 2 sides/panel x 30 panels = 120 SF
Access Signs: 2sf/side x 2 sides/sign x 10 signs = 40 SF
Residential Entrance Signs: 10 SF/side x 2 sides/sign x 2 signs = 40 SF
Residential Building Identification Signs: 5 SF/side x 2 sides/sign x 10 signs = 100 SF

PARKING AND LOADING ANALYSIS (§2309.7)

The following information replaces the parking and loading information in the May 2007 MSP Traffic Study report. The shared parking worksheets in the Technical Appendix Volume II remain unchanged.

Parking. Pursuant to §2309.7.2, a shared parking analysis is required if the number of project "off-street" parking spaces is less than the requisite number of spaces per zoning. The zoning requirement for the project parking consists of 1,125 spaces based on 2 spaces per unit for residential; 100 spaces for municipal; and 5 spaces per 1,000 Sf of commercial space. The project design provides for a total of 1,035 spaces, excluding a total of 117 spaces of "on-street" parking along Streets A, B, C, and D.

The 1,035 spaces is 90 spaces less than the 1,125 spaces required per zoning because the 117 spaces of "on-street" parking within the Project can not be counted for zoning compliance. Those spaces are effectively available for use to support the Project. Therefore in reality the total parking spaces available for use within the project are 1,152 or 27 more than zoning requires.

The shared parking analysis was conducted to ensure that the project design is adequate for the mixed use project based on industry information. It is expected that the analysis will be re-evaluated during the site plan permitting phase as programming details are finalized. Parking data compiled by the Urban Land Institute (ULI) Shared Parking and parking data compiled by the Institute of Transportation Engineers (ITE) Parking Generation 3rd Edition were reviewed.

Shared parking consists where there are differing land uses that over the course of a day share the same parking space. This is because the sharing uses either operate at totally different times, or if they do operate at the same time, the uses do not peak at the same time. For the residential component of up to 100 units, 200 parking spaces have been identified solely for the residential units.

Analyses were performed reviewing the peak characteristics of the proposed uses, as well as an analysis during December conditions (typical peak time for a retail development). The worksheets for the shared parking analysis were provided in the transportation Technical Appendix II in the May 2007 MSP submittal.

For the non-December conditions, the analysis of parking based on the ITE and ULI data for weekday and Saturdays shows a range of parking requirements ranging from 1,013 spaces to 1,101 spaces without shared parking. With shared parking, the range of required spaces is from 826 spaces to 912 spaces, less than 1,152 spaces that will actually be available for the project.

The second analysis of parking was based on the ITE and ULI data for weekday and Saturdays December conditions. This data shows a range of parking requirements ranging from 1,129 spaces to 1,437 spaces without shared parking. With shared parking, the range of required spaces is from 937 spaces to 1,208 spaces. The available project parking spaces of 1,152 is within the shared parking range.

Loading. All truck access will by way of the Route 20 site driveway. Truck access to Route 27 will be restricted. The project proponent will work with the retail tenants to restrict deliveries to off-peak hours. For the smaller retail uses, loading will be from the parking field associated with each retail use or from "on-street" parking spaces. For the potential supermarket tenant, trucks will enter from Route 20 and use the first retail driveway to access the supermarket along the external roadway (Street D) at the southerly edge of the site. Loading for the supermarket is contemplated along the east side of the building, where three loading bays are proposed. The ultimate location of the loading docks will be determined during the site plan permitting phase. These trucks would egress the site through the parking field north of the supermarket, use Street B to loop around the site in a counter-clockwise flow back to Street A and then to Route 20.

REQUESTED SPECIAL PERMITS.

In our May 18, 2007 application, we requested a number of special permits as noted in sections 8 and 9 of our application letter and in the Attachment 3 application form. The requests made there continue to be made with respect to our updated submissions, subject to the following:

- Height. The building locations and elevations shown on plans must be subject to change as we tenant the project. Therefore, rather than request that the special permit allow the heights shown on those plans, we will make a submission shortly setting forth maximum heights in alternative locations. We request that the special permit authorize those heights as maximums in those alternative locations subject to Phase I Site Plan Approval.

- Setbacks. As the layout has evolved through the hearing process, streets have narrowed and to keep in proportion building setbacks from curb have been reduced to 13' 6" along Streets A, B and C. Therefore the requested special permit is (i) to reduce the setback requirement to 13' 6" along Streets A, B and C, (ii) to clarify that there is no setback requirement applicable from curbs in parking or loading areas or other parts of the site other than Streets A, B and C (or alternatively to reduce to zero any setback requirement other than along Streets A, B and C), and (iii) to permit lampposts and other lighting fixtures, signs, awnings, benches, bus shelters, kiosks, and fences within the required setback area (or alternatively reduce to zero the required setback for any of such items).

In light of the requirement to indicate all special permits being requested, we also advise that we are separately submitting a request for a special permit in the Aquifer Protection District under §198-1603.3 to permit the Town Center project for which our MSP application was filed on May 18, 2007, as it has been and may be supplemented. That special permit is a technical filing under §198-1603.3.3 and 1603.3.4 and if applicable §198-1603.3.6, and depending on the public hearing schedule the request may or may not be consolidated with this MSP application.

ARTICLE 6 SITE PLAN APPROVAL.

We continue to request Article 6 Site Plan Approval and the waiver of submittal requirements if different from the MSP submittal requirements, all as set forth in our May 18, 2007 submittal as updated. In addition, pursuant to §198-507 we request that the Planning Board, as the Site Plan Approval Granting Authority, modify the requirements of §198-507 to allow loading to occur from off-street and on-street parking areas throughout the MUOD rather than from on-premises loading areas, except in the case of the Size Category A establishment (as defined in §198-2308.3.1) (which shall be required to have loading areas as determined in Phase I Site Plan Approval).

Article 16 Site Plan Approval. We believe that the necessary information has been provided and request that Article 16 Site Plan Approval be granted in the MSP decision rather than later.

Town Green. In light of the fact that the 2 acre open space referred to as the Town Green or Public Green is crossed by a roadway, pursuant to §198-2309.9 we request that the Planning Board approve the smaller area of 1.65 acres (the area to the east of that roadway) in order to avoid doubt whether the required area is contiguous.

Municipal Parking. Pursuant to §198-2309.7.1.7, we request that the Planning Board determine that 100 parking spaces (the number contemplated in the Development Agreement) is necessary for municipal uses considering the range of activities potentially involved, to provide a maximum of safety and a minimum of congestion on the adjacent roadways.

SUDBURY RIVER VIEW

Attachment 14 provides an updated view of the current project layout from the Sudbury River and replaces the May 18, 2007 information.

Please do not hesitate to contact me with any questions or concerns.

Sincerely,
TWENTY WAYLAND, LLC

By: Francis X. Daugherty
Francis X. Dougherty, authorized representative

Master Special Permit Application Table of Contents

	Attachment	Original Date	Latest Revision
Drawing List	1	5/18/07	10/5/07
Master Special Permit Fee Receipt	2	5/18/07	5/18/07
MSP Application Form and Checklist	3	5/18/07	5/18/07
Parties of Interest	4	5/18/07	5/18/07
Property Deed	5	5/18/07	5/18/07
Project Schedule	6	5/18/07	5/18/07
MSP Design w/ Concept Plan Determination	7	5/18/07	5/18/07
MSP Compliance w/ MUOD Design Principles	8	5/18/07	5/18/07
Alternative Site Layouts	9	5/18/07	5/18/07
Signage Criteria Book	Bound Separately	5/18/07	10/5/07
Draft Deed Rider	11	5/18/07	5/18/07
Storm water Study	Bound Separately	5/18/07	10/5/07
Programming Summary	13	5/18/07	10/5/07
Sudbury River View	14	5/18/07	10/5/07
Open Space Plan	15	5/18/07	5/18/07
Proposal For Interchangeable Uses	16	5/18/07	5/18/07
Lighting Study	17	5/18/07	5/18/07
Project Sustainability	18	-	10/5/07

ATTACHMENT 1

DRAWING LIST

10/5/07

ATTACHMENT 1 MASTER SPECIAL PERMIT APPLICATION DRAWING LIST Revised October 5, 2007				
DWG Number	**Title**	**Prepared By**	**Original Date**	**Latest Revision**
A0	Cover Sheet	Arrowstreet Architects	05/10/07	10/05/07
A1	Orthographic Map	Arrowstreet Architects	05/10/07	10/05/07
A2	Neighborhood Contextual Map	Arrowstreet Architects	05/10/07	10/05/07
A3	Commercial Signage Plan	Arrowstreet Architects	05/10/07	10/05/07
A3a	Commercial Signage Plan Elevations	Arrowstreet Architects	05/10/07	10/05/07
A4	Use and Massing Plan	Arrowstreet Architects	05/10/07	10/05/07
A5	Commercial Building Elevations	Arrowstreet Architects	05/10/07	10/05/07
A6	Commercial Building Elevations	Arrowstreet Architects	05/10/07	10/05/07
A7	Commercial Building Elevations	Arrowstreet Architects	05/10/07	10/05/07
A8	Commercial & Residential Building Elevations	Arrowstreet Architects	05/10/07	10/05/07
A9	Perspective Massing Views	Arrowstreet Architects	05/10/07	10/05/07
A10	Building R-1 Plans	Sheskey Architects	05/10/07	10/05/07
A11	Building R-1 Elevations	Sheskey Architects	05/10/07	10/05/07
A12	Building R-2 Plans	Sheskey Architects	05/10/07	10/05/07
A13	Building R-2 Elevations	Sheskey Architects	05/10/07	10/05/07
A14	Building R-3 Plans	Sheskey Architects	05/10/07	10/05/07
A15	Building R-3 Elevations	Sheskey Architects	05/10/07	10/05/07
A16	Building R-4 Plans	Sheskey Architects	05/10/07	10/05/07
A17	Building R-4 Elevations	Sheskey Architects	05/10/07	10/05/07
A18	Building R-5 Plans	Sheskey Architects	05/10/07	10/05/07
A19	Building R-5 Elevations	Sheskey Architects	05/10/07	10/05/07
A20	Building R-6, 7, 8, 9 + 10 Plans + Elevations	Sheskey Architects	05/10/07	10/05/07
A21	Building R-11, Plans + Elevations	Sheskey Architects	05/10/07	10/05/07
C0	Abbreviation, Legend, and Notes	RJ O'Connell & Associates	05/10/07	10/05/07
C1	Existing Conditions Plan	RJ O'Connell & Associates	05/10/07	10/05/07
C2	Demolition & Erosion Control Plan	RJ O'Connell & Associates	05/10/07	10/05/07
C3	Grading & Drainage Plan	RJ O'Connell & Associates	05/10/07	10/05/07
C4	Utility Plan	RJ O'Connell & Associates	05/10/07	10/05/07
C5	Parking & Traffic Control Plan	RJ O'Connell & Associates	05/10/07	10/05/07
C6	Development Plan	RJ O'Connell & Associates	-	10/05/07
C7	Erosion Control Details	RJ O'Connell & Associates	05/10/07	10/05/07
C8	Drainage Details	RJ O'Connell & Associates	05/10/07	10/05/07
C9	Utility Details I	RJ O'Connell & Associates	05/10/07	10/05/07
C10	Utility Details II	RJ O'Connell & Associates	05/10/07	10/05/07
C11	Subsurface Sewage Disposal System Details	RJ O'Connell & Associates	05/10/07	10/05/07
C12	Fast System Details	RJ O'Connell & Associates	05/10/07	10/05/07
C13	Layout and Materials Details I	RJ O'Connell & Associates	05/10/07	10/05/07

ATTACHMENT 1 MASTER SPECIAL PERMIT APPLICATION DRAWING LIST Revised October 5, 2007				
DWG Number	**Title**	**Prepared By**	**Original Date**	**Latest Revision**
C14	Layout and Materials Details II	RJ O'Connell & Associates	05/10/07	10/05/07
ES1	Legend, Notes, Lighting Fixture Sch.	ID Group	05/10/07	10/05/07
ES2	Electrical Utility Site Plan – Demo	ID Group	05/10/07	10/05/07
ES3	Electrical Util. Site Plan – New Work	ID Group	05/10/07	10/05/07
ES4	Electrical Site Plan – Lighting	ID Group	05/10/07	10/05/07
ES5	Miscellaneous Details – Sheet 1	ID Group	05/10/07	10/05/07
ES6	Miscellaneous Details – Sheet 2	ID Group	05/10/07	10/05/07
L1	Landscape Plan	CBA Landscape Architects	05/10/07	10/05/07
L2	Landscape Detail Plan	CBA Landscape Architects	05/10/07	10/05/07
L3	Buffer Planting Plan	CBA Landscape Architects	05/10/07	10/05/07
L4	Street Tree Planting Plan	CBA Landscape Architects	05/10/07	10/05/07
L5	Landscape Sections & Plant List	CBA Landscape Architects	05/10/07	10/05/07
L6	Landscape Site Details	CBA Landscape Architects	05/10/07	10/05/07
LH1	Landscape Plan	CBA Landscape Architects	-	10/05/07
LH2	Landscape Detail Plan	CBA Landscape Architects	-	10/05/07
LH3	Site Materials Design Palette 1	CBA Landscape Architects	-	10/05/07
LH4	Site Materials Design Palette 2	CBA Landscape Architects	-	10/05/07
LH5	Site Materials Design Palette 3	CBA Landscape Architects	-	10/05/07
LH6	Prototypical Sections	CBA Landscape Architects	-	10/05/07
LH7	Buffer Planting Section & Elevation	CBA Landscape Architects	-	10/05/07

ATTACHMENT 8

MSP COMPLIANCE WITH MUOD DESIGN PRINCIPLES

10/5/07

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2304.3.1	Obtain MSP	The MUP Master Special Permit (a) specifies the Mixed-Use Project's design, architectural character, public amenities, site improvements, traffic improvements, mitigation, specific location of buildings, and categories of uses for buildings; and (b) defines categories of interchangeable uses, for establishments in Size Category B in the Section 198-2308.3.1 establishment size chart, that will not require Phase II Site Plan Review under Section 198-2304.4.5.	**This has been complied with.**
2304.3.2.1	Site Development Plan	A Master Special Permit Plan, containing a site development plan (signed by a registered architect or other pertinent design/engineering professional) showing the location, size of footprint(s) of all buildings; site grading with finish floor elevations; parking; landscaping; roads, walkways and access ways; open space and wetlands.	**This has been complied with. See Drawing C6.**
2304.3.2.2	Utilities Plan	A utilities plan showing the location of hydrants and wastewater facilities; the location and type of storm water facilities; and the sources of water to be used on the site.	**This has been complied with. See Drawing C4 and supplemental design information**
2304.3.2.3	Lighting Plan	A lighting plan including a photometric plan and information regarding light poles, bases and fixtures.	**This has been complied with. See Dwgs E31 – E S6**
2304.3.2.4	Signage Plan	A signage plan for the Mixed-Use Project, which plan must include existing and proposed signage throughout the MUOD.	**This has been complied with. See Drawings A-3 and A-3a, Tenant Signage Criteria Book and Site Identification and Wayfinding Program / Tenant Sign Design Criteria book**
2304.3.2.5	Subdivision Plan	A subdivision plan(s), if applicable.	**Not Applicable**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2304.3.2.6	Architectural Plans	A plan showing the location, elevations with heights, proposed categories of uses, general architectural design, and sizes of all buildings and structures.	**This has been complied with. See Drawings A0-A21.**
2304.3.2.7	Additional Special Permits	Reference to any separate special permit(s) being requested in conjunction with the MUP Master Special Permit.	**This has been complied with.**
2304.3.3	Compliance with Performance Standards	No MUP Master Special Permit shall be granted unless the Mixed-Use Project is in compliance with the performance standards set forth in Section 198-2309.	**This has been complied with.**
2304.3.4	Future Developments	The MUP Master Special Permit shall govern (a) all future development in a particular Mixed-Use Project; and (b) the uses of all streets within the Mixed-Use Project and all streets that provide access between the Mixed-Use Project and any public way. All construction and associated improvements must be in compliance with the MUP Master Special Permit.	**Agreed.**
2304.3.5	Submittal Documents	The applicant must supply the Planning Board with sufficient copies of the application for a MUP Master Special Permit, along with all supporting documents and plans, as are necessary to provide to other local boards, agencies, and officials, such as the Conservation Commission, Fire Chief, Police Chief, Board of Health, Building Commissioner, Board of Road Commissioners, Water Commissioners, Wastewater Management District Commission, Finance Committee, Park and Recreation Commission, Board of Selectmen, and others as designated in the Planning Board's rules and regulations for the MUOD, for their review and comment.	**This has been complied with. Sufficient copies, as determined by the town Planner, have been provided.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.1.1	Landscaping	Landscaping within the MUOD shall be designed to promote the establishment, protection and enhancement of the natural landscape; ensure the appropriate use of plant material; preserve natural tree cover; and promote inclusion of new tree planting in order to reduce visual blight, noise and glare, prevent soil erosion, reduce storm water runoff, increase ground water discharge, create shade, and reduce solar overheating.	**This has been complied with. See Drawings L1 – L 6 and Drawings LH1 – LH7**
2309.1.2	Landscaping	The applicant shall prepare a landscaping plan showing that the Mixed-Use Project will meet these standards and the standards set forth in Section 198-606.	**This has been complied with.**
2309.2.1	Massing	Massing within the MUOD should promote buildings designed in a traditional New England style and create a Mixed-Use Project with an authentic, New England regional character to its buildings.	**This has been complied with. The massing has been reviewed with the Planning Board and their technical consultant**
2309.2.1.1	Visual Relief	Any buildings proposed for a Mixed-Use Project shall provide visual relief, generally every 30 feet, along the façade of each building.	**This has been complied with.**
2309.2.1.2	Visual Relief	Building design throughout a Mixed-Use Project shall include designs which promote visual relief by including varying roof lines and roof heights.	**This has been complied with.**
2309.2.1.3	Residential Buildings	A Mixed-Use Project shall include residential buildings and buildings with multiple non-residential uses and a mix of buildings containing single or multiple establishments.	**This has been complied with. See Drawing A4 Use and Massing Plan.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.3.1	Screening and Buffering	Screening and buffering should create visual barriers between features of the Mixed-Use Project from public streets and abutting properties. Such features shall include dumpsters and trash handling areas, mechanical equipment at ground level or rooftop, service entrances and utility facilities for building operation, loading docks and spaces, above-ground backflow preventers, and other components of the Mixed-Use Project as may be reasonably determined by the Planning Board to require screening and buffering.	**Screening and Buffering has been provided. See Drawings L3 and LH7. Further detail for building specific related screening will be provided during the Site Plan Permit Application**
2309.4.1	Allowable Signage	Signage must (a) be in keeping with a traditional New England town center; and (b) be integrated into the overall architectural design of the Mixed-Use Project. 2309.4.2. The dimensional standards shall apply per *Section 198-2309.4.28.3.1.*	**This has been complied with.**
2304.2	Primary and Secondary Signage	An establishment can have only one primary wall, to be designated in the signage plans referenced in Section 2309.4.6. All other designations will be made in the signage plans.	**This has been complied with. See Drawing A-3. Building specific signage details will be further refined and provided during the Site Plan Permit Application**
2304.3	Category B Signage	For Size Category B, the allowed aggregate area of an establishment's main signs on the primary wall can be up to 90 sq.ft.	**Agreed.**
2304.4.4	Signage Special Permit	For all Size Categories, the aggregate area of signage will be determined by special permit.	**Agreed.**
2304.4.5	Sign Lighting	Signs may be illuminated externally, but no sign can be illuminated internally.	**This has been complied with. See page 8 of the Tenant Signage Criteria Book**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.4.6	Aggregate Signage	The applicant shall prepare signage plans indicating aggregate signage, maximum sign area, and proposed lighting, demonstrating that signs and proposed lighting will comply with Section 198-2309.4, Section 198-501 (except that the area and height limits specified in Section 198-501.1 shall not apply), and the Planning Board's rules and regulations for the MUOD.	**This has been complied with. See Drawings A-3 and A-3a and Signage Summary dated 5 October 2007.**
2309.4.7	Varying Signage	By special permit, the Planning Board may allow signage that varies from that which is permitted in Section 198-501.1 and Section 198-2309.4, including signage not on the same premises as the building, structure, or use to which the signage pertains (provided the signage is still within the MUOD).	**Agreed. The Signage Special Permit has been requested in the May 18, 2007 Master Special Permit Application.**
2309.5.1	MDEP Storm water Compliance	The storm water management system within the MUOD should provide an adequate system for managing storm water and should comply with all applicable federal, state and local laws, rules, regulations and bylaws, including the Storm water Management Policy of the Massachusetts Department of Environmental Protection or any successor agency.	**This has been complied with. See Storm water Report dated October 5, 2007 , and prepared by RJ O'Connell**
2309.6.1	Streets	Streets within the MUOD should provide for adequate access for emergency vehicles; accommodate the normal traffic expected in the Mixed-Use Project; provide for safe pedestrian access; and maintain pedestrian flow in, between, and throughout the residential and non-residential portions of the MUOD.	**This criterion has been included in the site design. The town's consultant, TEC, has agreed that the standard has been met.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.6.2	Streets serving MUOD	The streets serving the Mixed-Use Project shall comply with the Planning Board's rules and regulations governing the subdivision of land, except to the extent waived by the Planning Board, and the Planning Board's rules and regulations for the MUOD.	**The streets have been designed to meet industry standard engineering design principles. However the streets within the project will remain private. Waiver requested to the extent streets as shown on submitted plans do not meet subdivision rules and regulations.**
2309.7.1	Parking Provisions	The parking and loading design within the MUOD must provide adequate parking for the Mixed-Use Project, including for any educational, religious, and municipal uses and for any child-care facilities; allow for shared parking as appropriate; create parking fields separated by landscaped areas; create off-street parking areas that minimize curb cuts within the Mixed-Use Project; and create safe and comfortable passageways for pedestrians.	**This has been provided. See the Shared Parking Study information in October 5, 2007 letter to Planning Board.**
2309.7.1.1	Parking Lot Layouts	A Mixed-Use Project shall provide multiple small parking areas of 50 or fewer spaces.	**This has been provided. See Drawing L2 and Drawing C5.**
2309.7.1.2	Parking Lot Landscaping	Any larger parking areas shall be separated, whether by buildings, landscape features, or both. At least 10% of the interior of the parking area shall be maintained with landscaping, including trees, in landscape islands.	**This has been complied with. See Drawings L2 and Drawing C5.**
2309.7.1.3	Small Parking Lot Design	Small parking areas shall be designed to include sidewalks at the perimeter to promote safe pedestrian passage; larger areas may incorporate pedestrian corridors delineated by paving materials, plantings and/or bollards.	**This has been accommodated See Drawings L5, LH3, and C4.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.7.1.4	Parking Compliance	The provisions of Sections 198-506 and 198-507 of the Town's Zoning Bylaw shall not apply to the Mixed-Use Project, except that all off-street parking shall be subject to the provisions of Sections 198-506.6 and 506.7; and except that all off-street loading facilities shall be subject to the provisions of Section 198-507.	**This has been accommodated. See Drawings L2, L3, and Drawing C5 and Parking Summary dated October 5, 2007.**
2309.7.1.5	Commercial Parking Ratio	For non-residential and non-municipal establishments, off-street parking space shall be provided at a minimum of five parking spaces per 1,000 square feet of Gross Floor Area.	**This has been accommodated. See Parking Study dated October 5, 2007**
2309.7.1.6	Residential Parking Ratio	For residential uses, parking space shall be provided at a minimum of two parking spaces per dwelling unit.	**This has been accommodated. See shared parking study and parking summary dated October 5, 2007.**
2309.7.1.7	Other Parking Ratios	For any and all uses or structures not specifically provided for in the foregoing provisions, the parking design shall provide such parking spaces as the Planning Board shall determine to be necessary, considering the activities involved, to provide a maximum of safety and a minimum of congestion on the adjacent roadways.	**This has been accommodated for. See the Shared Parking Study. We have requested that the Planning Board determine that the 100 spaces called for in the Development Agreement are necessary.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.7.2	Parking/Loading Study	An application for a MUP Master Special Permit must include a parking/loading plan setting forth the number, location, and design (including landscaping and lighting) of parking spaces and loading areas. The application must also include a parking-and-loading study that supports the design of the parking/loading plan. Such study must be prepared by a qualified traffic engineer who is licensed by the Commonwealth of Massachusetts as either a Professional Traffic or Transportation Engineer or a Professional Civil Engineer with certification by the Transportation Professional Certification Board as a Professional Traffic Operations Engineer, as may be more fully described in the Planning Board's rules and regulations for the MUOD. If such study demonstrates that the interaction of uses will allow for shared parking and thus for a reduction in the otherwise-required minimum number of parking spaces, the Planning Board may, in Phase I or Phase II Site Plan Review, approve such a reduction.	**This has been accommodated. See the Parking and Loading Study. In addition, the applicant has testified that the grocery store is the only establishment to have a loading dock, to be definitively located during Phase I Site Plan Review. We have requested that in Article 6 Site Plan Review the Planning Board modify that all other stores will unload at the street. Loading and unloading areas will be established during the Site Plan Permit Application. Requirements of §198-507 to allow loading for all other uses to occur from off-street and on-street parking areas throughout the MUOD rather than from on-premises loading areas.**
2309.8.1	Lighting Design	The lighting design within a Mixed-Use Project should accommodate public safety and welfare, and protect the night sky from unnecessary ambient light. Any lighting plan submitted for a Mixed-Use Project shall, at a minimum, include the following:	**This has been accommodated. See the Drawings ES1–ES-6.**
2309.8.1.1	Lighting Standards	All lighting installations shall be designed to achieve no greater than the minimum luminance levels for the activity as recommended by the Illuminating Engineering Society of North America (IESNA).	**This has been accommodated.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.8.1.2	Prevent Lighting Glare	To prevent glare on off-site locations, all outdoor lighting fixtures shall be full cutoff. Where necessary to prevent light trespass or glare, accessories such as hoods and shields shall be used on lighting fixtures. The source of light shall be so arranged and shielded as to prevent direct glare from the light source into any public street or onto adjacent property.	**This has been accommodated.**
2309.8.1.3	Lighting Shielding	Security lighting shall be shielded and directed at a downward angle.	**This has been accommodated.**
2309.8.2	Lighting Study	The applicant must submit a lighting study showing that the Mixed-Use Project will meet these standards and the applicable standards set forth in Section 198-606.	**This has been complied with in the May 18, 2007 application.**
2309.9.1	Open Space	The design of the Mixed-Use Project shall promote and ensure public common space within the MUOD. Any MUP Master Special Permit shall provide at least two acres of contiguous upland open space to serve as a public commons, and additional suitable open space throughout the Mixed-Use Project to serve public purposes; provided, however, the Planning Board may approve a smaller open space area where such open space promotes the purposes set forth in this standard. The applicant shall prepare an open space plan indicating the bounds of such open space, and a plan for the ownership, operation and maintenance of the open space.	**This has been accommodated. The original MSP application drawings have been revised to address town comments on open space. The updated drawings, dated October 5, 2007, reflect the town's comments on open space. In light of the fact that a roadway crosses the open space, we have requested that the Planning Board approve the smaller area of 1.65 acres (the area to the east of that roadway) in order to avoid doubt whether the required area is contiguous.**
2309.10.1	Aquifer Protection	The Mixed-Use Project must comply with Article 16 of the Town's Zoning Bylaw (the "Aquifer Protection District" bylaw); provided, however, that Section 198-1604.1 shall not apply and that for purposes of Section 198-302.2 and 198-1604.2, no land within the MUOD shall be construed to be a "residential lot."	**A separate application is being made for a special permit, as a technical filing under Section 198-1603.3.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.10.2	Groundwater Recharge	The Article 16 groundwater recharge requirements shall be inapplicable to the extent necessary (and only for the duration of time specified by the LSP) to comply with an activity-and use limitation or other restriction imposed on the site by or under the supervision of the Licensed Site Professional of record ("LSP") acting pursuant to the provisions of MGL Chapter 21E or 310 CMR 40.000 *et seq.*, as evidenced by documentation from the LSP of record submitted to the Planning Board.	**To be addressed in due course if necessary.**
2309.10.3	Article 16	2309.10.3. The Article 16 groundwater recharge requirements shall be inapplicable to the extent inconsistent with (and only for the duration of time specified by the LSP) a response action taken or a response action to be undertaken pursuant to the provisions of MGL Chapter 21E or 310 CMR 40.000 *et seq.*, with respect to oil or hazardous materials on this site or affecting the site, as evidenced by documentation from the LSP of record submitted to the Planning Board.	**To be addressed in due course if necessary.**
2309.10.4	Maximum Impervious Area	Notwithstanding any provision of Article 16 to the contrary, the impervious surface area of a Mixed-Use Project shall not exceed 65% of the upland area of the MUOD.	**This has been complied with. See updated coverage calculations dated October 5, 2007.**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.11.1	Affordable Units	In lieu of Article 22 of the Town's Zoning Bylaw (the "Inclusion of Affordable Housing" bylaw), the following standards shall apply in the MUOD. At least 25% of the dwelling units shall be Affordable Units. The term "Affordable Unit" shall mean a dwelling unit reserved in perpetuity for rental or ownership by a household earning less than 80% of area median family income, and priced to conform with the standards of the Massachusetts Department of Housing and Community Development ("DHCD") for rental or ownership units set forth in 760 CMR 45.03(4), as amended from time to time, in order that such Affordable Units shall be included in the DHCD Subsidized Housing Inventory. Affordable Units shall be subject to the following conditions:	**Will be complied with.**
2309.11.1.1	Deed Rider	Each Affordable Unit shall be affordable in perpetuity. A Deed Rider or other suitable restriction shall assure this condition. The Deed Rider shall be structured to survive any and all foreclosures.	**Will be complied with**
2309.11.1.2	Affordable Unit Sale	When an Affordable Unit is proposed for sale, the continuing enforcement of the Deed Rider through subsequent resales shall be the subject of a Monitoring Agreement and in accordance with Sections 198-2207.3 and 198-2207.6 of Article 22 of the Town's Zoning Bylaw.	**Will be complied with**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.11.1.3	Deed Rider Requirement	The Deed Rider and the Monitoring Agreement shall be drafted in compliance with 760 CMR 45.00 (Local Initiative Program), as amended from time to time, and guidelines promulgated thereunder. The Deed Rider and the Monitoring Agreement shall be subject to review and approval by the Planning Board and approved as to form by Town Counsel prior to the issuance of the first certificate of occupancy for any dwelling unit in the MUOD.	**Has been and will be complied with**
2309.11.1.4	Affordable Unit Compliance	The Affordable Units shall conform to the DHCD standards for inclusion in the DHCD Subsidized Housing Inventory.	**Will be complied with**
2309.11.1.5	Right of First Refusal	A right of first refusal in accordance with Section 198-2207.7 of the Town's Zoning Bylaw shall be granted to the Town or its designee for a period not less than 120 days after notice thereof.	**Will be complied with**
2309.11.1.6	LIP Compliance	The Affordable Units must satisfy the design and construction standards of the Local Initiative Program, 760 CMR 45.00, as amended from time to time, with regard to indistinguishability from market-rate units. It is the intent of this Article 23 that the Affordable Units shall be eligible for inclusion in the DHCD Subsidized Housing Inventory as Local Initiative Program units.	**Will be complied with**
2309.11.1.7	Affordable Unit Construction Schedule	The Affordable Units must be constructed and occupancy permits obtained at the rate of one Affordable Unit for every three market-rate units.	**Will be complied with**
2309.11.1.8	Affordable Unit Calculation	In computing the number of required Affordable Units, any fraction of a unit shall be rounded up, and the result shall be the number of Affordable Units to be built within the MUOD and not off-site.	**Will be complied with**

TABLE 8A – MASTER SPECIAL PERMIT COMPLIANCE CHECKLIST			
Section	**Requirement**	**Detail Description**	**Compliance**
2309.12.1	Green Design	Every effort shall be made to design buildings and use materials and construction techniques to optimize daylight in building interiors, natural ventilation, and energy efficiency; to minimize exposure to and consumption of toxics and non-renewable resources; and to incorporate appropriate "green" design techniques.	**This has been accommodated.**
2309.13.1	Underground Utilities	To the extent practicable, electric, telephone, cable TV, and other utilities on the site shall be placed underground.	**This has been accommodated.**

ATTACHMENT 14

SUDBURY RIVER VIEW

10/5/07



Figure 3-5
Sudbury River Visual Impact Analysis

Wayland Town Center
Wayland, Massachusetts

Epsilon

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9/26/07

ATTACHMENT 18

PROJECT SUSTAINABILITY

10/5/07

18. Sustainable Design

The Wayland Town Center Project Applicant supports the goals of the Commonwealth of Massachusetts and the Town of Wayland to promote sustainable design measures for new development projects. Throughout the early design process the Applicant has incorporated sustainable design features into the Project, and intends to continue to do so as the design evolves and matures. The following sections outline the key sustainable design provisions the Applicant and the Project Design Team have incorporated to-date, and those measures currently being assessed.

Summary of Sustainable Design Philosophy

The Wayland Town Center Project will promote environmental awareness and sustainable business operations. The Wayland Town Center Project design has been focused on striving to minimize potential environmental impacts through sensitive awareness of the land upon which the Project will be developed. During the on-going design development process the Applicant and the Project Design Team will continuously evaluate and assess the design to determine the ability to include new technology and/or to revise the site orientation to reduce environmental impacts, accommodate future transportation needs and address sustainability in all aspects of the site and building design.

The Wayland Town Center Project will continue to coordinate with the many reviewing environmental agencies and organizations to better the Project Team's understanding of and to increase the Team's involvement in the sustainable and environmentally responsible re-development of this site. As presented herein, the Wayland Town Center Project will achieve many sustainable design goals, will set the standard for sustainability in the Town of Wayland, and will continue to raise the bar regionally for similar mixed-use developments.

The Wayland Town Center Project will see that all employees receive environmental awareness training and will appoint an environmental coordinator who will be responsible for continually updating environmental policies of the Applicant and for educating tenant employees on methods to insure the Project's sustainability goals are met. To reduce environmental impacts and energy consumption the Applicant will consider the use of solar power or other alternative sources of power, will employ energy-reducing technologies such as energy-efficient lighting, and will implement a rigorous recycling and waste reduction program.

The Wayland Town Center Project is aware of local Low Impact Development (LID) working groups' goals, such as those championed by the Sudbury River Stewardship Council, and will continue to evaluate the Project in the light of such goals and incorporate LID technologies where practicable. The Project has and will make numerous sustainable design commitments including the promotion of bicycle and pedestrian use, the minimization of disturbance to the

land through a unique compact design philosophy, the incorporation of water saving and energy efficient building design and daylighting, institution of construction and permanent recycling programs, and the use of FSC certified wood products and regionally manufactured construction materials where possible.

As indicated above, the Wayland Town Center Project is committed to making this mixed-use Project one that environmental advocates can commend and that can serve as a model for future retail development. As also indicated above, a great deal of attention will be focused on LID technology. Overall, the Wayland Town Center Project will make the effort to better identify how this Project can be a leader in sustainable business operations and development by implementing and following the environmental policies and planned design/development guidelines summarized in the following sections.

Building Design and Materials

The Wayland Town Center buildings will incorporate roofing design that reduces the cooling load of the buildings and reduces the urban heat island effect. Daylight will be brought into portions of the buildings to reduce the energy consumption of electrical lighting.

A significant portion of the buildings' energy demand consists of cooling and lighting. To reduce fossil fuel consumption, the buildings will be designed to incorporate day lighting to the extent practicable. Lighting systems will be zoned to allow perimeter spaces to turn off their lights when the level of daylight is adequate. Orientation-specific, energy efficient glazing systems, including Low-E, will be used to reduce heat gain and increase light transmission.

Energy Supply and Systems

The Wayland Town Center Project will work with a renewable energy developer to assess the feasibility of utilizing solar power technology to generate pollution-free electricity at this site. Other measures being taken to become more energy efficient include the implementation of strict energy conservation policies and the introduction of new energy-efficient lighting, air conditioning and mechanical systems. The Applicant is seeking to incorporate energy efficient technologies consistent with its operational needs. Technologies that will be considered include innovative lighting controls, HVAC economizer systems, evaporative cooling, heat recovery systems, "Smart" building systems, Variable Frequency Drive (VFD) pumping systems and others. The systems will be analyzed, verified and optimized by a commissioning effort that will simulate various operating conditions, confirm system efficiencies, and perform system integration testing.

Energy Management Systems

Calibration will be included to optimize start/stop of air systems, roof top unit run time totalization, trend logging, temperature readouts, equipment monitoring and control, economizer cycles, space temperature control and operational safeties. Off-hour (night and other non-operating times) temperature setback and outside air control will also be included.

Recycling Program

The Wayland Town Center Project policies will incorporate innovative ways of reducing waste material content. The Wayland Town Center Project will use a transportation program that includes continuous measuring and monitoring of transport activities between the suppliers and the tenants to further support ongoing improvements in package and transport systems. In accordance with its waste management policies, all Wayland Town Center tenants will be required to implement waste management systems that sort waste by the largest fractions of recyclable material.

Water Conservation

Building water consumption will be minimized through several water conservation measures, including the use of water saving plumbing fixtures.

Environmentally Responsible Guidelines

The Wayland Town Center Project is being designed with a goal of minimizing environmental impacts and pursuing compliance with applicable guidelines to the extent practical. As discussed earlier, a wide range of sustainable design elements will be employed to ensure that the Project achieves this goal to the extent practicable. In addition, the Project is being designed to meet many of the criteria under the US Green Building Council Leadership in Energy and Environmental Design (LEED) categories of Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials and Resources, Indoor Air Quality and Innovation and Design Process.

Sustainable Sites

Site Selection. The site design is being completed with a design philosophy and guidelines consistent with the goal of minimizing environmental impacts by avoiding development of inappropriate site scale and reducing environmental impacts from the location and orientation of the buildings. The Project represents an appropriate re-use of the land and has been sited and designed in an environmentally responsible manner.

Erosion and Sedimentation Control. The Wayland Town Center Project will incorporate a detailed erosion and sedimentation control plan in accordance with state and local guidelines

and regulations. The Project will also take additional steps towards sustainability by utilizing 100% biodegradable straw-coconut matrix erosion control blankets or sprayed-on fiber mesh and seeding with a native erosion control seed mix to protect exposed slopes on the Project site.

Storm water Management. The storm water management system is being designed to remove over 80% of the average annual post development total suspended solids (TSS), and will likely exceed this 80% state standard.

Alternative Transportation - Public Transportation Access. To encourage alternate means of transportation, the Wayland Town Center Project will cooperate with the Town of Wayland and the regional transit authority to encourage the use of public transportation.

Alternative Transportation - Bicycle Storage and Changing Rooms. To encourage bicycle commuting, the Project will incorporate bike storage racks on-site and will provide lockers or storage areas for the employees of the Wayland Town Center Project tenants within the buildings. Dedicated bike paths will be incorporated into the Wayland Town Center plan providing direct access from Project entry points and a potential Town bike trail proposed adjacent to the site on the MBTA right-of–way. Careful consideration will be given to the location of bike racks throughout the Project to ensure the accommodation of bicyclists, pedestrians and vehicular traffic in a safe and efficient manner.

Water Efficiency

Water Efficient Landscaping and Irrigation. Selection of drought tolerant plants to the extent allowed by the Town and reduced irrigation schemes to reduce potable water consumption will be utilized to the extent practical. All planting will require periodic irrigation during the "grow in" period. Once the landscaping has been established, the buffer areas will not have irrigation; plantings around buildings, hardscape areas, and street trees will have drip irrigation or similar water conservation type facilities; and typical irrigation for the Town Green areas. During periods of required water conservation (ie "Water Bans" imposed by the town), the project will comply with such restrictions. In addition, should the town choose to implement a water reuse program when the existing wastewater treatment plant is upgraded, the project will participate in the program for irrigation use.

Energy and Atmosphere

Optimize Energy Performance. Energy Performance is optimized through conservation within the building envelope, lighting, mechanical systems and controls.

Renewable Energy. The Wayland Town Center Project will work with a renewable energy developer, to determine if solar power technology to generate a source of pollution-free electricity is feasible.

Materials and Resources

Storage and Collection of Recyclables. The Wayland Town Center Project will implement a waste management plan at the Project. The Wayland Town Center Project has a strong commitment to recycling the waste stream of its future tenants. To facilitate the recycling of waste products, the buildings will provide the space necessary to support a recycling program.

Construction Waste Management. The Wayland Town Center Project will recycle and utilize construction and land clearing waste to the maximum extent practicable. For example, rock found on site will be salvaged and used for construction of riprap slopes, drainage outlet structures and in detention basins; stumps will be chipped and mixed with topsoil to be used on the site.

To the extent feasible, demolition materials, including unpainted and uncoated brick and concrete, will be reused on-site. These materials will be separated during the demolition process and crushed on-site for reuse as paving sub-base material. Demolition debris will be reused in accordance with DEP's guidelines regarding the recycling of asphalt, brick and concrete materials to the maximum extent feasible. It is expected that the structural steel building frame will be recycled through the metals reclamation market. It is also expected that other pieces of major capital equipment such as boilers and transformers will be similarly recycled as market conditions dictate. The remaining demolition materials will be trucked to an appropriately licensed disposal facility.

All recyclable materials from construction and land clearing that cannot be utilized on-site will be salvaged by subcontractors that can document future use of the materials.

Recycled Content. The Wayland Town Center Project will encourage the use of site and building products that have incorporated recycled materials.

Local/Regional Materials. Design efforts are underway to incorporate, to the extent available, regionally manufactured materials.

Indoor Environmental Quality

Carbon Dioxide (CO_2) Monitoring. To sustain long-term occupant health and comfort, the Project intends to provide indoor air quality monitoring systems.**Construction Indoor Air Quality (IAQ) Management Plan.** The Project will implement an indoor air quality

management plan to prevent indoor air quality problems resulting from the construction process.

Low-Emitting Materials. To reduce quantities of air-borne contaminants and attempt to meet or exceed VOC limits, low emitting materials will be specified for this Project including adhesives and sealants, paints and coatings, carpet systems and composite wood products.

Indoor Chemical and Pollutant Source Control. In order to avoid exposure of building occupants to potentially hazardous chemicals, systems will be designed to minimize cross-contamination of regularly occupied areas by chemical pollutants.

Thermal Comfort. The buildings will be designed such that an operator will be able to control the thermal environment to protect the health of employees and customers.

Daylighting and Views. Daylighting strategies will be incorporated to the extent possible, including lighting systems zoned to allow perimeter spaces to turn off lights when the level of daylight is adequate. Orientation-specific, energy efficient glazing systems, including Low-E, will be used to reduce heat gain and increase light transmission.

Design Process

From the beginning of the Project the Wayland Town Center Project Applicant has understood that the site lies within the boundary of Baldwin Wells recharge area and abuts the Sudbury River and associated sensitive natural resource areas. As such, the first site design criterion that was established was the no disturbance criteria for work within the state-regulated bordering vegetated wetlands. In addition to that criteria, the storm water management system will be designed to pre-treat over the first ½-inch and up to first 1-inch of rainfall, the standard used for storm water systems discharging to Outstanding Resource Waters (ORWs). (ORWs). The site landscaping design will also be much more intensive than typical commercial sites. That landscaping will include many storm water quality treatment systems, such as rain gardens, that improve water quality and protect the resource areas.

Twenty Wayland, LLC
45 Broad Street, 4th Floor
Boston, MA 02109

WAYLAND TOWN CENTER Wayland, MA

Site Identification and Wayfinding Program/ Tenant Sign Design Criteria

October 5, 2007

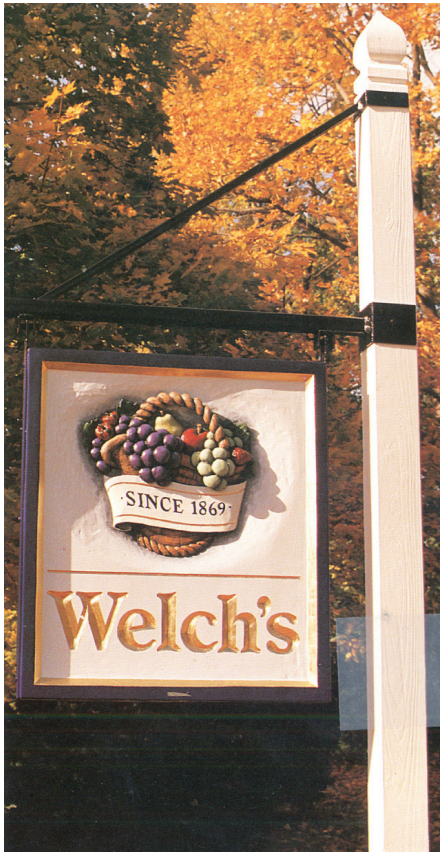
ARROWSTREET GRAPHIC DESIGN
212 ELM STREET SOMERVILLE MA 02144
617.623.5555 FAX 617.625.4646

Site Identification and Wayfinding Program

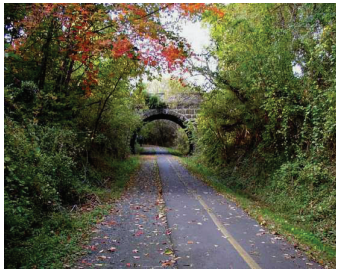
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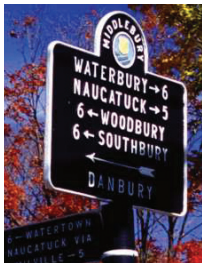
















Wayland Town Center

Site Identification and Wayfinding Program

ARROWSTREET
GRAPHIC
DESIGN

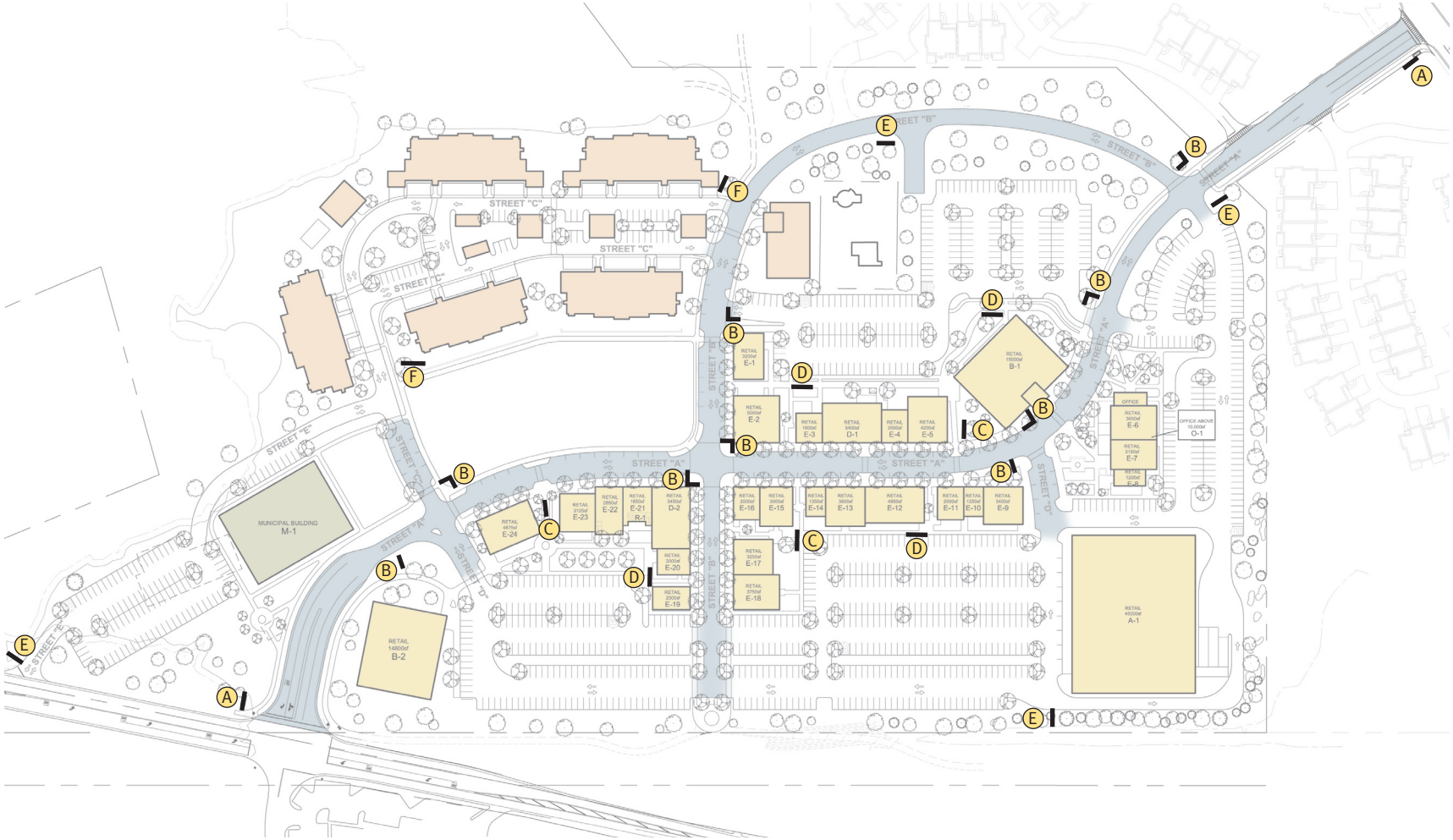
ARROWSTREET INC.
212 ELM STREET
SOMERVILLE MA 02144
617.623.5555
FAX 617.625.4646

DATE
October 5, 2007

TITLE
Precedent Images

SHEET
1

Sign Location Plan



Wayland Town Center

Site Identification and Wayfinding Program

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GRAPHIC
DESIGN

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FAX 617.625.4646

KEY

A. Monument Sign
B. Vehicular Directional
C. Directory
D. Pedestrian Directional
E. Access Sign
F. Residential Entrance

DATE

October 5, 2007

TITLE

Sign Location Plan
scale: nts

SHEET

2

Arrowstreet
Graphic
Design

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Somerville MA 02144
617.623.5555
fax 617.625.4646

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

Regular

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

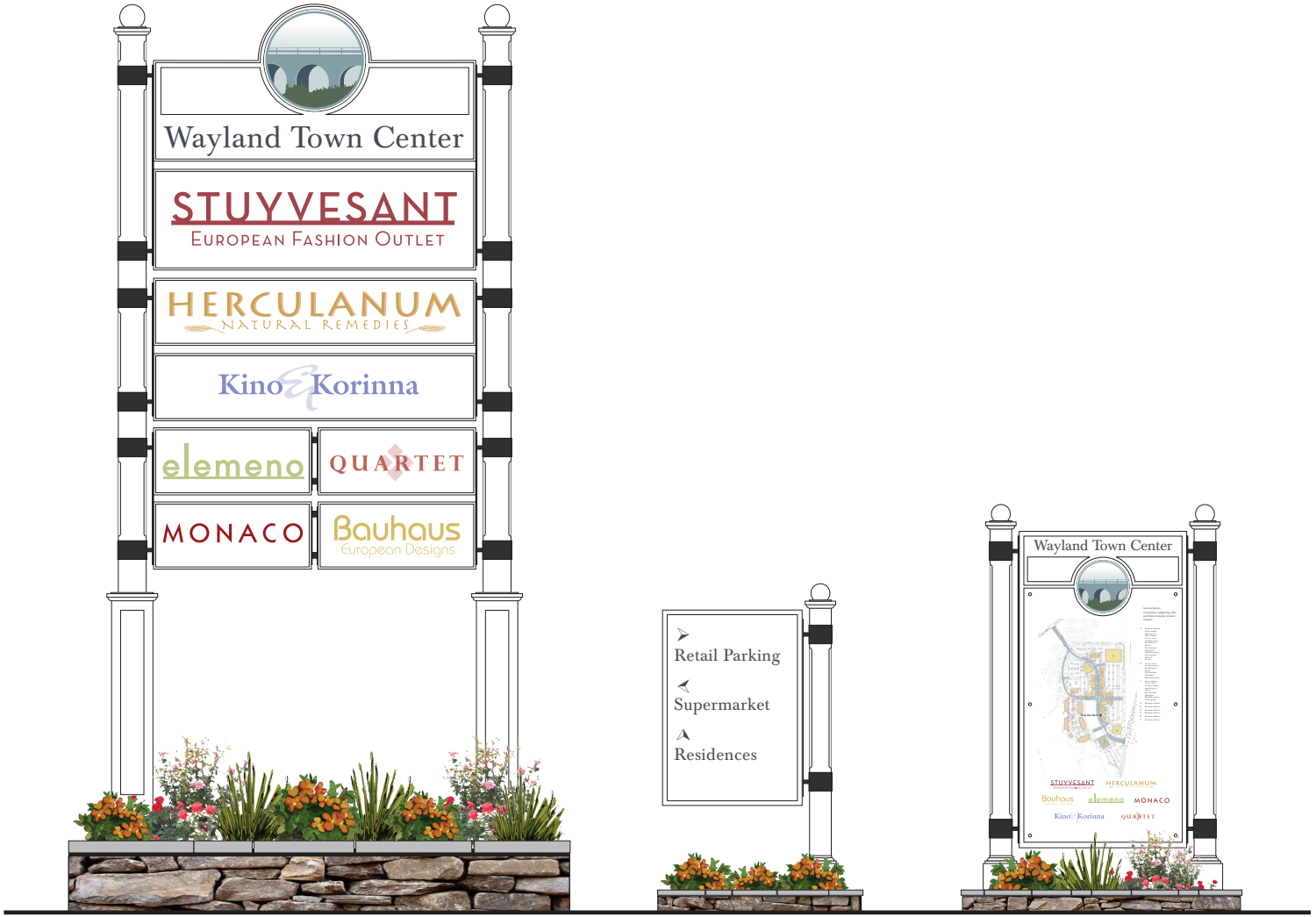
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abcdefghijklmnopqrstuvwxyz 1234567890

Medium

DATE
October 5, 2007

TITLE
Site Standard Type



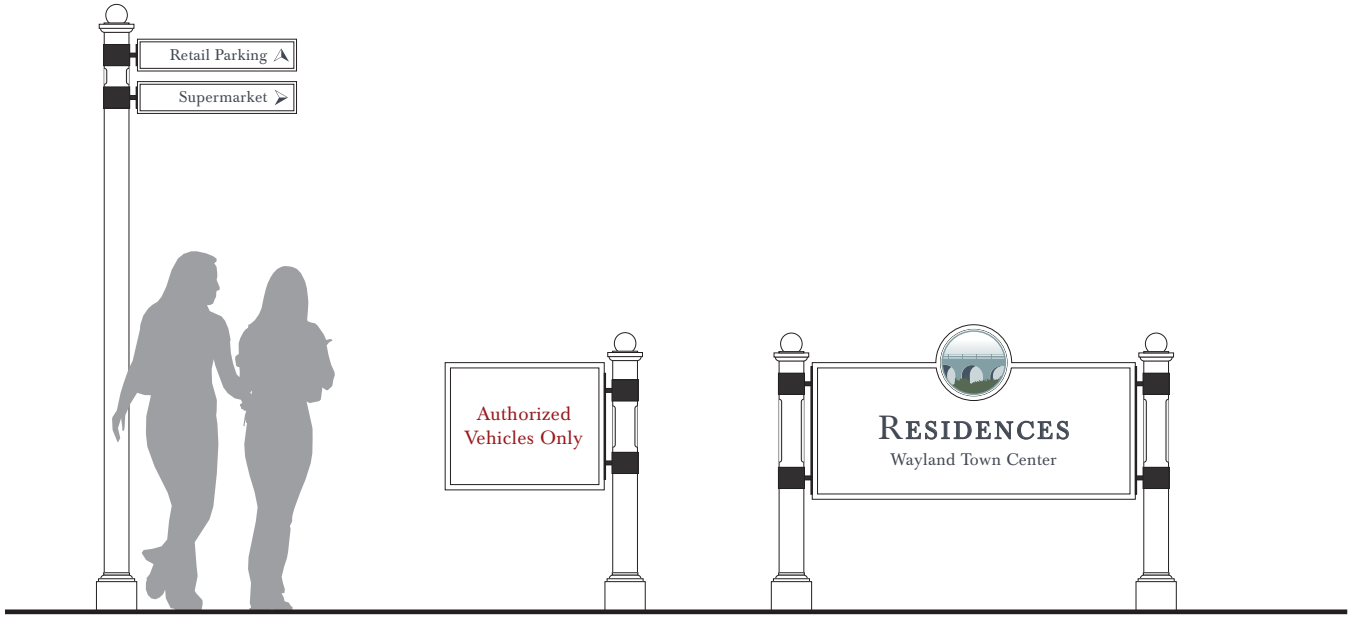
A
Monument Sign

B
Vehicular Directional

C
Directory

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Design

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fax 617.625.4646



D
Pedestrian Directional

E
Access Sign

F
Residential Entrance

DATE
October 5, 2007

TITLE
Sign Family

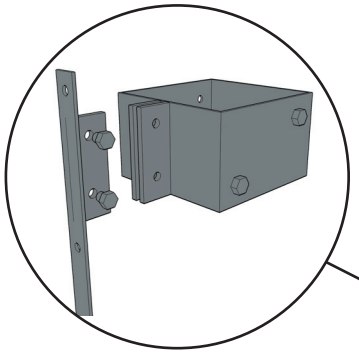
Sign Location Plan



Notes:

Option 1: Carved wood sign posts in white with carved wood sign panels and wrought iron bracket connections. Mounted on stone base. Externally illuminated.

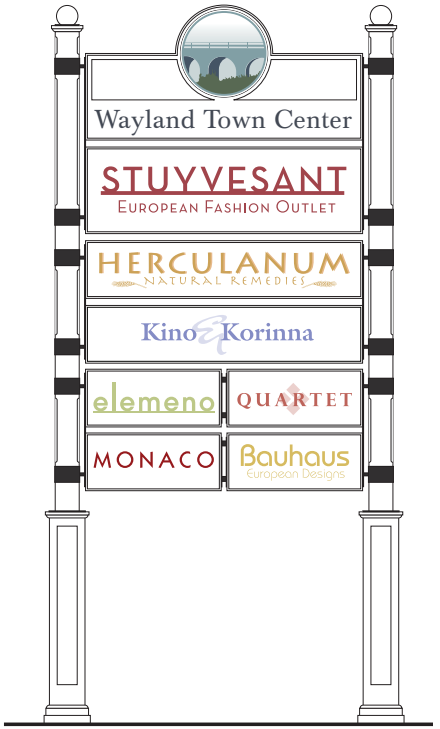
Option 2: Same construction as Option 1 but without stone base.



Detail: Bracket

Option 1:
Front Elevation

Option 1:
Side Elevation



Option 2:
Front Elevation

Wayland Town Center

Site Identification and Wayfinding Program

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DESIGN

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FAX 617.625.4646

DATE
October 5, 2007

TITLE
Monument Sign
scale: 1/4" = 1'-0"

Context Elevation



Wayland Town Center

Site Identification and Wayfinding Program

ARROWSTREET
GRAPHIC DESIGN

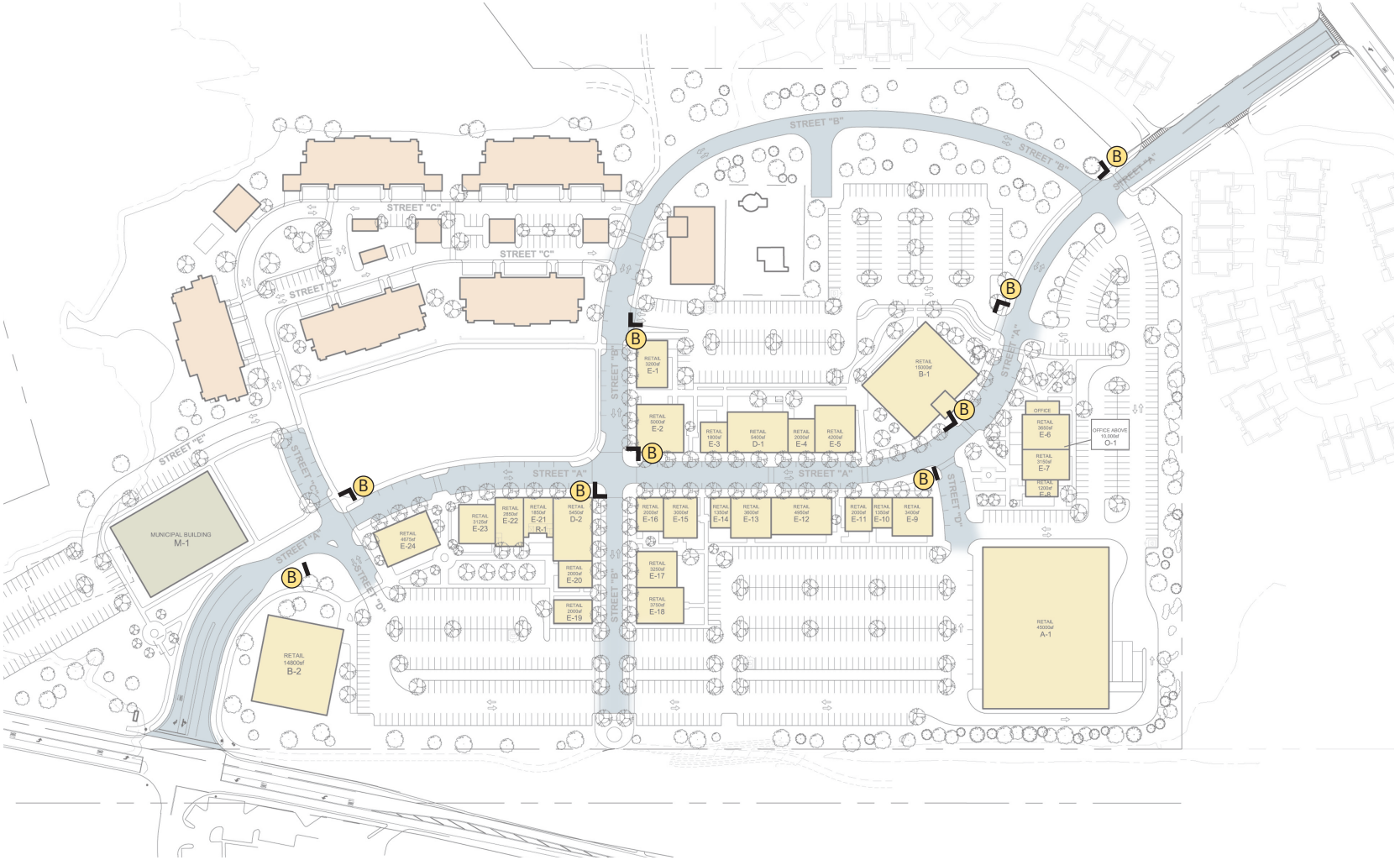
ARROWSTREET INC.
212 ELM STREET
SOMERVILLE MA 02144
617.623.5555
FAX 617.625.4646

DATE
October 5, 2007

TITLE
Monument Sign

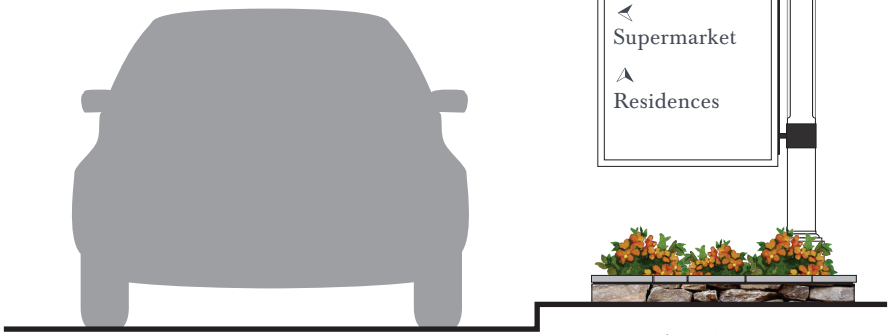
SHEET
6

Sign Location Plan

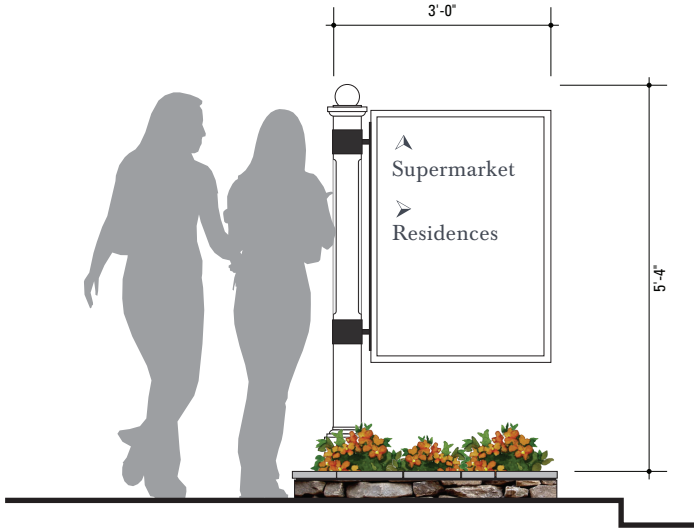


Vehicular Directional

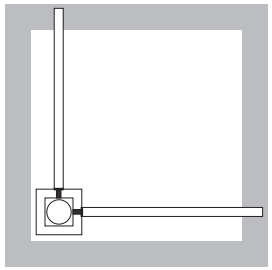
Notes: Carved wood sign posts in white with carved wood sign panels and wrought iron bracket connections. Mounted in stone planter. Externally illuminated.



Front Elevation



Side Elevation



Plan

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GRAPHIC
DESIGN

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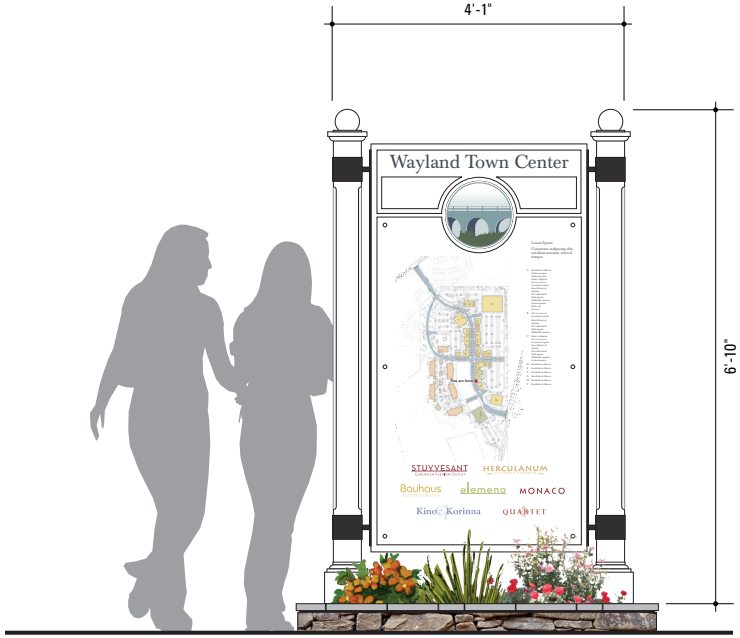
DATE
October 5, 2007

TITLE
Vehicular Directional
scale: 3/8" = 1'-0"

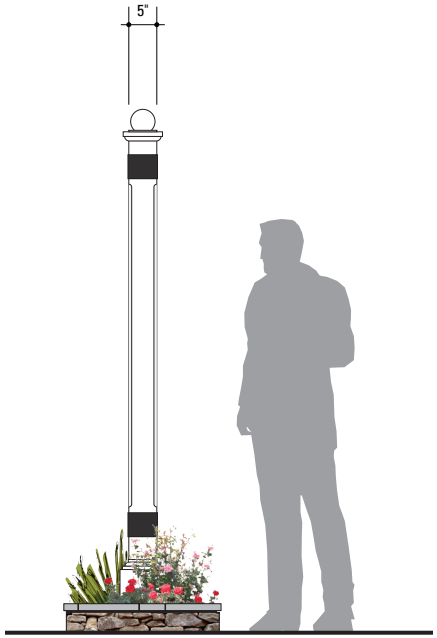
Sign Location Plan



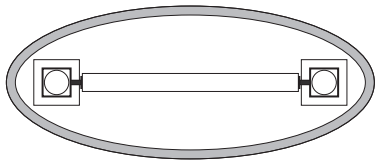
Notes: Carved wood sign posts in white with carved wood sign panel and wrought iron bracket connections. Mounted in stone planter. Externally illuminated.



Front and Back Elevation



Side Elevation



Plan

Wayland Town Center

Site Identification and Wayfinding Program

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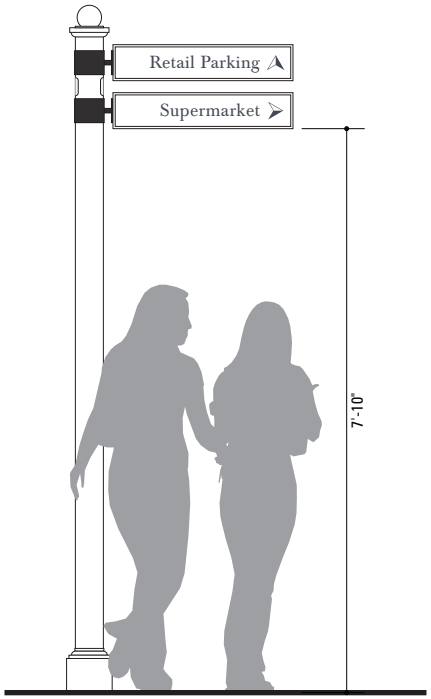
DATE
October 5, 2007

TITLE
Directory
scale: 3/8" = 1'-0"

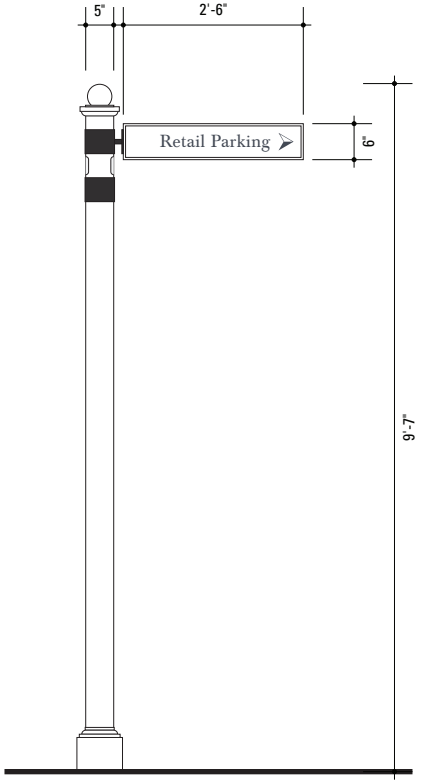
Sign Location Plan



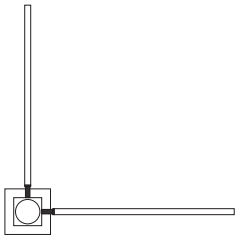
Notes: Carved wood sign posts in white with carved wood sign panels and wrought iron bracket connections. Non-illuminated.



Front Elevation



Side Elevation



Plan

Wayland Town Center

Site Identification and Wayfinding Program

ARROWSTREET
GRAPHIC
DESIGN

ARROWSTREET INC.
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617.623.5555
FAX 617.625.4646

DATE
October 5, 2007

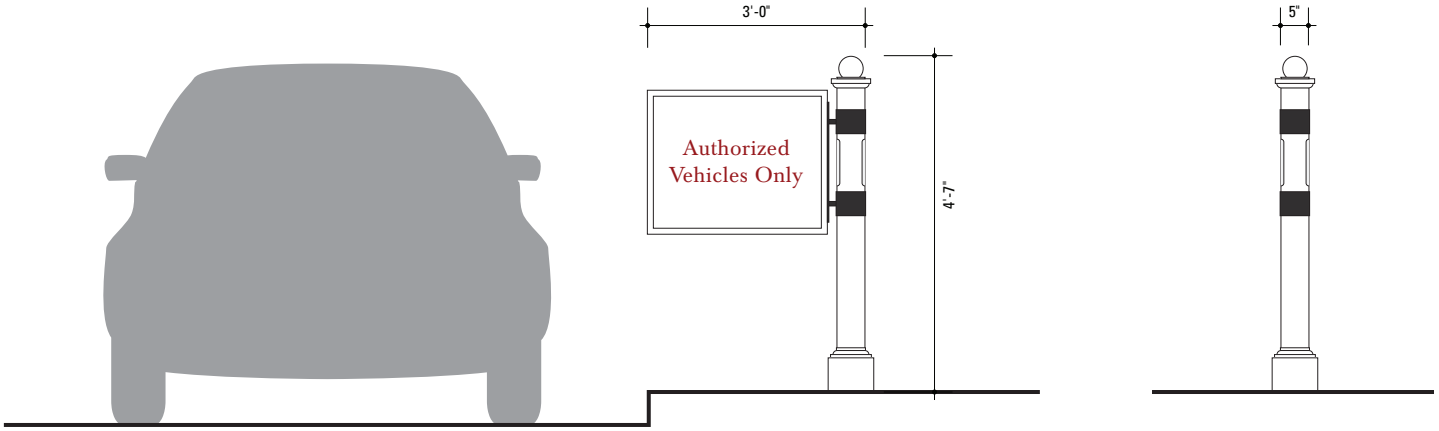
TITLE
Pedestrian Directional
scale: 3/8" = 1'-0"

Sign Location Plan



Access Sign

Notes: Carved wood sign post in white with carved wood sign panel and wrought iron bracket connections. Non-illuminated.



Front Elevation

Side Elevation



Plan

Arrowstreet
Graphic
Design

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Somerville MA 02144
617.623.5555
fax 617.625.4646

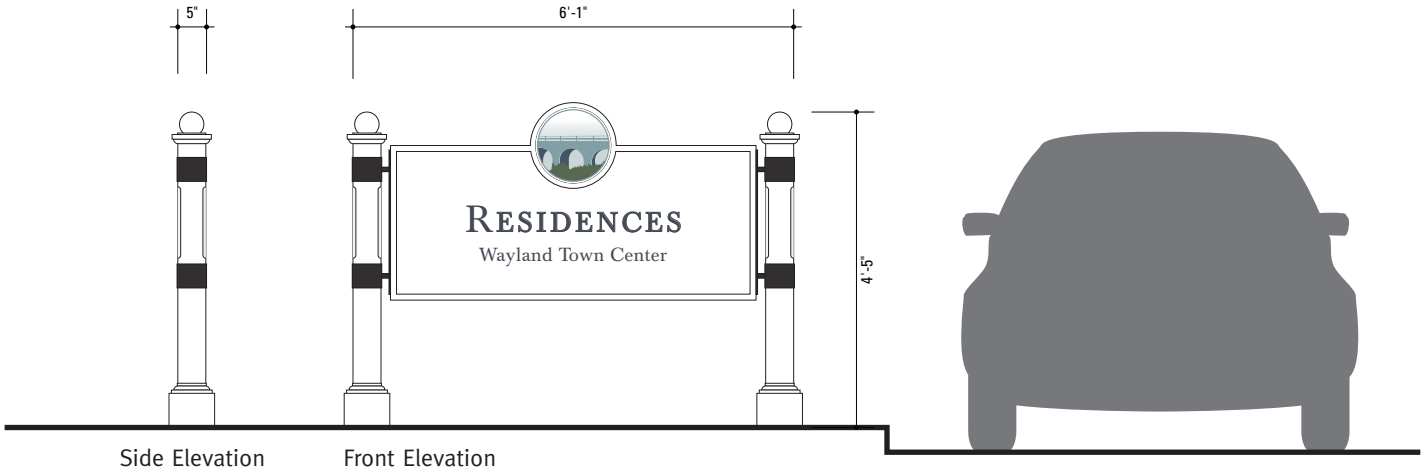
DATE
October 5, 2007

TITLE
Access Sign
scale: 3/8" = 1'-0"

Sign Location Plan



Notes: Carved wood sign posts in white with carved wood sign panel and wrought iron bracket connections. Externally illuminated.



Side Elevation Front Elevation

Wayland Town Center

Site Identification and Wayfinding Program

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GRAPHIC
DESIGN

ARROWSTREET INC.
212 ELM STREET
SOMERVILLE MA 02144
617.623.5555
FAX 617.625.4646

DATE
October 5, 2007

TITLE
Residential Entrance Sign
scale: 3/8" = 1'-0"

Tenant Sign Design Criteria

INTRODUCTION

Wayland Town Center is new mixed-use district designed in keeping with a traditional New Enland town Center and provides a fashionable outdoor shopping experience within an attractive, pedestrian friendly environment. Located in Wayland, Massachusetts, the atmosphere of this upscale center is relaxing and pleasurable with trees, wide pedestrian walkways, extensive landscaped areas and outdoor seating which encourage shoppers to stay longer. With the easy access parking, this center allows patrons to avoid mall congestion and keeps them closer to home. Great care has gone into creating a shopping environment that uses high quality natural materials which, along with lighting and landscaping, have been designed to create a quiet and sophisticated backdrop to storefronts exhibiting eye catching beauty and distinctive detailing.

The standards contained within this Tenant Sign Design Criteria Manual are intended to ensure quality of design and construction throughout Wayland Town Center. This document, referred to as the Tenant Sign Design Criteria Manual, generally describes the obligations of the Tenants and is intended to assist in the technical design and construction of the Tenants' signage.

This Manual is for use by Tenants, including those having regionally or nationally recognizable identities, and who may have to modify those designs to conform to specific criteria. While the Landlord invites the Tenants to express their individuality and distinctive identity, it is the intent of these Criteria to visually coordinate the ensemble of individual stores while maintaining a consistent level of quality and integrity complimentary to this very special place. Tenants are encouraged to discuss specific thoughts or questions regarding their stores with the Landlord prior to beginning design work. Obviously, special circumstances may require interpretations of the Criteria; however, deviations from the Criteria that undermine its intent will not be approved.

Any renderings, drawings and floor plans contained in the Manual are included for illustrative purposes only to help Tenants comply with the Sign Design Criteria. The actual design and configuration of each Tenant sign may vary from such renderings, drawings and floor plans. As design and construction of the project progress and these designs evolve, the Landlord may issue revised Design Criteria and Tenant sign requirements.

sign precedents:







TENANT SIGN DESIGN & CONSTRUCTION CRITERIA

INTRODUCTION

The principal function of signage is to identify the business' location, but it also sends signals about the quality of service or merchandise offered. The sign which will best accomplish these objectives is one which complements the building's architecture. Creating a sign inspired by a building's intrinsic design features is not difficult. A good design can result from a commonsense evaluation process that can be simultaneously enjoyable and rewarding economically for the shop owner. First the desired image for the business must be considered, then existing signs must be evaluated to determine if they promote that image. Customers will link good sign design with the entire building's image, thereby providing a means of locating the shop within the shopping center and making a positive impact on the shopper. A good fit between building and sign will result in a distinctive sign that provides a solid marketing advantage for the represented business and a visual asset for the town center as a whole.

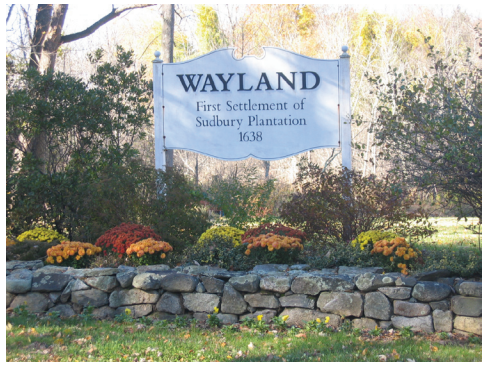
SIGN DESIGN CRITERIA

The purpose of the Sign Criteria is to assure consistency in quality, color, maximum size, placement and configuration of signage and graphics. Tenant signage is intended to enhance the project's character as well as convey the Tenants branding and identity. This distinction warrants a unique and original approach to signage and graphics that encourage a lively outdoor atmosphere. For this reason, specific restrictions on signs are set forth below. This shall not limit the Landlord's right to reject or to require modification of any Tenant sign. In all cases, as signage at Wayland Town Center is viewed as an integral part of the project's image and success, Landlord's judgment as to aesthetics quality, number (as specified by the Town of Wayland), color, size and method of installation shall be final and binding.

Storefront signs are the Tenant's first opportunity to engage the customers at Wayland Town Center and should be seamlessly integrated into Tenant's storefront design. Artistic and imaginative sign designs that reflect this principle will enhance the overall retail and entertainment experience. The Landlord recognizes that most Tenants' have made paramount efforts in creating a unique design and sign style which is consistent with the design intent for Wayland Town Center as a whole.

The use of logos and distinctive typestyles is encouraged for all tenant signs. Tenants may adapt

sign precedents:





established typestyles, logos and/or images that are in use on similar buildings operated by them, provided that the said styles are architecturally compatible and approved by the Landlord. Type may be arranged in one or two lines of copy and may consist of upper and/or lower case letters. Regardless of the above, wording of the signage shall be limited to the Tenant's trade name, and shall not include specification of merchandise sold or services rendered, regardless of Tenant "legal name."

Except with the prior written approval of Landlord, no advertising placards, banners, pennants, names, insignia, trademarks, or other descriptive material shall be affixed or maintained upon the glass panes and supports of the show windows and doors, or upon the exterior walls of the storefront or building.

The following signs are not allowed by Tenants at Wayland Town Center:

1. Temporary wall signs, pennants, flags, inflatable displays or sandwich boards;
2. Window signs held off the glazing or sign boxes located off the storefront glazing except where specifically approved by the Landlord;
3. Pre-manufactured signs, such as franchise signs, that have not been modified to meet the criteria;
4. Simulated materials (i.e. wood grained plastic laminates, etc) or wall covering
5. Flashing, blinking, moving animated or audible signs
6. Internally illuminated awning backgrounds
7. Advertising or promotional signs on parked vehicles

DESIGN CONTROL ZONE

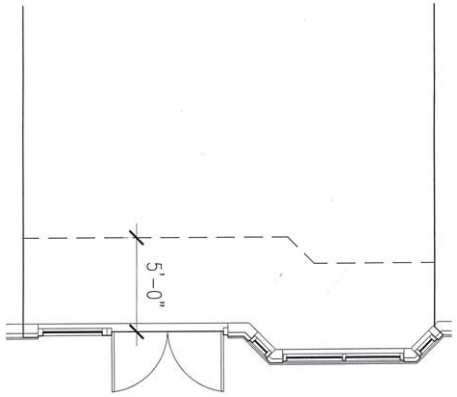
The Design Control Zone is a 5'-0" deep area extending inward from the Lease line and 5'-0" inward from recessed entry and running the full width and full height of the storefront. The Landlord considers this zone an extension of the storefront into the store interior. The finishes within this space are critical to the customer experience of the entire center and so all graphics, display fixtures, finish materials and lighting within this area are subject to approval by the Landlord. A sense of style and drama should be established through the use of inventive merchandising, displays, quality materials, and suitable lighting.

In the Design Control Zone, the Tenant will employ incandescent lighting or halogen fixtures exclusively. Electrical outlets are not to be located within the Design Control Zone. No mass merchandising (i.e., slat wall, etc.) is permitted in this area and durable flooring materials are

sign precedents:







required. Vinyl or rubber flooring, carpet tile, carpet or laminate floor products are not permitted in this area.

Sales counters and/or fixtures will not be located closer than five feet (5'-0") to the Lease Line. The Tenant will not place or maintain any temporary or permanent fixtures for the display of merchandise in front of or within six feet (6'-0") of any entrance to the Premises. A hard-surface ceiling, such as drywall, is required within the Design Control Zone; suspended acoustical ceiling systems are not permitted. Access to sign transformers and equipment must be provided for maintenance purposes.

Primary Storefront Sign

Tenants may utilize any of a wide variety of sign construction types for Storefront Signage integrated into their storefronts. All signage must have three-dimensional characters and be illuminated by a light source fully integrated with the architecture of the storefront. Among the signage types that may be considered are the following:

1. Free standing dimensional letters illuminated via remote lighting (i.e., goose-neck fixtures, pin spots, or ledge lit).

2. Sandblasted wood signs in natural wood finish with painted, raised letters and/or logos illuminated via remote lighting (i.e., goose-neck fixtures, pin spots, or ledge lit).

The following sign and lighting types will not be allowed:

1. Neon (all types)
2. Back-lit (halo effect)
3. Internally illuminated face-lit signs (all types)
4. Signs employing luminous-vacuum formed plastic letters
5. Signs employing unedged or uncapped plastic logos or letters with no returns and exposed fastenings
6. Box style cabinet signs or "can signs" with illuminated, translucent background and silhouette, translucent or acrylic letters
7. Simulated materials (i.e., wood grained plastic laminates, Zolatone etc.) or wall covering
8. Animated components, flashing lights, formed plastics, injected molded plastics, clear faced channel letters and box-type backlit signs with translucent background panels.
9. Plasma screens, back projection screens or similar mixed media presentations.

sign precedents:







10 Exposed conduit, tubing or raceways, conductors, transformers and other equipment, shall not be permitted. All signs, bolts, fastenings and clips shall be galvanized iron, stainless steel, chrome plated steel, aluminum, brass or bronze.

11 No sign maker's labels or other identification shall be permitted on the exposed surfaces of signs, except those required by code. If required by code, such labels or identification shall be placed as inconspicuously as allowed.

Tenant Identification Blade Signs

Tenants are encouraged to provide blade signs identifying their place of business. These signs shall be no larger than 4 square feet and be located no less than 7'-6" off grade mounted perpedicular to the face of the building. They are not required to be externally illuminated. Merchandizing information is not allowed. Suitable materials may consist of wood, painted metal, acrylic or by approval of the owner. Lighting shall conform to the same standards as for wall signs (see above).

Awnings

Awning graphics are encouraged. Dimensional or applied graphics are acceptable, however no part of an awning should block a neighbor's signage or storefront, or be mounted so low as to be a hazard to pedestrians. Artwork is emphasised over identity. Merchandising is not allowed.

Decorative Banners

Under certain conditions, some tenants may be encouraged to provide a decorative signage program which relates to their place of business. This system would consist of metal brackets permanently fastened to the building supporting a changable banner program. These may or may not be externally illuminated. See illustrations throughout this document for recommended sizes and locations.

Window Displays

The area just to the inside of the storefront to 5' deep into the lease space, and the full height and width of the storefront glazing should be used as display area. Attractive, professionally designed storefront window displays are highly encouraged. Clutter, inappropriate signage, storage, advertising posters, window shade film, inappropriate shade devices, and other

sign precedents:





unattractive elements are not allowed within this zone. This area is considered an extension of the beautification of the surrounding streetscape, facades and signage.

Primary Address Sign

Tenant shall display the street number of the Premises to allow for precise identification of the Premises. The street numerals of the Premises are to be applied second surface on the interior of the storefront glazing in five-inch high numerals with no less than a 3/4“ stroke, in the Landlord’s standard numeral typeface for the shopping center.

Store identity and hours of operation shall be located at all door entries. Size and location shall be consistant for all storefronts but design and type should vary. Total area shall not exceed 4 sq. ft.

Rear Door Address Sign

If Tenant has a non-customer door for receiving merchandise, Tenant shall place only its street number and name on this door, in a location approved in writing by Landlord’s tenant coordinator. Numerals and names shall be vinyl appliqué, mounted first surface to the exterior face of the door and shall be 3” high with no less than 7/16” stroke, in the Landlord’s standard numeral font style for the shopping center. Where more than one (1) Tenant uses the same door, each suite number may be applied. Landlord’s Tenant Coordinator may also specify the color and placement of the numerals on the door.

Glazing Signs

Signs applied to the storefront glazing must have the prior written approval of Landlord. If so approved, Tenant signs on storefront glass will appear in gold or silver leaf, or applied machine cut vinyl letters. All letters will be finished on both sides of the glass with no mastic or adhesive visible. Painted signs shall be of consistent color without visible brush strokes.

Sign Area

Refer to the elevation examples for recommended sign locations and sign area.

sign precedents:





Power

Electrical service to the Tenant's sign shall be installed by the Tenant and not be part of the Landlord's operating costs. The sign shall be controlled by a time clock. Electrical service to all signage to be on a time clock, on a separate circuit and wired to Tenants' electric meter. Each Tenant sign must remain illuminated one-hour prior, during, and one-hour after opening hours.

1. PK housing, (or other U.L. approved insulating sleeve approved by Landlord and local building codes), is required for all through wall penetrations and must be indicated on the sign shop drawings.
2. All conductors, conduits, tubing, crossovers, transformers, wiring raceways, cabinets and other equipment must be concealed. Visible fasteners and hardware will not be permitted.
3. All illuminated signage shall be UL listed and bear the UL label; their installation shall comply with all local building and electrical codes. UL labels shall be placed in accordance with approved display guidelines.

Illumination

Sign illumination is required to be external only (i.e., goose-neck fixtures, pin spots, or ledge lit). The following are basic standards for sign illumination:

1. All remote or external lighting shall be reviewed and approved by the Landlord prior to installation. Cut sheets for proposed fixtures must be submitted along with Tenant's shop drawings.
2. Color tempurature must be within a 3200K^{o} - 5000K^{o} range and not exceed xx candles/sf.
3. Each Tenant sign is to be individually illuminated.

Details

The following details should be observed in the design and construction of Tenant's signage:

1. Non-ornamental hardware used to attach sign to storefront may not be exposed to view.
2. All exterior signage components (logos and all individual letters) shall stand off the face of the wall surface by a distance of 1 inch min. This shall be accomplished by the use of nylon or acrylic spacers placed between the face of the wall and the back of the logo or Letter.
3. Tenant may use Landlord bulkhead for lateral bracing only.
4. Threaded rods or anchor bolts shall be used to mount sign letters spaced out from background pane. Angle clips attached to letter sides will not be permitted. All bolts, fastenings, and clips shall be of hot-dipped galvanized iron, stainless steel, aluminum, brass or bronze, and no black iron materials of any type shall be permitted.

sign precedents:





Specific Guidelines (Town of Wayland MUOD and 2006 Special Town Meeting Warrant)

2309.4 Wall Signs

2309.4.1 Signage must (a) be in keeping with a traditional new England town Center: and (b) be integrated into the overall architectural design of the mixed use project.

2309.4.2 See Location Plan Diagram on Page 12 for dimensional standards. An
2309.4.3 establishment can have only one primary wall, to be designated in the signage
2309.4.4 plans referenced in Section 2309.4.6.

2309.4.5 Signs may be illuminated externally, but no sign can be illuminated internally.

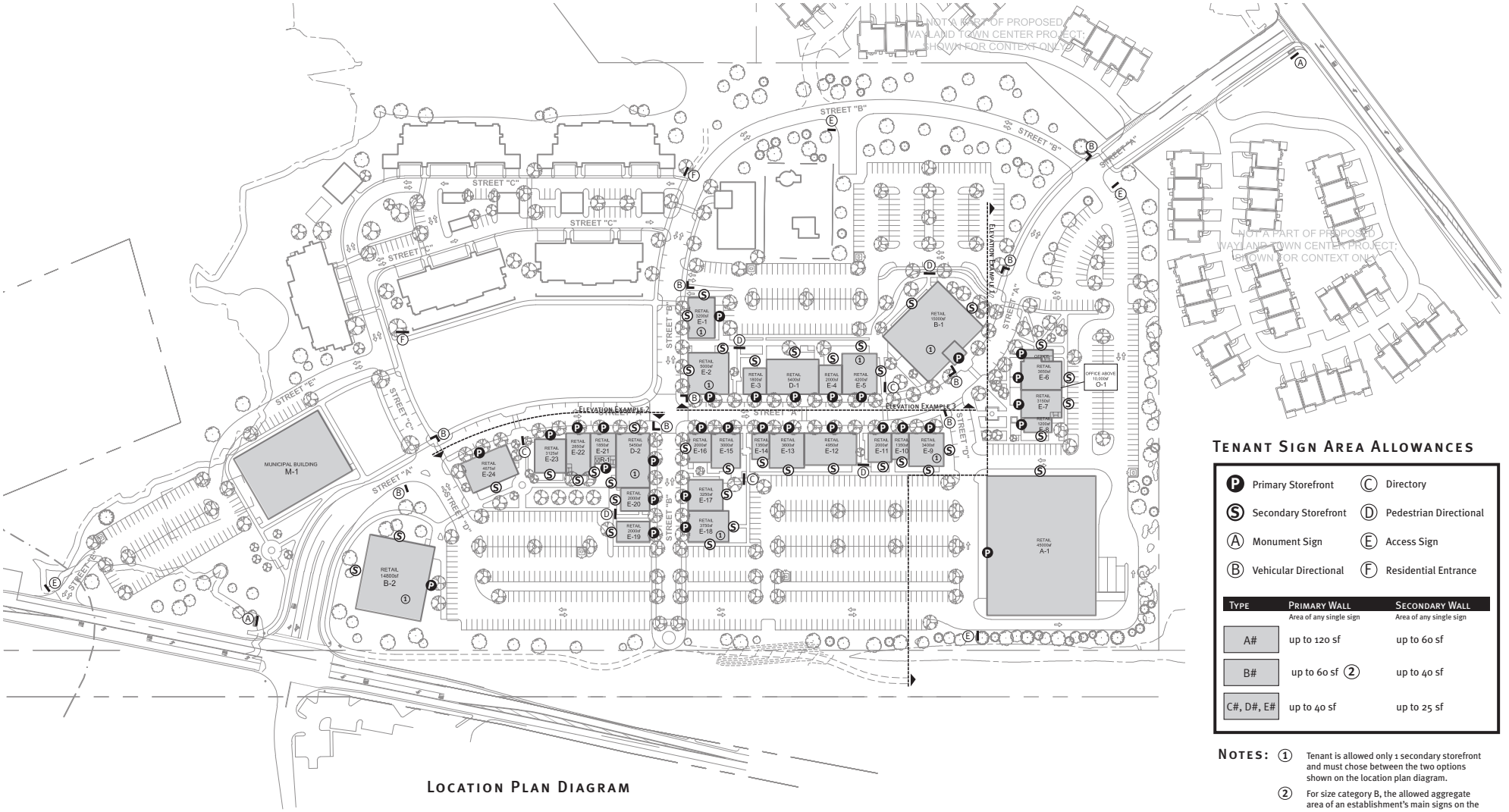
2309.4.6 The applicant shall prepare signage plans indicating aggregate signage, maximum sign area, and proposed lighting, demonstrating that signs and proposed lighting will comply with Section 198-2309.4, Section 198-501 (except that the area and height limits specified in Section 198-501.1 shall not apply), and the Planning Boards rules and regulations for the MUOD.

2309.4.7 By special permit, the Planning Board may allow signage that varies from that which is permitted in Section 198-501.1 and Section 198-2309.4, including signage not on the same premises as the building, structure, or use to which the signage pertains (provided the signage is still within the MUOD).

sign precedents:







Location Plan Diagram

Tenant Sign Area Allowances

(P) Primary Storefront	(C) Directory
(S) Secondary Storefront	(D) Pedestrian Directional
(A) Monument Sign	(E) Access Sign
(B) Vehicular Directional	(F) Residential Entrance

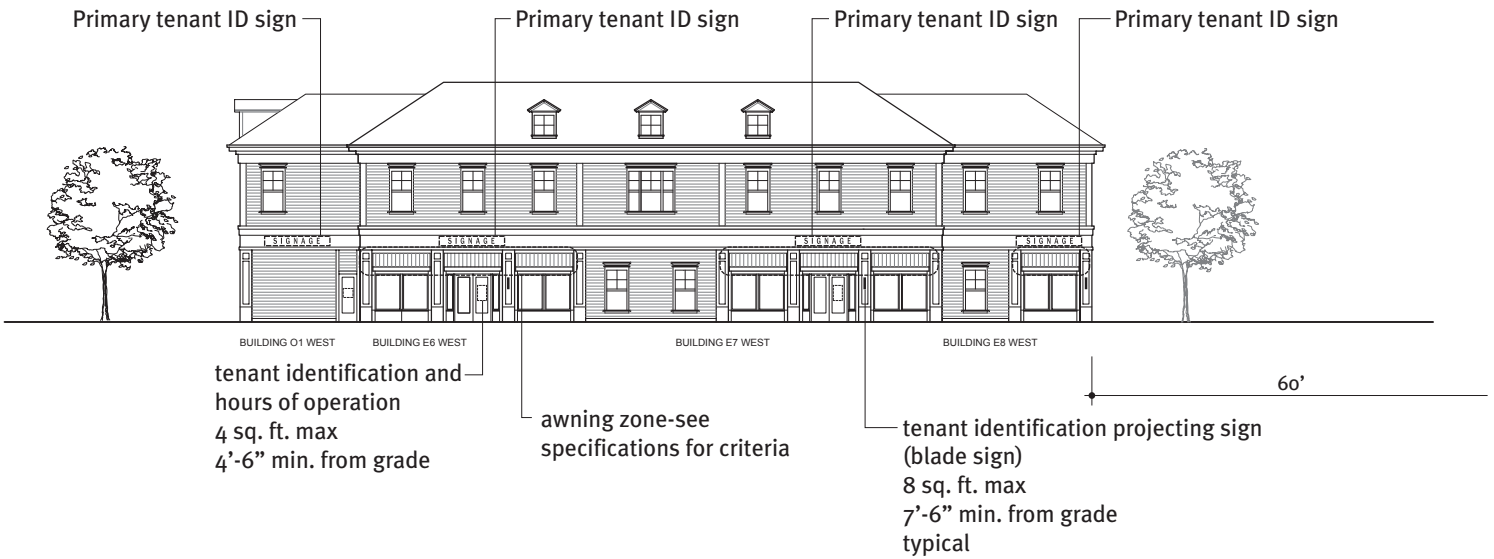
Type	Primary Wall Area of any single sign	Secondary Wall Area of any single sign
A#	up to 120 sf	up to 60 sf
B#	up to 60 sf (2)	up to 40 sf
C#, D#, E#	up to 40 sf	up to 25 sf

Notes:

(1) Tenant is allowed only 1 secondary storefront and must chose between the two options shown on the location plan diagram.

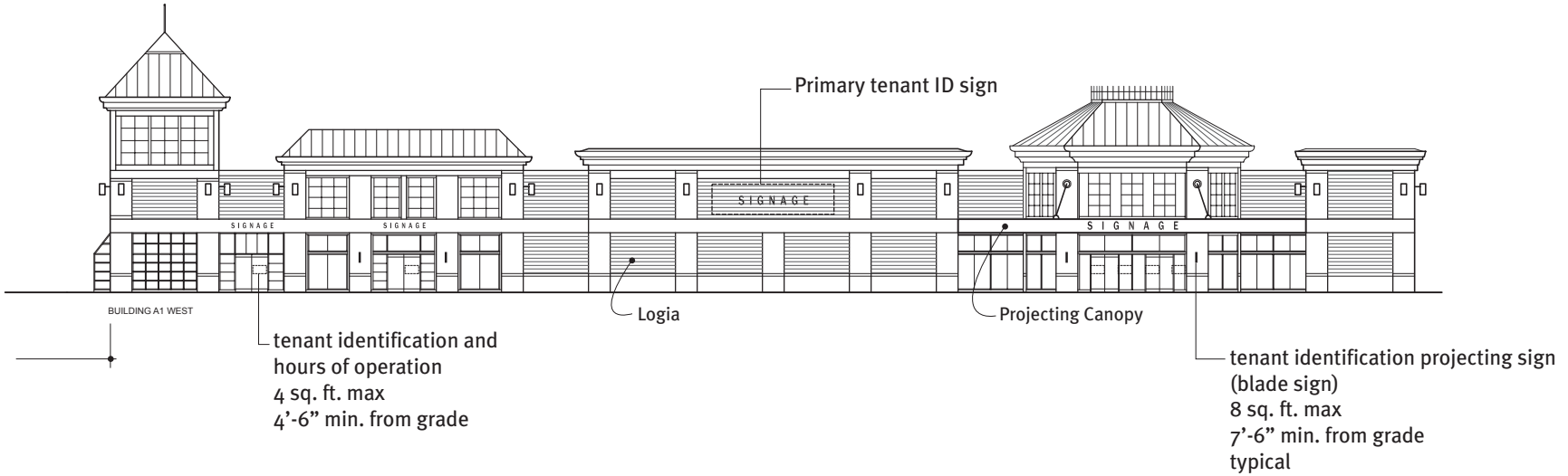
(2) For size category B, the allowed aggregate area of an establishment's main signs on the primary wall can be up to 90 sq ft.

(3) Location of Primary and Secondary Signage designations are shown in prototypical locations and shall be subject to change based on tenant requirements and will be finalized



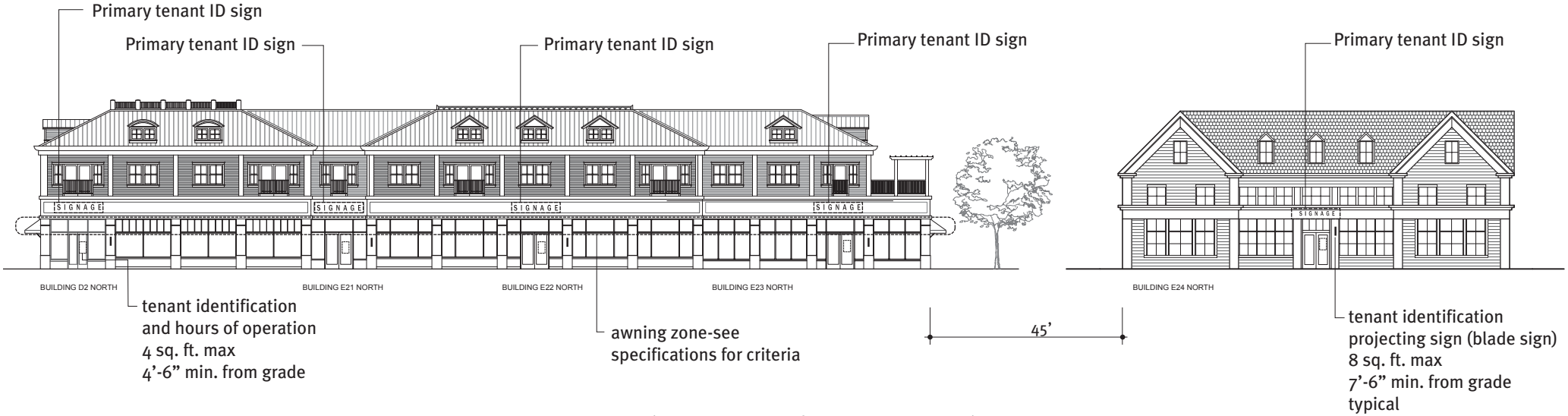
Elevation Example 1 - 'D' Street Off 'A' Street (West Facing)

1.a

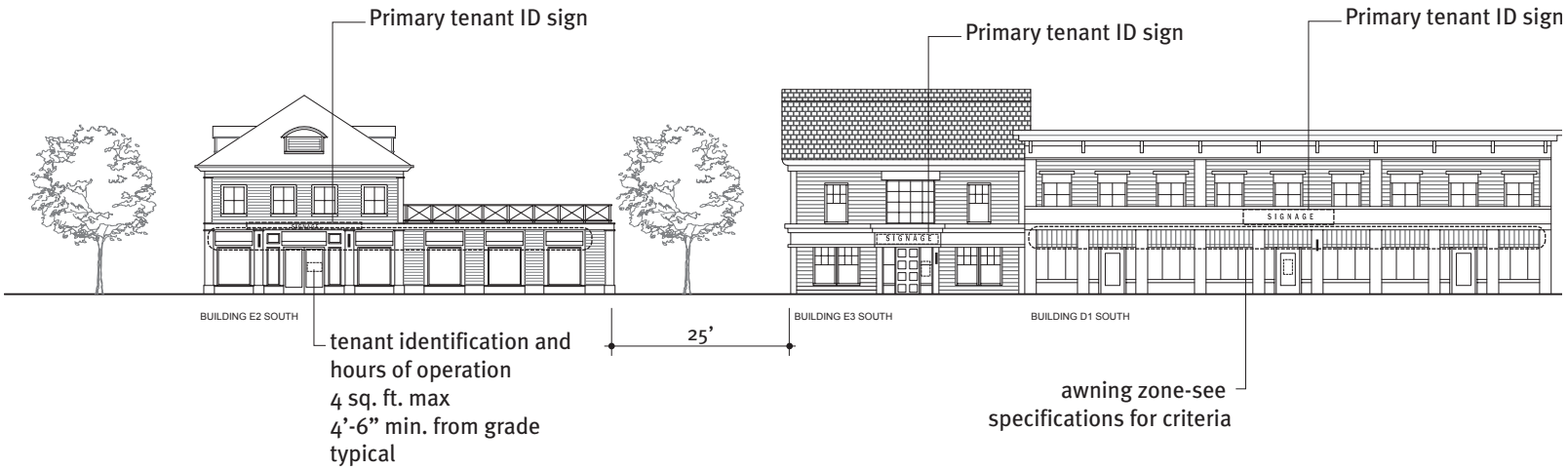


Elevation Example 1 - 'D' Street Off 'A' Street (West Facing)

1.b

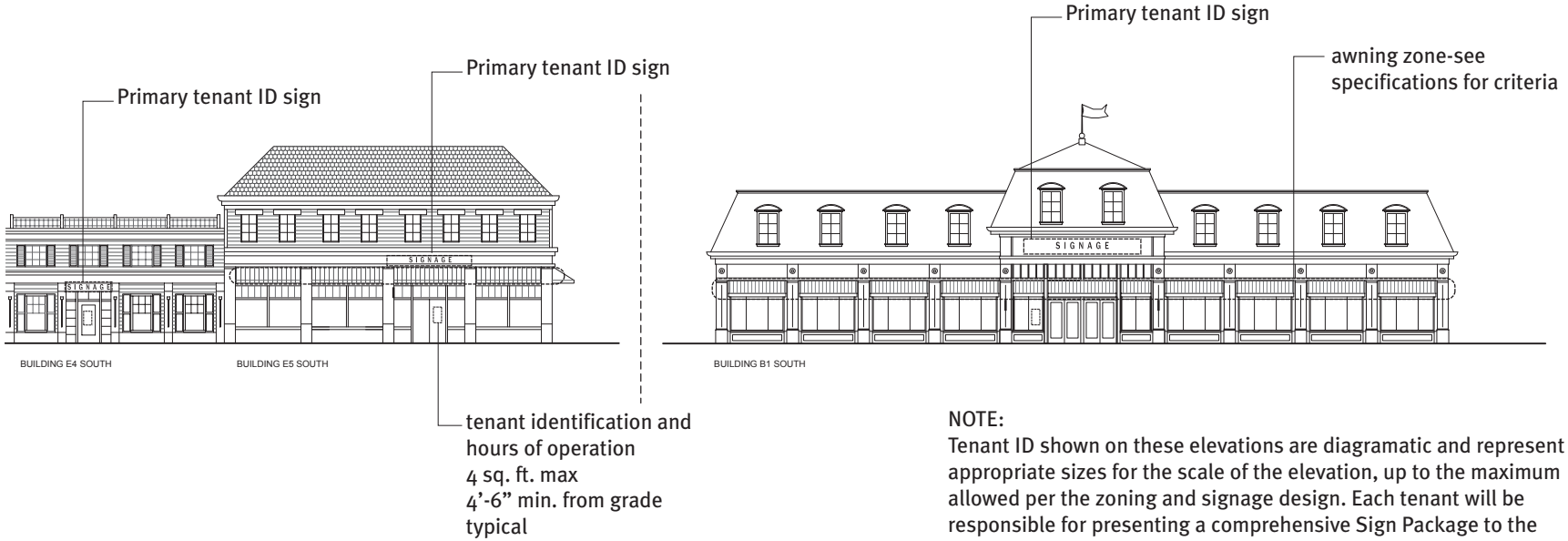


Elevation Example 2 - 'A' Street at Public Green (South Side/North Facing)



Elevation Example 3 - 'A' Street (North Side/South Facing)

3.a



NOTE:
Tenant ID shown on these elevations are diagramatic and represent appropriate sizes for the scale of the elevation, up to the maximum allowed per the zoning and signage design. Each tenant will be responsible for presenting a comprehensive Sign Package to the Town of Wayland in the Site Plan Permit Application for approval.

Elevation Example 3 - 'A' Street (North Side/South Facing)

3.b

Stormwater Management Study

Wayland Town Center
Wayland, MA

Applicant:
Twenty Wayland, LLC
45 Broad Street
4th Floor
Boston, MA 02109

Prepared by:

RJ O'CONNELL
& ASSOCIATES, INC.
Civil Engineers & Land Planners
80 Montvale Ave
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Date: October 5, 2007

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APPENDIX A: EXISTING CONDITIONS HYDROLOGY

APPENDIX B: PROPOSED CONDITIONS HYDROLOGY

APPENDIX C: STORM SEWER SIZING CALCULATIONS

Project Location and Description

The project site has an area of approximately 56.9 acres and is located at 400 Boston Post Road, in Wayland, MA (See Figure 1 - Locus Map). The site is bound by Route 20 (Boston Post Road) to the south, the Wayland Business Center property to the North, Sudbury River to the west and the Wayland meadows property and Route 27 (Old Sudbury Road) to the East. There are wetland areas on the site. The larger wetland is located at the western portion of the site adjacent to Sudbury River, two smaller wetland areas are at the north east portion of the site adjacent to the Wayland Business Center property, and on the south east portion of site adjacent to Route 20.

Approximately 25 acres of the site is currently developed. The existing development contains a building formerly occupied by Raytheon with a footprint area of ±272,700 square feet and a ±10,500 square foot building formerly utilized as a daycare center and associated parking. There is a Wastewater Treatment facility on site which is owned and operated by the Town of Wayland. The existing topography of the project site generally slopes east to west and ranges from elevation ±146 at the eastern property line adjacent to the Wayland Meadows Property to elevation ±116 at the western side of the site in the large wetland area adjacent to Sudbury River.

The proposed development program consists of demolishing the existing 272,700 square foot building and constructing a mixed use development consisting of residential, municipal and retail use buildings, with associated parking facilities, utilities, and stormwater collection system (See Figure 2 - Site Plan). The stormwater management system for the proposed project has been designed in accordance with the MADEP's Stormwater Management Policy and Standards and the Town of Wayland's Wetlands and Water Resources Bylaw Chapter 194 Rules and Regulations.

Stormwater quality control will be achieved through a program of Best Management Practices (BMP's). The proposed stormwater management system will significantly improve the quality of the stormwater runoff. The existing pavement runoff drains to catch basins which direct runoff to wetland resource areas without additional water quality treatment. The proposed stormwater management system for the project will include new catch basins with deep sumps and hoods, and the use of innovative low impact development (LID) techniques.

Low Impact Development is a stormwater management approach with the goal to mimic the site's pre-development hydrology. This is done by using design techniques that infiltrate, filter, store, and detain water throughout the site using decentralized micro-scale controls. LID includes structural and non-structural strategies such as retention areas, reduction of impervious surfaces, lengthening of flow paths, and the preservation of existing vegetation and landscape features. Redevelopment and improving stormwater quality of existing sites, and energy and water conservation are also examples of LID techniques.

LID techniques proposed for the project include the use of water quality swales, rain gardens, and bio-retention basins to increase times of concentration, promote groundwater recharge, and enhance water quality. The water quality swales will be planted with grass on the bottom and sides to slow the runoff velocity and filter pollutants. The rain gardens and bio-retention basins will be planted with a combination of grasses, perennials, shrubs, and small trees. The clean stormwater runoff from the building rooftops will be directed to the water quality swales and bio-retention basins to provide additional groundwater recharge.

Based on a review of The National Flood Hazard Insurance Rate Map for the Town of Wayland, Massachusetts, Community Panel No 250224 0002 C, Dated (Revised) February 19,1986, the project site is located within the following zones:

Zone A - Area of 100 year flood
Zone B – Area between 100 year and 500 year floods
Zone C - Area of Minimal Flooding

Design Objectives and Methodologies

The stormwater management system was designed to control post-development peak runoff from the site by keeping it at or below the levels of pre-development. This was done by analyzing the 2-year, 10-year, and 100-year 24-hour storm events using the Hydraflow Hydrographs 2004 computer program. Hydraflow uses TR-20, the SCS Unit Hydrograph method (an industry accepted method) capable of developing runoff hydrographs for both simple and complex drainage basins. Hydraflow computes SCS Method Runoff Hydrographs by convoluting a rainfall hyetograph through a unit hydrograph.

Utilizing the TR-20 method in Hydraflow, the following data is necessary for input:

Watershed Area: Areas of each watershed are calculated and expressed in acres for these calculations.
SCS Curve Number (CN): Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the existing watersheds utilizing Table 2-2a- *Runoff Curve Numbers For Urban Areas* and *Worksheet 2, Runoff Curve Number and Runoff* from the Soil Conservation Service Technical Release 55 – Urban Hydrology for Small Watersheds
Time Interval (Minutes): For the most compatible results with the existing conditions, this value is defined at 2 minutes.
Time of Concentration, Tc (Minutes): The time of concentration for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of concentration. Time of concentrations were calculated using TR-55 worksheets with a minimum recommended time of concentration of 6 minutes.
SCS 24-Hour Storm Type: For the greater New England region, a Type III storm is recommended for drainage calculations.
Rainfall Precipitation: Rainfall precipitations for the 2, 10, and 25 year, 24-hour storm events were obtained using Figure B-1 from Technical Paper No. 40 (TP-40) Rainfall Frequency Atlas of the United States and are as follows for Wayland, MA:

2-year storm event: 3.1 inches
10-year storm event: 4.5 inches
25-year storm event: 5.3 inches

As per Town of Wayland Wetland regulations, a 24 hour storm event with a depth of 1 inch will be required as part of the analysis. The minimum depth for a 24 hour 100 year storm depth will be 7 inches as per the Town of Wayland Wetland Regulations.

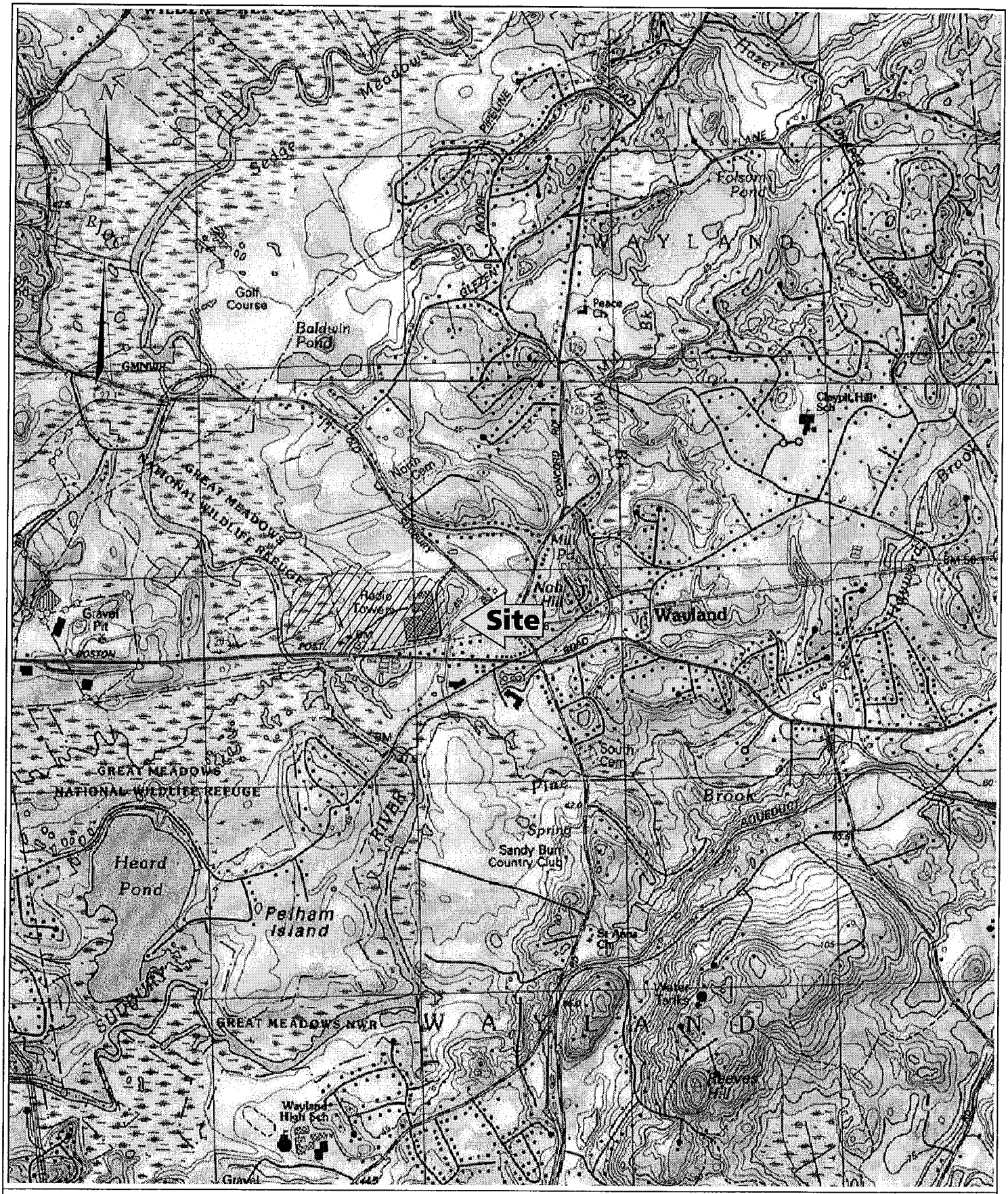
An on-site subsurface storm drainage collection system was designed to carry a minimum 10-year storm event through the site using the Hydraflow Storm Sewers Program. This program uses the Rational Method for estimating runoff and storm drainage pipes are sized based on calculated flows using Manning's Equation.

The site was divided into sub-areas, each contributing runoff to an individual catch basin inlet or roof drain. A value for area, time of concentration, and a runoff coefficient were calculated for each contributing sub-area. Rainfall intensities are calculated based on regional precipitation values provided in Technical Memorandum Hydro-35.

Existing Soils

The Soil Survey of Middlesex County, Massachusetts, completed by the National Resource Conservation Service (NRCS, formerly the Soil Conservation Service), was reviewed for general information on the soils within the site area (See Figure 3 - Soil Map). The mapped soils shown within the site limits are identified as follows:

Soil Number	Soil Type	Hydrologic Group
255A	Windsor Loamy Sand, 0 to 3 percent slopes	A
602	Urban Land	Null
36A	Saco Mucky Silt Loam, 0 to 1 percent slopes	D



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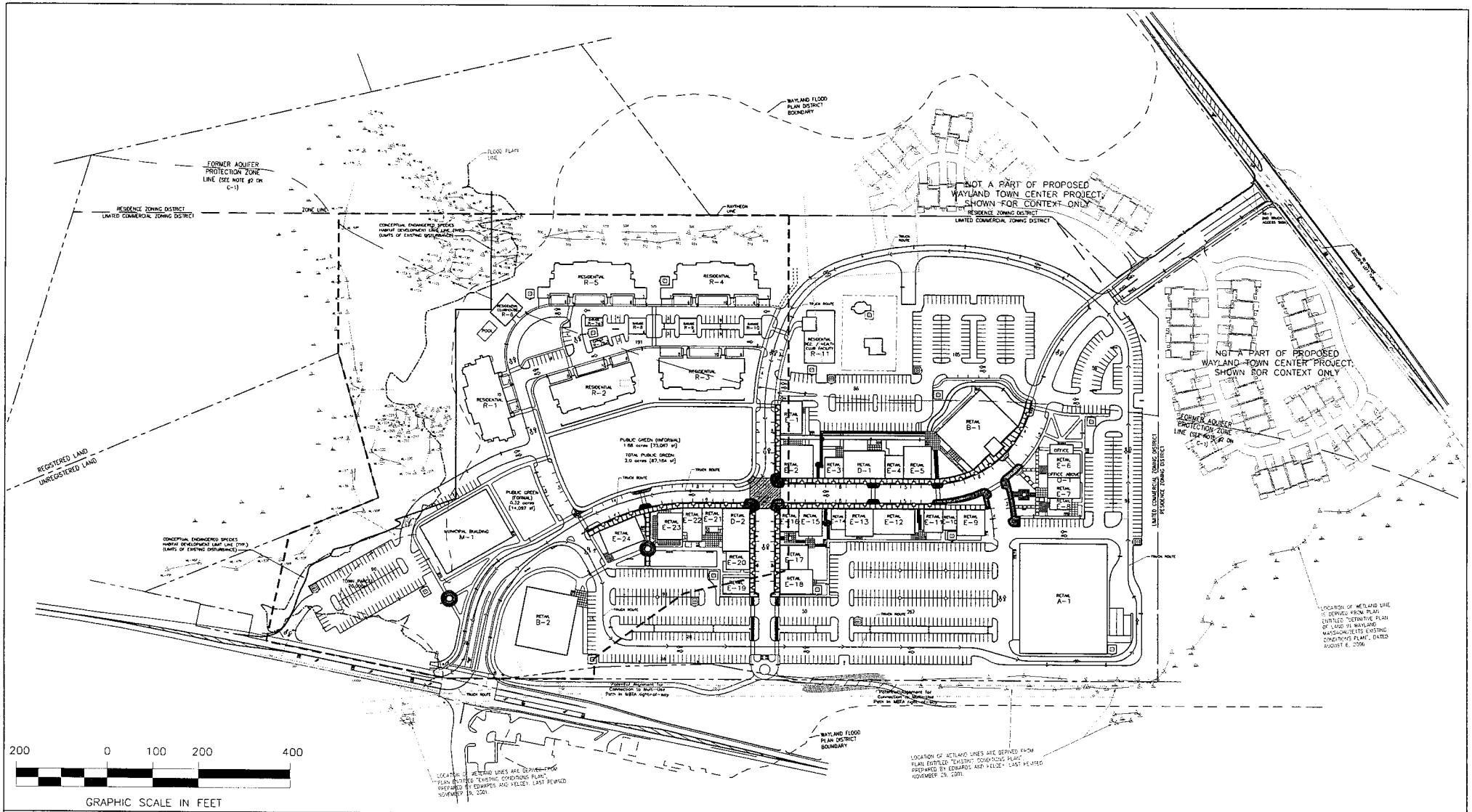
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WAYLAND, MA

Drawing Name:
SITE LOCUS MAP
WAYLAND, MA
QUADRANGLE
MAP DATE: 1977

Drawing No.:
FIG. 1

Project No.: 06032



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WAYLAND, MA

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SITE PLAN

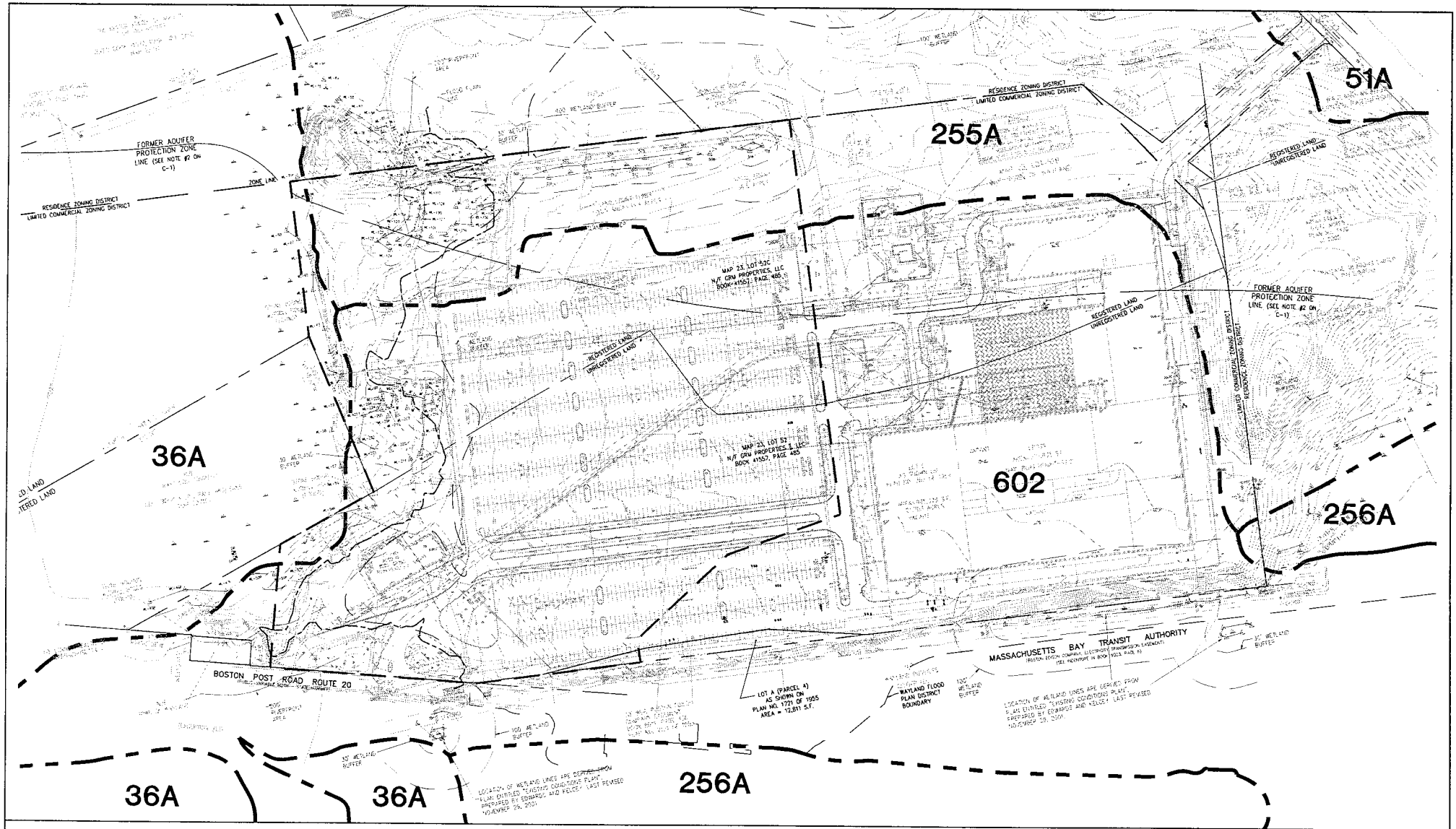
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FIG.-2

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WAYLAND, MA

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SOIL MAP PLAN

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FIG-3

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Existing Conditions Runoff

The existing topography and land cover has been analyzed and 6 watershed areas were delineated with a combined area of ±43 acres for stormwater runoff. The watershed areas consist of the project site as well as any contributing off-site areas that direct runoff onto the project site. Six analysis points corresponding to the watersheds were used for determining the existing runoff leaving the site. The same points were used for the proposed runoff leaving the site to ensure that there will be no increase in peak runoff rates for the 2, 10, 25, and 100 year, 24 hour design storms (see Figure 4 – Pre-development watershed).

Watershed EW-1 is 17.42 acres and is predominantly impervious, consisting of the 6.26 acres of roof area of the existing Raytheon building, sidewalks and landscaped islands, a small area of runoff from offsite and a large portion of the existing parking lot. Runoff currently travels east to west and is captured by a number of catch basins and piped to a 36"combined sewer and storm pipe which discharges into the large wetland.

Watershed EW-2 has an area of 4.11 acres and consists mainly of paved areas with a small portion of a landscaped island and the roof runoff from the existing 10,500 square foot building. Runoff sheet flows northwest and is collected by catch basins and discharges directly into the wetland through an existing 18" storm pipe.

Watershed EW-3 is 12.31 acres in size and groundcover is predominantly previous consisting of grass, brush, woods and a small portion of the existing paved area. Runoff from this watershed is overland flow, which travels east to west directly into the existing wetland without any stormwater collection system capturing the runoff.

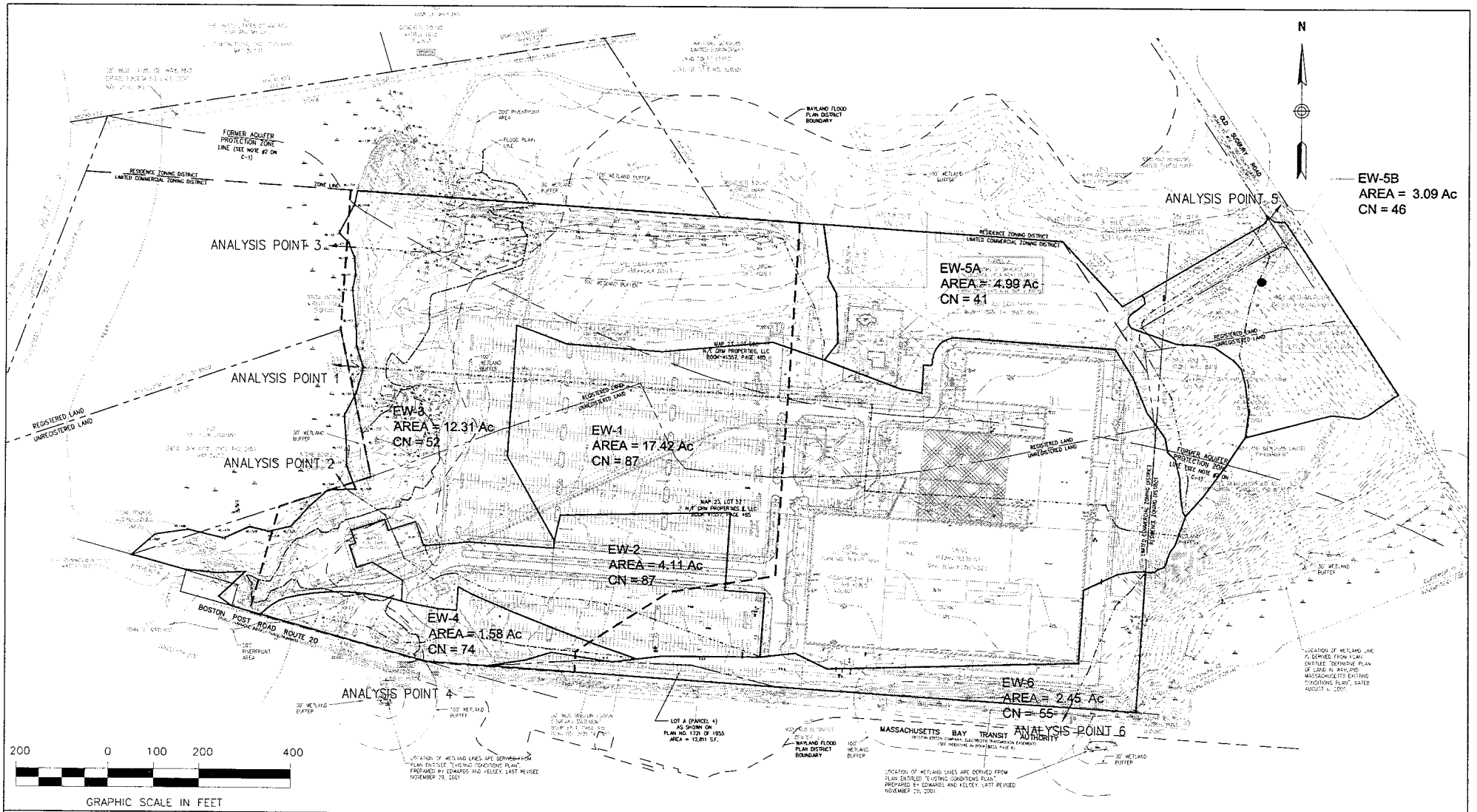
Watershed EW-4 has an area of 1.58 acres and is made up of the existing paved area and grass lawn area. Runoff currently sheet flows southwest into two ponds which are separated by the existing driveway entrance from Route 20 (Boston Post Road). These two ponds are connected by a culvert under the driveway and have no outlet, therefore during a large storm event, the ponds will overflow into Route 20.

Watershed EW-5 (EW-5A and EW-5B) is 8.08 acres in size and is consists of pavement, lawn, and brush areas. The existing Wayland Wastewater treatment plant is part of this watershed and a portion of runoff from off-site areas contributes to this watershed. Runoff from Watershed EW-5A is sheet flow which eventually flows north to the Wayland Commons property. Runoff from EW-5B consists of the Route 27 driveway and off-site areas. This runoff is collected in swales and a drainage culvert and flows to the wetland system north of the site.

Watershed EW-6 has an area of 2.45 acres, and is made up of the existing access driveway at the south east corner of the Raytheon Building and thick brush along the south east corner of the property. Runoff sheet flows south directly into the existing wetland located at the south-east corner of the property.

The existing peak rates of stormwater runoff leaving the site are summarized as follows:

Analysis Point	Contributing Watersheds	1-inch (CFS)	2-YEAR (CFS	10-YEAR (CFS)	25-YEAR (CFS)	100-YEAR (CFS)	Receiving Watershed
Analysis Point 1 Existing 36" CMP combined storm/sewer culvert at Wetland	EW-1	3.37	32.36	54.24	66.82	93.47	Wetland system west of site
Analysis Point 2 Existing Culvert at Wetland	EW-2	<1	8.25	13.82	17.03	23.83	
Analysis Point 3	EW-1, EW2, EW-3	4.17	40.12	67.90	84.73	122.31	
Analysis Point 4 Overland flow southeast to Boston Post Road	EW-4	<1	<1	<1	<1	<1	Boston Post Road
Analysis Point 5 Overland flow to wetland system north of site	EW-5	<1	<1	<1	1.48	5.40	Wetland system north of site
Analysis Point 6 Overland flow southeast to existing wetland	EW-6	<1	<1	2.03	3.47	7.07	Wetland system south of site



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Project Name:
WAYLAND TOWN CENTER
WAYLAND, MA

Drawing Name:
PRE-DEVELOPMENT WATERSHED PLAN

Drawing No.:
FIG.-4

Project No.: 06032

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Proposed Conditions Runoff

The proposed site was also broken up into five watersheds with a combined area of ±43 acres (See Figure 5 – Proposed Watershed Plan). Proposed watershed 4 was removed as there is no proposed runoff to Route 20. Catch basins and water quality swales and rain gardens have been designed to collect runoff and discharge into bio-retention basins which will discharge the runoff at a controlled rate. Six analysis points corresponding to the watersheds were used for determining the proposed runoff that will leave the site. The same points were used for the existing runoff leaving the site to ensure that there will be no increase in runoff rates for the 2, 10, 25, and 100 year, 24 hour design storms. A curve number and time of concentration were calculated for each watershed using Soil Conservation Service TR-55 methods (See Appendix C for Proposed Conditions Hydrology Calculations). The recommended minimum time of concentration of 6 minutes was used for watersheds PW-1, PW-2B, PW-5B, and PW-6B.

Watershed PW-1 (PW-1A and PW-1B) is made up of the proposed paved areas, sidewalks, landscaped islands, roof areas and the proposed town green area. The runoff from this watershed is collected in catch basins rain gardens and water quality swales and directed to Basin 2. Runoff from Basin 2 is discharged into the large wetland located at the western portion of the site (Analysis Point 1).

Watershed PW-2 is made up of paved areas, sidewalks, one roof area and landscaped areas located at the southern portion of the site. The total area of all watersheds in PW-2 is 1.31 acres. The majority of the runoff from PW-2 is collected in the existing basins located at the southern portion of the site adjacent to Rte 20. Runoff is discharged into an existing drain pipe which discharges into the large wetland located at the western portion of the site (Analysis Point 2).

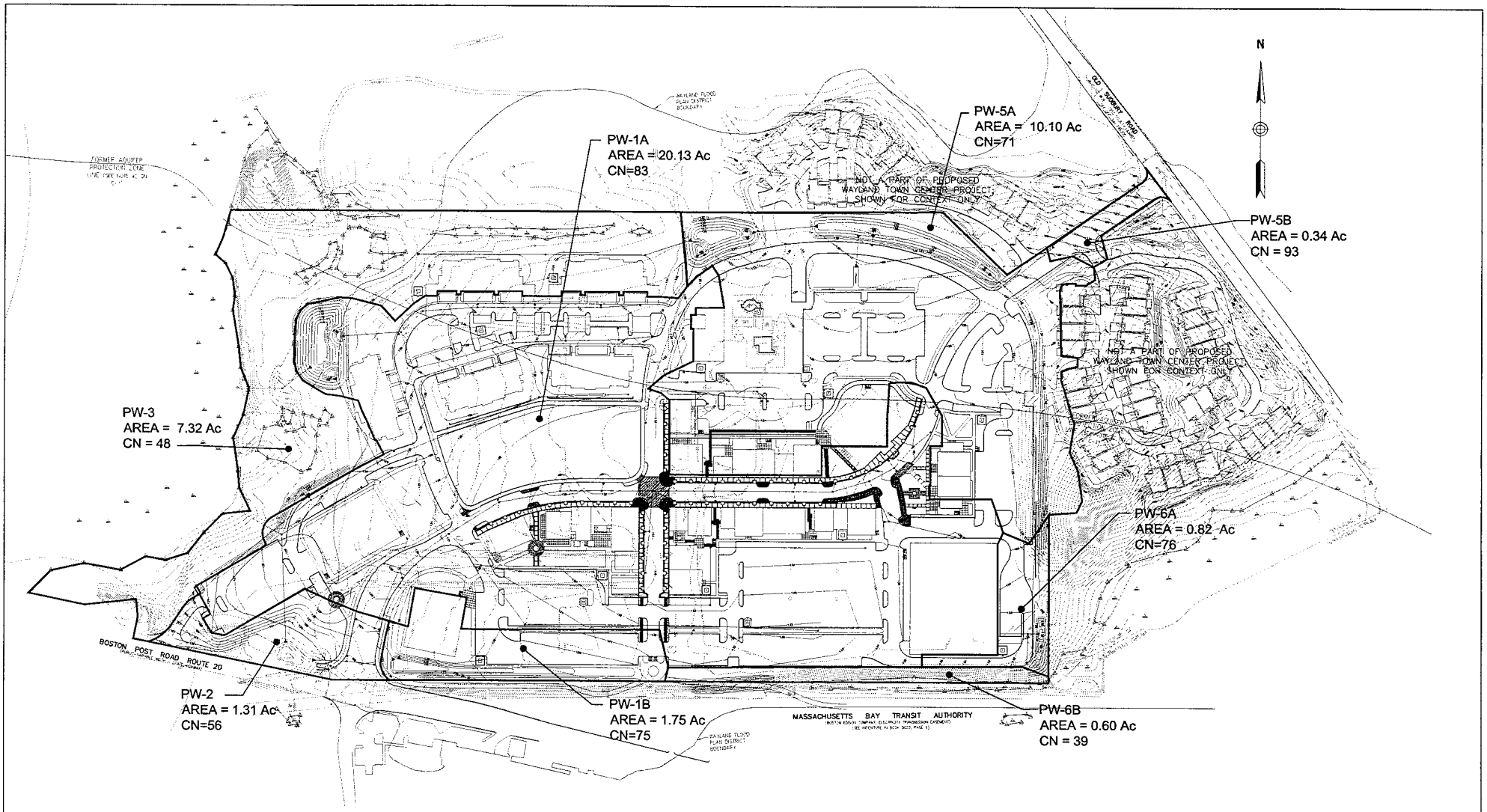
Watershed PW-3 is made up of undisturbed area consisting of grass, brush, and woods. The total area of all watersheds in PW-3 is 7.32 acres and is located in the western portion of the site. Runoff from this watershed will continue to runoff as it does presently, which is overland flow into the large wetland (Analysis Point 3).

Watershed PW-5 (PW-5A and 5B) is made up of paved areas and grass. The total area of all watersheds in PW-5 is 10.44 acres and is located at the north-eastern portion of the site. Runoff from PW-5A is predominately sheet flow into catch basins and a water quality swale which outlets into Bio-retention Basin 3A and 3B.Infiltration is the primary outlet for both basins, however overflow from these basins is discharged into the large wetland area located at the western part of the site. Runoff from PW-5B is collected in swales and catch basins and is discharged to the wetland system via overland flow and a drainage culvert.

Watershed PW-6 (PW-6A and PW-6B) is made up of paved areas, landscaped islands, sidewalks and a small undisturbed area consisting of grass, and brush. The total area of all watersheds in PW-6 is 1.42 acres and it is located at the south eastern portion of the site. Runoff from the developed area (PW-6A) is sheet runoff into a water quality swale which outlets into Bio-retention basin 6. Runoff from the undisturbed area (PW-6B) will continue to runoff as it does presently, which is overland flow into the small wetland located at the south eastern corner of the property.

The peak rates of stormwater runoff leaving the site from the proposed development are summarized as follows:

Analysis Point	Contributing Watersheds	1 inch (CFS)	2-YEAR (CFS)	10-YEAR (CFS)	25-YEAR (CFS)	100-YEAR (CFS)	Receiving Watershed
Analysis Point 1 Existing CMP combined storm/sewer culvert at Wetland	PW-1	<1	17.08	35.40	45.25	67.99	Wetland system west of site
Analysis Point 2 Existing Culvert at Wetland	PW-2	<1	<1	<1	<1	<1	
Analysis Point 3 Wetlands West of Site	PW-1, PW2, PW-3	<1	17.26	37.46	51.33	82.62	
Analysis Point 4 Overland flow southeast to Boston Post Road	PW-4	<1	<1	<1	<1	<1	Boston Post Road
Analysis Point 5 Overland flow north to Wayland Meadows	PW-5	<1	<1	<1	1.19	1.60	Wetland system north of site
Analysis Point 6 Overland flow southeast to existing wetland	PW-6	<1	<1	<1	1.44	2.58	Wetland system south of site



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Project Name:

WAYLAND TOWN CENTER
WAYLAND, MA

Drawing Name:

POST-DEVELOPMENT WATERSHED PLAN

Drawing No.:

FIG.-5

Project No.: 06032

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Water Quality

Stormwater quality control will be achieved through a program of Best Management Practices (BMP's). The proposed development is designed to achieve a minimum 80% total suspended solids (TSS) removal in accordance with the MA DEP Stormwater Management Standards. Effective stormwater management practices include the use of curbing along all pavement edges, catch basins with deep sumps and hoods, and detention/infiltration devices, which will treat stormwater runoff from the proposed development and minimize potential indirect, long term impacts to down gradient resources. In addition, a sediment and erosion control plan will be implemented to protect these areas during and after construction of the proposed development.

Catch Basins:

The proposed catch basins will be equipped with deep sumps and hoods. The sumps capture sediments and coarse particles, and the hoods prevent hydrocarbons and other floatable debris from entering the drainage system, which will improve the performance of subsequent BMP's. The sump will be no less than 4' in depth and a regular maintenance schedule will be followed. A regular inspection and cleaning will ensure optimal effectiveness.

Water Quality Swales:

Water quality swales are used to provide peak runoff control as well as enhanced water quality. The swales will be planted with grass on the bottom and sides to slow the runoff velocity and filter pollutants. Runoff volume is controlled by reducing runoff velocity and promoting infiltration. Pollutant removal is achieved through sedimentation, filtration, nutrient uptake, and infiltration.

Bioretention Basins and Rain Gardens:

Bioretention basins and rain gardens are low impact development techniques that serve to promote groundwater recharge, and enhance water quality. They will be planted with a combination of grasses, perennials, shrubs, and wetland plantings and are designed to maximize the removal of pollutants from stormwater runoff through vegetation uptake, retention, and settling.

The following tables provide the Design Rates of Removal as set forth in the Massachusetts Stormwater Management Policy for the various BMP's utilized in this project:

Runoff collected in water quality swales and rain gardens:

BMP	Design Rate	Cumulative TSS Removal
Parking Lot Sweeping	10%	10%
Water Quality Swale / Rain Garden	70%	73%
Bio-retention Basin	80%	95%

Runoff collected in catch basins:

BMP	Design Rate	Cumulative TSS Removal
Parking Lot Sweeping	10%	10%
Catch Basin w/ Deep Sumps & Hooded Outlet	25%	33%
Forebay	25%	49%
Bio-retention Basin	80%	90%

Groundwater Recharge

Groundwater recharge for the proposed development will be provided in accordance with the MA DEP Stormwater Management Standards. These standards require that the annual recharge from the post-development site shall approximate the annual recharge from pre-development site conditions based on soil types. For hydrologic group A soil types, the volume that is required to be recharged is equal to 0.40 inches multiplied by the increase in impervious area. The proposed development is located entirely within hydrologic group A soils, therefore the volume required to be recharged is as follows:

Existing impervious area: ±21.8 acres
Proposed impervious area: ±22.2 acres
Increase in impervious area: ±0.4 acres

$$V = 0.4\ acres\ x\ 0.40\ inches\ x\ \frac{43{,}560\ s.f.}{1\ acre}\ x\ \frac{1\ ft.}{12\ inches} = 580\ cubic\ ft.$$

The stormwater management system will provide the required groundwater recharge through the use of water quality swales, rain gardens, and bio-retention basins.

Summary

The stormwater collection and management system for the proposed development will provide mitigation of post-development stormwater runoff conditions utilizing a combination of detention basins and Low Impact Development techniques and "Best Management Practices" to reduce pollutant loadings within the stormwater prior to discharging it off site.

As shown in the following summary, the proposed stormwater management system has been designed to match or reduce post development peak discharges to less than the existing rates for all modeled storms.

Analysis Point 1 - Existing 36" CMP Summary Existing vs. Proposed Peak Discharge Rates		
Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	3.37	<1
2-year	32.36	17.08
10-year	54.24	35.40
25-year	66.82	45.25
100-year	93.47	67.99

Analysis Point 2 – Existing Culvert (Behind Daycare Building) Summary Existing vs. Proposed Peak Discharge Rates		
Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	<1	<1
2-year	8.25	<1
10-year	13.82	<1
25-year	17.03	<1
100-year	23.83	<1

Analysis Point 3 –Wetlands West of Site (Sudbury River) Summary Existing vs. Proposed Peak Discharge Rates		
Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	4.17	<1
2-year	40.12	17.26
10-year	67.90	37.46
25-year	84.73	51.33
100-year	122.31	82.62

Analysis Point 4 - Boston Post Road

Summary Existing vs. Proposed Peak Discharge Rates

Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	<1	<1
2-year	<1	<1
10-year	<1	<1
25-year	<1	<1
100-year	<1	<1

Analysis Point 5 – Wetlands North of Site (Adjacent to Wayland Meadows)

Summary Existing vs. Proposed Peak Discharge Rates

Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	<1	<1
2-year	<1	<1
10-year	<1	<1
25-year	1.48	1.19
100-year	5.40	1.60

Analysis Point 6 – Wetlands South of Site

Summary Existing vs. Proposed Peak Discharge Rates

Storm Event:	Existing Flow (CFS)	Proposed Flow (CFS)
1-inch	<1	<1
2-year	<1	<1
10-year	2.03	<1
25-year	3.47	1.44
100-year	7.07	2.58

Stormwater Management Operation And Maintenance Plan

1. For inspection and maintenance schedule during and immediately following construction, see General and Erosion Control Notes included with Site Plans. The NPDES general permit will also include schedule information for inspection and maintenance of erosion controls during construction.

2. A checklist of all maintenance items will be developed and used for each stormwater treatment component. Each time an inspection is completed or a maintenance procedure is performed, it will be documented on the checklist. The checklist will be kept on the project site.

3. The property owner will be financially responsible for the implementation of this plan and for future system repairs as needed.

4. Sweep parking lot and driveway areas to remove sediments before they can enter the catch basins, twice annually, in the early spring and late fall, and on an as needed basis at other times.

5. Inspect and clean deep sump catch basins including the oil/grease traps to prevent blockage and to remove accumulated sediments on an annual basis in the spring.

6. Inspect and clean water quality swales and rain gardens an annual basis in the spring and on an as needed basis at other times.

7. Inspect and clean bio-retention basins on an annual basis in the spring and on an as needed basis at other times.

8. Inspect dumpster and compactor areas for spillage and clean as necessary.

9. Inspect landscape areas and edges of paved areas for any signs of erosion. Perform any necessary curb replacement, earth repair, reseeding or mulching upon identification.

10. Routinely pick up and remove litter from the parking areas and perimeter landscape areas. Clean leaves or trash from catch basin grates when observed.

APPENDIX A: EXISTING CONDITIONS HYDROLOGY

Runoff Curve Numbers and Runoff
Time of Concentration
Pond Reports
Hydrograph Plots (2, 10, 25, 100 year storm events)

TR55 Tc Worksheet

Hyd. No. 1

EW-1 (PT. 1)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.200		0.011		0.011		
Flow length (ft)	= 136.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 14.70		0.00		0.00		
Travel Time (min)	**= 7.22**	**+**	**0.00**	**+**	**0.00**	**=**	**7.22**
Shallow Concentrated Flow							
Flow length (ft)	= 60.00		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 1.44		0.00		0.00		
Travel Time (min)	**= 0.70**	**+**	**0.00**	**+**	**0.00**	**=**	**0.70**
Channel Flow							
X sectional flow area (sqft)	= 7.00		0.00		0.00		
Wetted perimeter (ft)	= 4.71		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 12.95		0.00		0.00		
Flow length (ft)	= 1800.0		0.0		0.0		
Travel Time (min)	**= 2.32**	**+**	**0.00**	**+**	**0.00**	**=**	**2.32**

Total Travel Time, Tc ..... 10.23 min

TR55 Tc Worksheet

Hyd. No. 2

EW-2 (PT. 2)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 2.14**	**+**	**0.00**	**+**	**0.00**	**=**	**2.14**
Shallow Concentrated Flow							
Flow length (ft)	= 673.00		0.00		0.00		
Watercourse slope (%)	= 1.20		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.23		0.00		0.00		
Travel Time (min)	**= 5.04**	**+**	**0.00**	**+**	**0.00**	**=**	**5.04**
Channel Flow							
X sectional flow area (sqft)	= 1.22		0.00		0.00		
Wetted perimeter (ft)	= 1.96		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 7.23		0.00		0.00		
Flow length (ft)	= 275.0		0.0		0.0		
Travel Time (min)	**= 0.63**	**+**	**0.00**	**+**	**0.00**	**=**	**0.63**

Total Travel Time, Tc ..... 7.81 min

TR55 Tc Worksheet

Hyd. No. 3

EW-3

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 0.50	0.00	0.00	
Travel Time (min)	**= 21.82**	**+ 0.00**	**+ 0.00**	**= 21.82**
Shallow Concentrated Flow				
Flow length (ft)	= 972.00	148.00	0.00	
Watercourse slope (%)	= 1.30	2.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 1.84	2.65	0.00	
Travel Time (min)	**= 8.81**	**+ 0.93**	**+ 0.00**	**= 9.74**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 31.55 min

TR55 Tc Worksheet

Hyd. No. 5

EW-4

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 2.50	0.00	0.00	
Travel Time (min)	**= 11.46**	**+ 0.00**	**+ 0.00**	**= 11.46**
Shallow Concentrated Flow				
Flow length (ft)	= 100.00	0.00	0.00	
Watercourse slope (%)	= 3.50	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 3.02	0.00	0.00	
Travel Time (min)	**= 0.55**	**+ 0.00**	**+ 0.00**	**= 0.55**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 12.01 min

TR55 Tc Worksheet

Hyd. No. 9

EW-5A

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 1.50	0.00	0.00	
Travel Time (min)	**= 14.06 +**	**0.00 +**	**0.00 =**	**14.06**
Shallow Concentrated Flow				
Flow length (ft)	= 130.00	0.00	0.00	
Watercourse slope (%)	= 2.50	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 2.55	0.00	0.00	
Travel Time (min)	**= 0.85 +**	**0.00 +**	**0.00 =**	**0.85**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00 +**	**0.00 +**	**0.00 =**	**0.00**

Total Travel Time, Tc ..... 14.91 min

TR55 Tc Worksheet

Hyd. No. 10

E-5B

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
Travel Time (min)	**= 16.53**	**+ 0.00**	**+ 0.00**	**= 16.53**
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 5.40	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 3.75	0.00	0.00	
Travel Time (min)	**= 1.64**	**+ 0.00**	**+ 0.00**	**= 1.64**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 18.18 min

TR55 Tc Worksheet

Hyd. No. 12

EW-6 (PT. 6)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 9.34**	**+**	**0.00**	**+**	**0.00**	**=**	**9.34**
Shallow Concentrated Flow							
Flow length (ft)	= 240.00		0.00		0.00		
Watercourse slope (%)	= 0.85		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.49		0.00		0.00		
Travel Time (min)	**= 2.69**	**+**	**0.00**	**+**	**0.00**	**=**	**2.69**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 12.03 min

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 1 (EW-1)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			3.24	126.36
A	Impervious (pavement, roof)	98			14.18	1389.64
A						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.		Totals =			**17.42**	**1516**

CN (weighted) = total product / total area **87.0264** Use CN= **87**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	2.00	3.29	5.38	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 2 (EW-2)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.80	31.20
A	Impervious (pavement, roof)	98			3.31	324.38
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**4.11**	**355.58**

CN (weighted) = total product / total area **86.5158** Use CN= **87**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	2.00	3.29	5.38	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 3 (EW-3)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			9.42	367.38
A	Impervious (pavement, roof)	98			2.32	227.36
A	Gravel	76			0.44	33.44
A	Wetland	83			0.13	10.79
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**12.31**	**638.97**

CN (weighted) = total product / total area **51.9066** Use CN= **52**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.20	0.67	1.79	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 4 (EW-4)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.63	24.57
A	Impervious (pavement, roof)	98			0.95	93.10
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.		Totals =			**1.58**	**117.67**

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ **74.4747** Use CN= **74**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	1.10	2.13	3.96	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 5A (EW-5A)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			4.79	186.81
A	Impervious (pavement, roof)	98			0.20	19.60
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**4.99**	**206.41**

CN (weighted) = total product / total area **41.3647** Use CN= **41**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.01	0.20	0.88	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 5B (EW-5B)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			2.73	106.47
A	Impervious (pavement, roof)	98			0.36	35.28
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**3.09**	**141.75**

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ **45.8738** Use CN= **46**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.07	0.39	1.27	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **Existing Watershed 6 (EW-6)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			1.79	69.81
A	Impervious (pavement, roof)	98			0.66	64.68
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.		Totals =			**2.45**	**134.49**

CN (weighted) = total product / total area **54.8939** Use CN= **55**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.28	0.83	2.06	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:24 PM

Pond No. 7 - EX. BASIN

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	118.00	1,828	0	0
1.00	119.00	5,668	3,748	3,748
2.00	120.00	8,193	6,931	10,679
3.00	121.00	20,000	14,097	24,775

Culvert / Orifice Structures

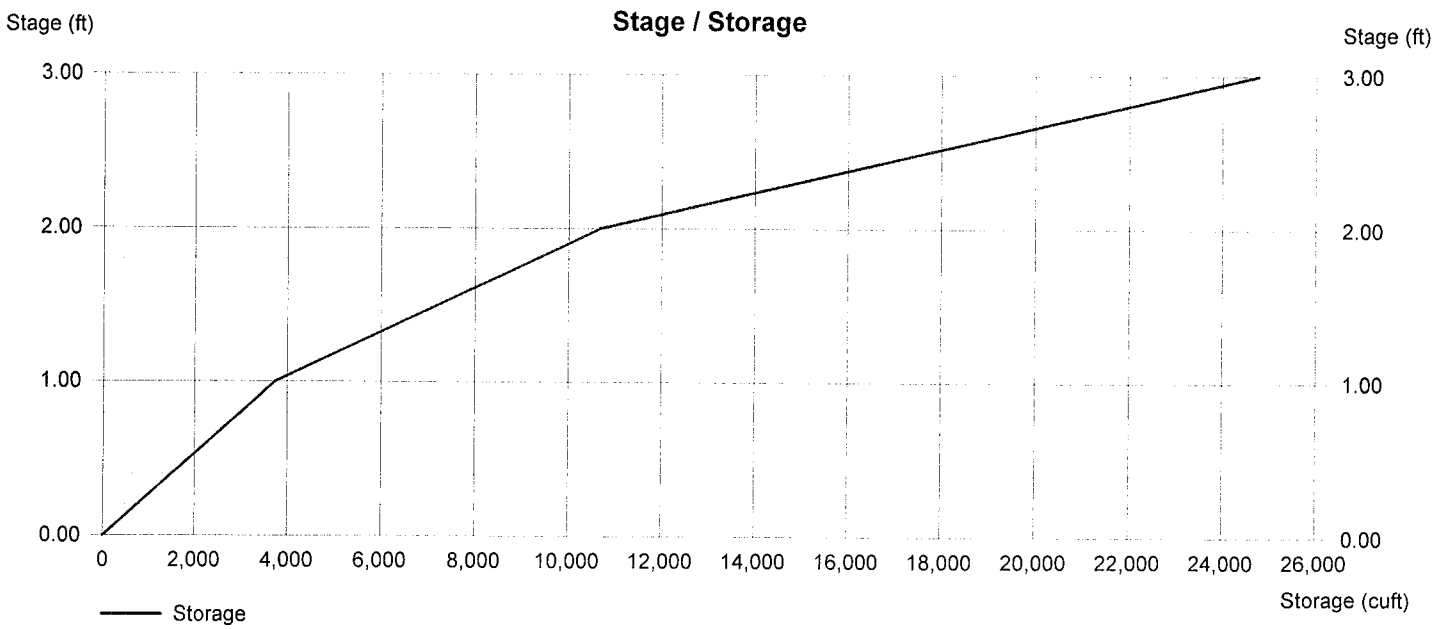
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 130.00	0.00	0.00	0.00
Crest El. (ft)	= 120.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.600 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.37	1	730	14,413	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	0.86	1	727	3,257	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	0.00	1	0	0	----	------	------	EW-3
4	Combine	4.17	1	729	17,670	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	0.00	1	890	131	----	------	------	EW-4
6	Reservoir	0.00	1	1064	120	5	118.01	35	EXIST. BASIN
7	Diversion1	0.00	1	1064	57	6	------	------	BASIN INFILTRATION
8	Diversion2	0.00	1	1064	63	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.00	1	0	0	----	------	------	EW-5A
10	SCS Runoff	0.00	1	0	0	----	------	------	E-5B
11	Combine	0.00	1	0	0	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	0.00	1	0	0	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	1.47	1	741	9,576	----	------	------	PW-1A
15	SCS Runoff	0.01	1	825	199	----	------	------	PW-1B
16	Reservoir	0.00	1	1056	185	15	126.02	61	BASIN 5
17	Diversion1	0.00	1	1056	138	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.00	1	1056	47	16	------	------	BASIN 5 OUTFLOW
19	Combine	1.47	1	741	9,622	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	0.20	1	957	9,608	19	117.45	3,943	BASIN 2
21	Diversion1	0.20	1	957	9,608	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	0.00	1	748	0	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.00	1	0	0	----	------	------	PW-2
24	Reservoir	0.00	1	0	0	23	118.00	0	BASIN 1
25	Diversion1	0.00	1	0	0	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.00	1	0	0	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	0.00	1	0	0	----	------	------	PW-3
28	SCS Runoff	0.01	1	1337	286	----	------	------	PW-5A
29	Reservoir	0.01	1	1421	273	28	126.03	101	BASIN 3
30	Diversion1	0.00	1	1421	173	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	0.00	1	1421	100	29	------	------	BASIN 3 OUTFLOW
32	Combine	0.00	1	1421	100	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.12	1	734	556	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	0.00	1	774	115	----	------	------	PW-6A
35	Reservoir	0.00	1	1027	102	34	128.04	34	BASIN 4
36	Diversion1	0.01	1	1027	239	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.00	1	0	-136	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.00	1	0	0	----	------	------	PW-6B
39	Combine	0.00	1	0	-136	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	32.36	1	728	117,574	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	8.25	1	726	26,572	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	0.35	1	773	6,744	----	------	------	EW-3
4	Combine	40.12	1	727	150,890	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	1.37	1	730	5,489	----	------	------	EW-4
6	Reservoir	0.20	1	787	5,478	5	118.59	2,202	EXIST. BASIN
7	Diversion1	0.10	1	787	2,601	6	------	------	BASIN INFILTRATION
8	Diversion2	0.11	1	787	2,878	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.00	1	1329	61	----	------	------	EW-5A
10	SCS Runoff	0.02	1	925	502	----	------	------	E-5B
11	Combine	0.02	1	1331	563	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	0.27	1	726	1,943	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	26.00	1	733	110,731	----	------	------	PW-1A
15	SCS Runoff	2.09	1	725	6,726	----	------	------	PW-1B
16	Reservoir	0.21	1	798	6,713	15	126.99	2,879	BASIN 5
17	Diversion1	0.16	1	798	5,011	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.05	1	798	1,702	16	------	------	BASIN 5 OUTFLOW
19	Combine	26.04	1	733	112,433	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	17.69	1	745	112,384	19	120.82	26,243	BASIN 2
21	Diversion1	0.61	1	745	25,345	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	17.08	1	745	87,039	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.10	1	765	1,177	----	------	------	PW-2
24	Reservoir	0.03	1	954	1,165	23	118.10	368	BASIN 1
25	Diversion1	0.02	1	954	599	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.02	1	954	566	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	0.07	1	893	1,948	----	------	------	PW-3
28	SCS Runoff	5.29	1	743	29,792	----	------	------	PW-5A
29	Reservoir	0.78	1	861	29,778	28	128.14	13,163	BASIN 3
30	Diversion1	0.26	1	861	13,159	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	0.52	1	861	16,620	29	------	------	BASIN 3 OUTFLOW
32	Combine	17.26	1	745	106,173	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.64	1	733	2,900	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	0.64	1	739	3,224	----	------	------	PW-6A
35	Reservoir	0.09	1	842	3,211	34	129.38	1,466	BASIN 4
36	Diversion1	0.19	1	842	7,395	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.00	1	0	-4,184	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.00	1	0	0	----	------	------	PW-6B
39	Combine	0.00	1	0	-4,184	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	54.24	1	728	199,459	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	13.82	1	725	45,078	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	3.32	1	753	26,655	----	------	------	EW-3
4	Combine	67.90	1	727	271,192	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	2.93	1	729	11,135	----	------	------	EW-4
6	Reservoir	0.37	1	787	11,124	5	119.18	4,985	EXIST. BASIN
7	Diversion1	0.18	1	787	5,293	6	------	------	BASIN INFILTRATION
8	Diversion2	0.19	1	787	5,831	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.12	1	821	2,976	----	------	------	EW-5A
10	SCS Runoff	0.37	1	749	3,697	----	------	------	E-5B
11	Combine	0.46	1	751	6,673	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	2.03	1	723	6,500	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	46.52	1	732	197,584	----	------	------	PW-1A
15	SCS Runoff	4.34	1	725	13,432	----	------	------	PW-1B
16	Reservoir	1.14	1	748	13,419	15	127.41	5,189	BASIN 5
17	Diversion1	0.19	1	748	7,044	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.94	1	748	6,375	16	------	------	BASIN 5 OUTFLOW
19	Combine	47.01	1	732	203,959	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	36.23	1	742	203,904	19	121.97	40,920	BASIN 2
21	Diversion1	0.83	1	742	28,667	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	35.40	1	742	175,237	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.50	1	755	3,761	----	------	------	PW-2
24	Reservoir	0.11	1	864	3,749	23	118.36	1,341	BASIN 1
25	Diversion1	0.06	1	864	1,928	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.05	1	864	1,821	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	1.27	1	748	10,882	----	------	------	PW-3
28	SCS Runoff	12.18	1	741	63,557	----	------	------	PW-5A
29	Reservoir	4.46	1	770	63,541	28	128.89	24,007	BASIN 3
30	Diversion1	0.33	1	770	16,540	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	4.13	1	770	47,001	29	------	------	BASIN 3 OUTFLOW
32	Combine	37.46	1	743	234,941	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.99	1	733	4,576	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	1.30	1	738	6,340	----	------	------	PW-6A
35	Reservoir	1.07	1	749	6,327	34	129.65	1,913	BASIN 4
36	Diversion1	0.21	1	749	9,838	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.85	1	749	-3,511	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.01	1	881	248	----	------	------	PW-6B
39	Combine	0.85	1	749	-3,263	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	66.82	1	728	247,842	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	17.03	1	725	56,013	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	6.16	1	750	42,300	----	------	------	EW-3
4	Combine	84.73	1	727	346,155	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	3.90	1	729	14,712	----	------	------	EW-4
6	Reservoir	0.41	1	803	14,701	5	119.47	7,029	EXIST. BASIN
7	Diversion1	0.20	1	803	7,036	6	------	------	BASIN INFILTRATION
8	Diversion2	0.21	1	803	7,665	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.59	1	747	6,318	----	------	------	EW-5A
10	SCS Runoff	0.91	1	743	6,578	----	------	------	E-5B
11	Combine	1.48	1	745	12,896	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	3.47	1	722	9,920	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	58.61	1	732	249,866	----	------	------	PW-1A
15	SCS Runoff	5.73	1	725	17,653	----	------	------	PW-1B
16	Reservoir	2.03	1	742	17,640	15	127.59	6,226	BASIN 5
17	Diversion1	0.21	1	742	7,812	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	1.82	1	742	9,827	16	------	------	BASIN 5 OUTFLOW
19	Combine	60.09	1	732	259,694	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	46.15	1	742	259,637	19	122.41	48,041	BASIN 2
21	Diversion1	0.90	1	742	30,232	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	45.25	1	742	229,406	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.83	1	752	5,675	----	------	------	PW-2
24	Reservoir	0.18	1	841	5,663	23	118.57	2,141	BASIN 1
25	Diversion1	0.09	1	841	2,913	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.09	1	841	2,751	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	2.78	1	743	18,500	----	------	------	PW-3
28	SCS Runoff	16.61	1	740	85,373	----	------	------	PW-5A
29	Reservoir	7.00	1	766	85,353	28	129.24	30,830	BASIN 3
30	Diversion1	0.36	1	766	17,959	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	6.64	1	766	67,394	29	------	------	BASIN 3 OUTFLOW
32	Combine	51.33	1	744	318,049	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	1.19	1	733	5,545	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	1.71	1	737	8,289	----	------	------	PW-6A
35	Reservoir	1.61	1	743	8,277	34	129.71	2,005	BASIN 4
36	Diversion1	0.22	1	743	10,739	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	1.39	1	743	-2,462	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.04	1	744	595	----	------	------	PW-6B
39	Combine	1.44	1	743	-1,868	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	93.47	1	728	352,671	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	23.83	1	725	79,704	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	13.92	1	746	83,057	----	------	------	EW-3
4	Combine	122.31	1	727	515,433	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	6.07	1	729	22,821	----	------	------	EW-4
6	Reservoir	0.55	1	820	22,810	5	120.08	11,767	EXIST. BASIN
7	Diversion1	0.25	1	820	10,887	6	------	------	BASIN INFILTRATION
8	Diversion2	0.30	1	820	11,922	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	2.66	1	737	16,624	----	------	------	EW-5A
10	SCS Runoff	2.74	1	737	14,642	----	------	------	E-5B
11	Combine	5.40	1	737	31,266	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	7.07	1	722	18,593	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	84.51	1	732	364,479	----	------	------	PW-1A
15	SCS Runoff	8.80	1	725	27,183	----	------	------	PW-1B
16	Reservoir	4.41	1	733	27,170	15	127.96	8,308	BASIN 5
17	Diversion1	0.24	1	733	9,236	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	4.17	1	733	17,934	16	------	------	BASIN 5 OUTFLOW
19	Combine	88.67	1	732	382,413	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	69.02	1	741	382,352	19	123.36	64,608	BASIN 2
21	Diversion1	1.03	1	741	33,201	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	67.99	1	741	349,152	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	1.68	1	749	10,491	----	------	------	PW-2
24	Reservoir	0.36	1	815	10,479	23	119.08	4,292	BASIN 1
25	Diversion1	0.17	1	815	5,282	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.19	1	815	5,196	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	7.45	1	737	39,243	----	------	------	PW-3
28	SCS Runoff	26.66	1	740	135,508	----	------	------	PW-5A
29	Reservoir	9.44	1	769	135,483	28	130.13	50,907	BASIN 3
30	Diversion1	0.47	1	769	20,683	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	8.97	1	769	114,799	29	------	------	BASIN 3 OUTFLOW
32	Combine	82.62	1	741	508,390	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	1.60	1	733	7,617	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	2.62	1	737	12,672	----	------	------	PW-6A
35	Reservoir	2.58	1	739	12,660	34	129.79	2,139	BASIN 4
36	Diversion1	0.23	1	739	12,376	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	2.35	1	739	285	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.28	1	728	1,726	----	------	------	PW-6B
39	Combine	2.58	1	739	2,010	37, 38	------	------	TOTAL TO PT. 6

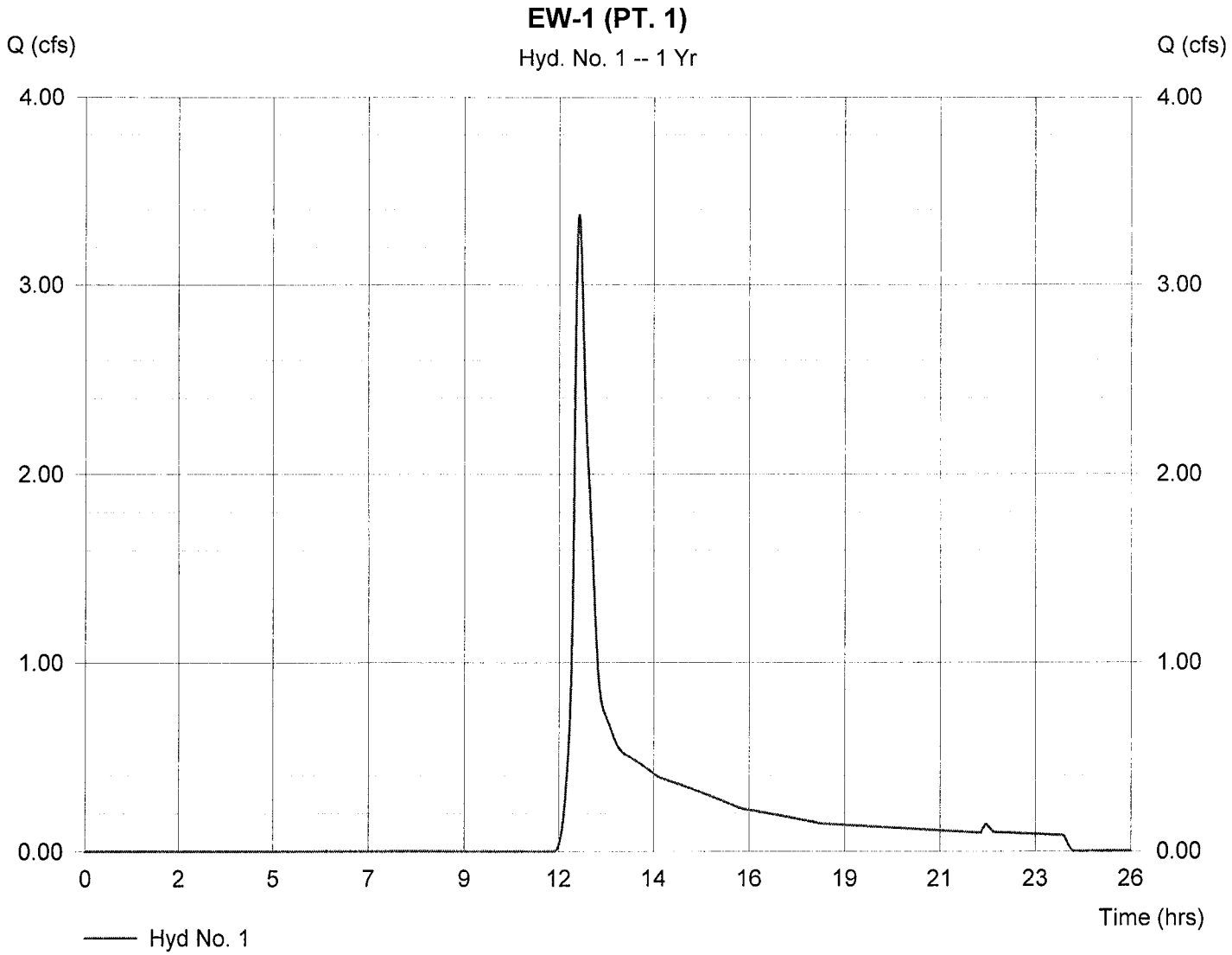
Hydrograph Plot

Hyd. No. 1

EW-1 (PT. 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.37 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 17.420 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.23 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 14,413 cuft



Hydrograph Plot

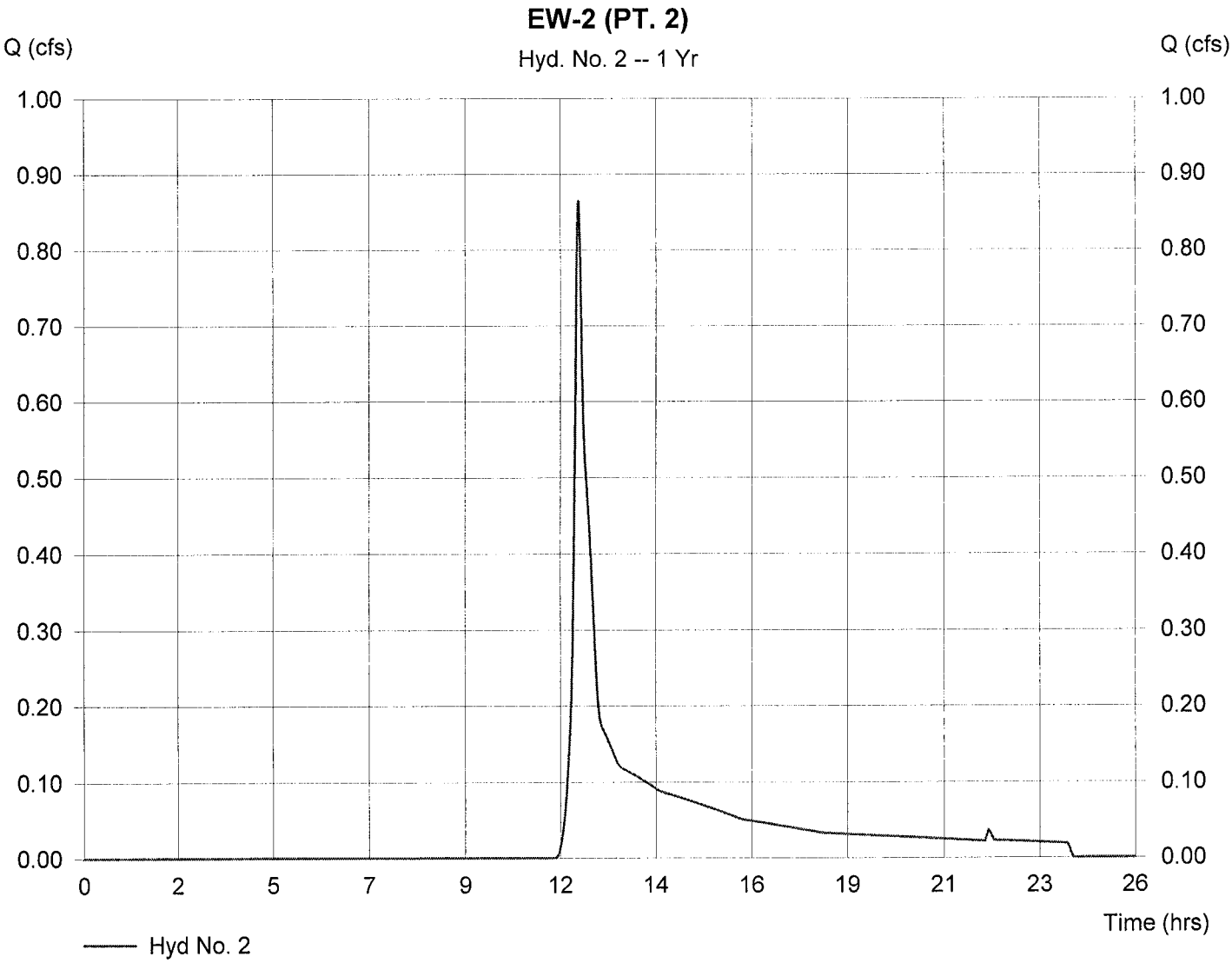
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Hyd. No. 2

EW-2 (PT. 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.86 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 4.110 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.81 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,257 cuft



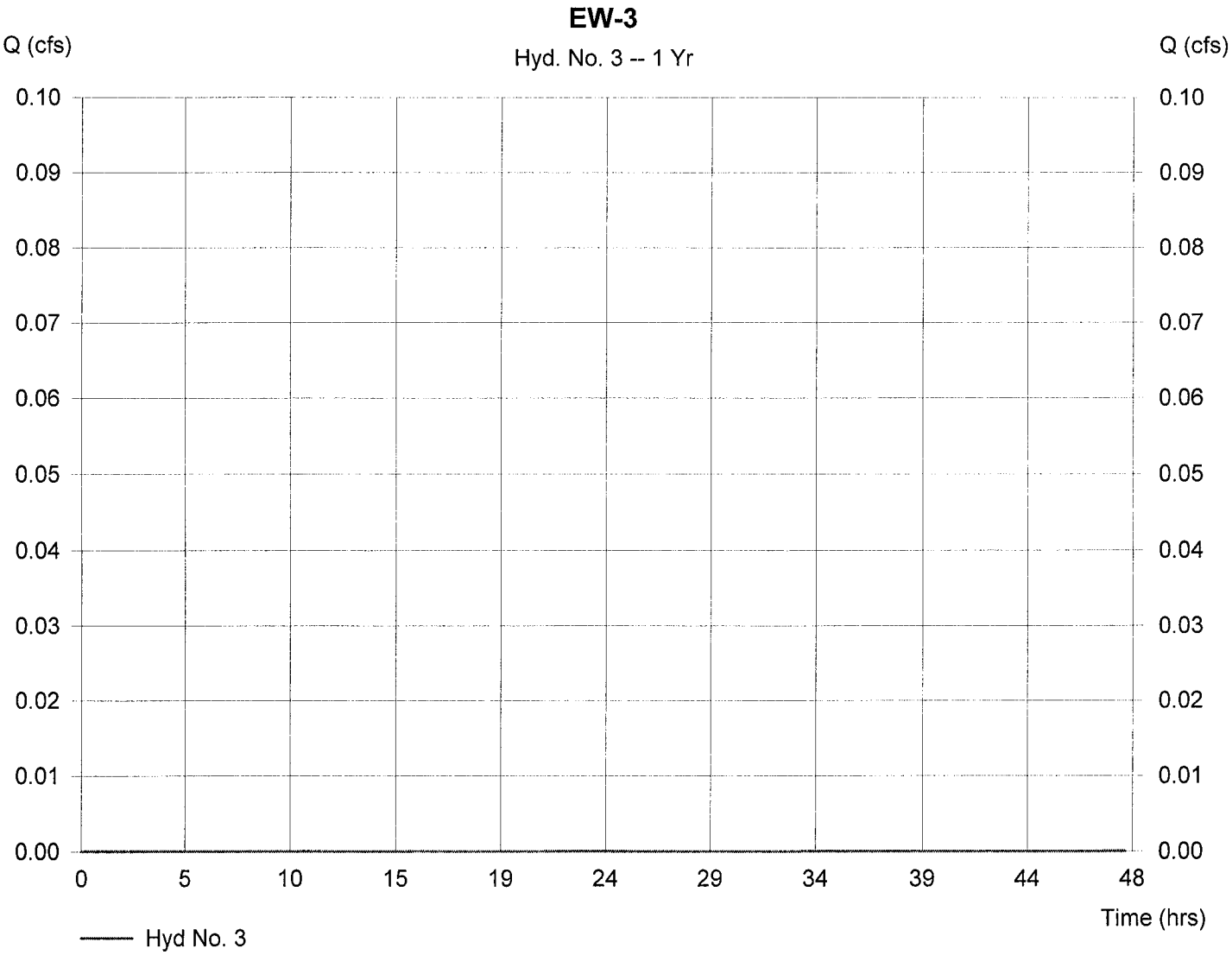
Hydrograph Plot

Hyd. No. 3

EW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 12.310 ac	Curve number	= 52
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.60 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

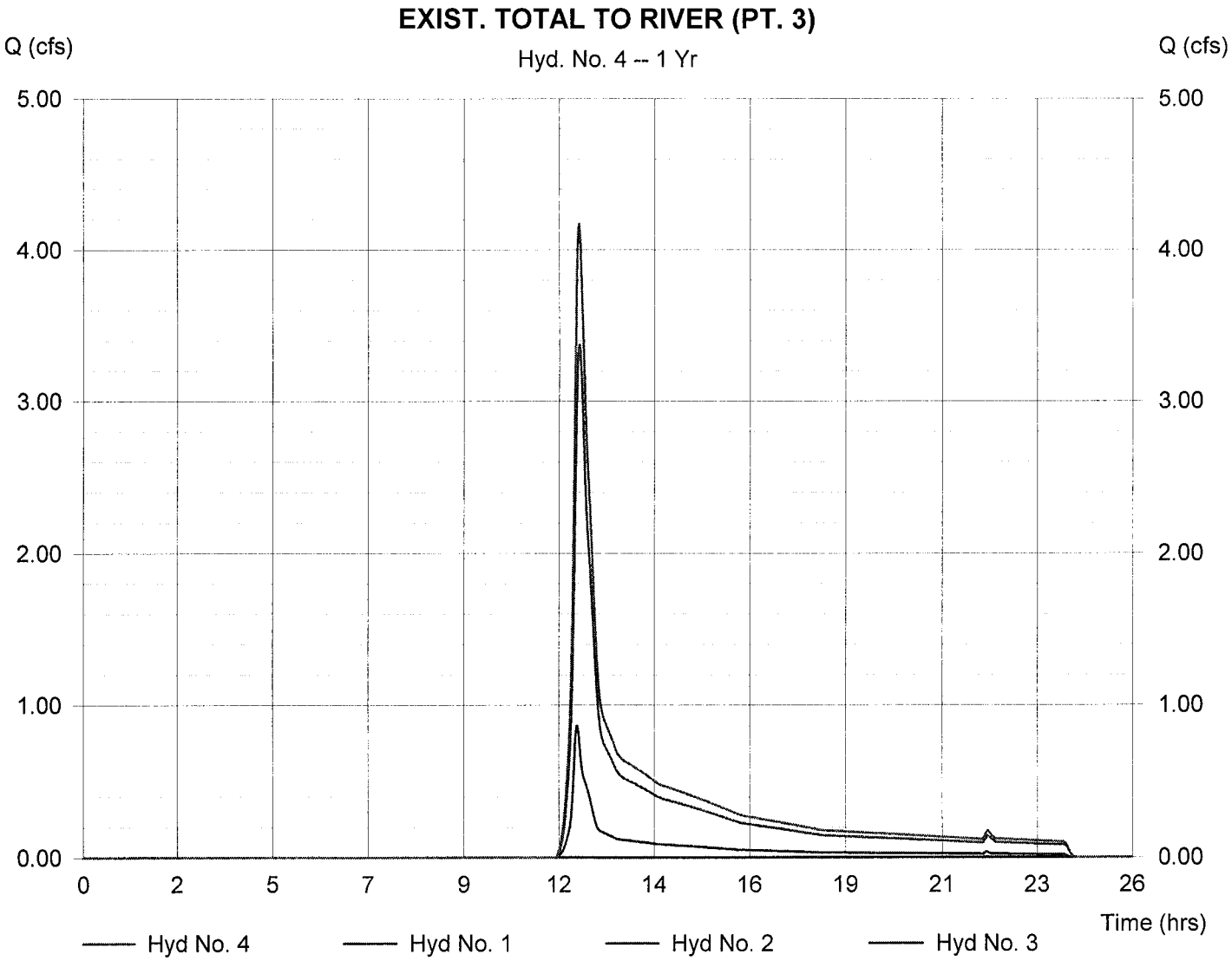
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Hyd. No. 4

EXIST. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 4.17 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyds.	= 1, 2, 3		

Hydrograph Volume = 17,670 cuft



Hydrograph Plot

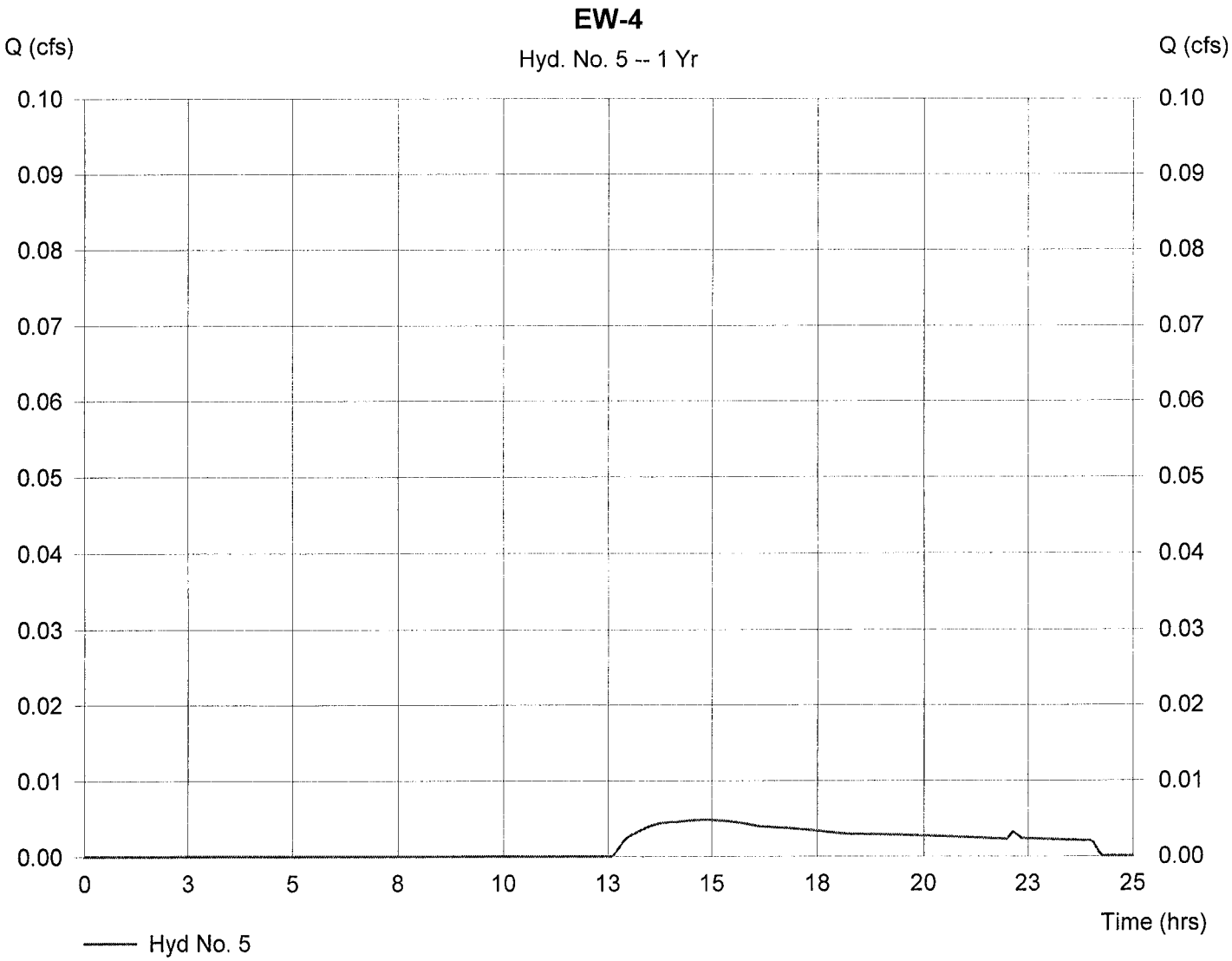
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:31 PM

Hyd. No. 5

EW-4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 1.580 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 131 cuft



Hydrograph Plot

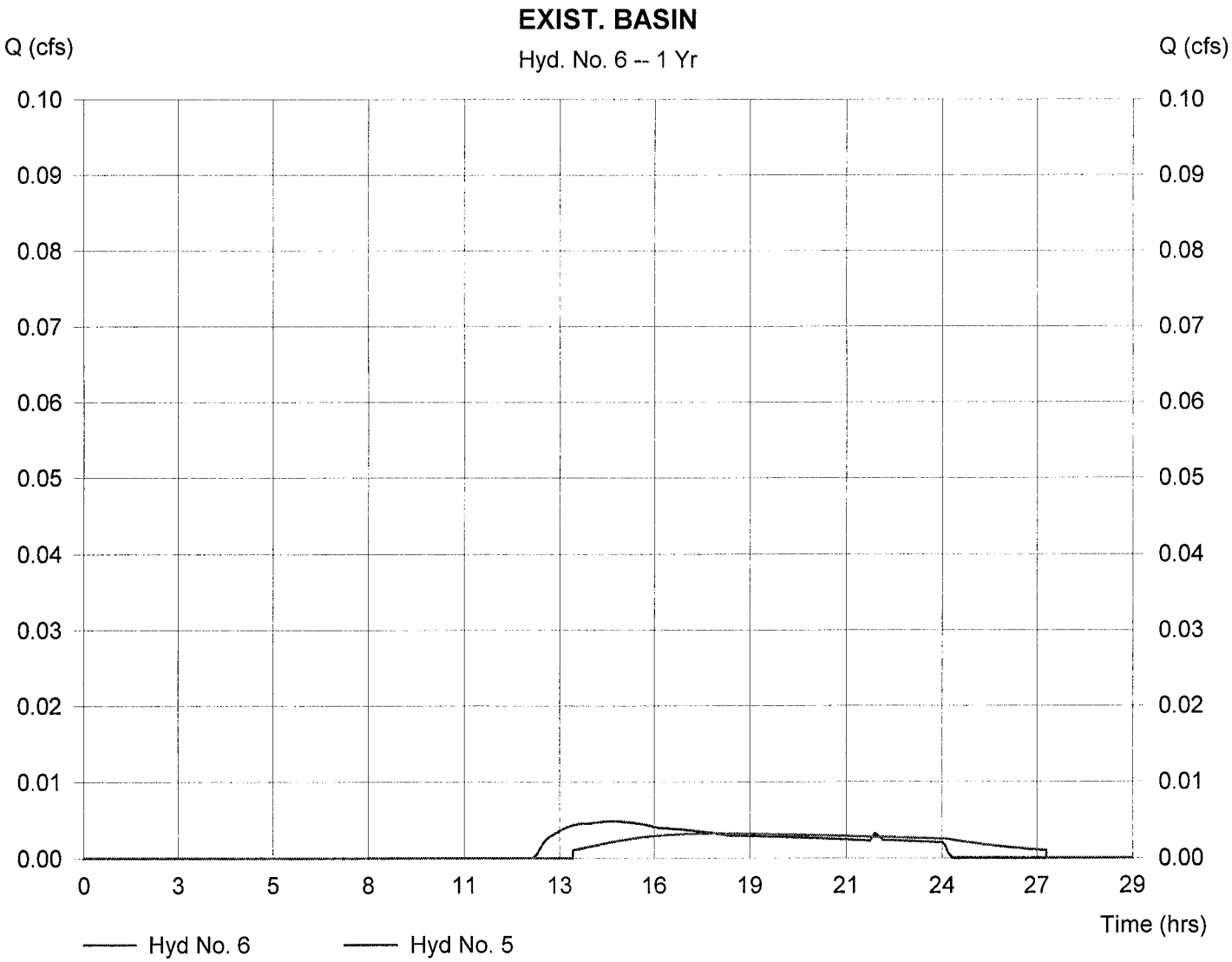
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:31 PM

Hyd. No. 6

EXIST. BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Max. Elevation	= 118.01 ft
Reservoir name	= EX. BASIN	Max. Storage	= 35 cuft

Storage Indication method used. | Hydrograph Volume = 120 cuft



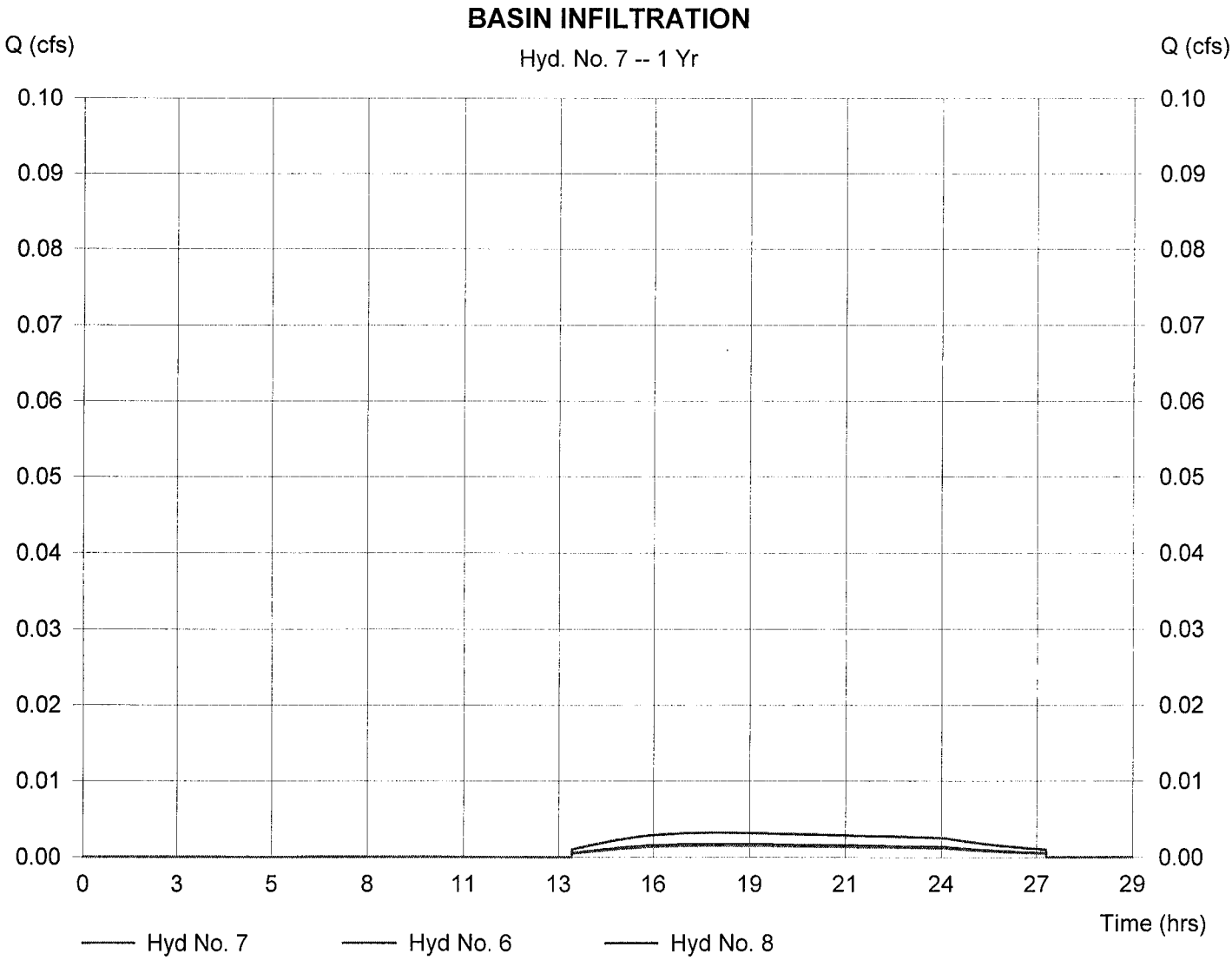
Hydrograph Plot

Hyd. No. 7

BASIN INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 8
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 57 cuft



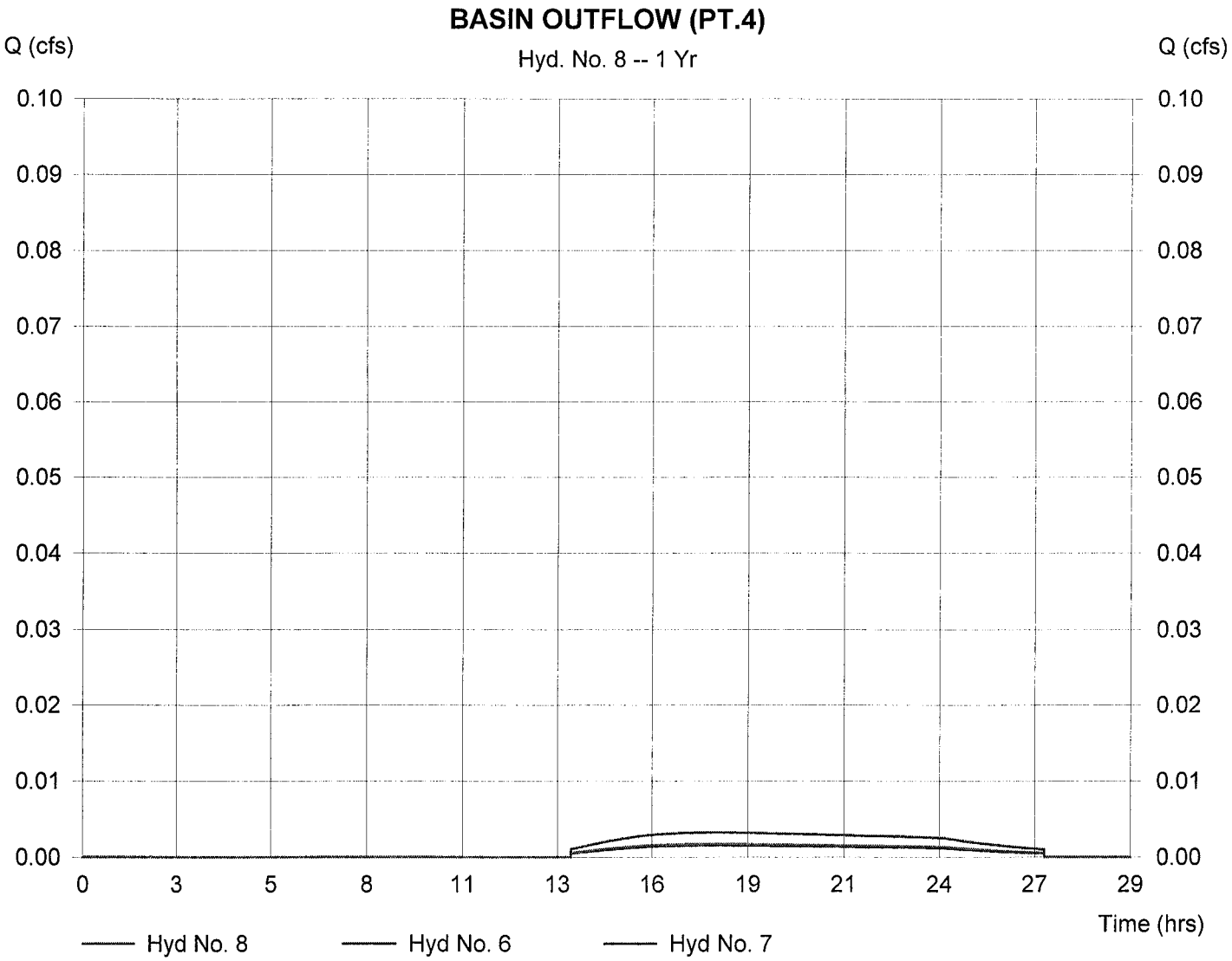
Hydrograph Plot

Hyd. No. 8

BASIN OUTFLOW (PT.4)

Hydrograph type	= Diversion2	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 7
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 63 cuft



Hydrograph Plot

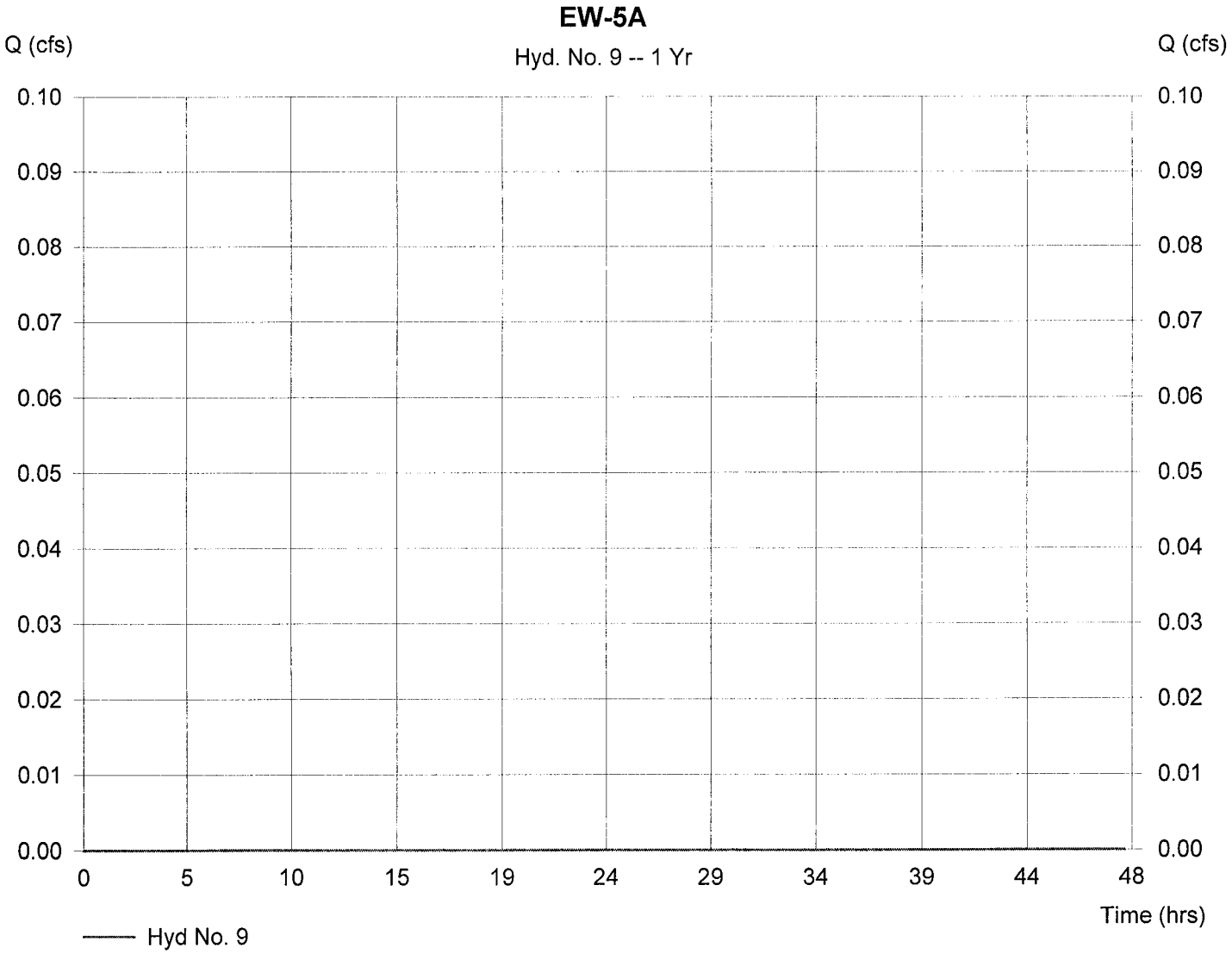
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:31 PM

Hyd. No. 9

EW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 4.990 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.90 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



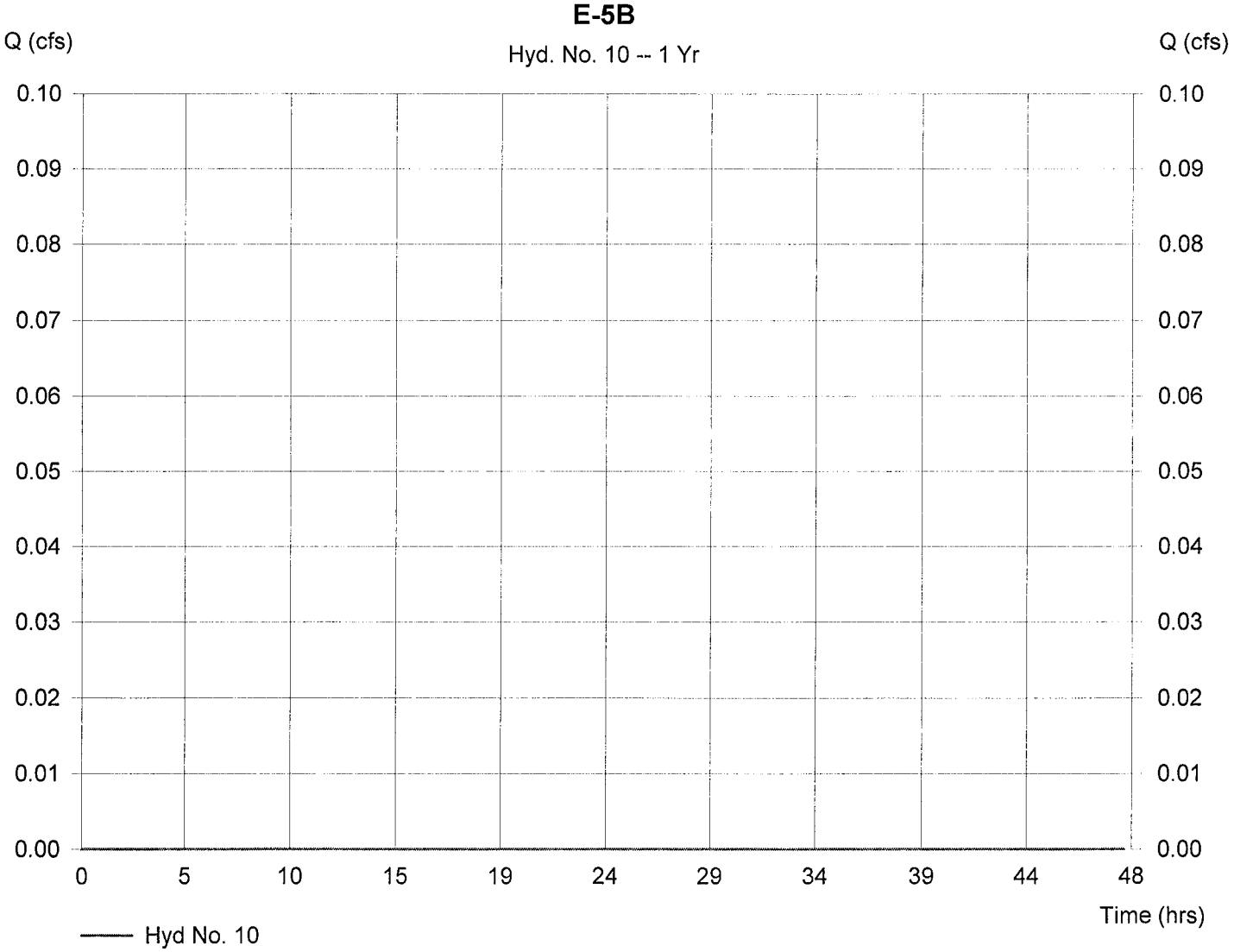
Hydrograph Plot

Hyd. No. 10

E-5B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 3.090 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:31 PM

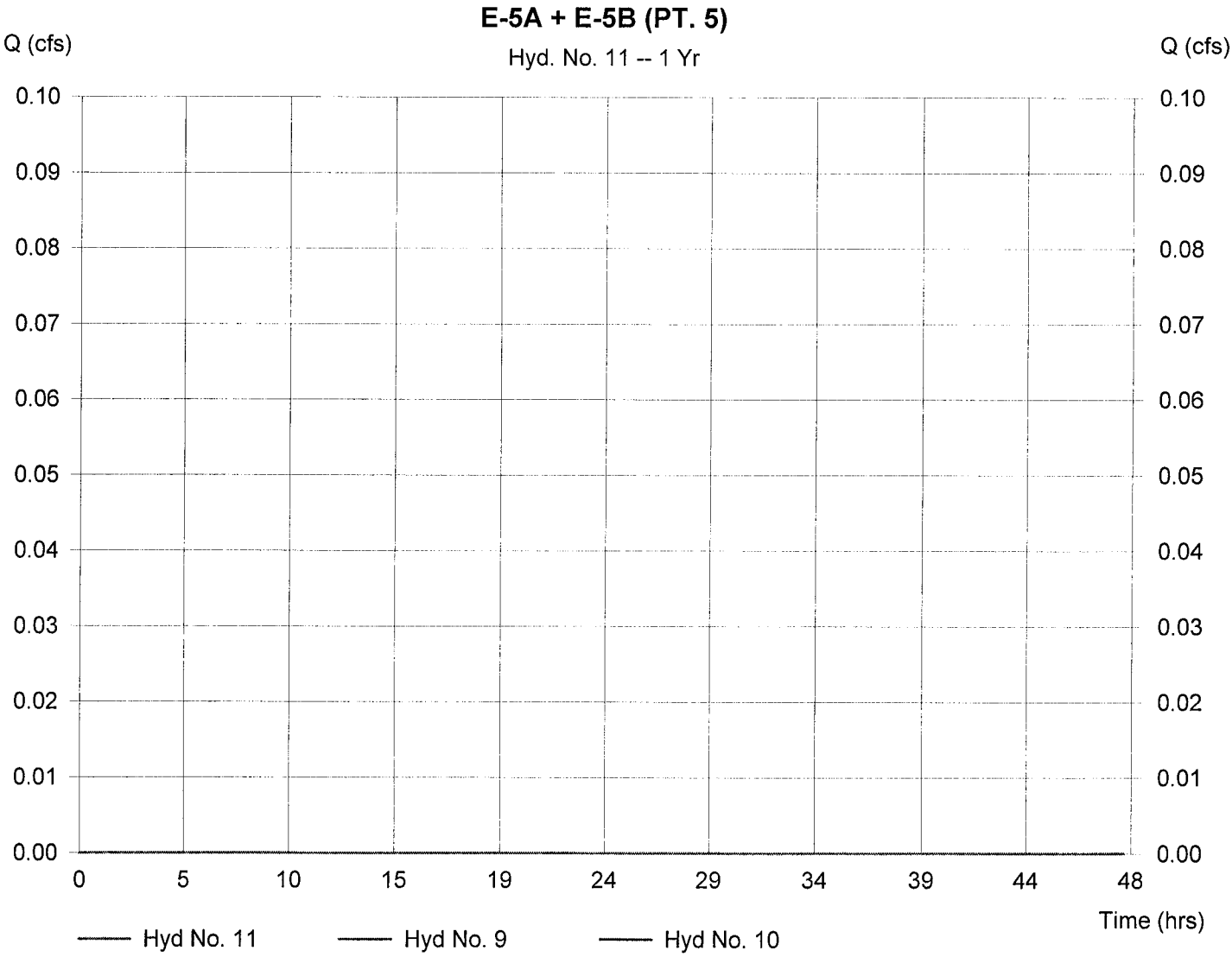
Hyd. No. 11

E-5A + E-5B (PT. 5)

Hydrograph type = Combine
Storm frequency = 1 yrs
Inflow hyds. = 9, 10

Peak discharge = 0.00 cfs
Time interval = 1 min

Hydrograph Volume = 0 cuft



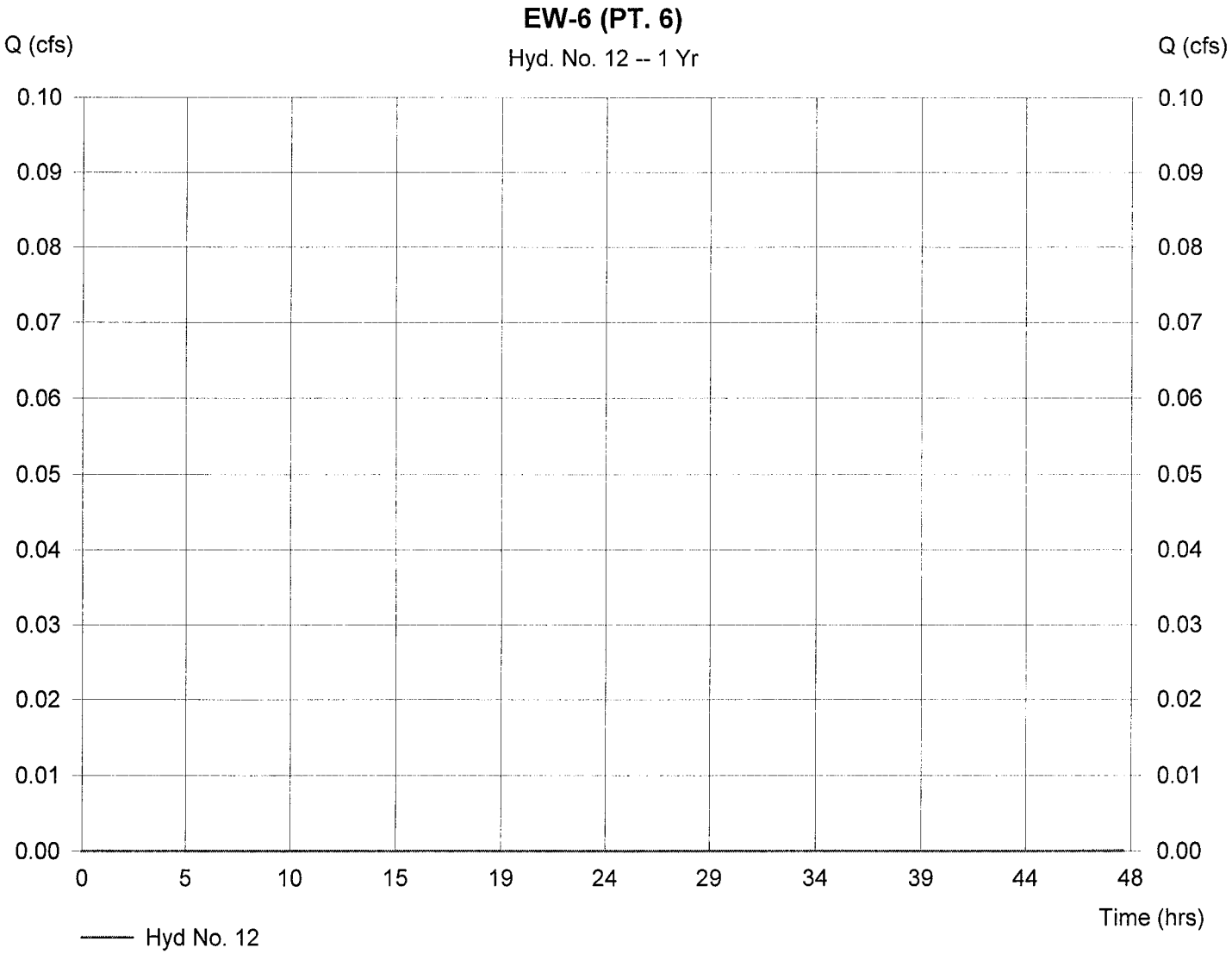
Hydrograph Plot

Hyd. No. 12

EW-6 (PT. 6)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 2.450 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.03 min
Total precip.	= 1.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

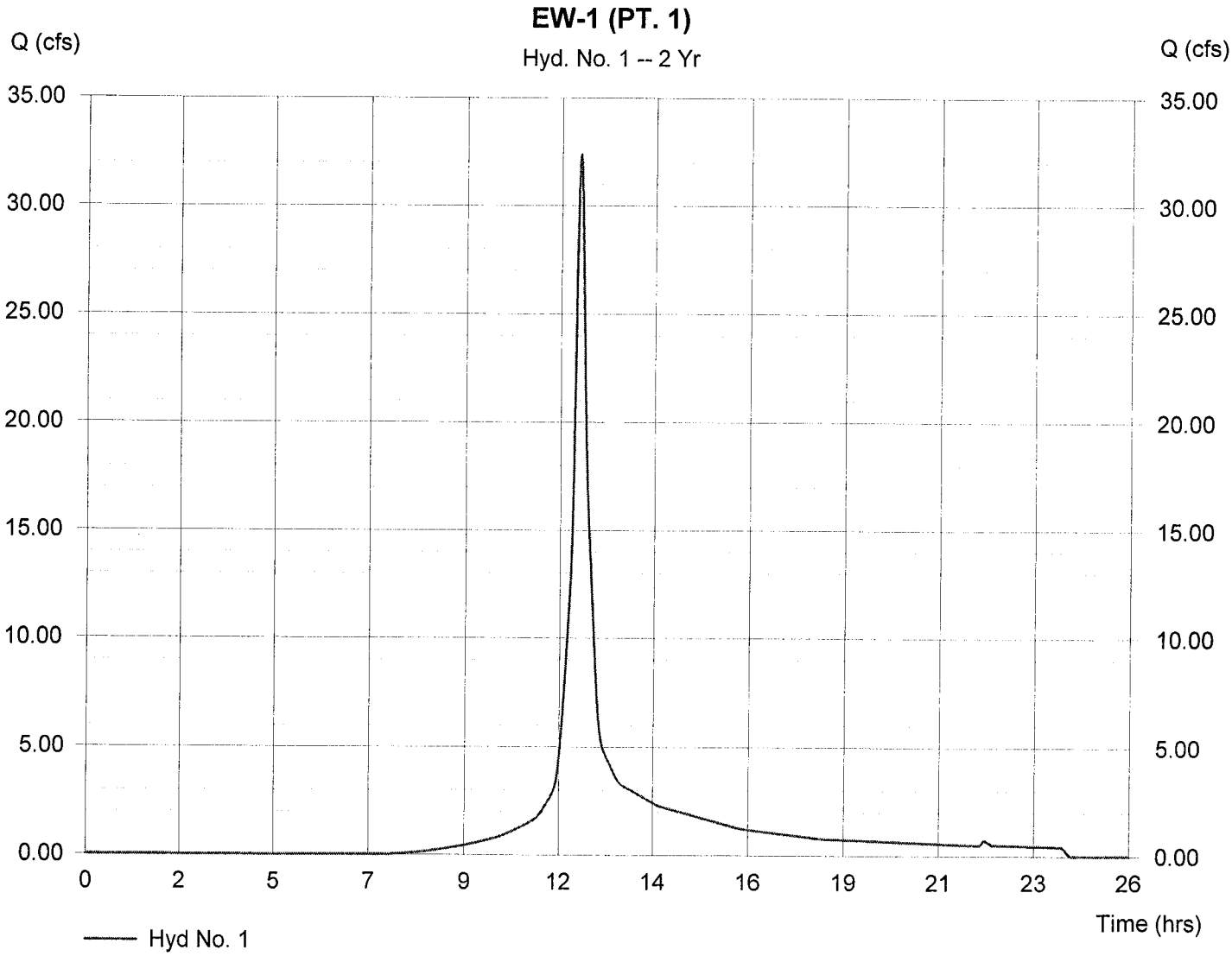
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 1

EW-1 (PT. 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 32.36 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 17.420 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.23 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 117,574 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

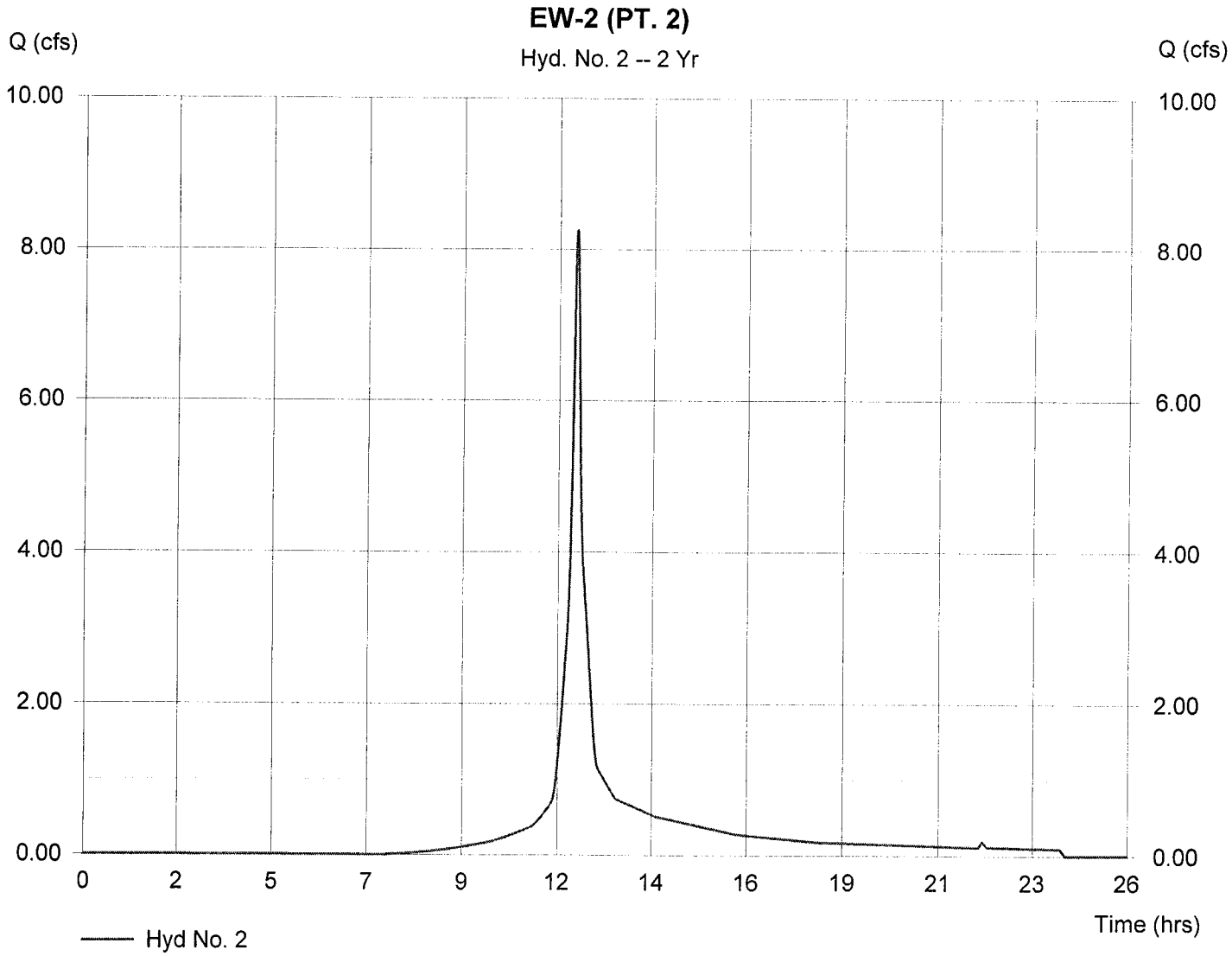
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 2

EW-2 (PT. 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 8.25 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 4.110 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.81 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 26,572 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

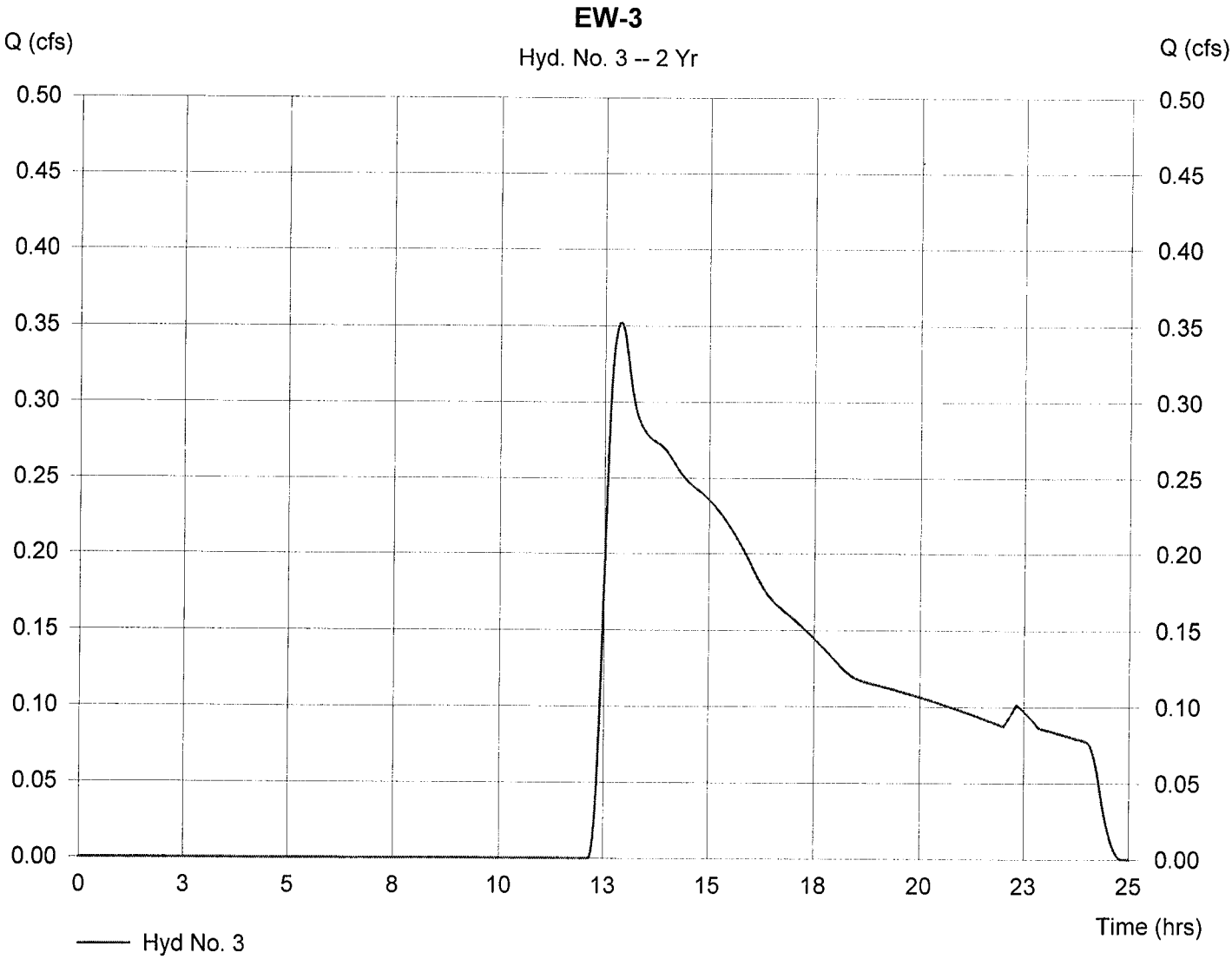
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 3

EW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.35 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 12.310 ac	Curve number	= 52
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.60 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,744 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

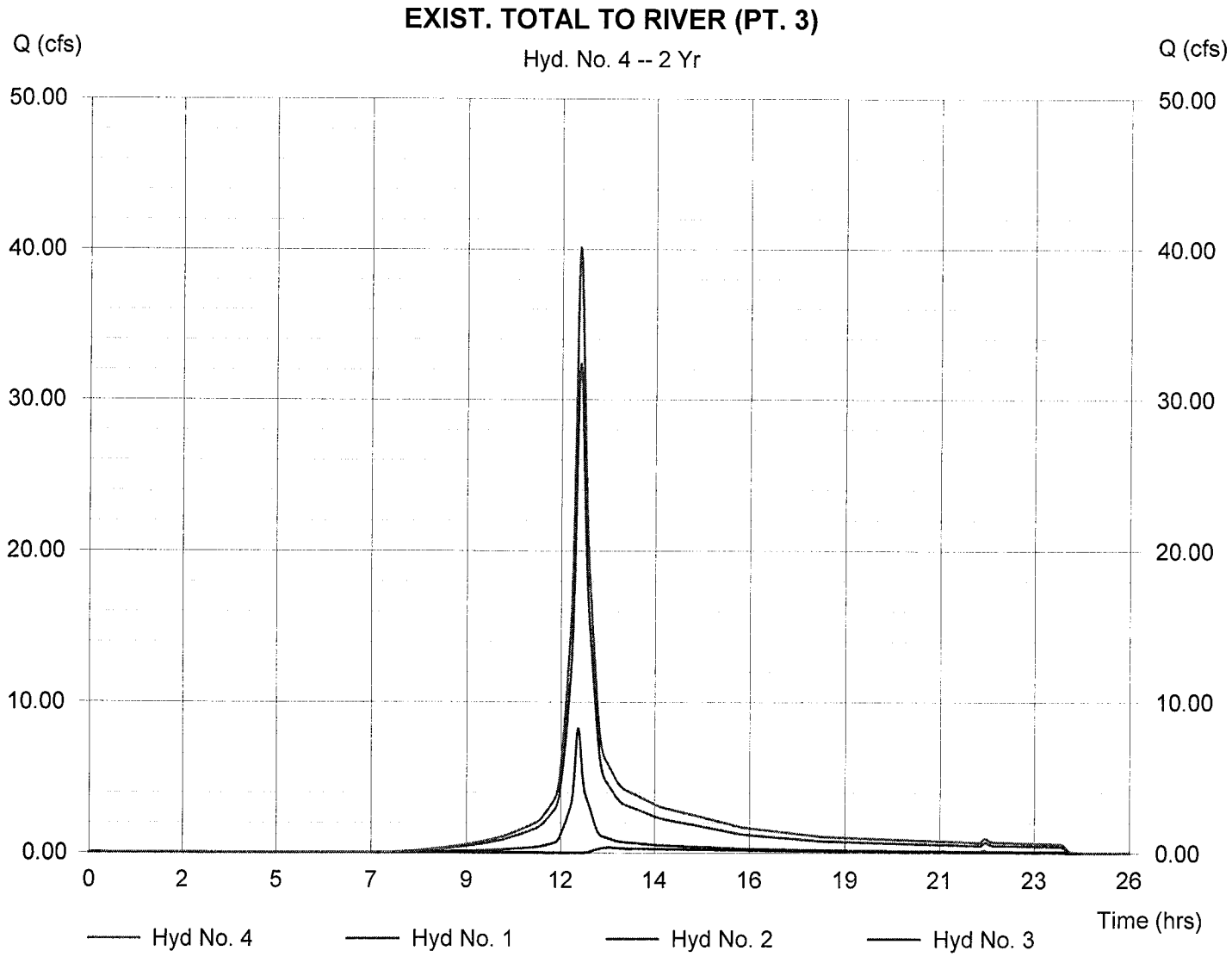
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 4

EXIST. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 40.12 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 1, 2, 3		

Hydrograph Volume = 150,890 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

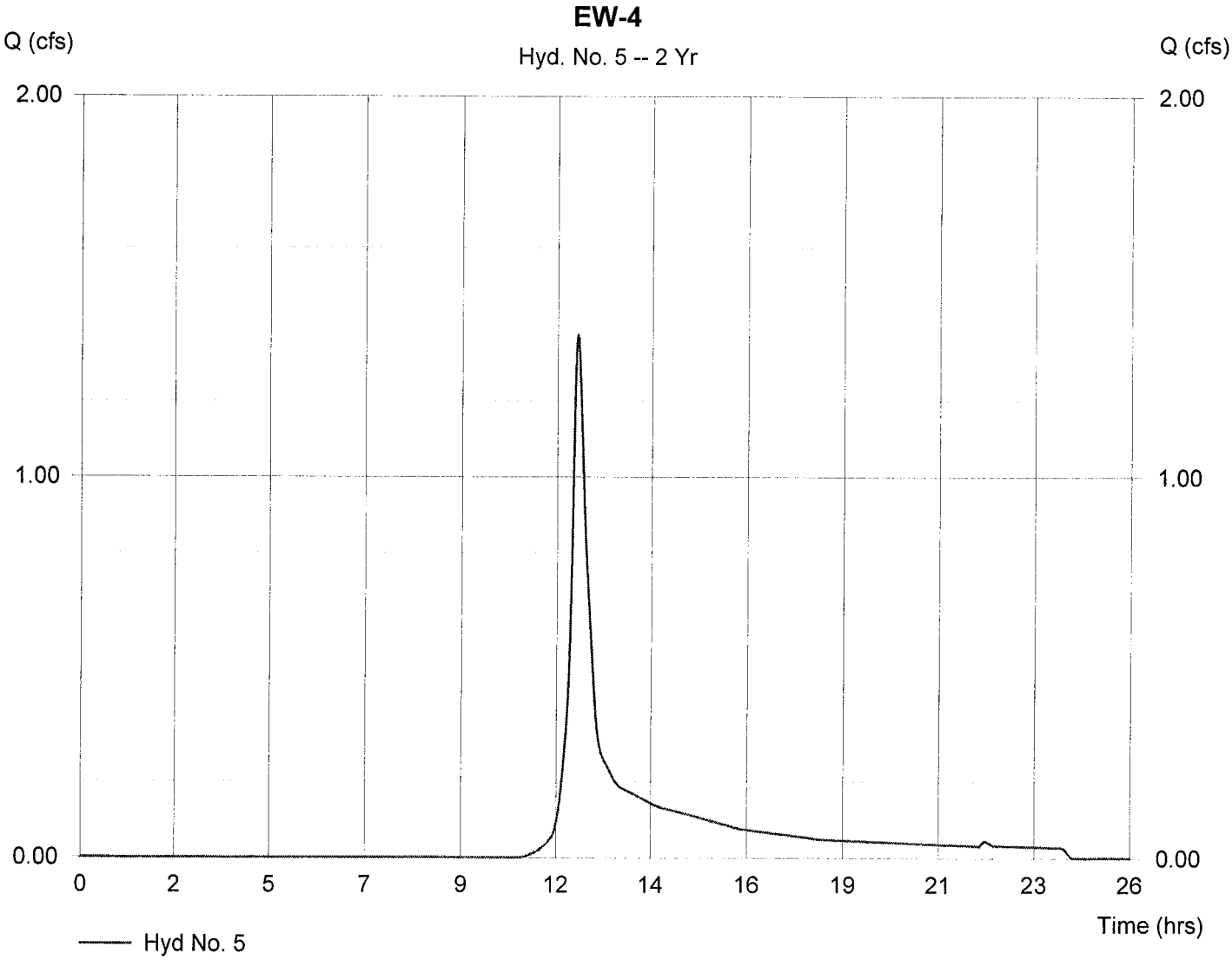
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Hyd. No. 5

EW-4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.37 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 1.580 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,489 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

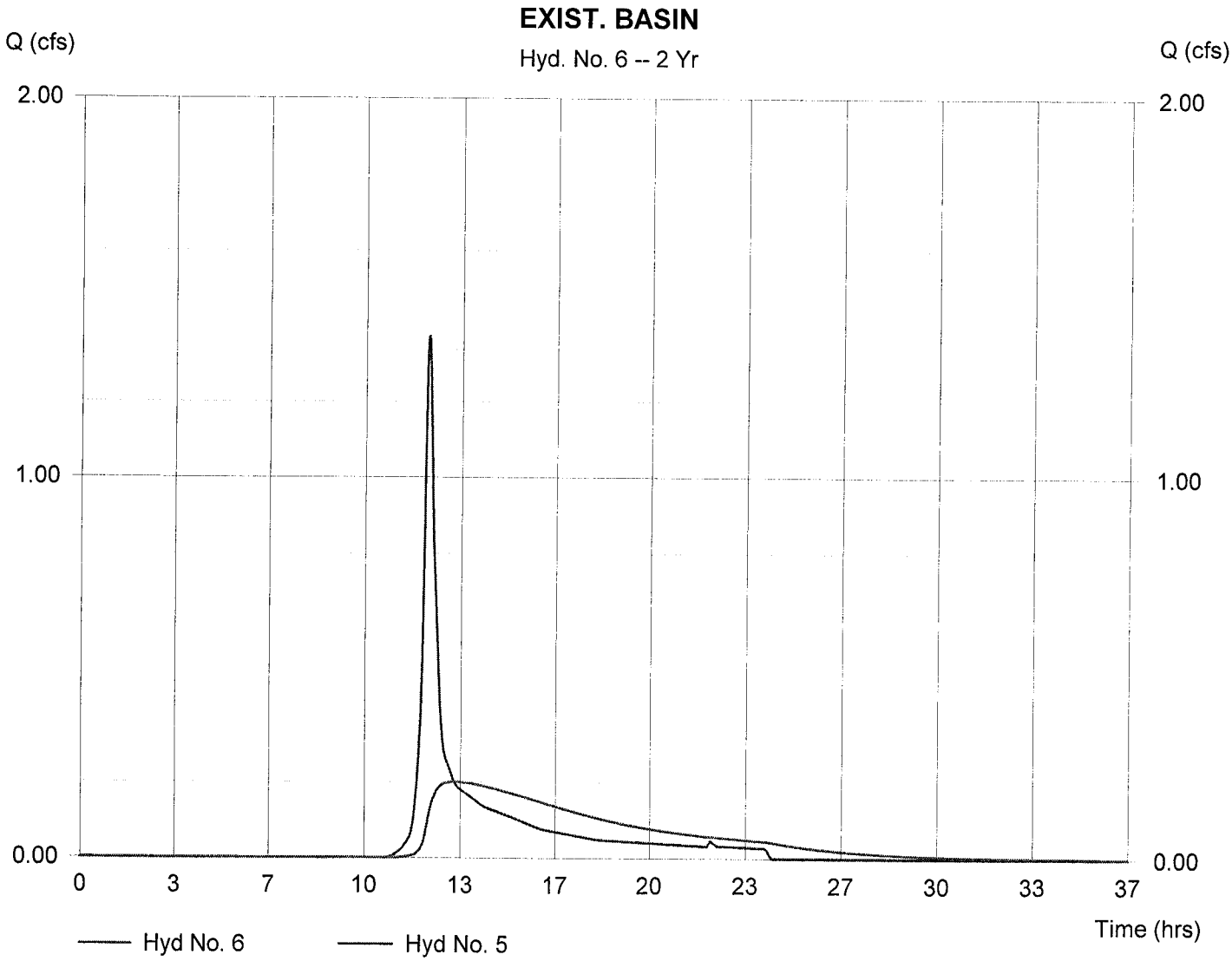
Hyd. No. 6

EXIST. BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.20 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Max. Elevation	= 118.59 ft
Reservoir name	= EX. BASIN	Max. Storage	= 2,202 cuft

Storage Indication method used.

Hydrograph Volume = 5,478 cuft



Hydrograph Plot

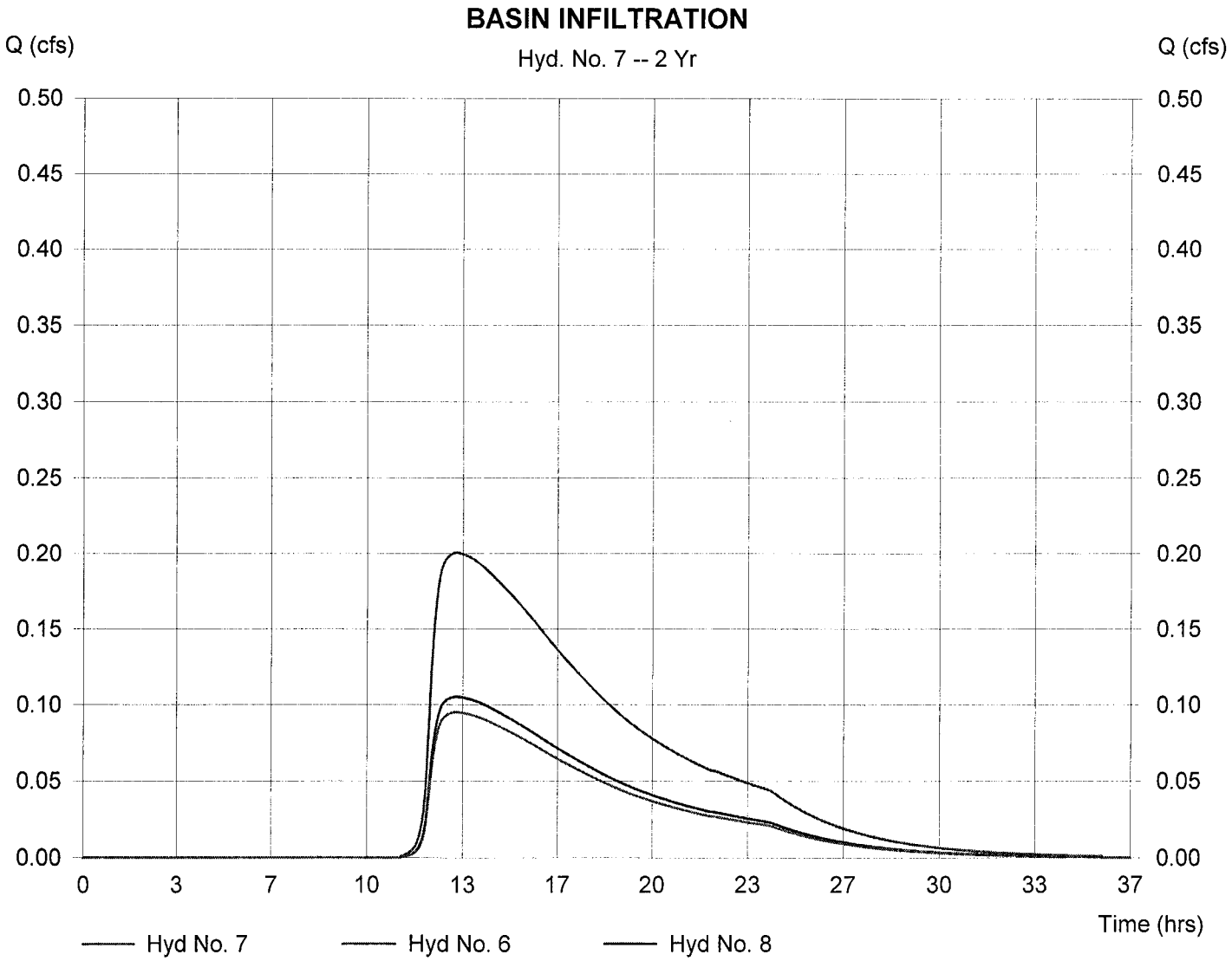
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Hyd. No. 7

BASIN INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.10 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 8
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 2,601 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

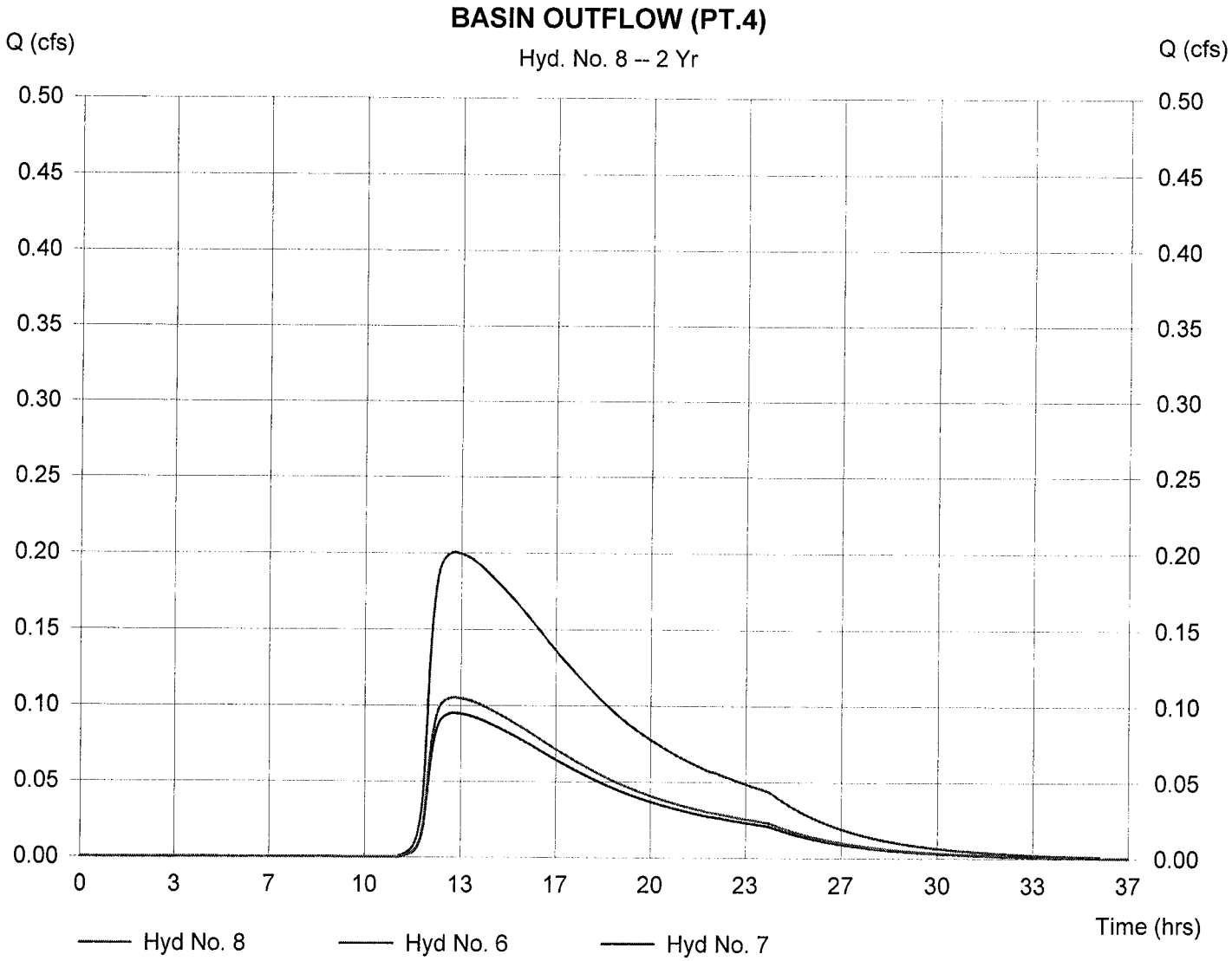
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 8

BASIN OUTFLOW (PT.4)

Hydrograph type	= Diversion2	Peak discharge	= 0.11 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 7
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 2,878 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

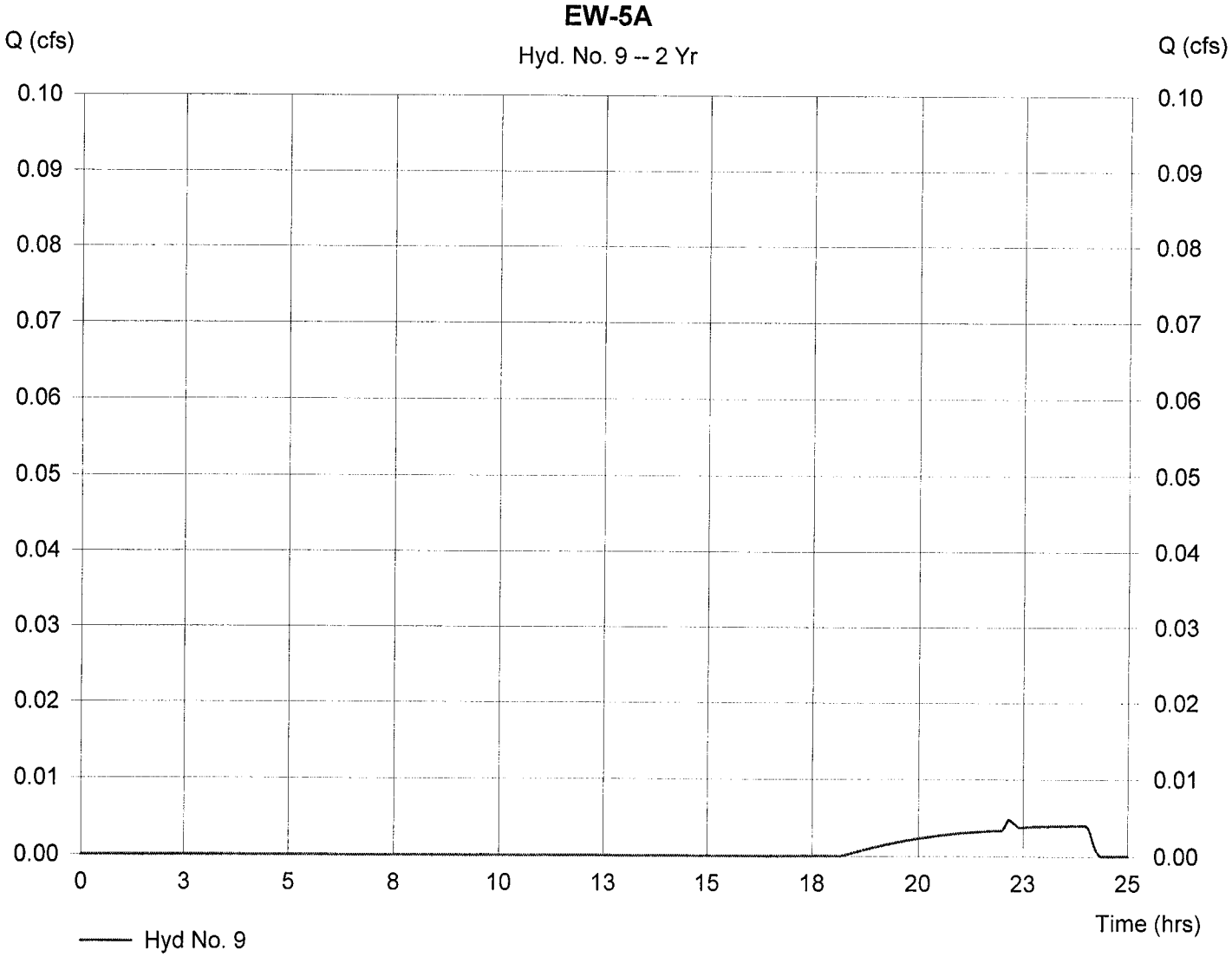
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 9

EW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 4.990 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.90 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 61 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

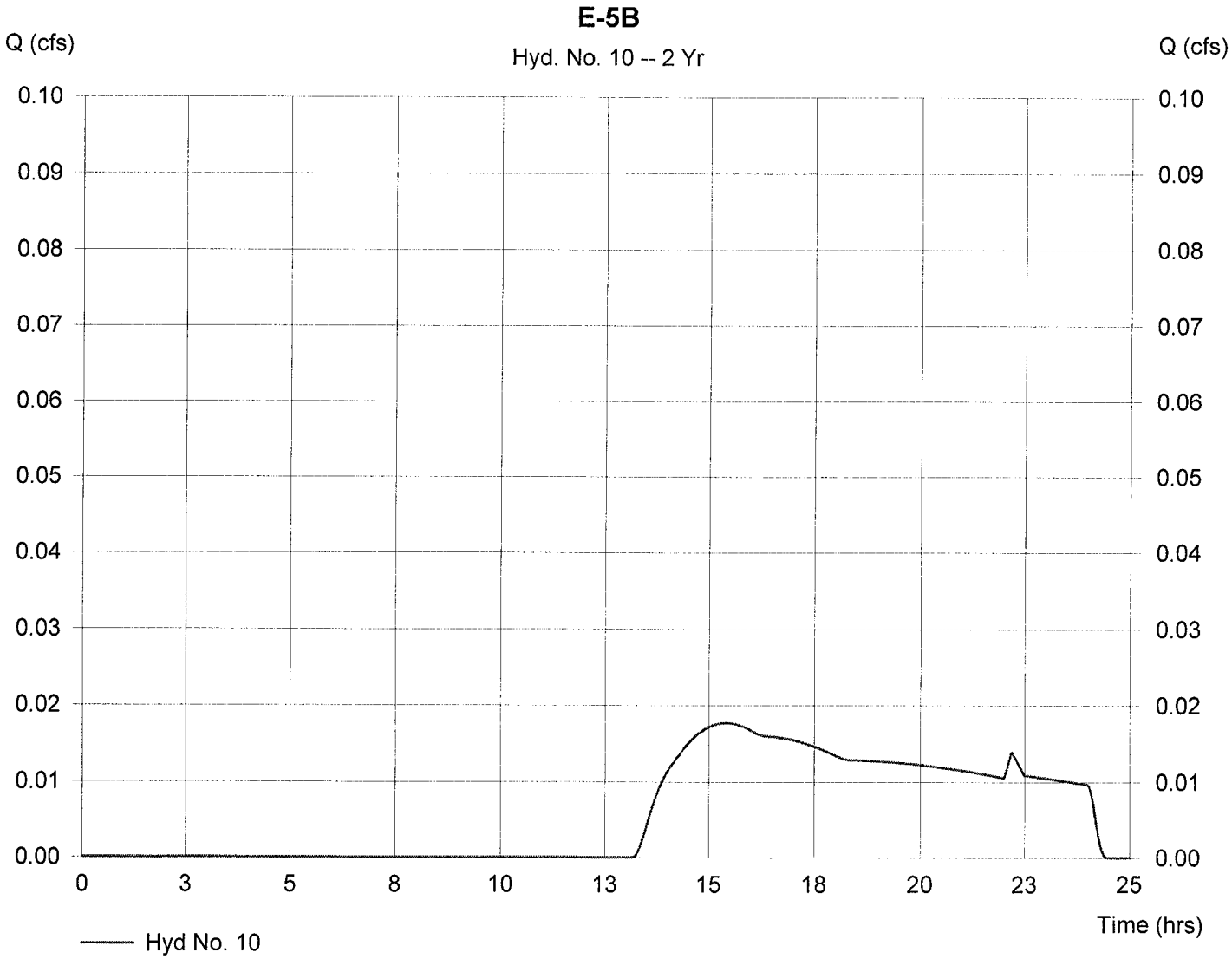
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 10

E-5B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.02 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 3.090 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 502 cuft



Hydrograph Plot

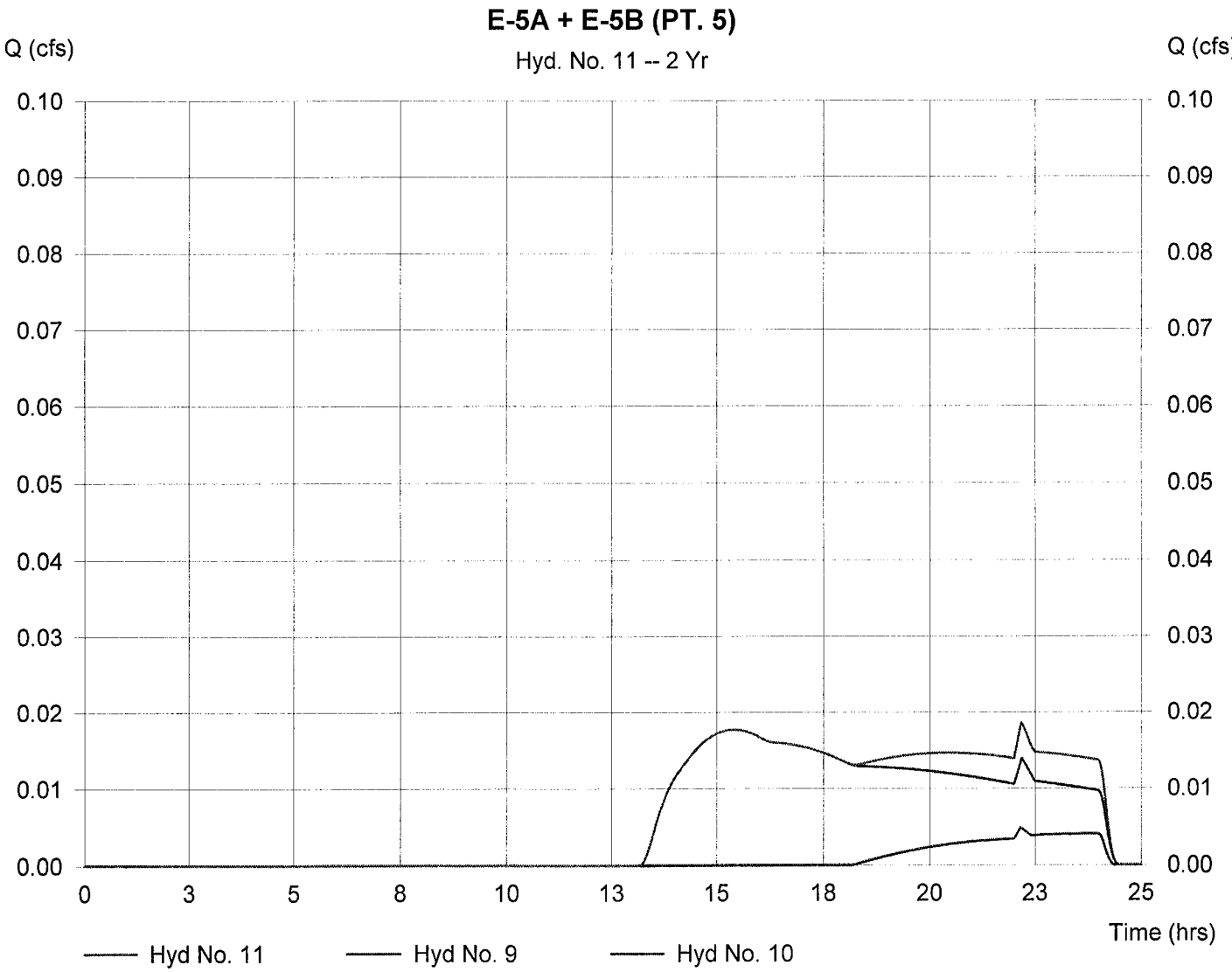
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Hyd. No. 11

E-5A + E-5B (PT. 5)

Hydrograph type	= Combine	Peak discharge	= 0.02 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 9, 10		

Hydrograph Volume = 563 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

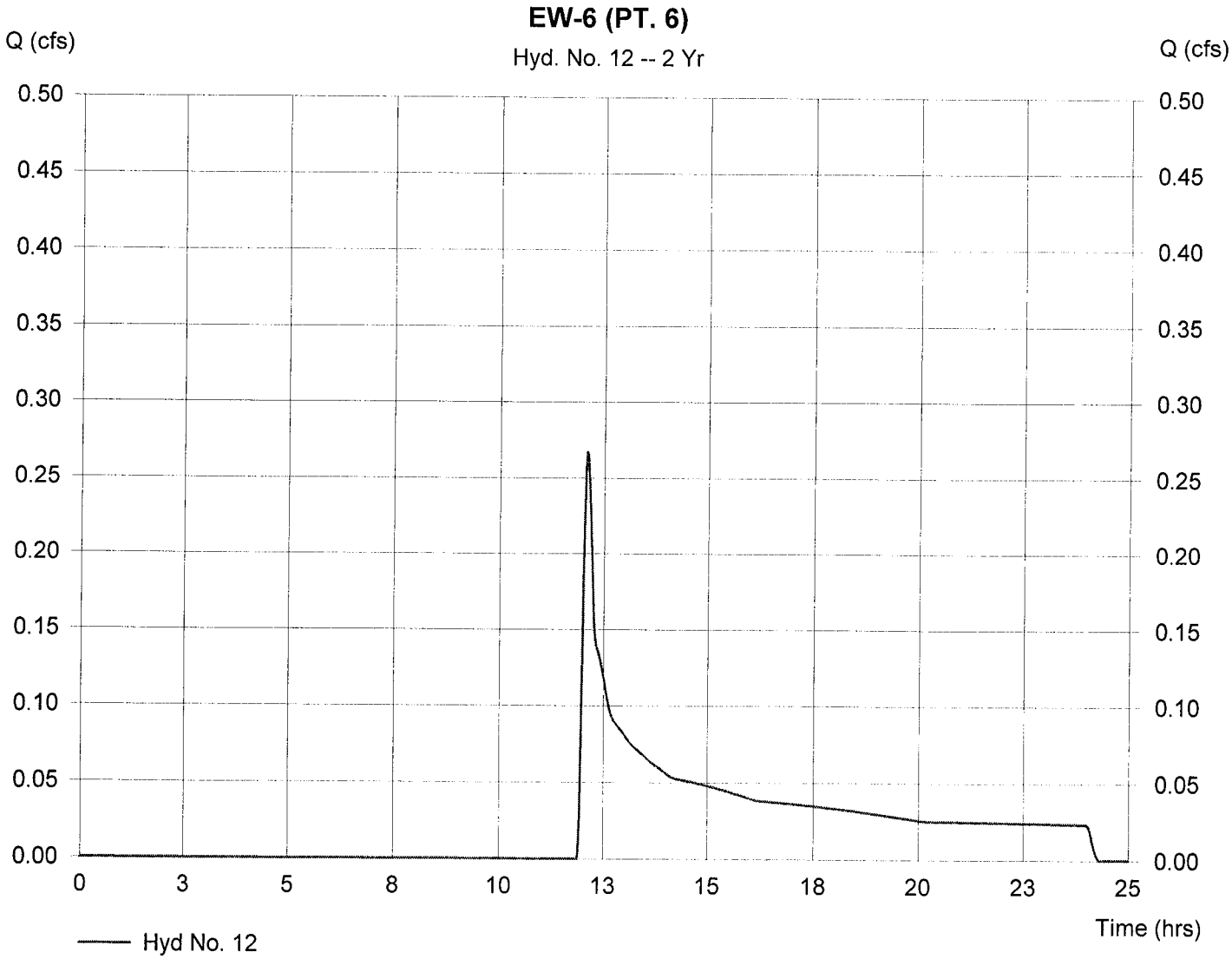
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 12

EW-6 (PT. 6)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.27 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 2.450 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.03 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,943 cuft



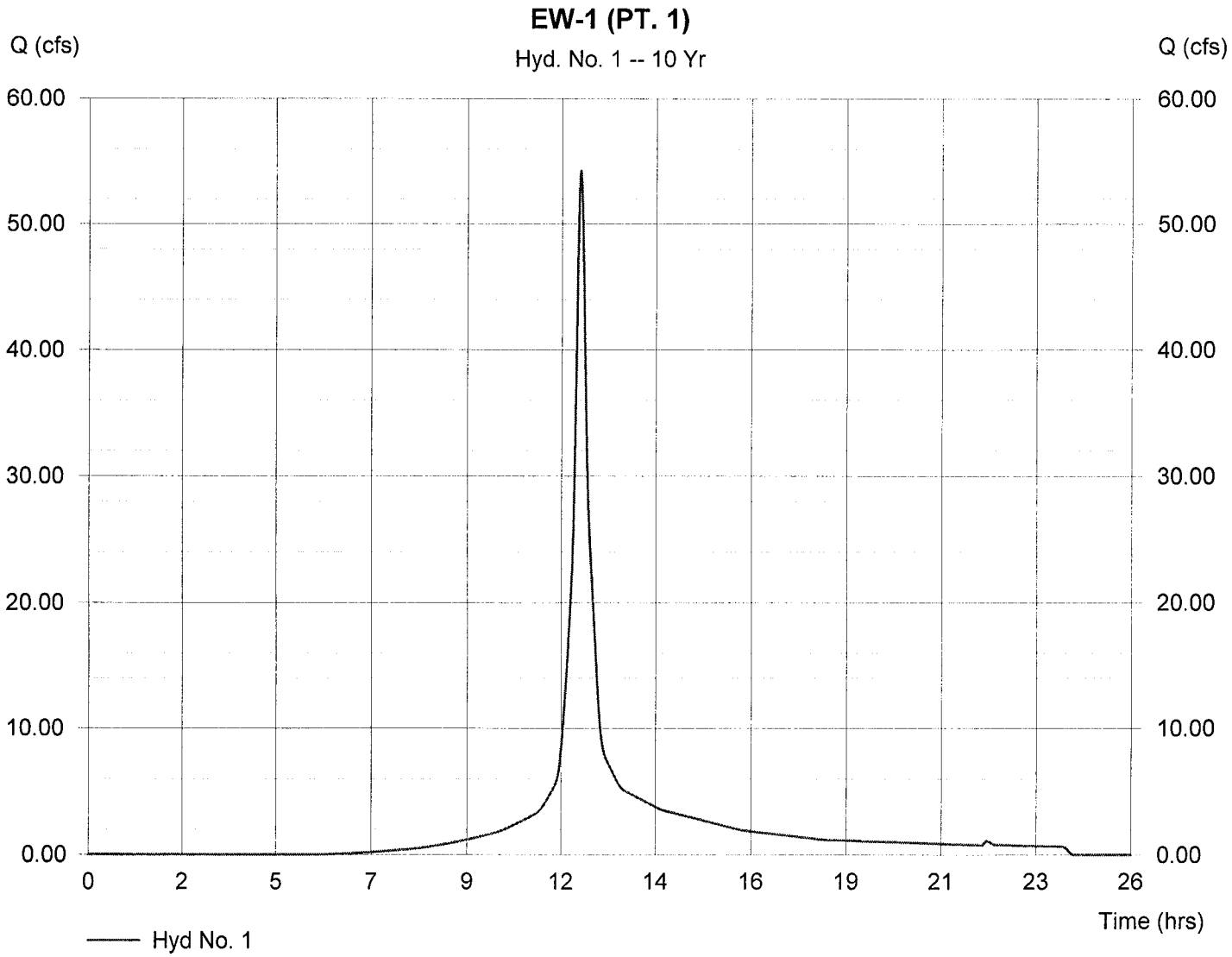
Hydrograph Plot

Hyd. No. 1

EW-1 (PT. 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 54.24 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 17.420 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.23 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 199,459 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

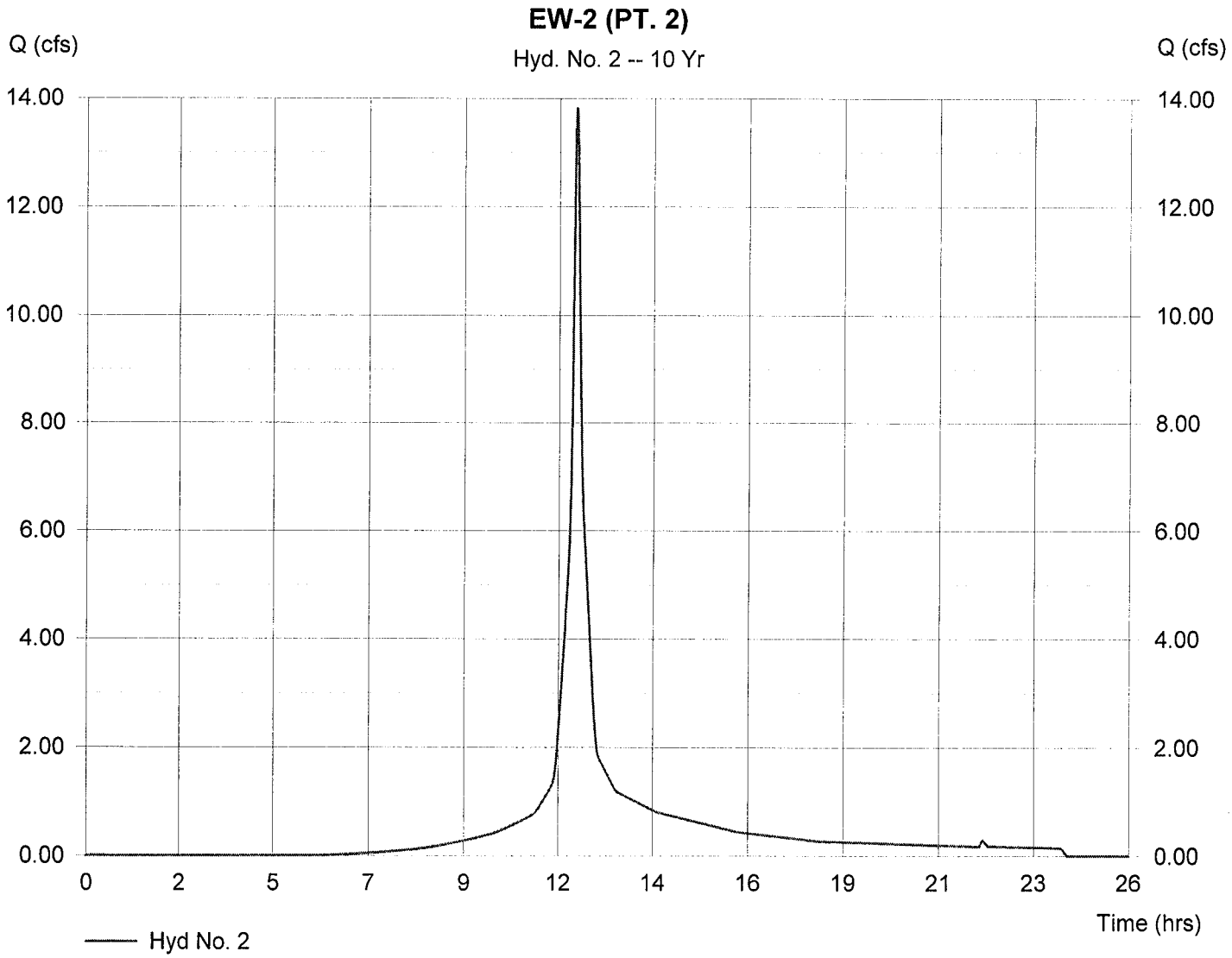
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 2

EW-2 (PT. 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.82 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 4.110 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.81 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 45,078 cuft



Hydrograph Plot

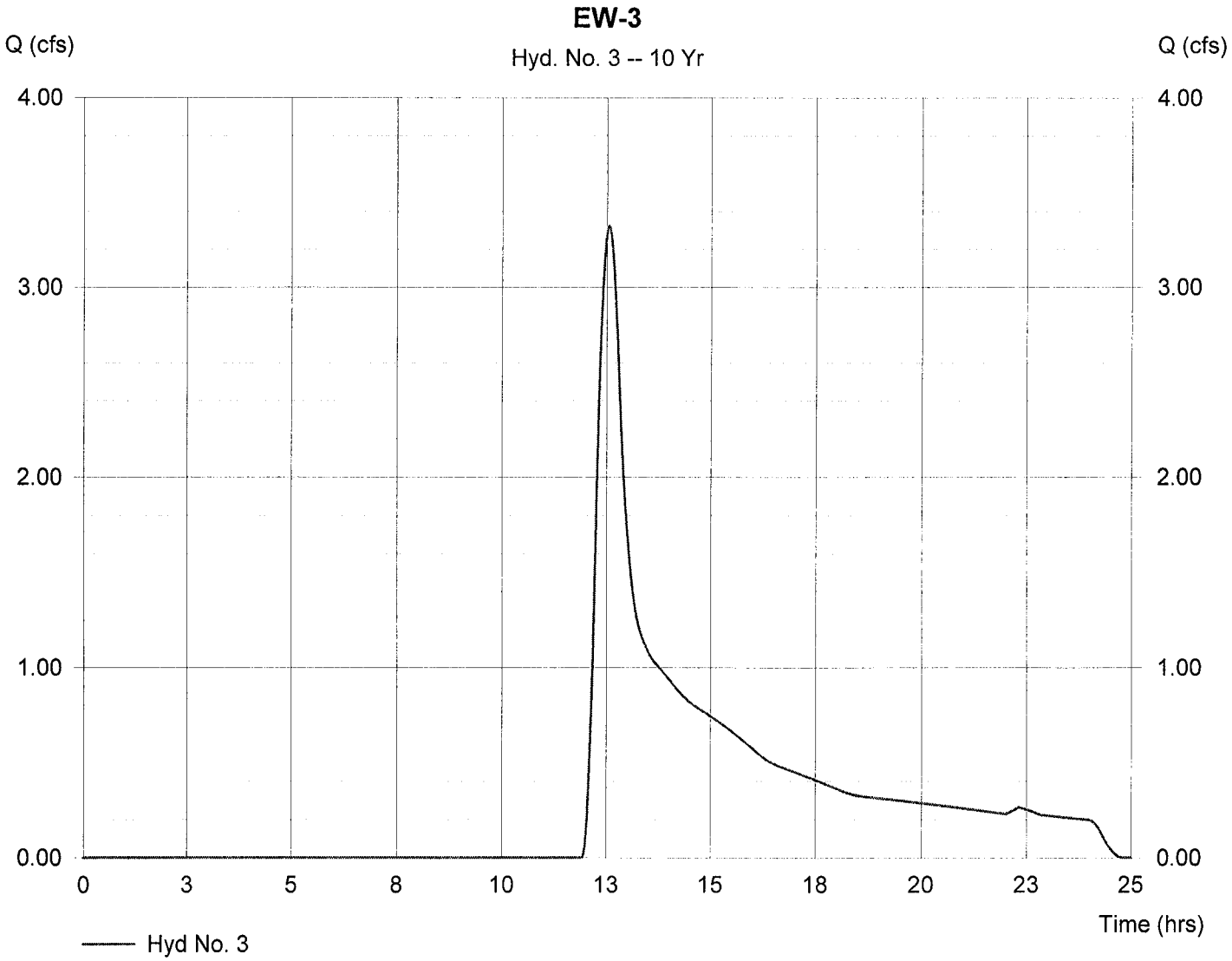
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Hyd. No. 3

EW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.32 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 12.310 ac	Curve number	= 52
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.60 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 26,655 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

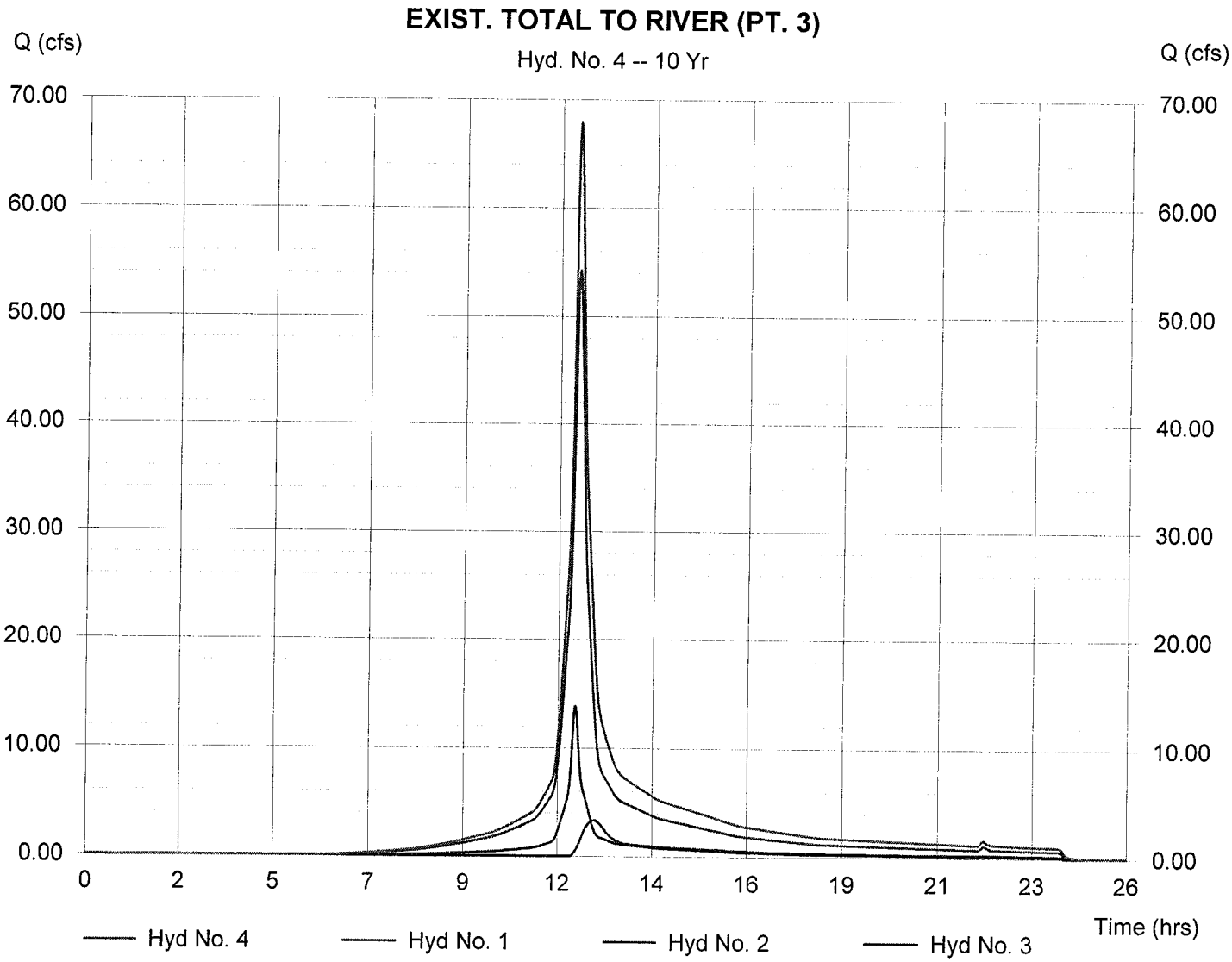
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 4

EXIST. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 67.90 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyds.	= 1, 2, 3		

Hydrograph Volume = 271,192 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

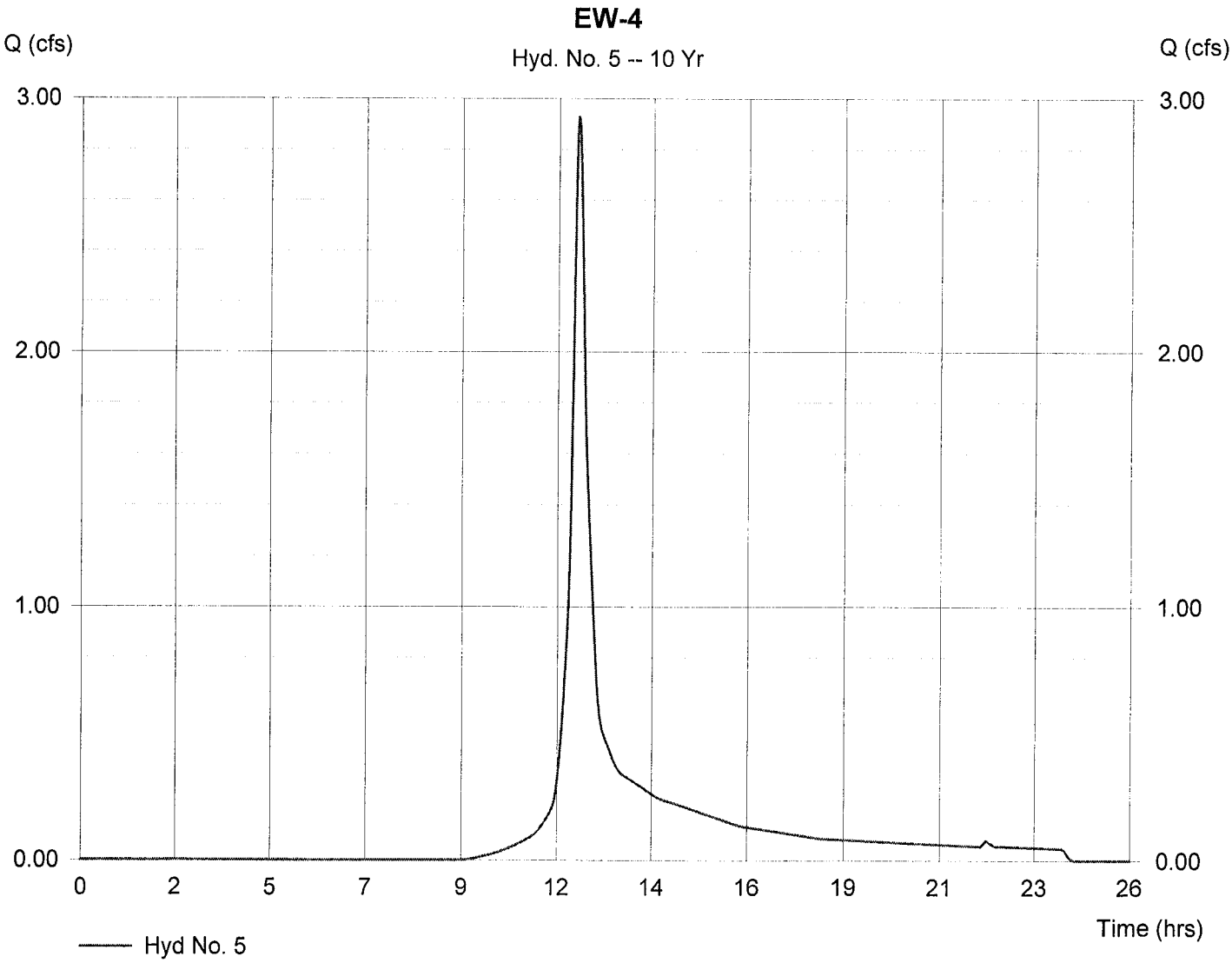
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 5

EW-4

Hydrograph type	= SCS Runoff	Peak discharge	= 2.93 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.580 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 11,135 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

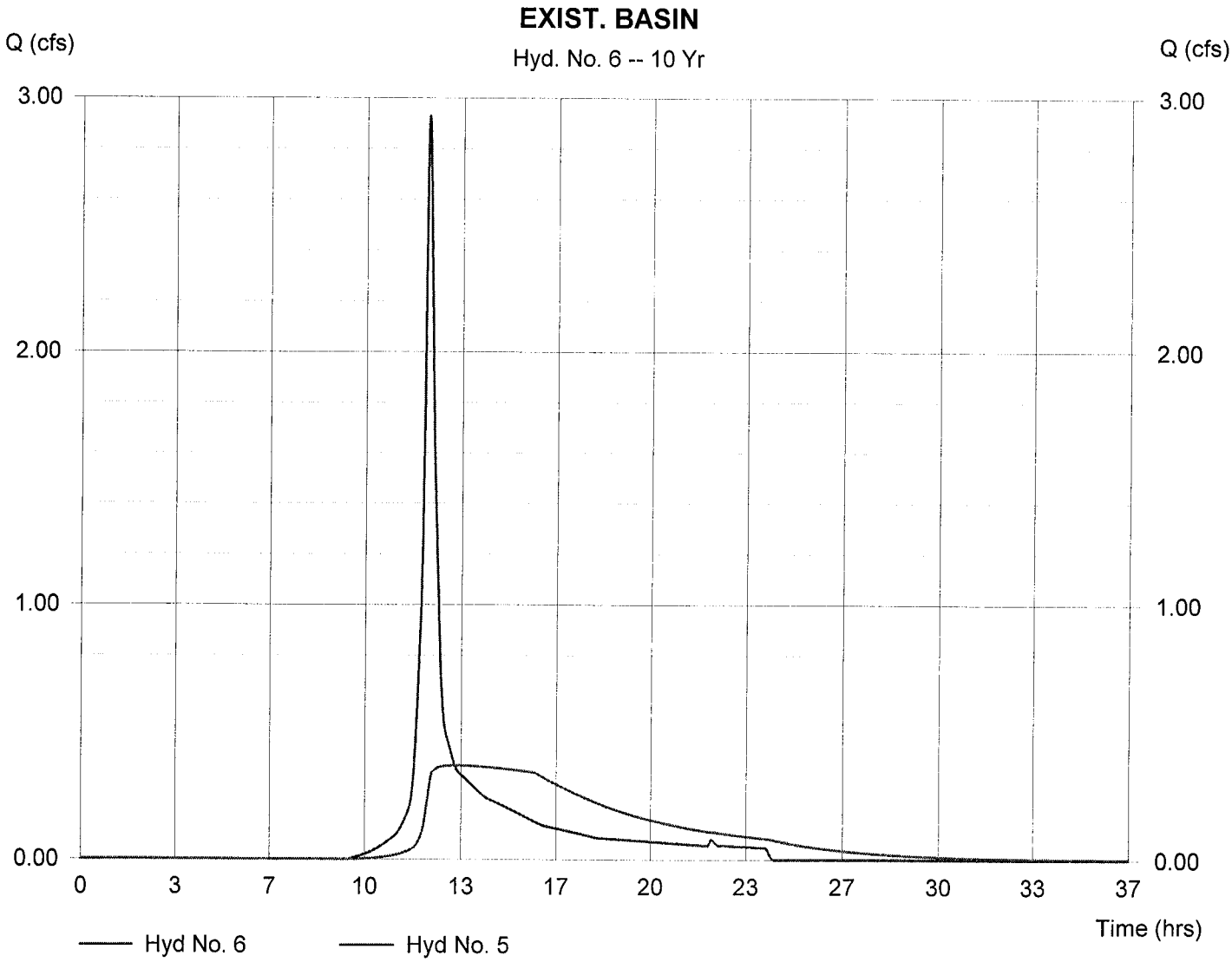
Hyd. No. 6

EXIST. BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.37 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Max. Elevation	= 119.18 ft
Reservoir name	= EX. BASIN	Max. Storage	= 4,985 cuft

Storage Indication method used.

Hydrograph Volume = 11,124 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

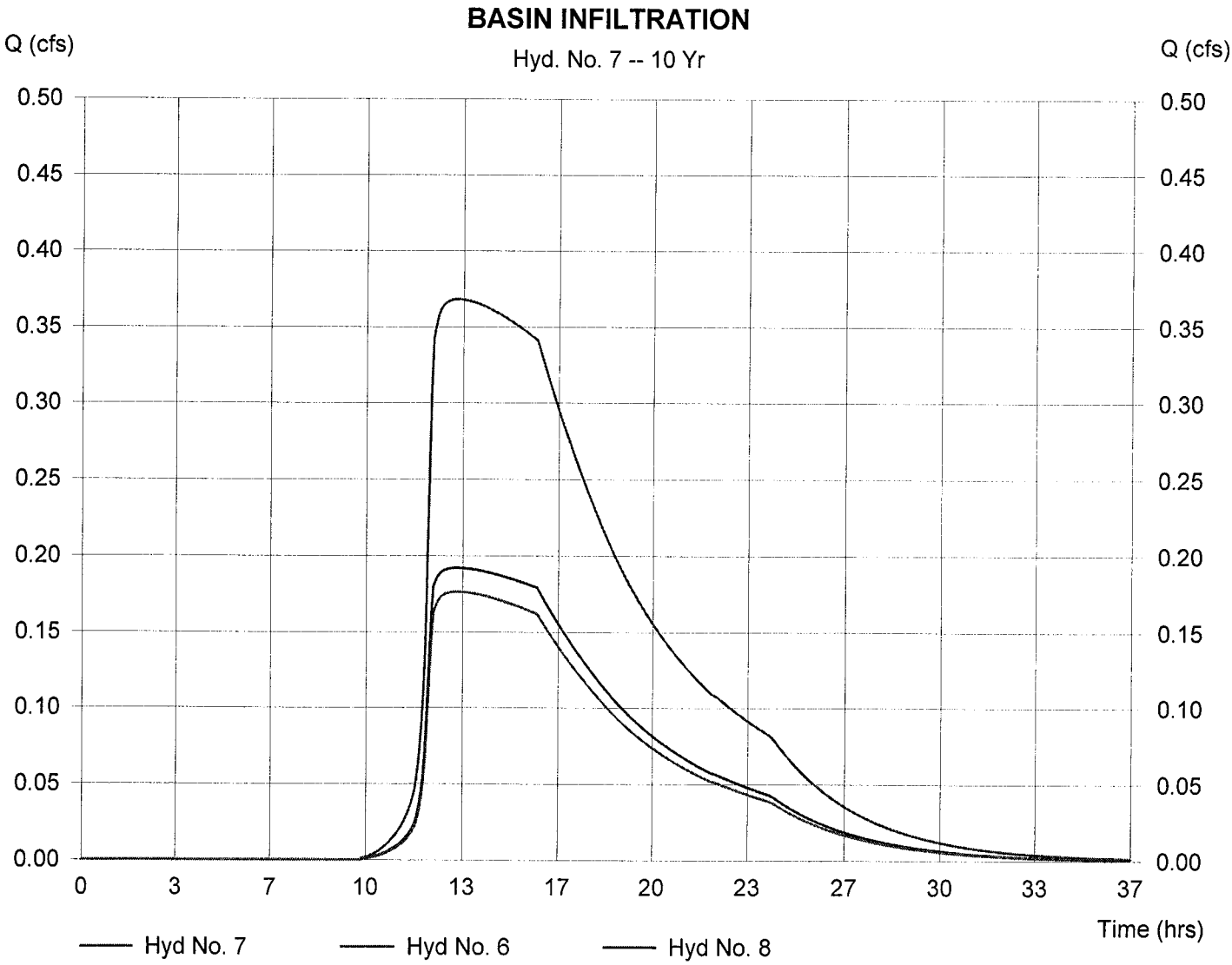
Hyd. No. 7

BASIN INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 10 yrs
Inflow hydrograph = 6
Diversion method = Pond - EX. BASIN

Peak discharge = 0.18 cfs
Time interval = 1 min
2nd diverted hyd. = 8
Pond structure = Exfiltration

Hydrograph Volume = 5,293 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

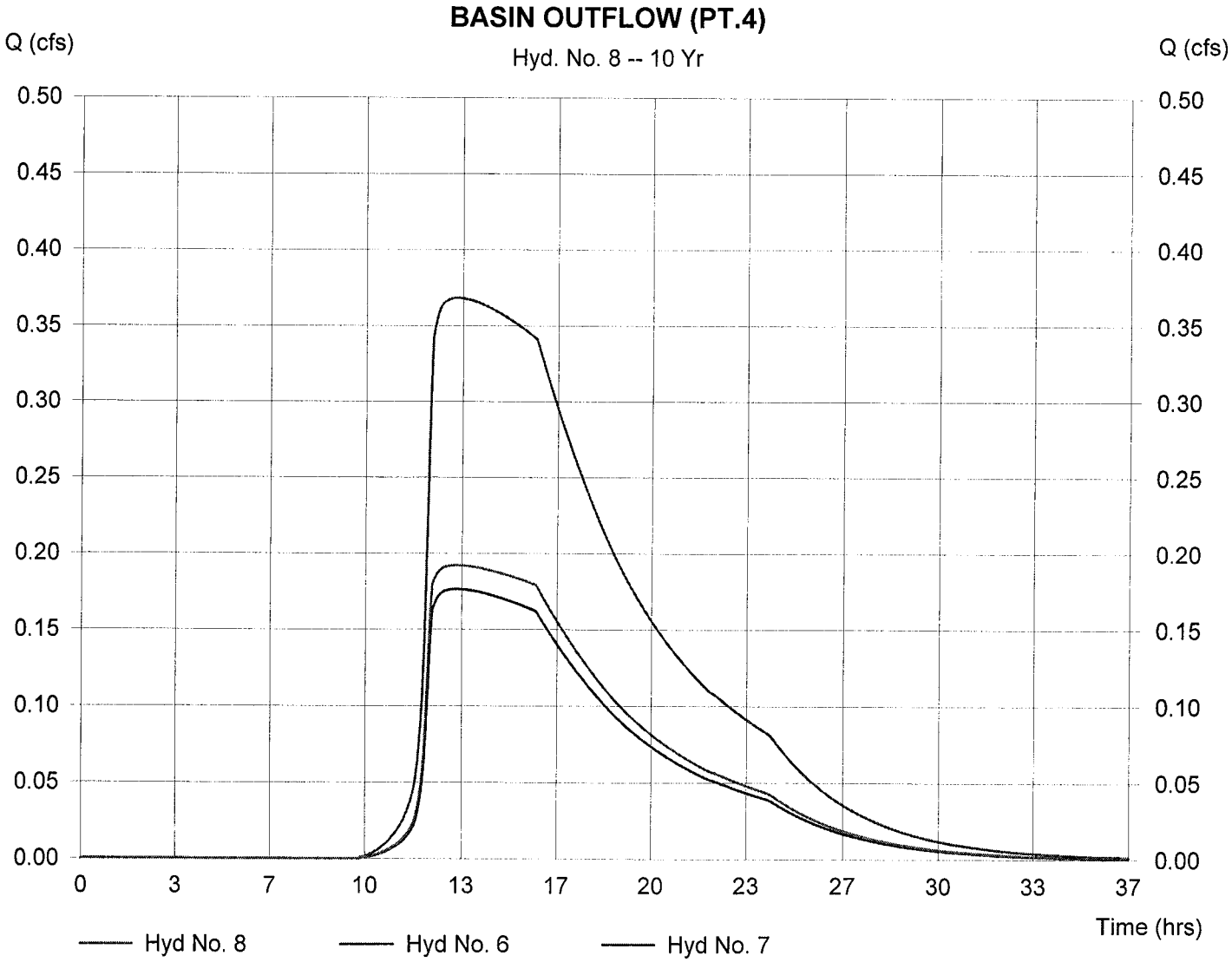
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 8

BASIN OUTFLOW (PT.4)

Hydrograph type	= Diversion2	Peak discharge	= 0.19 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 7
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 5,831 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

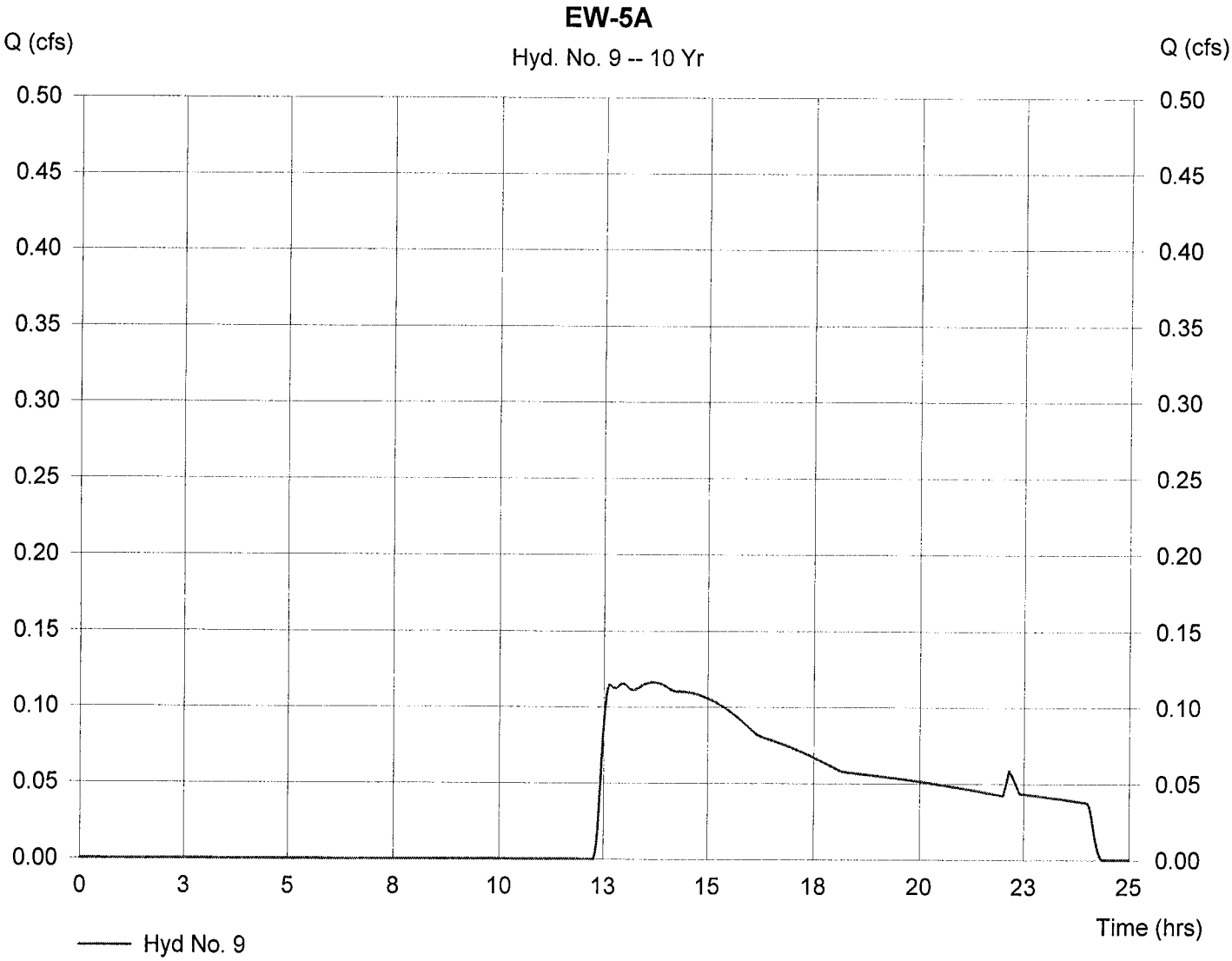
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 9

EW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.12 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 4.990 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.90 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,976 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

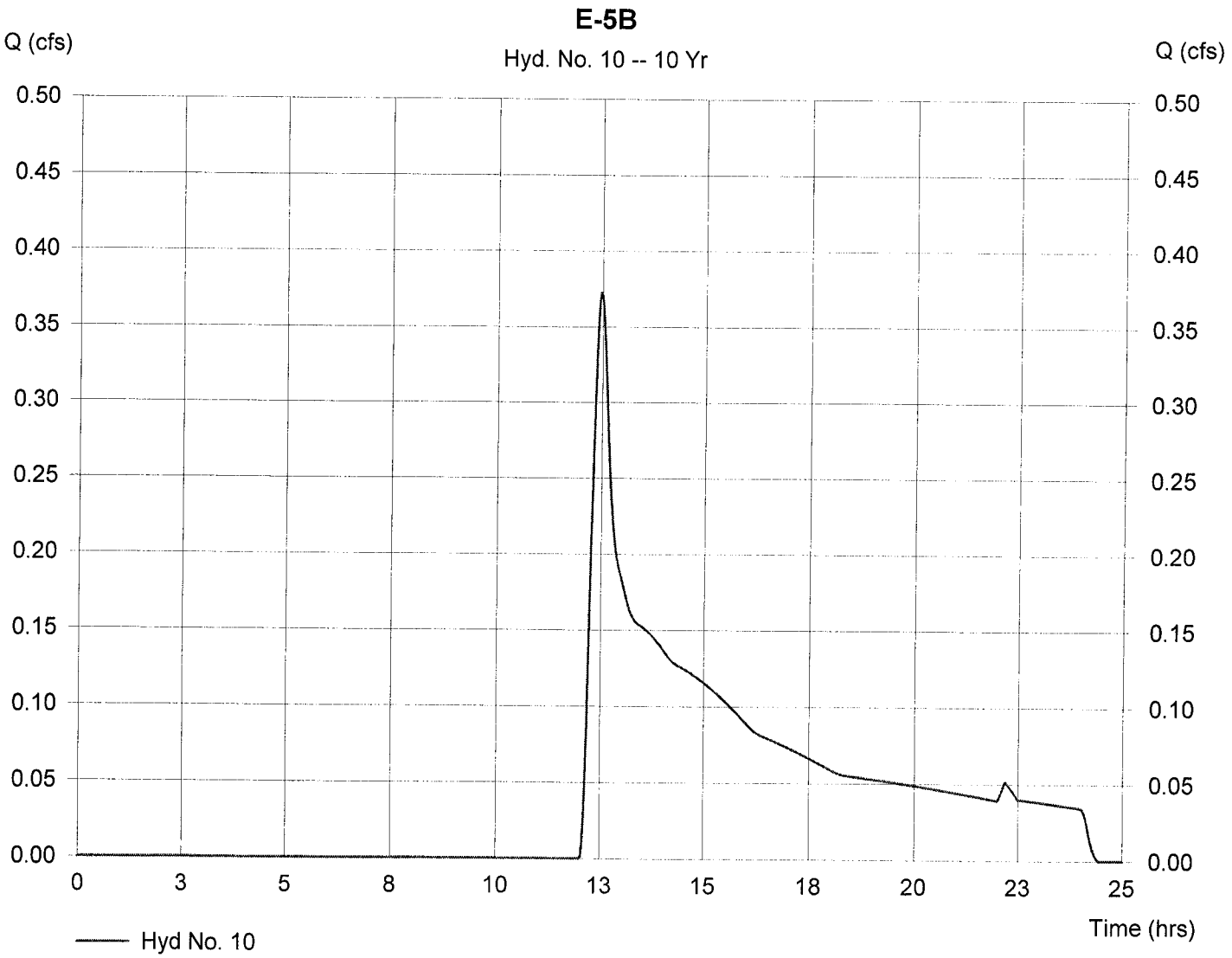
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 10

E-5B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.37 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 3.090 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,697 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

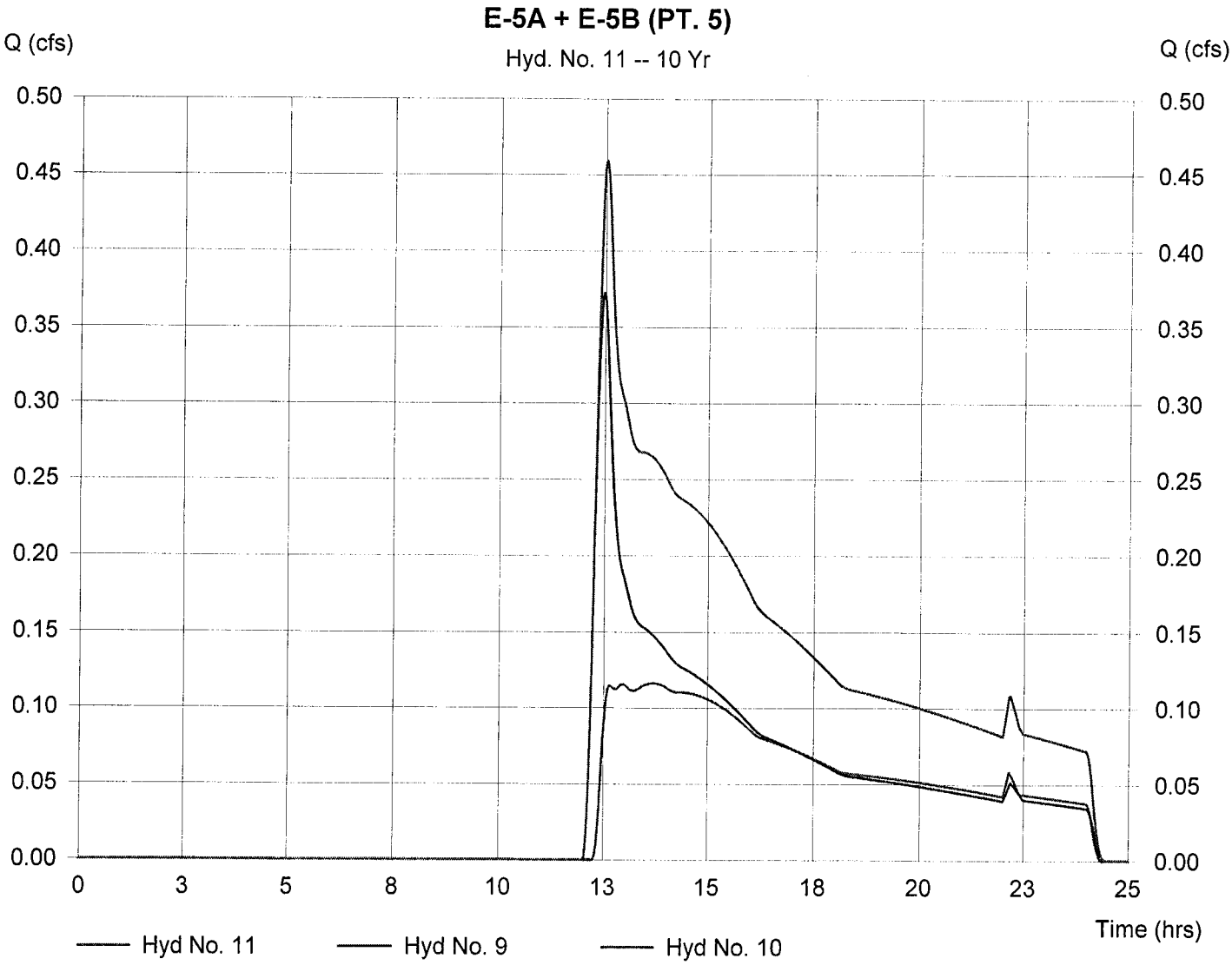
Hyd. No. 11

E-5A + E-5B (PT. 5)

Hydrograph type = Combine
Storm frequency = 10 yrs
Inflow hyds. = 9, 10

Peak discharge = 0.46 cfs
Time interval = 1 min

Hydrograph Volume = 6,673 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

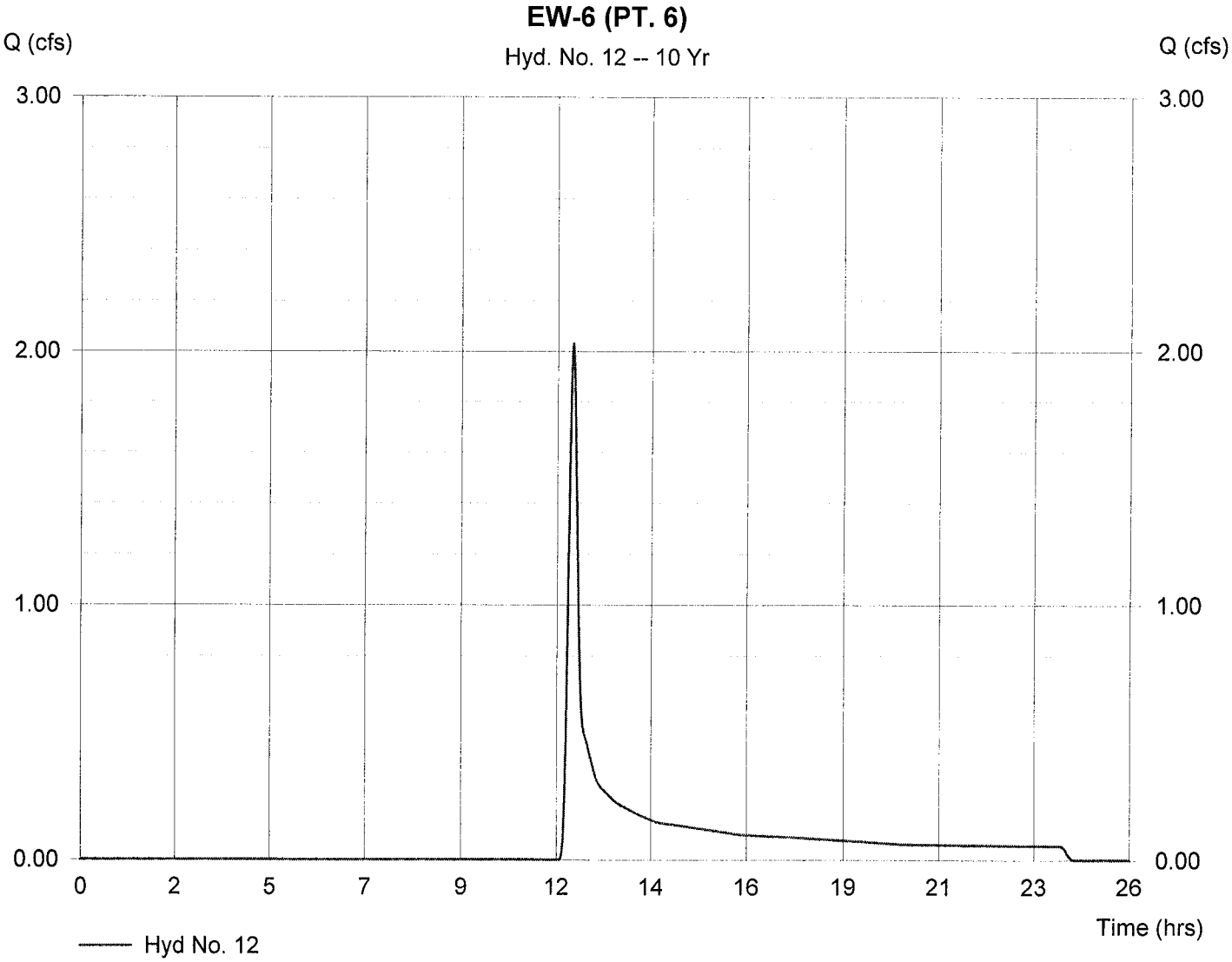
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 12

EW-6 (PT. 6)

Hydrograph type	= SCS Runoff	Peak discharge	= 2.03 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.450 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.03 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,500 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

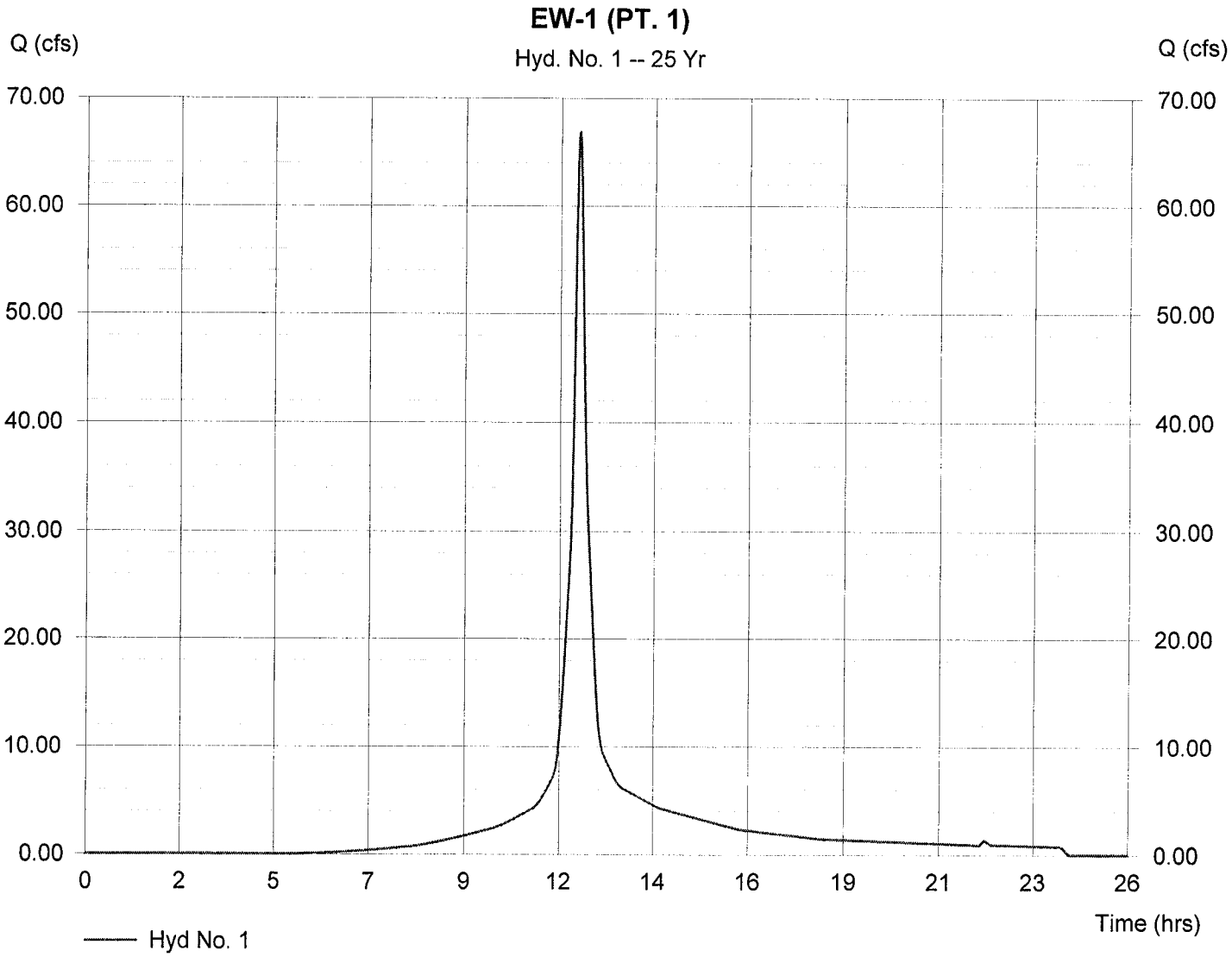
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 1

EW-1 (PT. 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 66.82 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 17.420 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.23 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 247,842 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

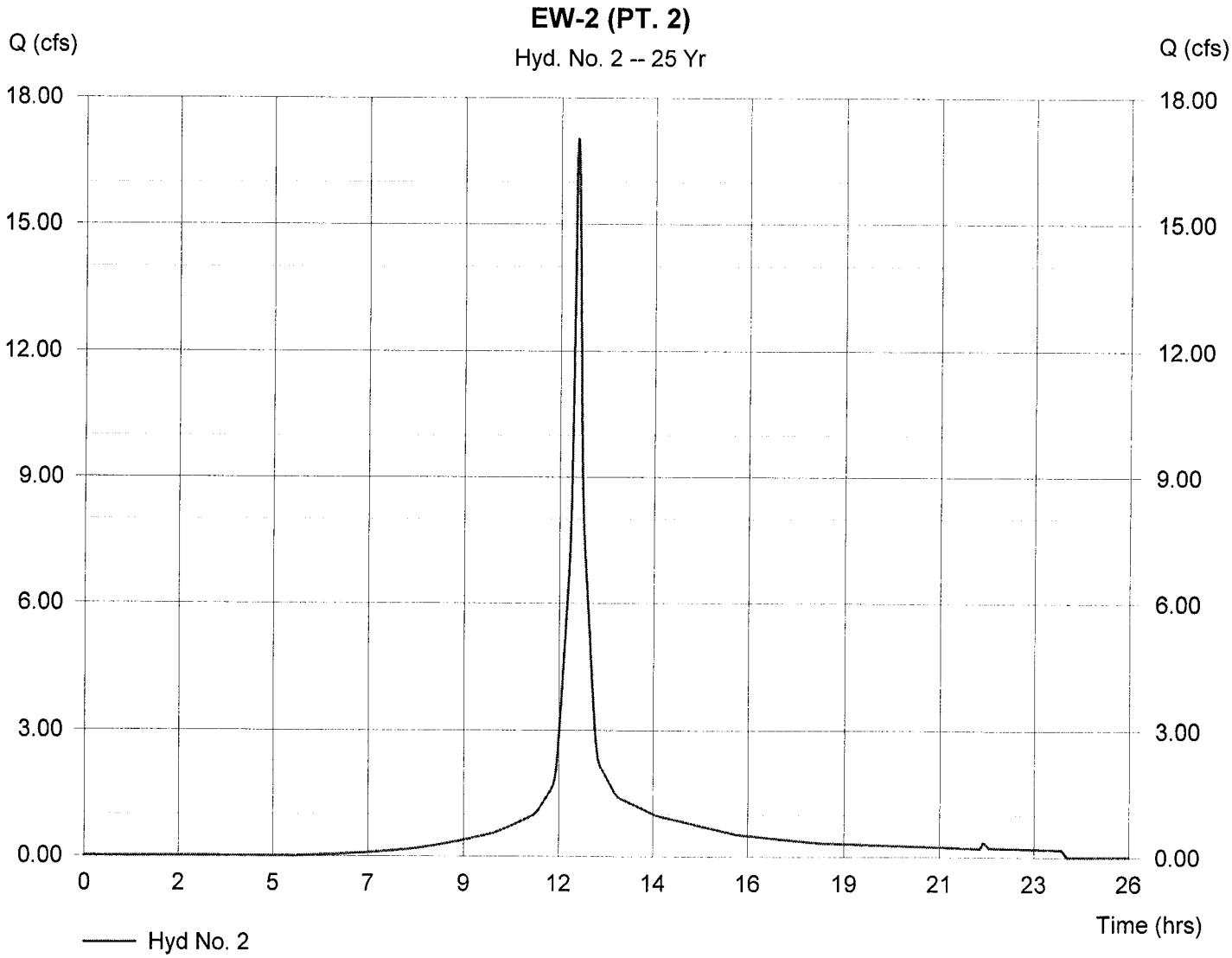
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Hyd. No. 2

EW-2 (PT. 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 17.03 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 4.110 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.81 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 56,013 cuft



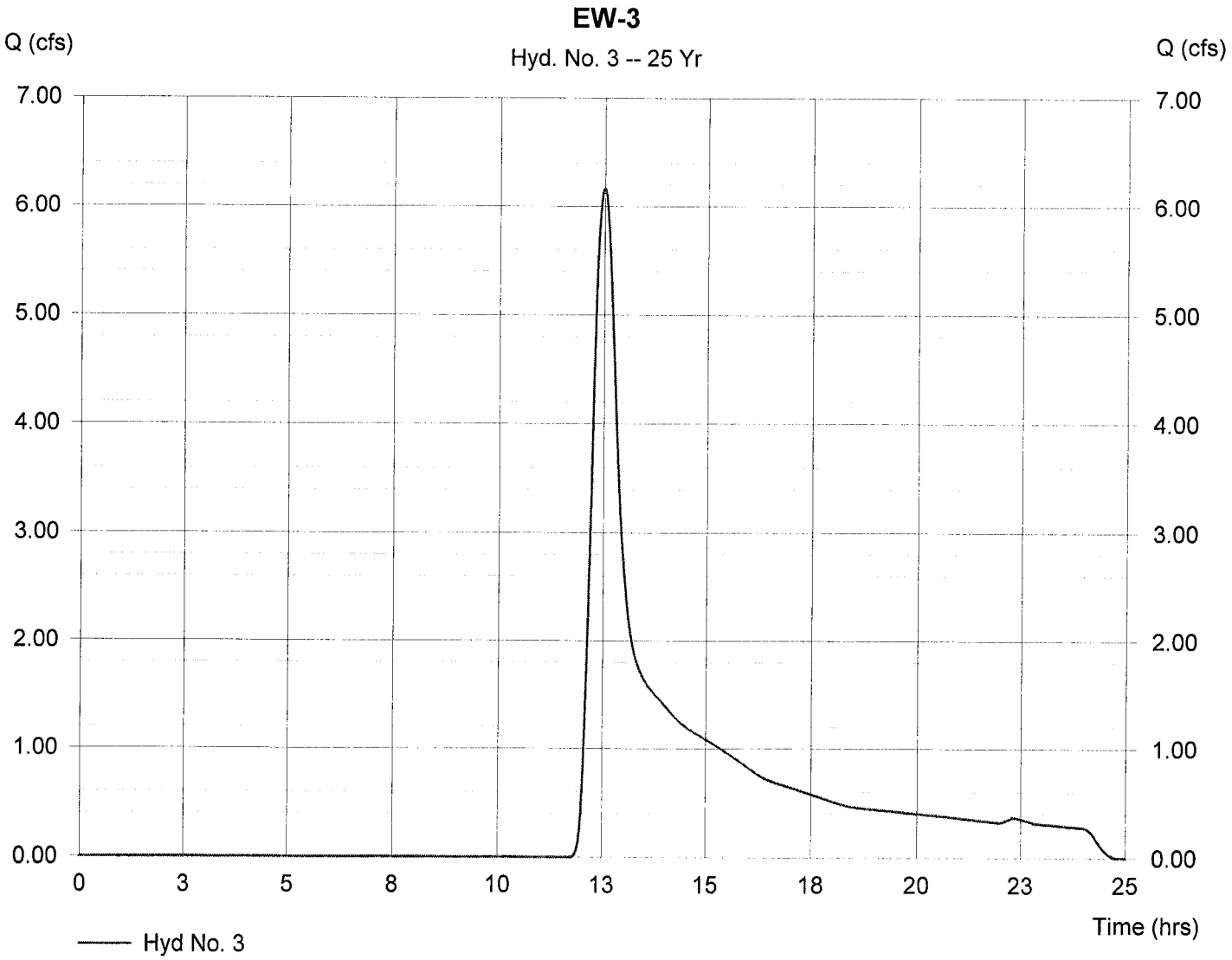
Hydrograph Plot

Hyd. No. 3

EW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 6.16 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 12.310 ac	Curve number	= 52
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.60 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 42,300 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

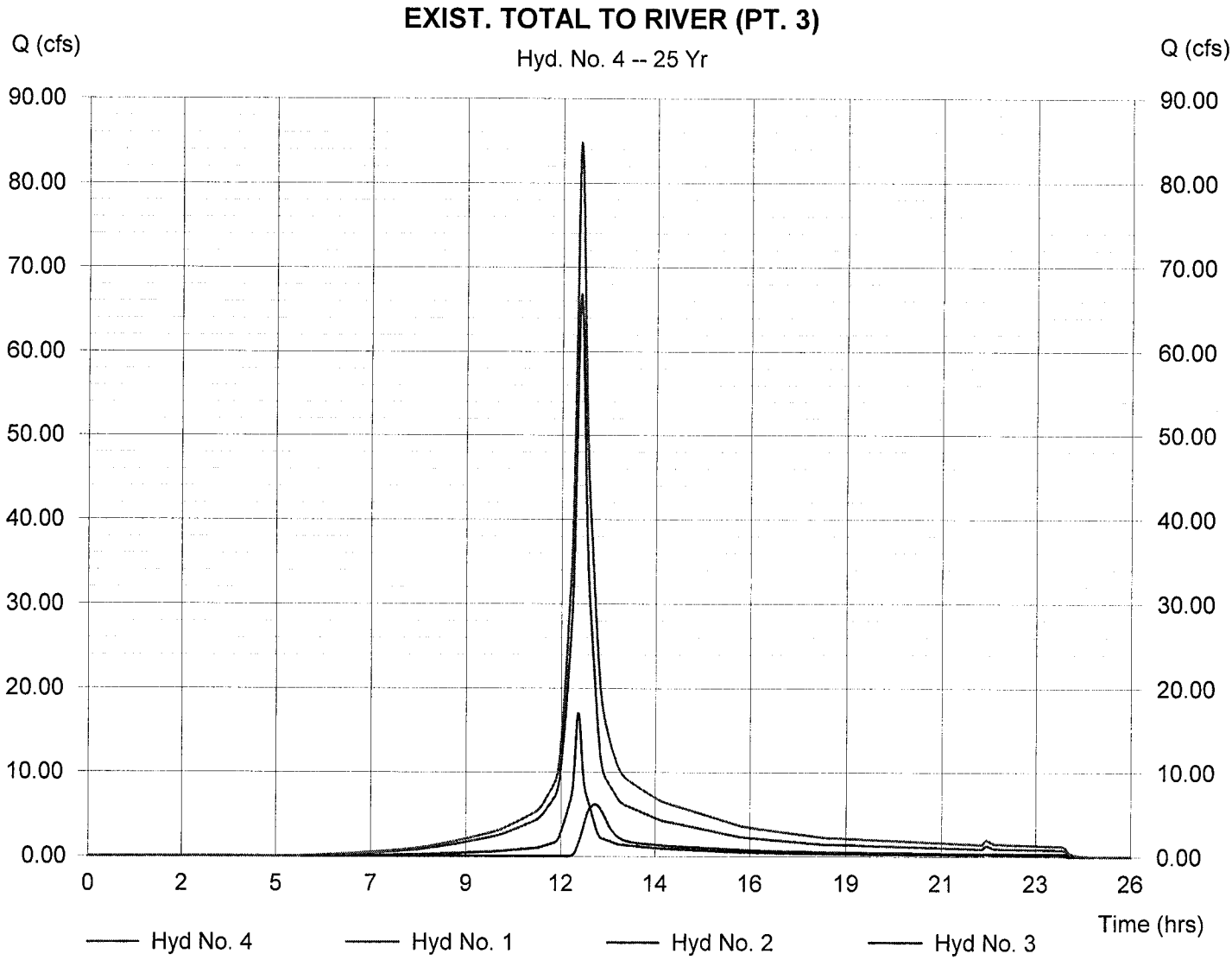
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 4

EXIST. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 84.73 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyds.	= 1, 2, 3		

Hydrograph Volume = 346,155 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

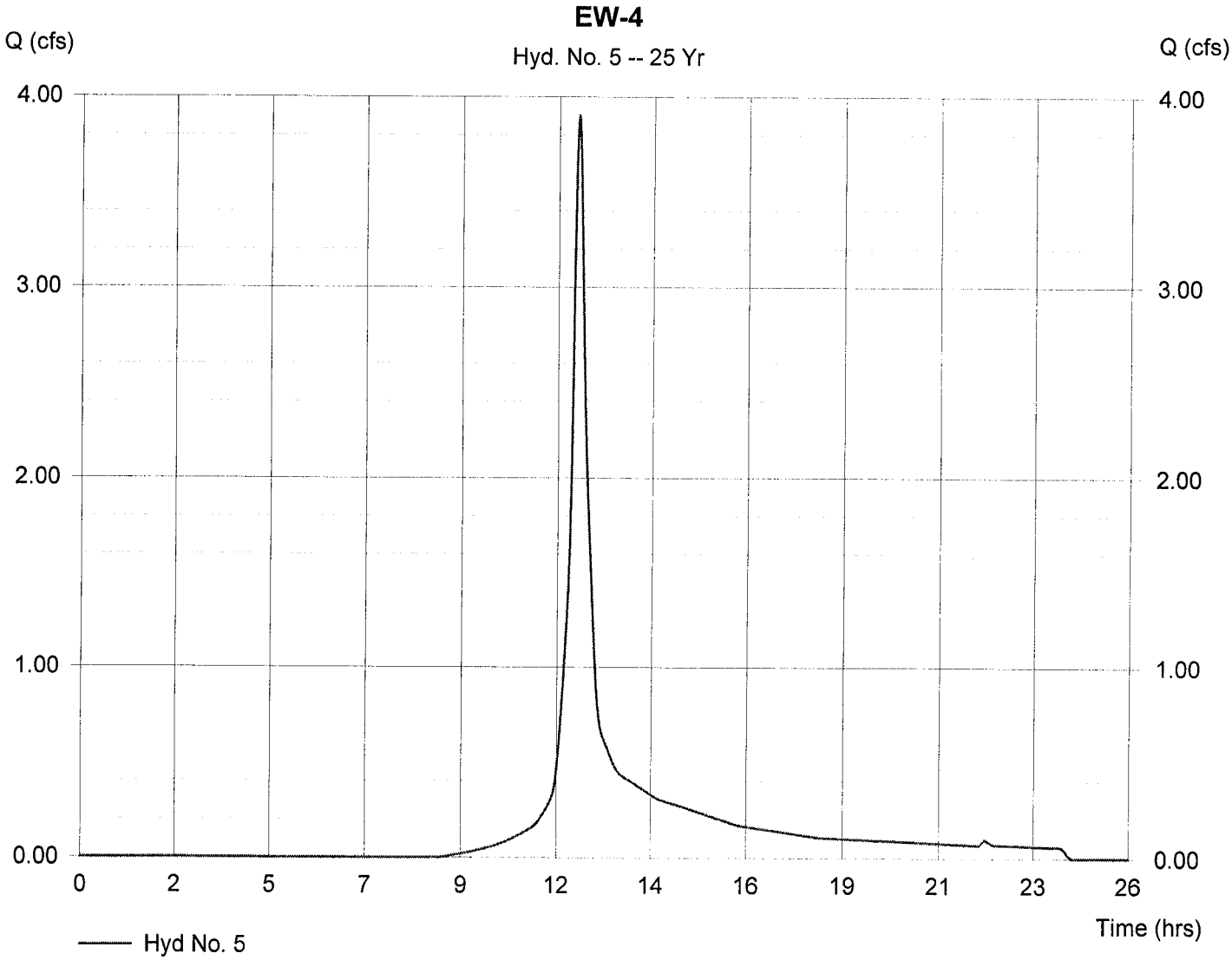
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 5

EW-4

Hydrograph type	= SCS Runoff	Peak discharge	= 3.90 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 1.580 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 14,712 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

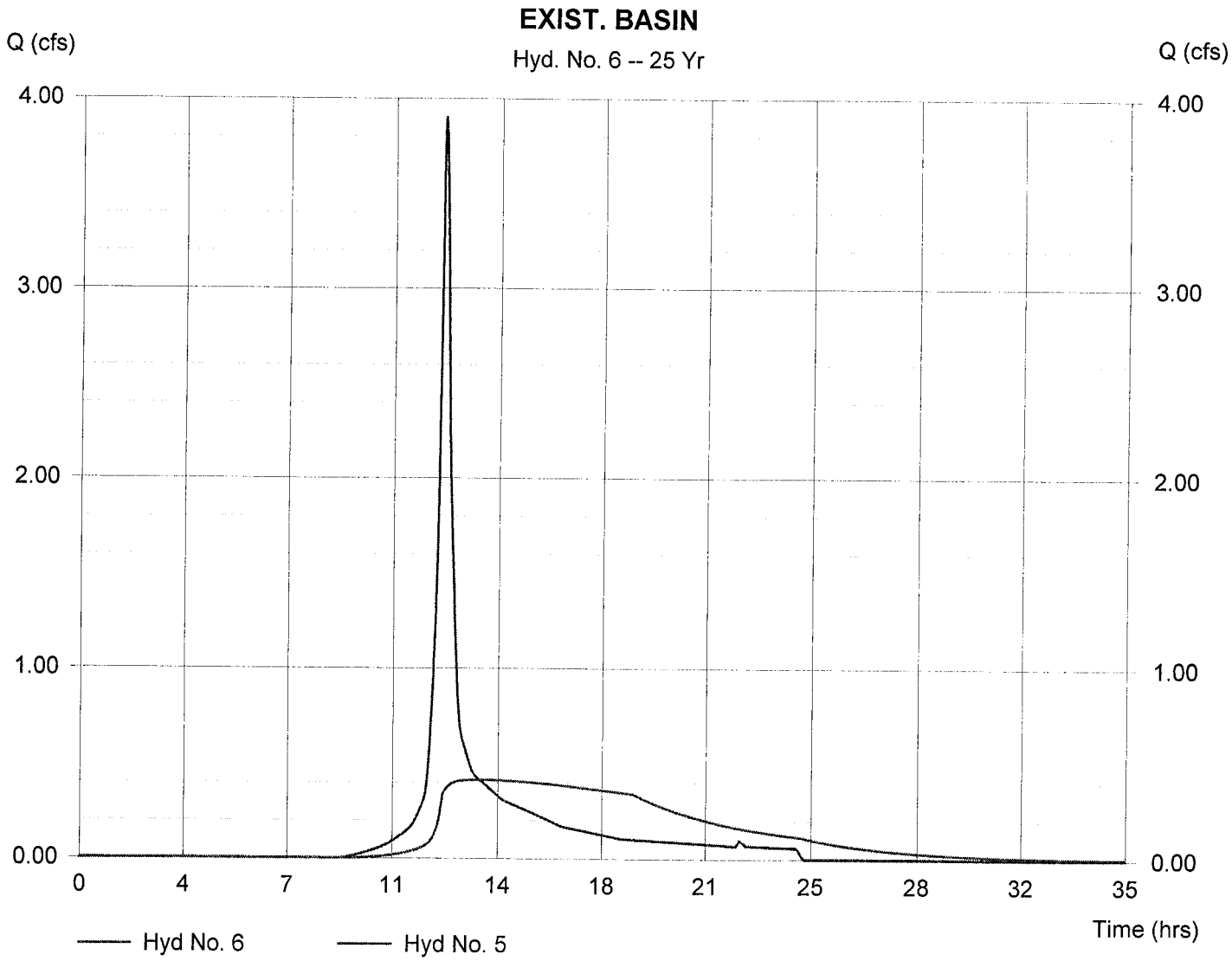
Hyd. No. 6

EXIST. BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.41 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Max. Elevation	= 119.47 ft
Reservoir name	= EX. BASIN	Max. Storage	= 7,029 cuft

Storage Indication method used.

Hydrograph Volume = 14,701 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

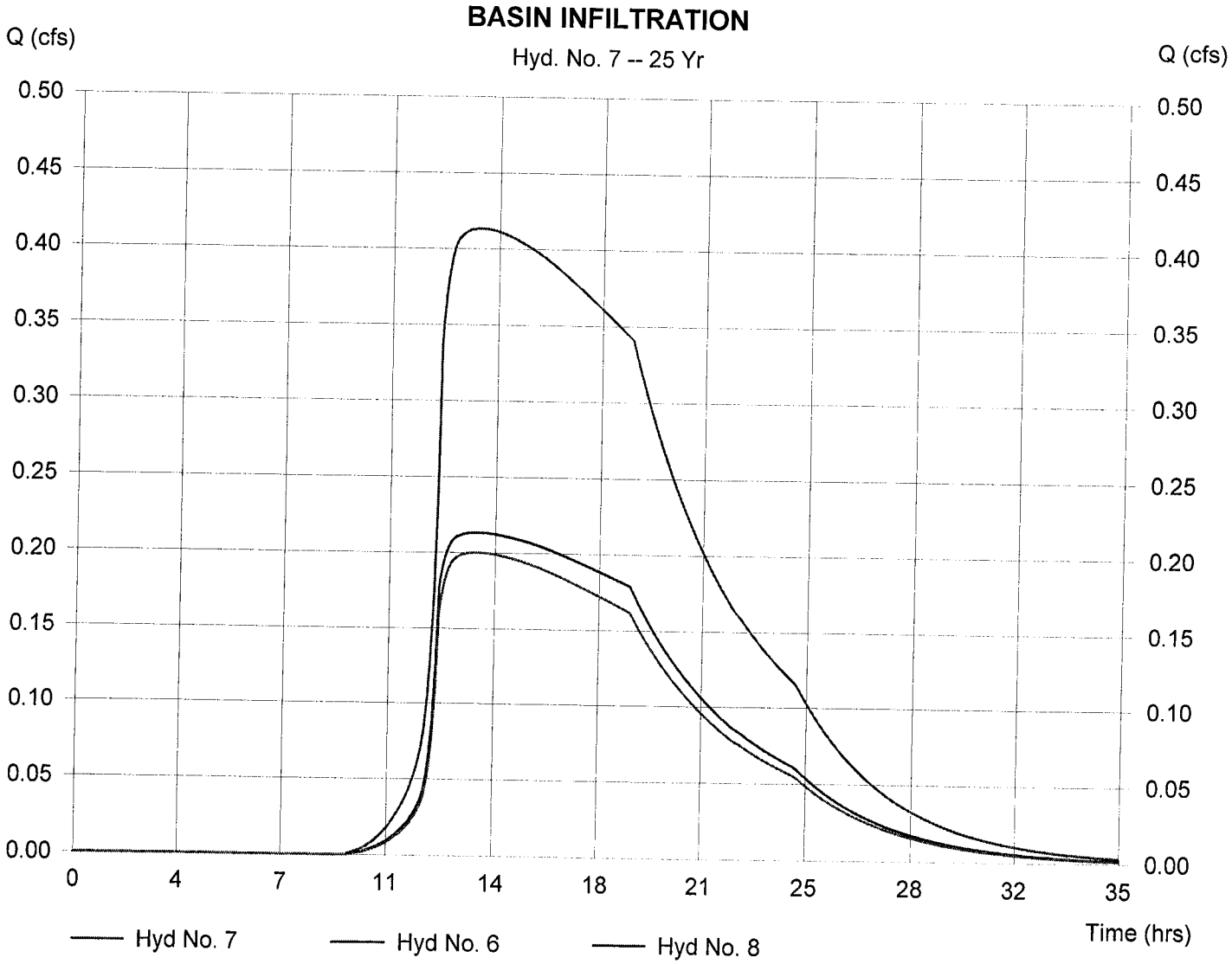
Hyd. No. 7

BASIN INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 25 yrs
Inflow hydrograph = 6
Diversion method = Pond - EX. BASIN

Peak discharge = 0.20 cfs
Time interval = 1 min
2nd diverted hyd. = 8
Pond structure = Exfiltration

Hydrograph Volume = 7,036 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

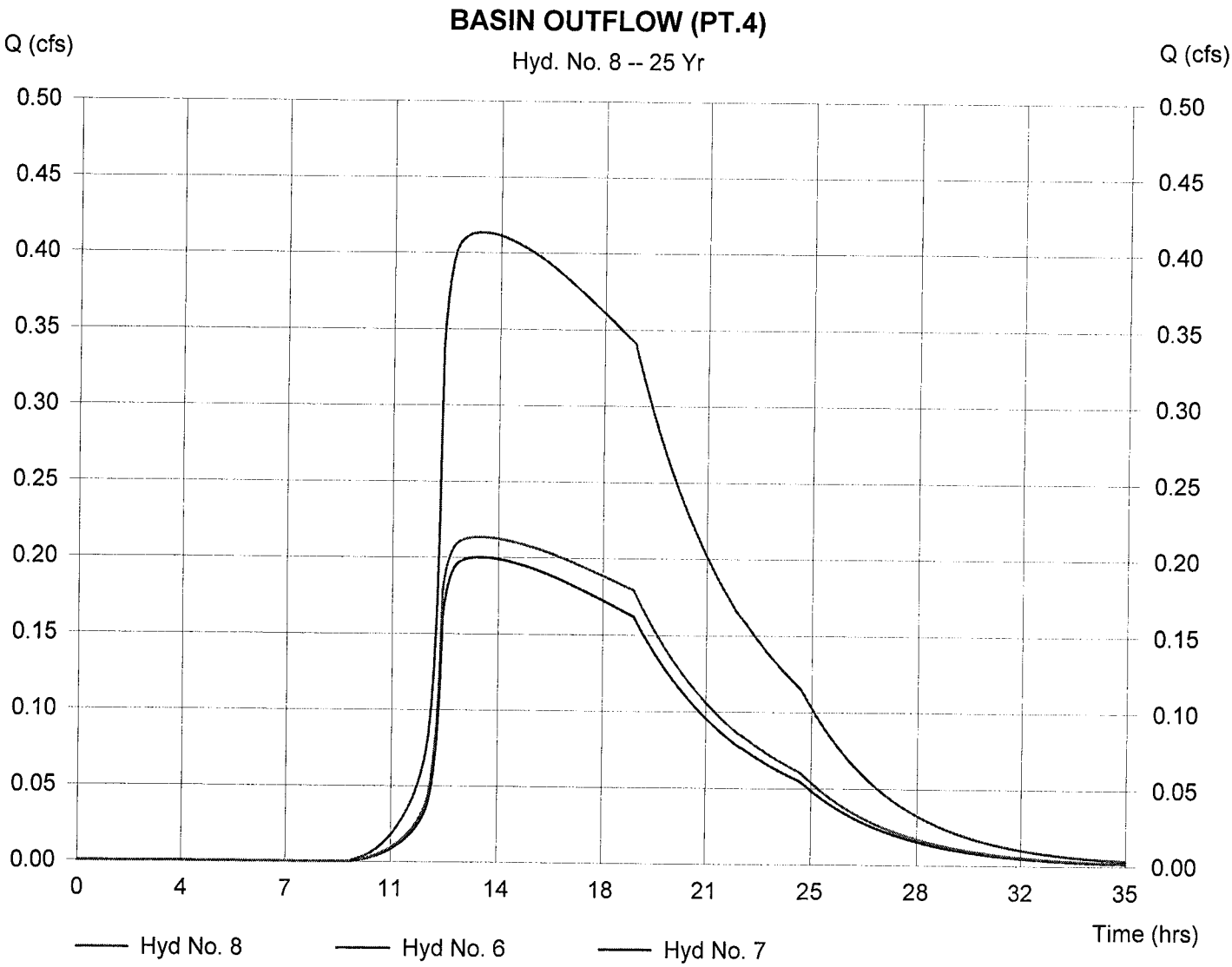
Hyd. No. 8

BASIN OUTFLOW (PT.4)

Hydrograph type = Diversion2
Storm frequency = 25 yrs
Inflow hydrograph = 6
Diversion method = Pond - EX. BASIN

Peak discharge = 0.21 cfs
Time interval = 1 min
2nd diverted hyd. = 7
Pond structure = Exfiltration

Hydrograph Volume = 7,665 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

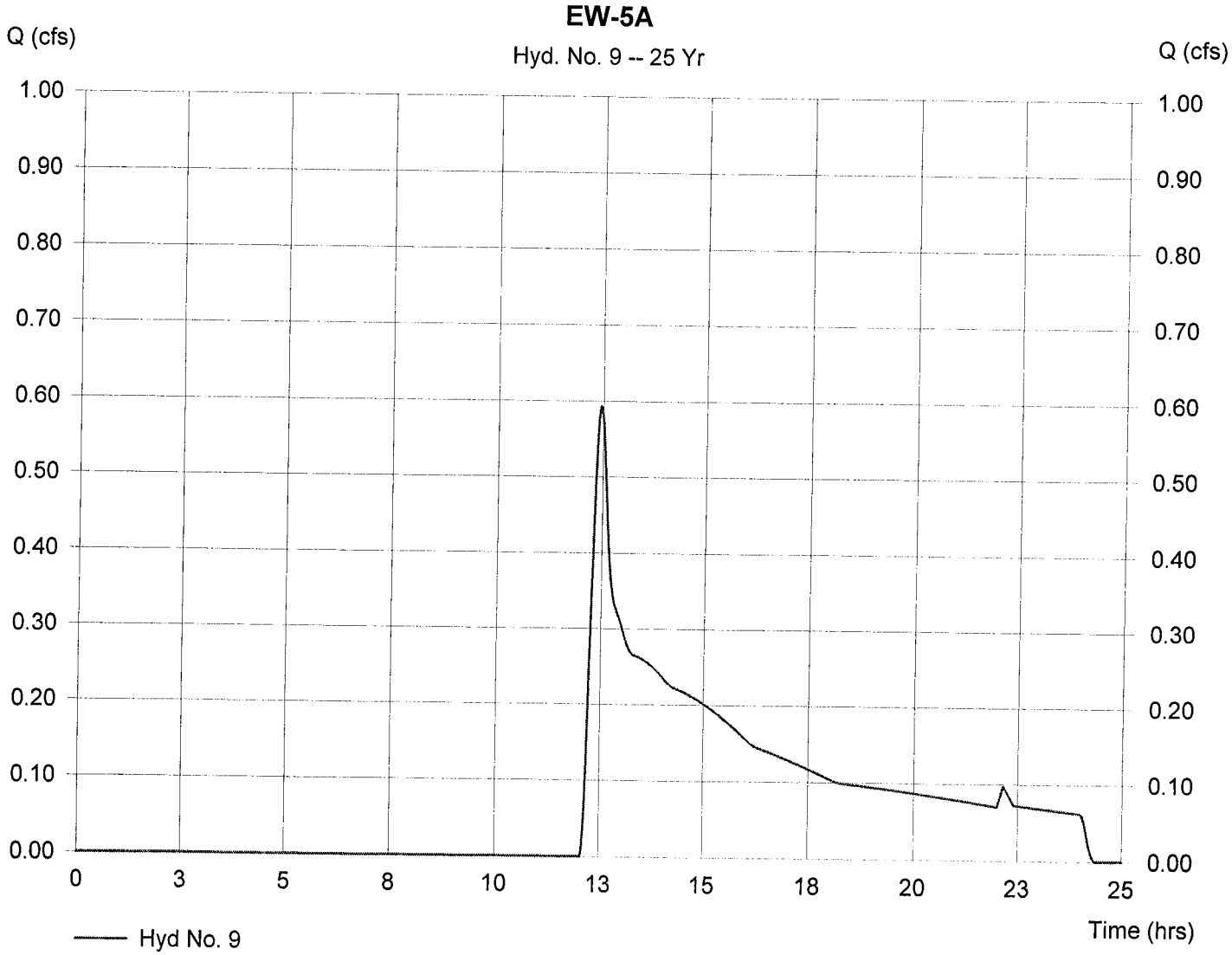
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 9

EW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.59 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 4.990 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.90 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,318 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

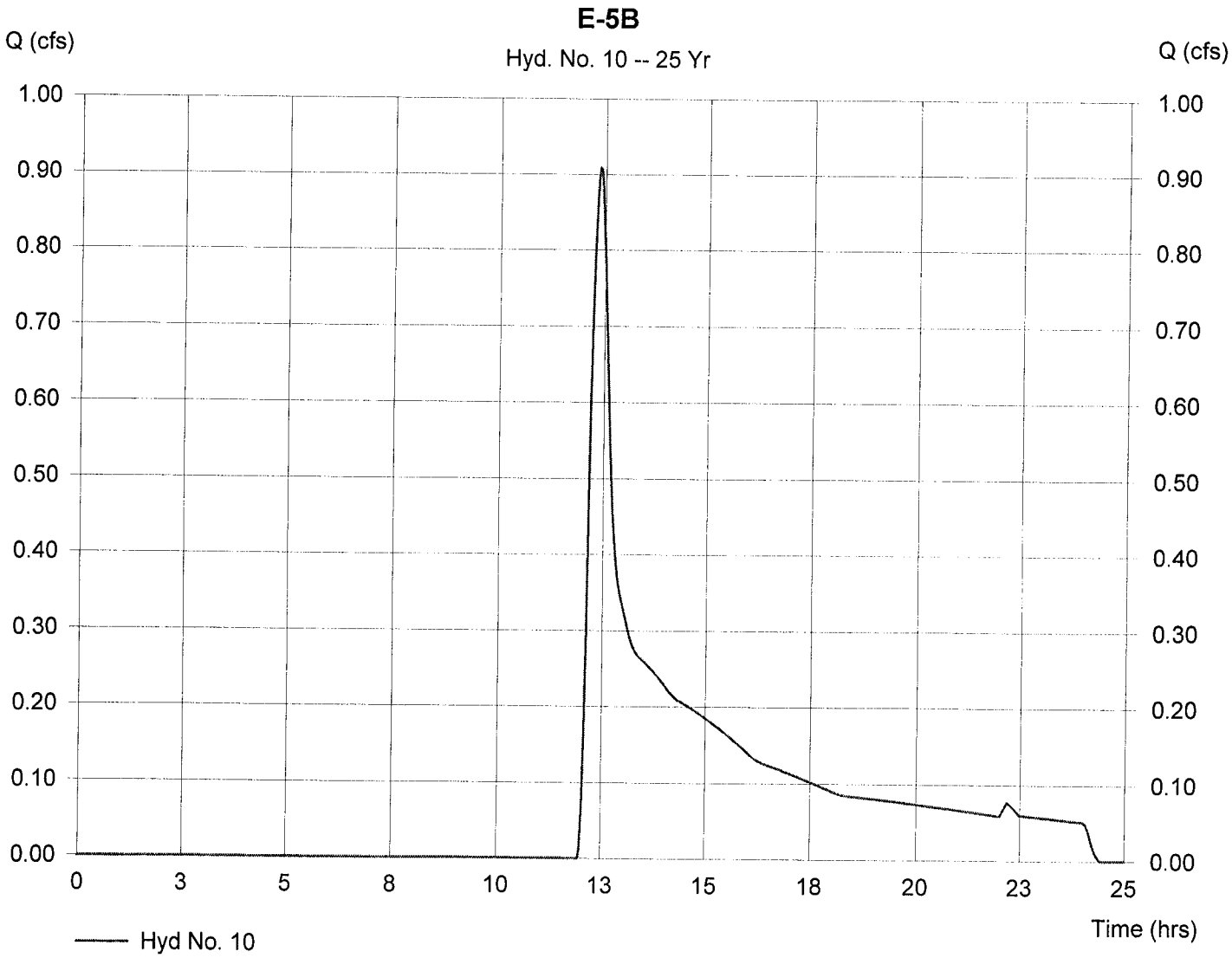
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 10

E-5B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.91 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 3.090 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,578 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

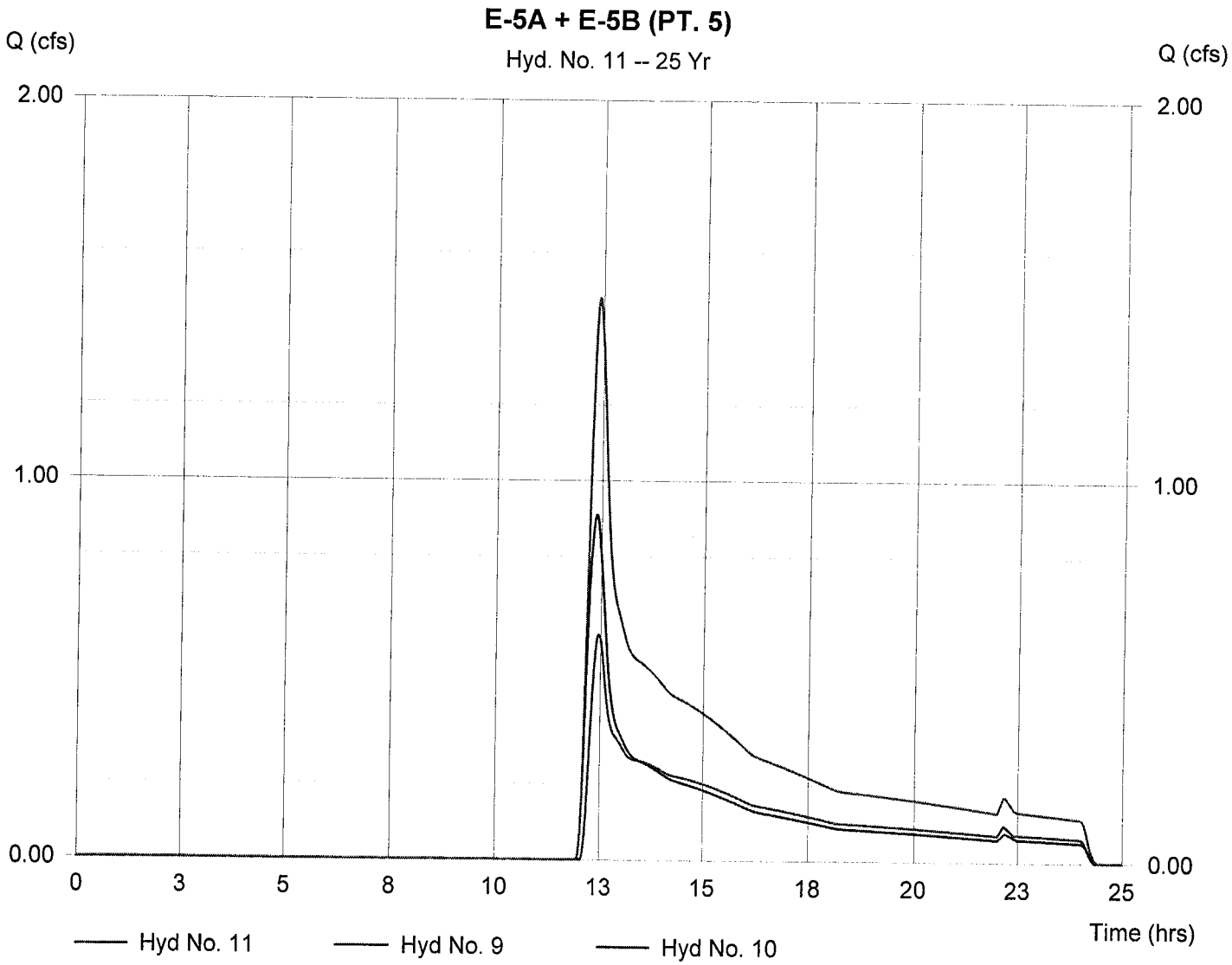
Hyd. No. 11

E-5A + E-5B (PT. 5)

Hydrograph type = Combine
Storm frequency = 25 yrs
Inflow hyds. = 9, 10

Peak discharge = 1.48 cfs
Time interval = 1 min

Hydrograph Volume = 12,896 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

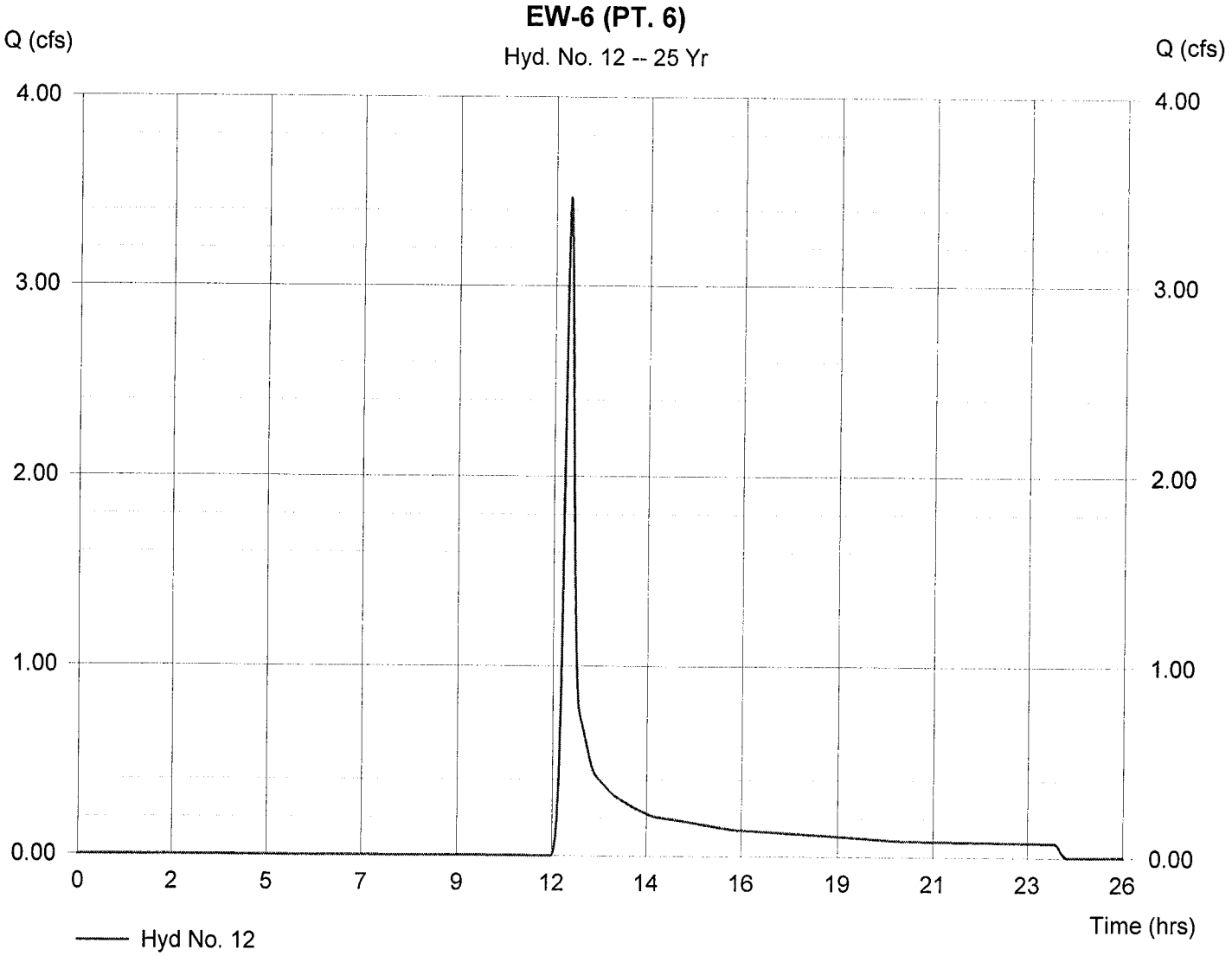
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 12

EW-6 (PT. 6)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.47 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 2.450 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.03 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,920 cuft



Hydrograph Plot

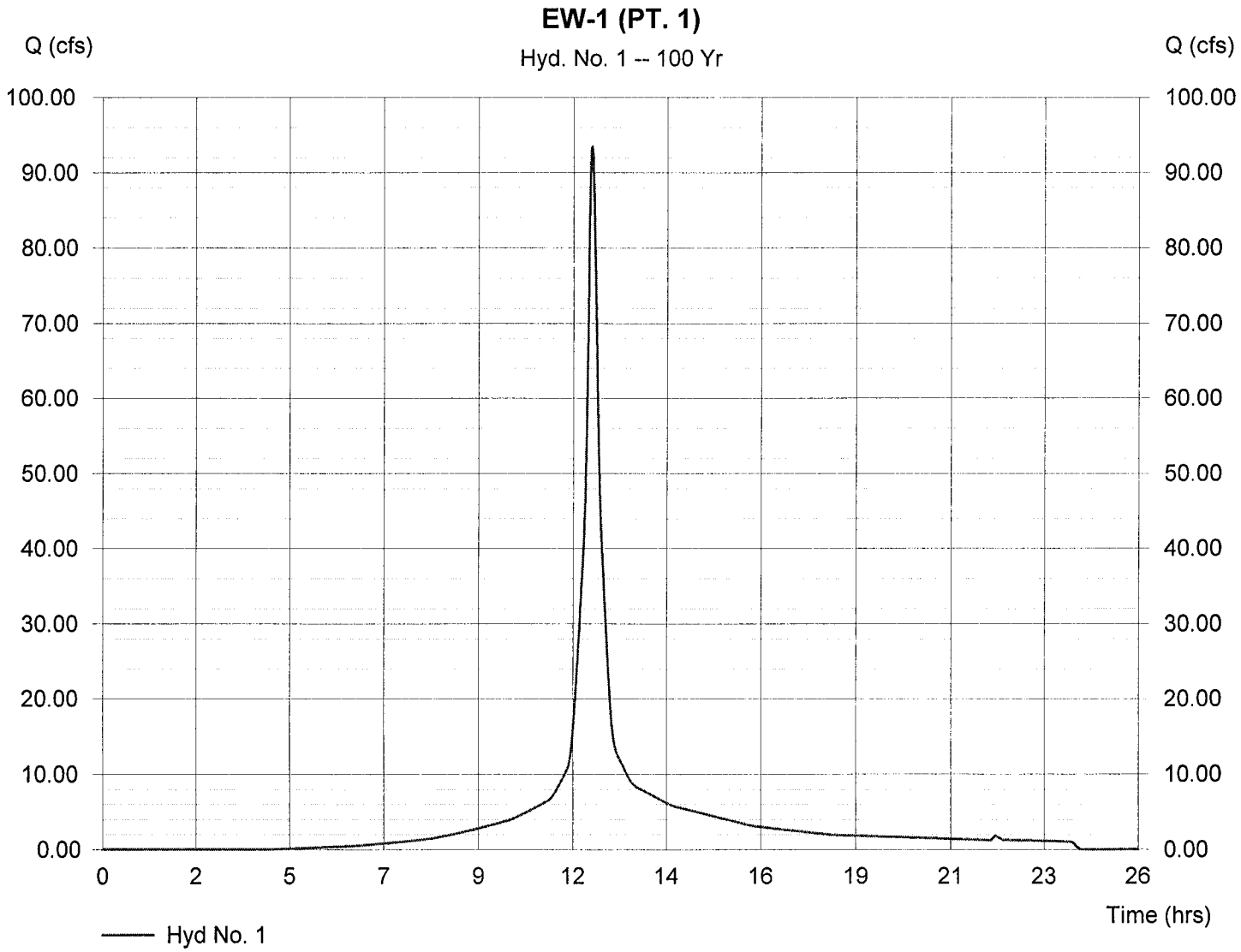
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 1

EW-1 (PT. 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 93.47 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 17.420 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.23 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 352,671 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

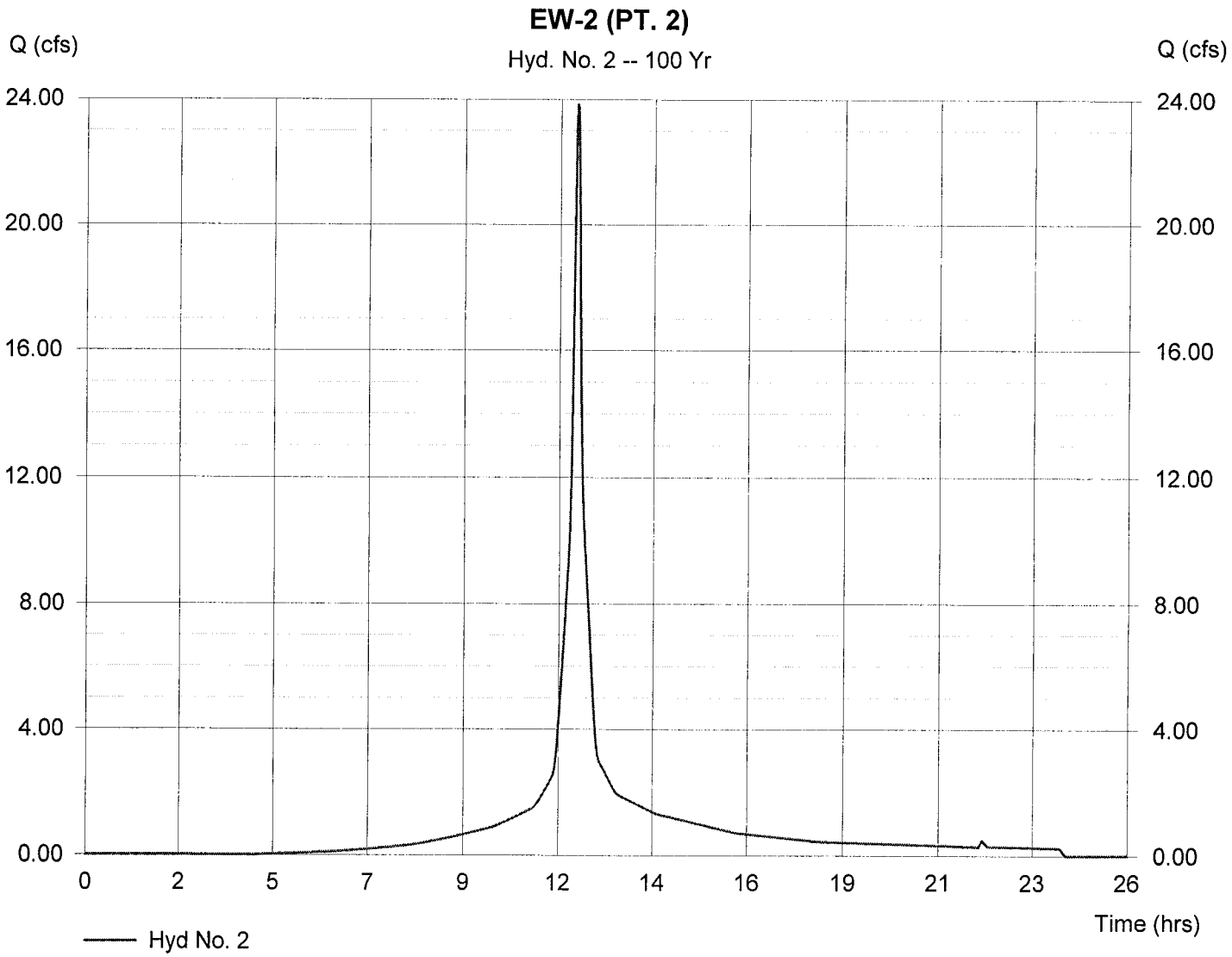
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 2

EW-2 (PT. 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 23.83 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 4.110 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.81 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 79,704 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

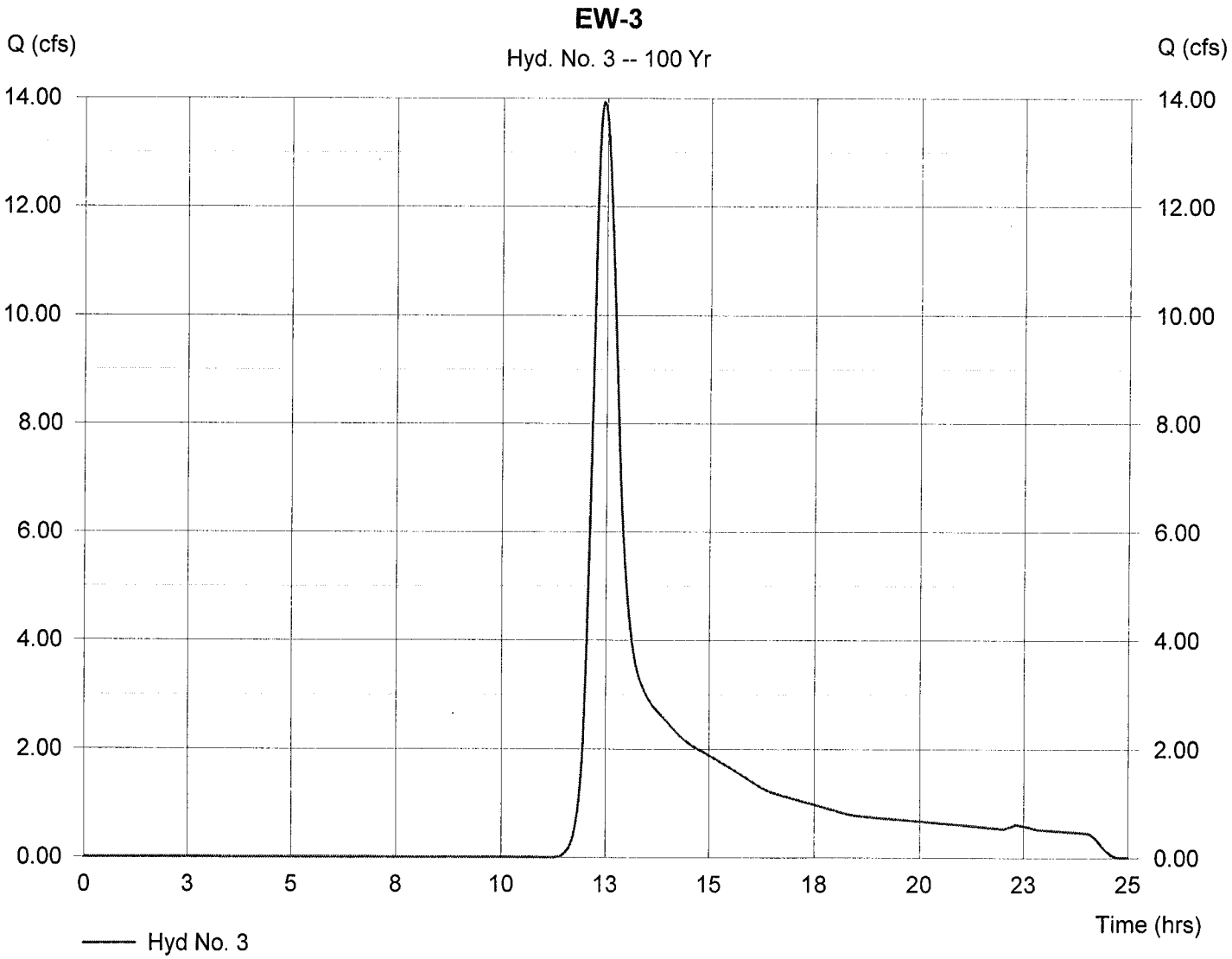
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 3

EW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 13.92 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 12.310 ac	Curve number	= 52
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.60 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 83,057 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

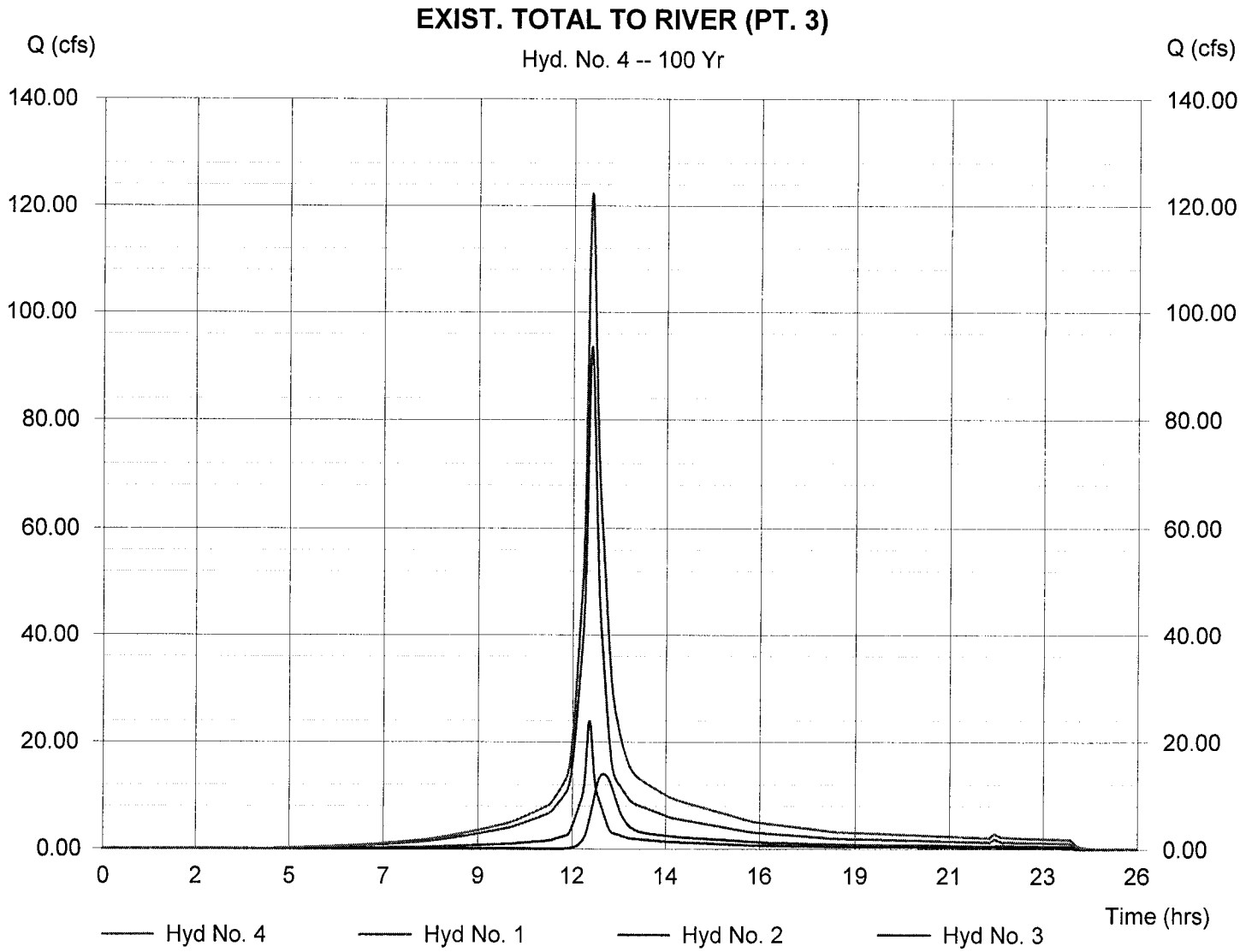
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 4

EXIST. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 122.31 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 1, 2, 3		

Hydrograph Volume = 515,433 cuft



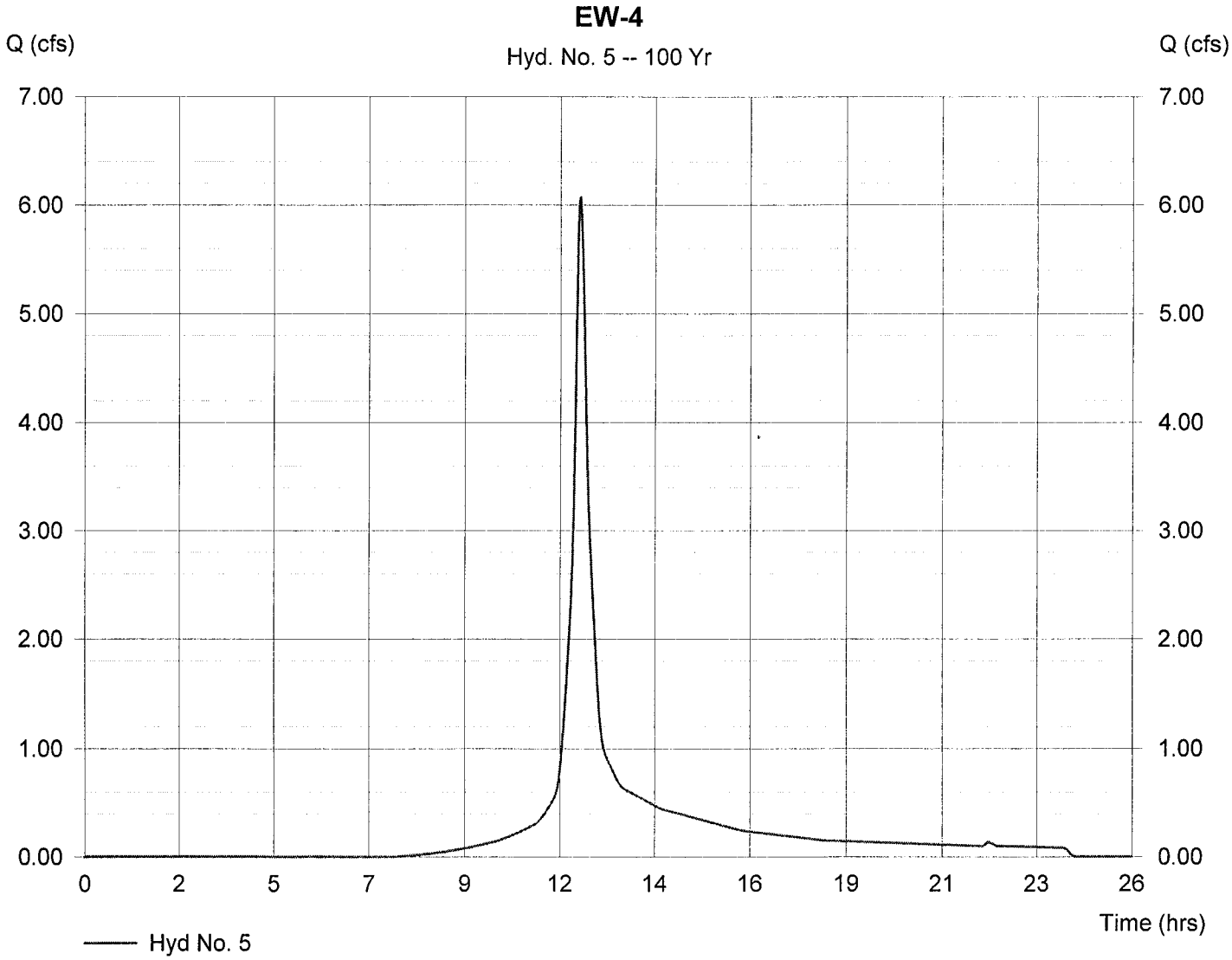
Hydrograph Plot

Hyd. No. 5

EW-4

Hydrograph type	= SCS Runoff	Peak discharge	= 6.07 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 1.580 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 22,821 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

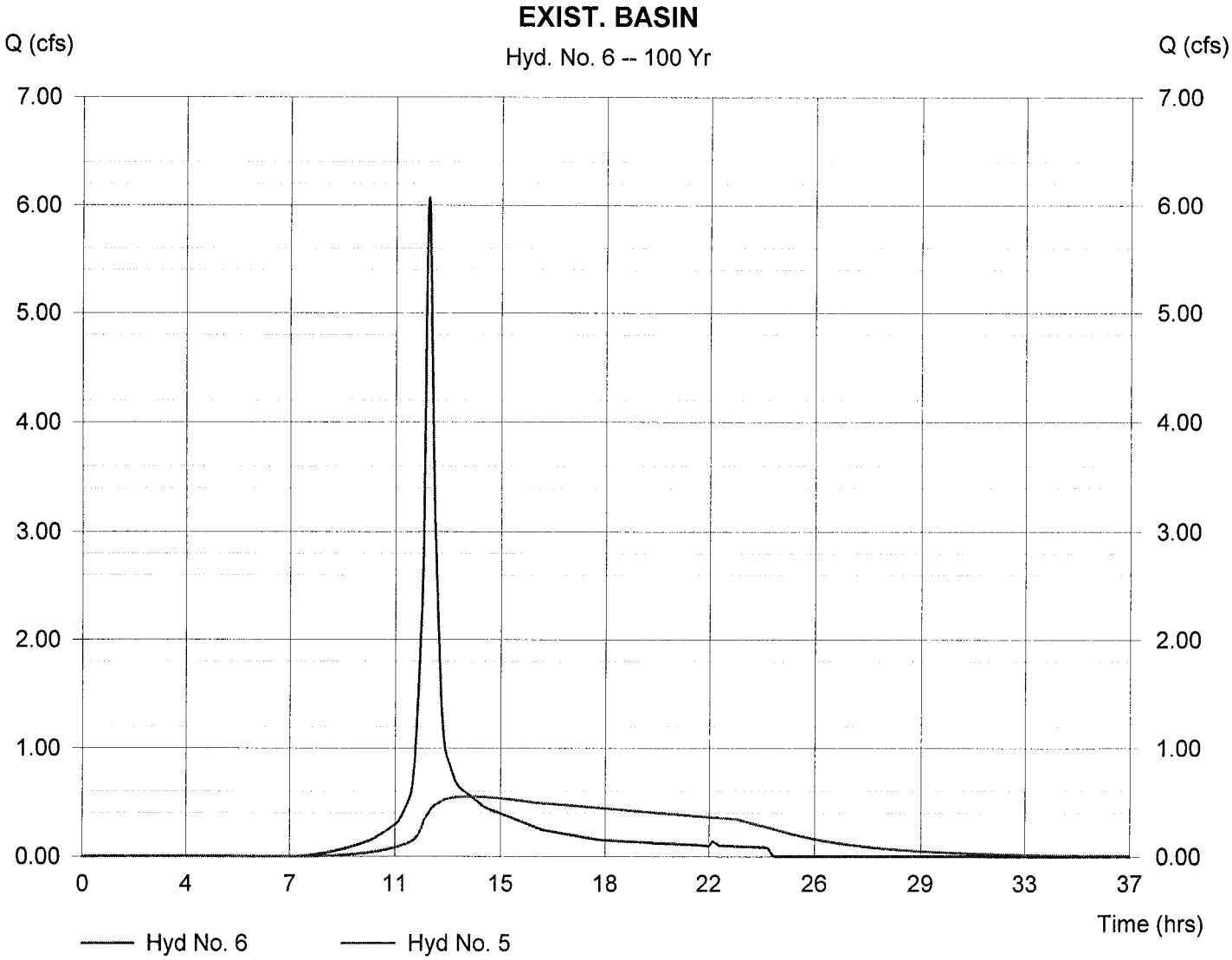
Hyd. No. 6

EXIST. BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.55 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Max. Elevation	= 120.08 ft
Reservoir name	= EX. BASIN	Max. Storage	= 11,767 cuft

Storage Indication method used.

Hydrograph Volume = 22,810 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

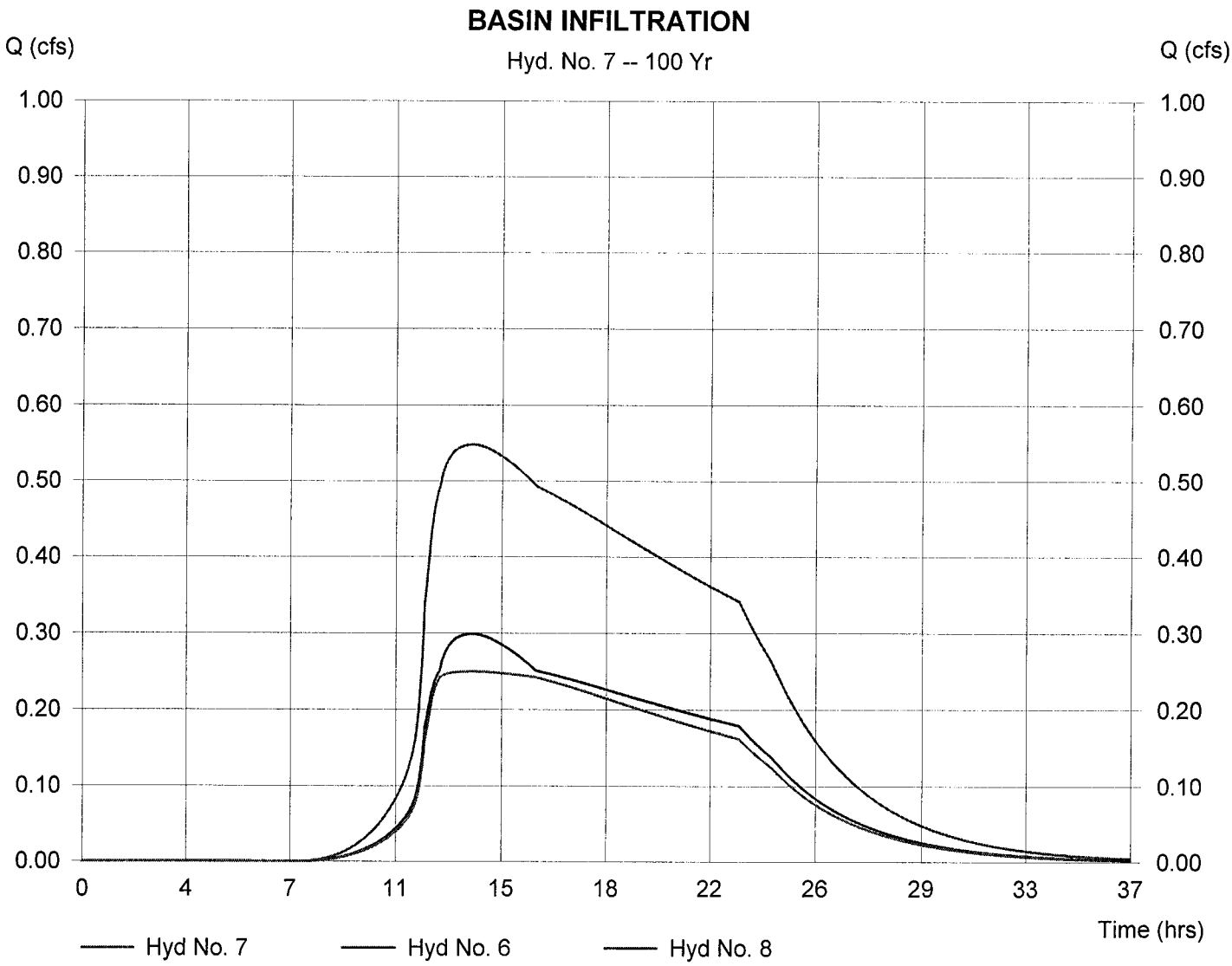
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 7

BASIN INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.25 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 8
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 10,887 cuft



Hydrograph Plot

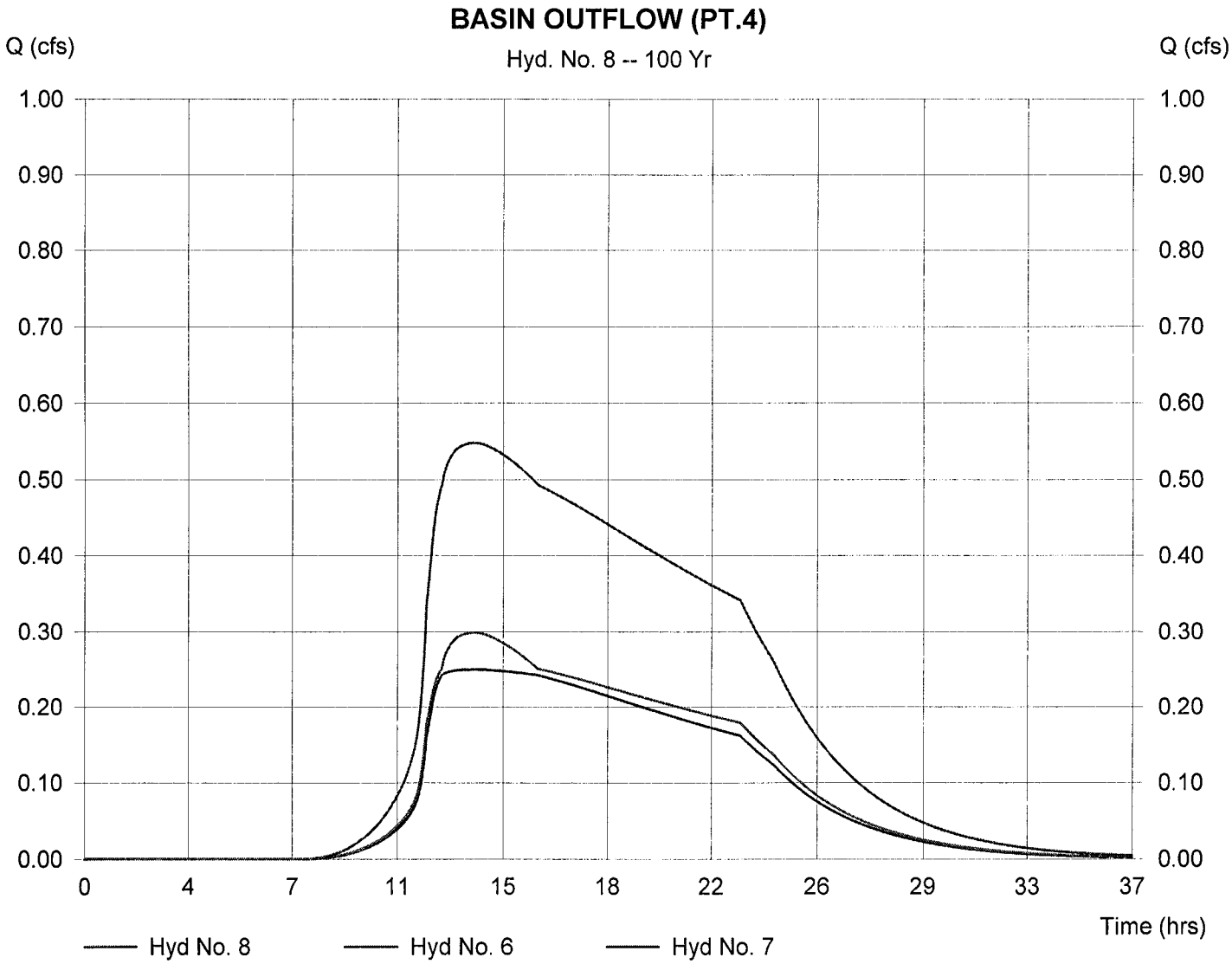
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 8

BASIN OUTFLOW (PT.4)

Hydrograph type	= Diversion2	Peak discharge	= 0.30 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 6	2nd diverted hyd.	= 7
Diversion method	= Pond - EX. BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 11,922 cuft



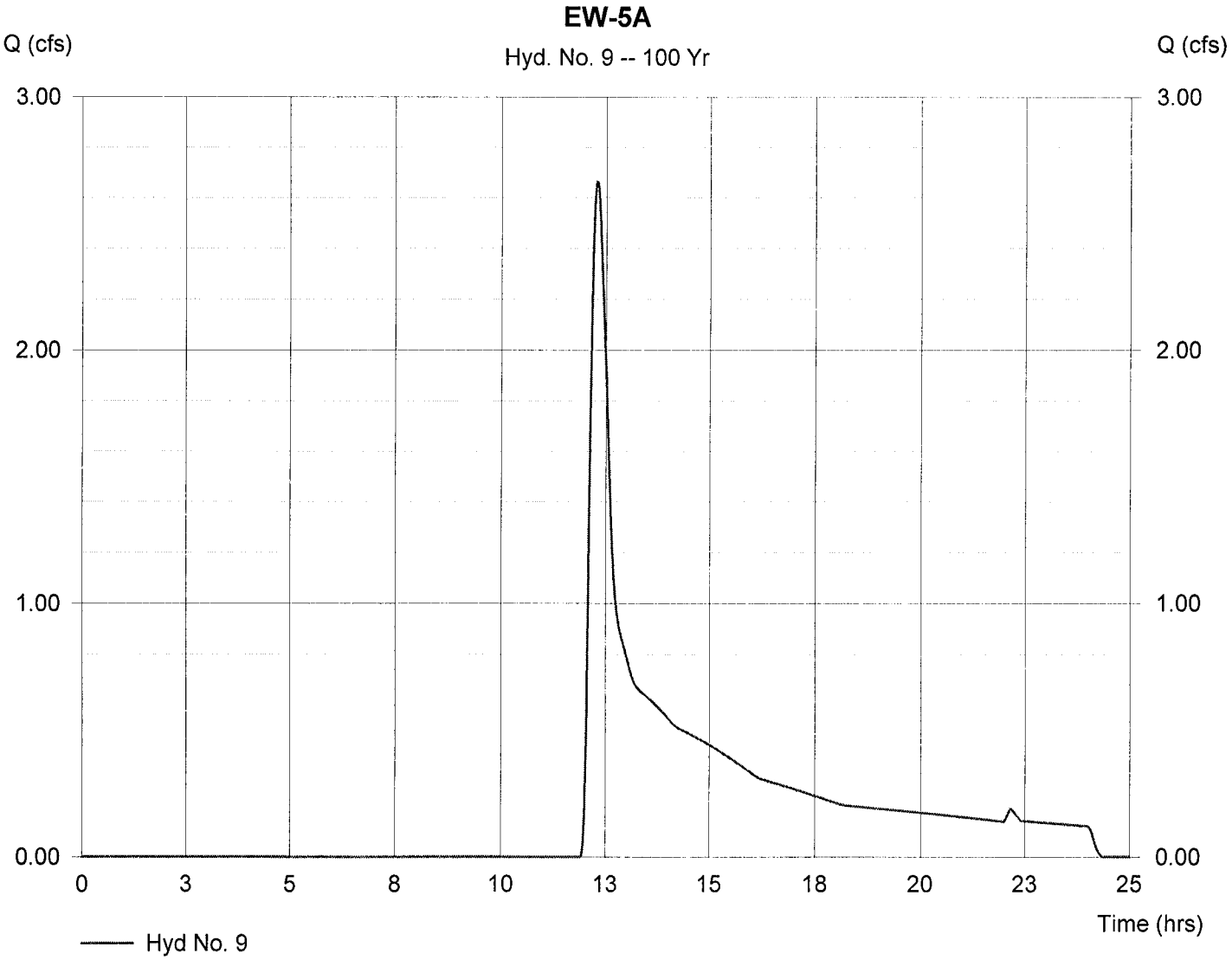
Hydrograph Plot

Hyd. No. 9

EW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.66 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 4.990 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.90 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 16,624 cuft



Hydrograph Plot

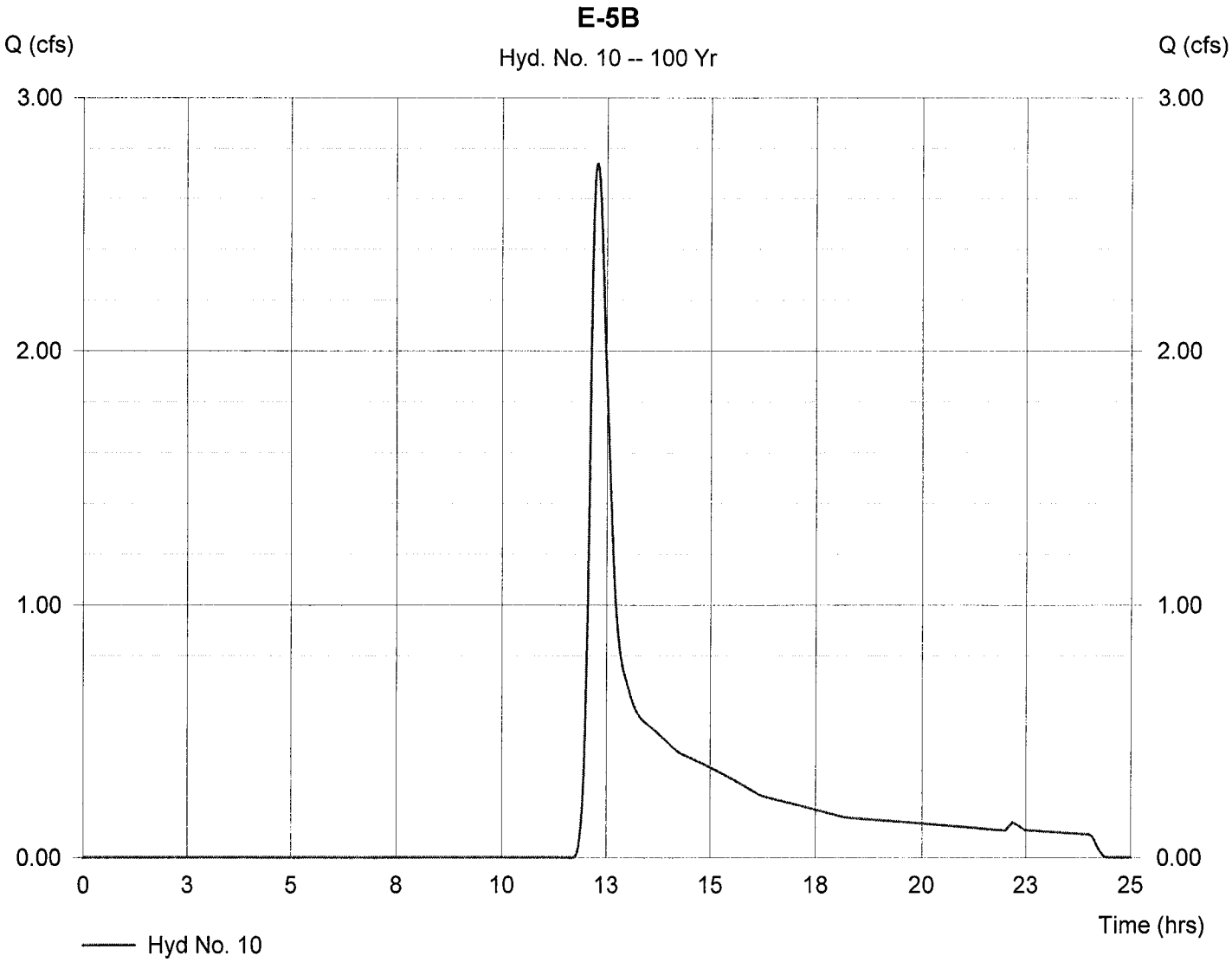
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 10

E-5B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.74 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 3.090 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 14,642 cuft



Hydrograph Plot

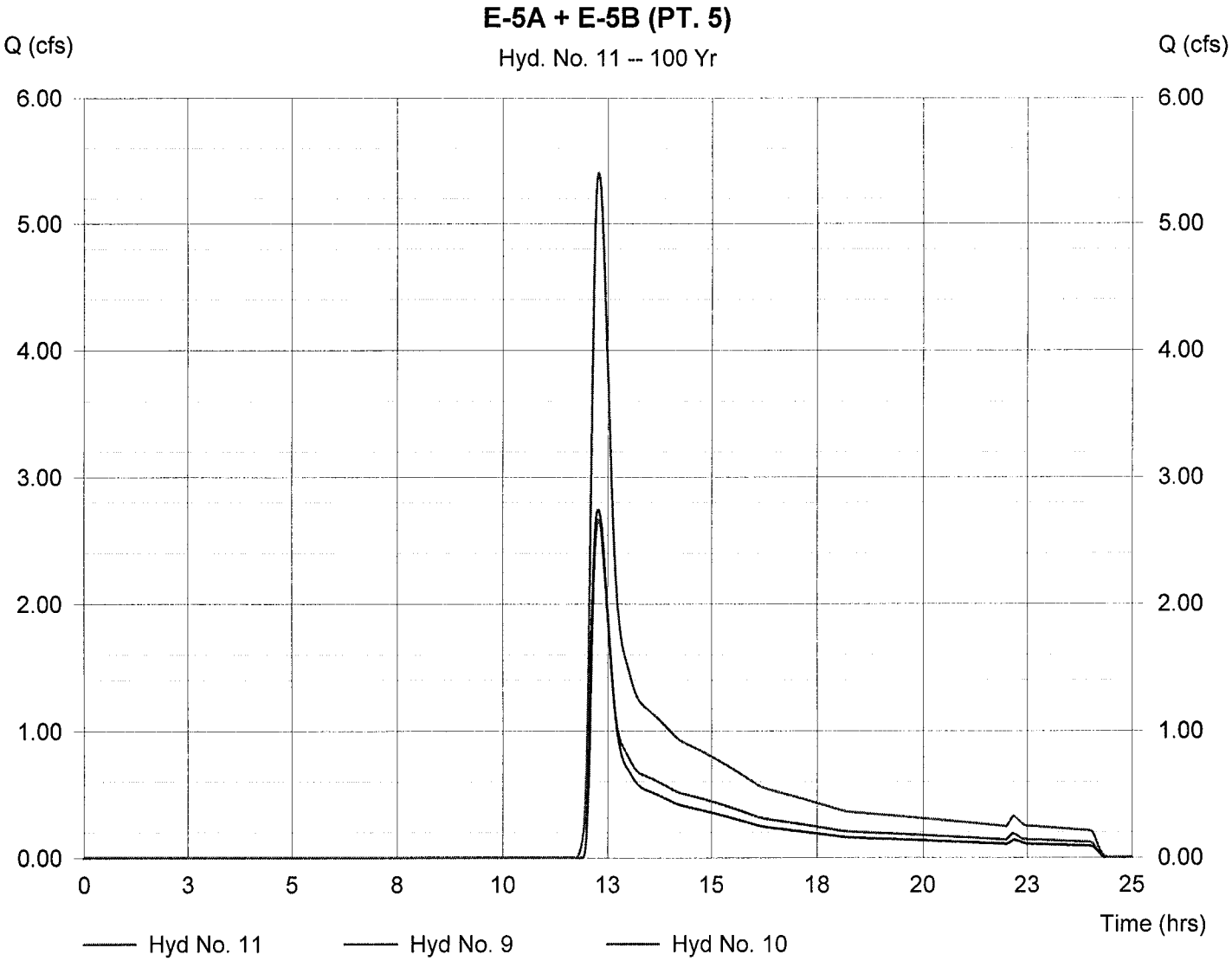
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 11

E-5A + E-5B (PT. 5)

Hydrograph type	= Combine	Peak discharge	= 5.40 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 9, 10		

Hydrograph Volume = 31,266 cuft



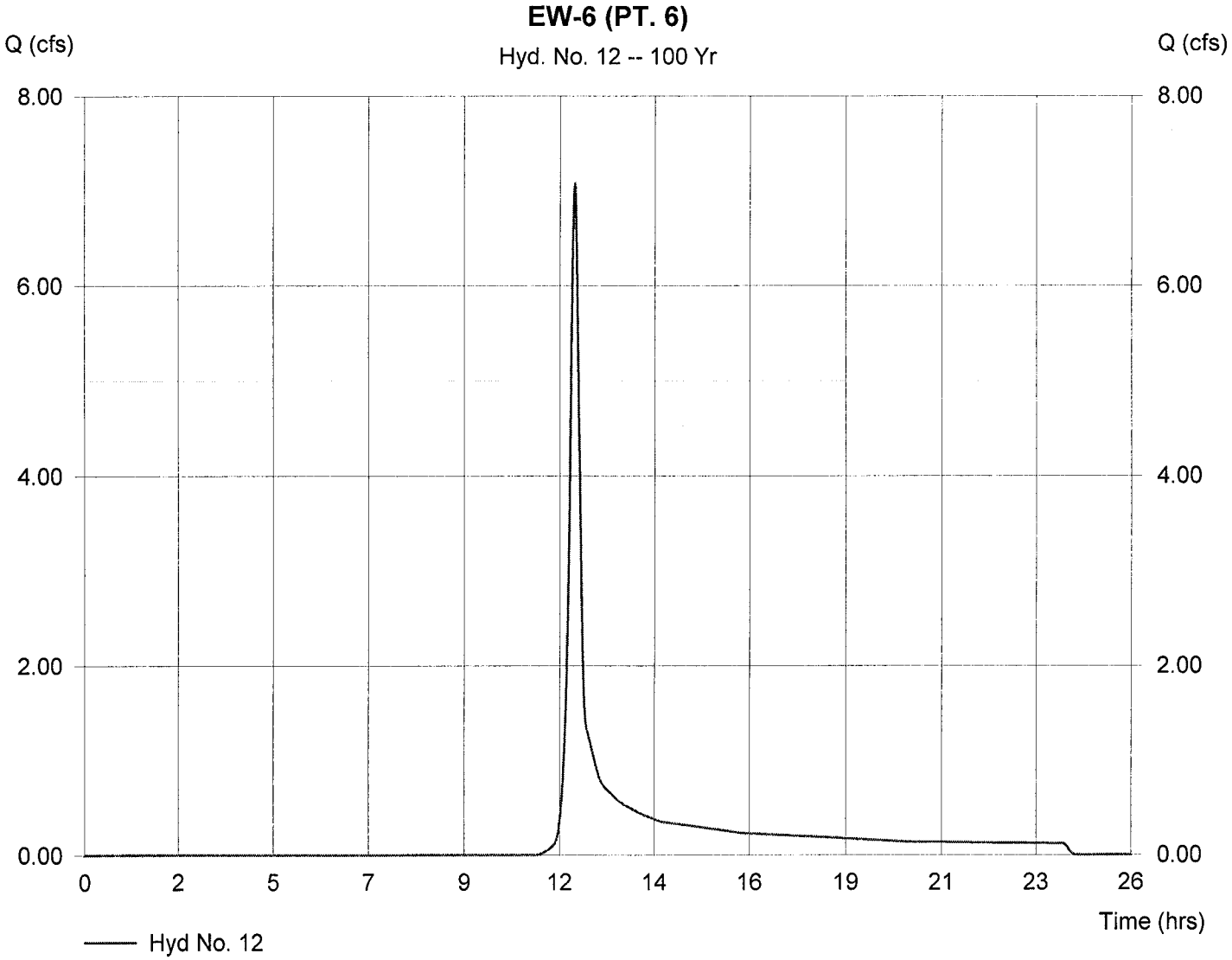
Hydrograph Plot

Hyd. No. 12

EW-6 (PT. 6)

Hydrograph type	= SCS Runoff	Peak discharge	= 7.07 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 2.450 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.03 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 18,593 cuft



APPENDIX B: PROPOSED CONDITIONS HYDROLOGY

Runoff Curve Numbers and Runoff
Time of Concentration
Pond Reports
Hydrograph Plots (2, 10, 25, 100 year storm events)

TR55 Tc Worksheet

Hyd. No. 14

PW-1A

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
Travel Time (min)	**= 16.53**	**+ 0.00**	**+ 0.00**	**= 16.53**
Shallow Concentrated Flow				
Flow length (ft)	= 70.00	0.00	0.00	
Watercourse slope (%)	= 1.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	0.00	0.00	
Travel Time (min)	**= 0.72**	**+ 0.00**	**+ 0.00**	**= 0.72**
Channel Flow				
X sectional flow area (sqft)	= 1.77	0.00	0.00	
Wetted perimeter (ft)	= 2.36	0.00	0.00	
Channel slope (%)	= 0.50	0.00	0.00	
Manning's n-value	= 0.012	0.015	0.015	
Velocity (ft/s)	= 7.24	0.00	0.00	
Flow length (ft)	= 540.0	0.0	0.0	
Travel Time (min)	**= 1.24**	**+ 0.00**	**+ 0.00**	**= 1.24**

Total Travel Time, Tc ..... 18.50 min

TR55 Tc Worksheet

Hyd. No. 23

PW-2

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 0.25	0.00	0.00	
Travel Time (min)	**= 28.79**	**+ 0.00**	**+ 0.00**	**= 28.79**
Shallow Concentrated Flow				
Flow length (ft)	= 400.00	0.00	0.00	
Watercourse slope (%)	= 0.25	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 0.81	0.00	0.00	
Travel Time (min)	**= 8.26**	**+ 0.00**	**+ 0.00**	**= 8.26**
Channel Flow				
X sectional flow area (sqft)	= 1.76	0.00	0.00	
Wetted perimeter (ft)	= 2.35	0.00	0.00	
Channel slope (%)	= 0.50	0.00	0.00	
Manning's n-value	= 0.012	0.015	0.015	
Velocity (ft/s)	= 7.23	0.00	0.00	
Flow length (ft)	= 205.0	0.0	0.0	
Travel Time (min)	**= 0.47**	**+ 0.00**	**+ 0.00**	**= 0.47**

Total Travel Time, Tc ..... 37.52 min

TR55 Tc Worksheet

Hyd. No. 27

PW-3

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	**= 12.53**	**+ 0.00**	**+ 0.00**	**= 12.53**
Shallow Concentrated Flow				
Flow length (ft)	= 430.00	0.00	0.00	
Watercourse slope (%)	= 0.50	0.00	0.00	
Surface description	= Unpaved	Unpaved	Unpaved	
Average velocity (ft/s)	= 1.14	0.00	0.00	
Travel Time (min)	**= 6.28**	**+ 0.00**	**+ 0.00**	**= 6.28**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 18.81 min

TR55 Tc Worksheet

Hyd. No. 28

PW-5A

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.200	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 0.50	0.00	0.00	
Travel Time (min)	**= 21.82 +**	**0.00 +**	**0.00 =**	**21.82**
Shallow Concentrated Flow				
Flow length (ft)	= 360.00	0.00	0.00	
Watercourse slope (%)	= 0.50	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.14	0.00	0.00	
Travel Time (min)	**= 5.26 +**	**0.00 +**	**0.00 =**	**5.26**
Channel Flow				
X sectional flow area (sqft)	= 1.76	0.00	0.00	
Wetted perimeter (ft)	= 2.36	0.00	0.00	
Channel slope (%)	= 0.50	0.00	0.00	
Manning's n-value	= 0.012	0.015	0.015	
Velocity (ft/s)	= 7.21	0.00	0.00	
Flow length (ft)	= 80.0	0.0	0.0	
Travel Time (min)	**= 0.18 +**	**0.00 +**	**0.00 =**	**0.18**

Total Travel Time, Tc ..... 27.26 min

TR55 Tc Worksheet

Hyd. No. 33

PW-5B (PT. 5)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.200		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 14.06**	**+**	**0.00**	**+**	**0.00**	**=**	**14.06**
Shallow Concentrated Flow							
Flow length (ft)	= 370.00		0.00		0.00		
Watercourse slope (%)	= 0.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.02		0.00		0.00		
Travel Time (min)	**= 6.04**	**+**	**0.00**	**+**	**0.00**	**=**	**6.04**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 20.10 min

TR55 Tc Worksheet

Hyd. No. 34

PW-6A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.200		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 21.82**	**+**	**0.00**	**+**	**0.00**	**=**	**21.82**
Shallow Concentrated Flow							
Flow length (ft)	= 200.00		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.14		0.00		0.00		
Travel Time (min)	**= 2.92**	**+**	**0.00**	**+**	**0.00**	**=**	**2.92**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 24.74 min

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 1 (PW-1)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			5.23	203.97
A	Impervious (pavement, roof)	98			14.90	1460.20
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**20.13**	**1664.17**

CN (weighted) = total product / total area **82.6711** Use CN= **83**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	1.69	2.90	4.93	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 1 (PW-1)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.68	26.52
A	Impervious (pavement, roof)	98			1.07	104.86
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**1.75**	**131.38**

CN (weighted) = total product / total area **75.0743** Use CN= **75**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	1.16	2.21	4.06	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 2 (PW-2)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.94	36.66
A	Impervious (pavement, roof)	98			0.37	36.26
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**1.31**	**72.92**

CN (weighted) = total product / total area **55.6641** Use CN= **56**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.31	0.89	2.15	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** **PROPOSED WATERSHED 3 (PW-3)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			6.02	234.78
A	Wetland	83			0.63	52.29
A	Impervious (pavement, roof)	98			0.67	65.66
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**7.32**	**352.73**

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ **48.1872** Use CN= **48**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.11	0.48	1.44	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 5A (PW-5A)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			4.69	182.91
A	Impervious (pavement, roof)	98			5.41	530.18
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**10.1**	**713.09**

CN (weighted) = total product / total area **70.6030** Use CN= **71**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.94	1.89	3.64	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 5B (PW-5B)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.03	1.17
A	Impervious (pavement, roof)	98			0.33	32.34
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**0.36**	**33.51**

CN (weighted) = total product / total area **93.0833** Use CN= **93**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	2.54	3.90	6.07	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 6A (PW-6A)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.30	11.70
A	Impervious (pavement, roof)	98			0.52	50.96
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**0.82**	**62.66**

CN (weighted) = total product / total area **76.4146** Use CN= **76**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	1.22	2.29	4.17	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project: **Wayland Town Center** By: **RBM** Date **10/05/07**

Location: **Wayland, MA** Checked: Date

Check One: **Present** Developed **PROPOSED WATERSHED 6B (PW-6B)**

1. Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic conditions percent impervious unconnected/connected impervious area ratio)	CN Table 2-2	CN Figure 2-3	CN Figure 2-4	Area X acres / mi² / %	Product of CN x Area
A	Grass - good	39			0.60	23.40
A	Impervious (pavement, roof)	98			0.00	0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
Use only one CN source per line.				Totals =	**0.6**	**23.4**

CN (weighted) = total product / total area **39.0000** Use CN= **39**

2. Runoff

		Storm #1	Storm #2	Storm #3	
Frequency	yr.	2	10	100	
Rainfall, P (24 hour)	in.	3.30	4.70	6.90	
Runoff, Q	in.	0.00	0.14	0.73	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:24 PM

Pond No. 8 - UPGRADED BASIN

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	118.00	1,828	0	0
1.00	119.00	5,668	3,748	3,748
2.00	120.00	8,193	6,931	10,679
3.00	121.00	20,000	14,097	24,775

Culvert / Orifice Structures

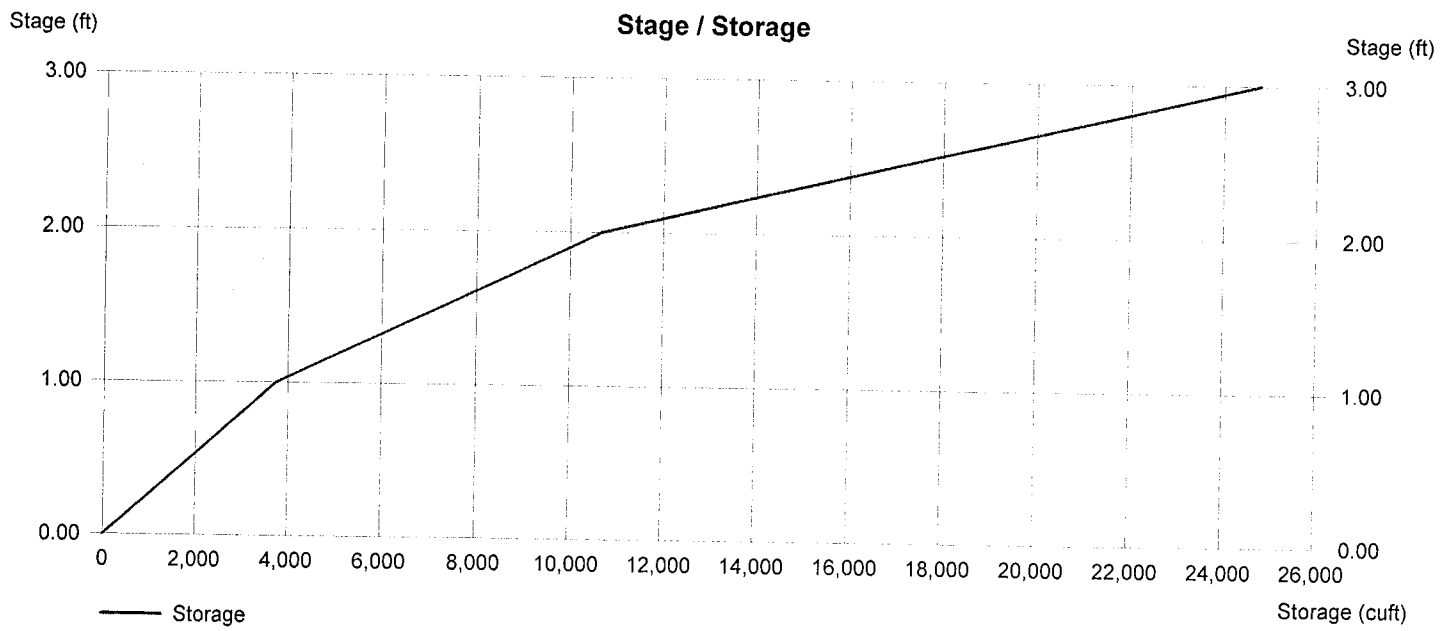
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 119.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.20	0.00	0.00	0.00
N-Value	= .012	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 130.00	0.00	0.00	0.00
Crest El. (ft)	= 120.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve — Wednesday, Sep 26 2007, 4:21 PM

Pond No. 1 - BASIN 2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	116.00	1,690	0	0
1.00	117.00	2,915	2,303	2,303
2.00	118.00	4,360	3,638	5,940
3.00	119.00	6,043	5,202	11,142
4.00	120.00	7,985	7,014	18,156
5.00	121.00	11,696	9,841	27,996
6.00	122.00	15,017	13,357	41,353
7.00	123.00	17,997	16,507	57,860
8.00	124.00	19,572	18,785	76,644

Culvert / Orifice Structures

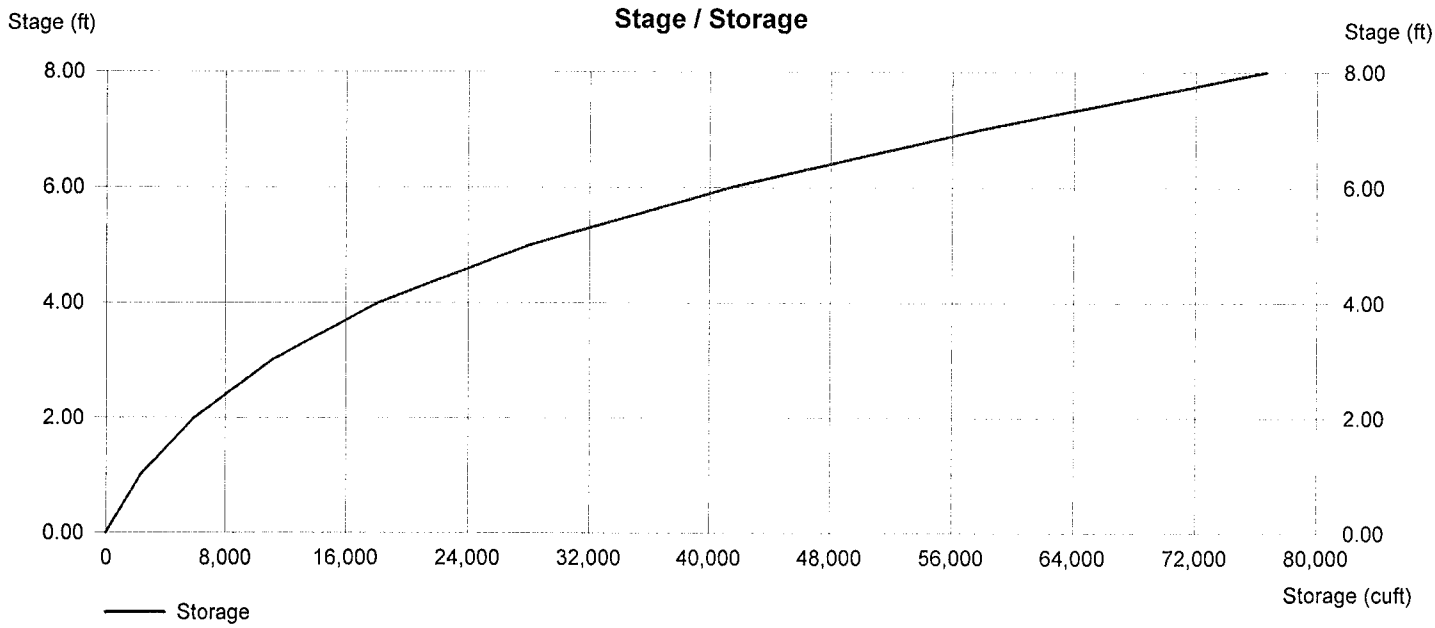
	[A]	[B]	[C]	[D]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 118.50	0.00	0.00	0.00
Length (ft)	= 45.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .012	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 122.80	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:21 PM

Pond No. 2 - BASIN 3A

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	126.00	2,172	0	0
1.00	127.00	3,880	3,026	3,026
2.00	128.00	5,778	4,829	7,855
3.00	129.00	7,901	6,840	14,695
4.00	130.00	10,251	9,076	23,771
5.00	131.00	11,511	10,881	34,652

Culvert / Orifice Structures

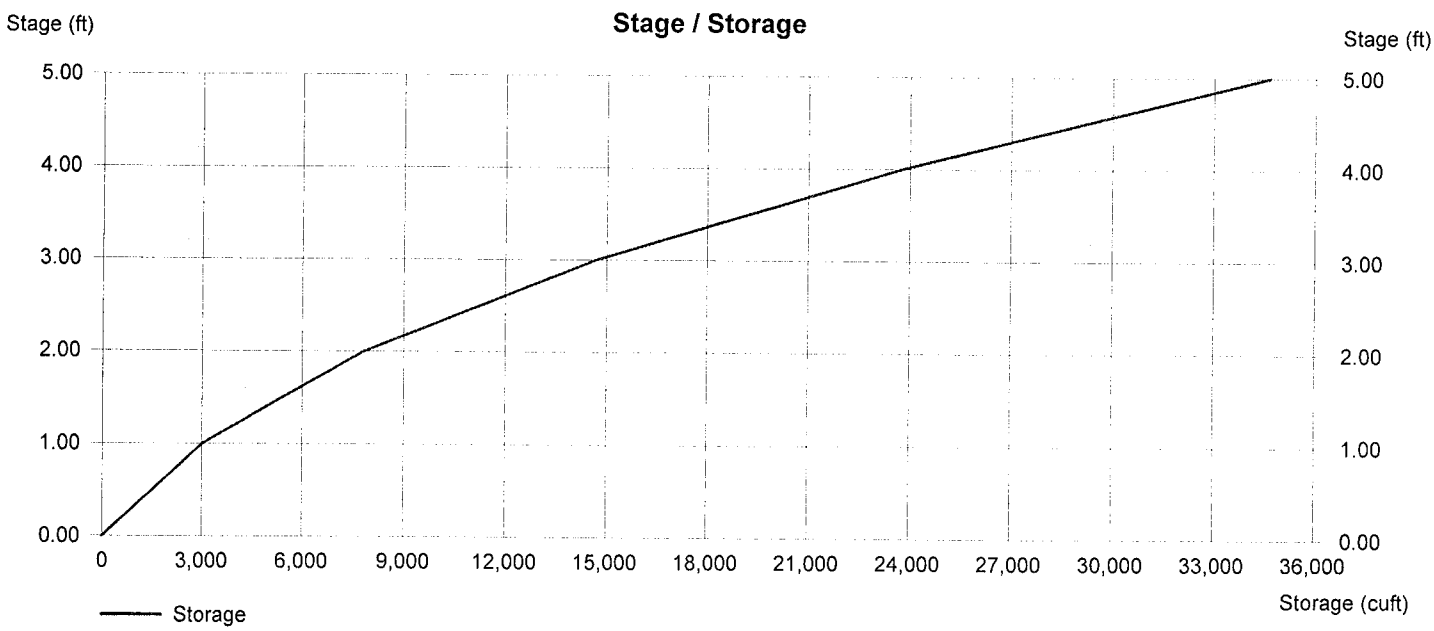
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 128.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .012	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:22 PM

Pond No. 3 - BASIN 3B

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	127.00	717	0	0
1.00	128.00	5,155	2,936	2,936
2.00	129.00	10,129	7,642	10,578
3.00	130.00	15,325	12,727	23,305
4.00	131.00	18,007	16,666	39,971

Culvert / Orifice Structures

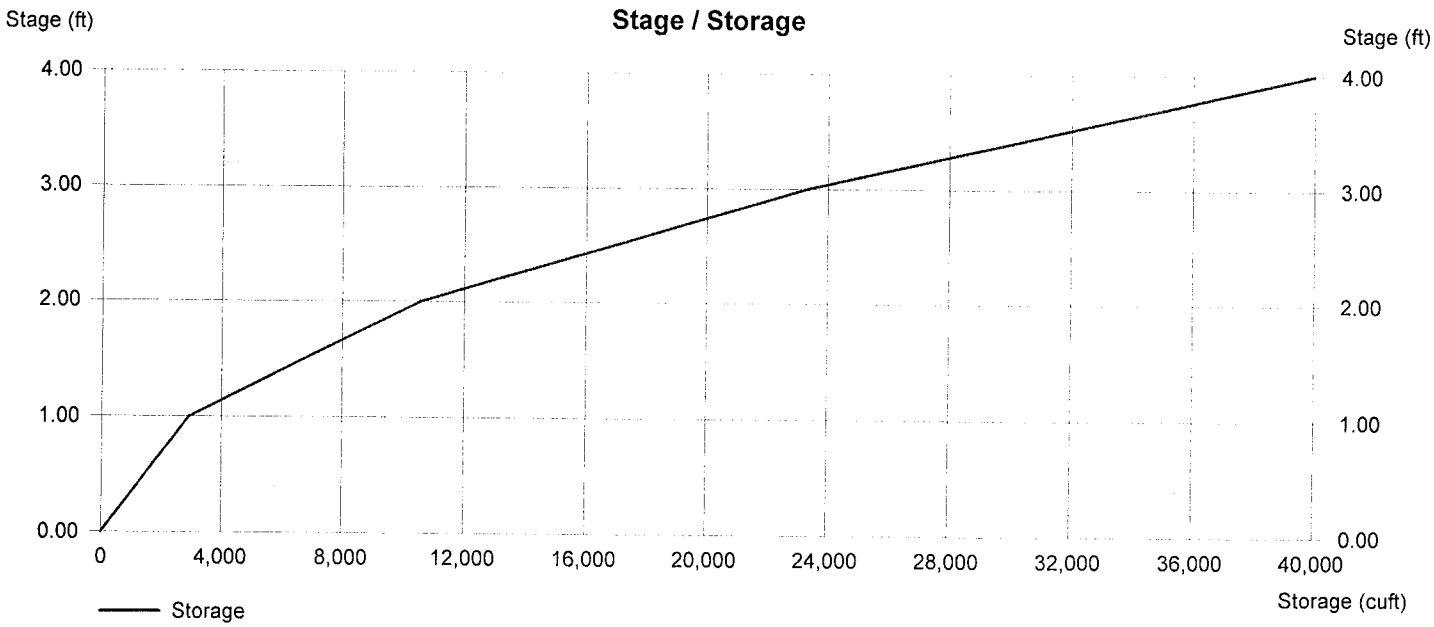
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 128.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:25 PM

Pond No. 9 - BASIN 3

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	126.00	2,172	0	0
1.00	127.00	4,597	3,385	3,385
2.00	128.00	10,933	7,765	11,150
3.00	129.00	18,030	14,482	25,631
4.00	130.00	25,576	21,803	47,434
5.00	131.00	29,518	27,547	74,981

Culvert / Orifice Structures

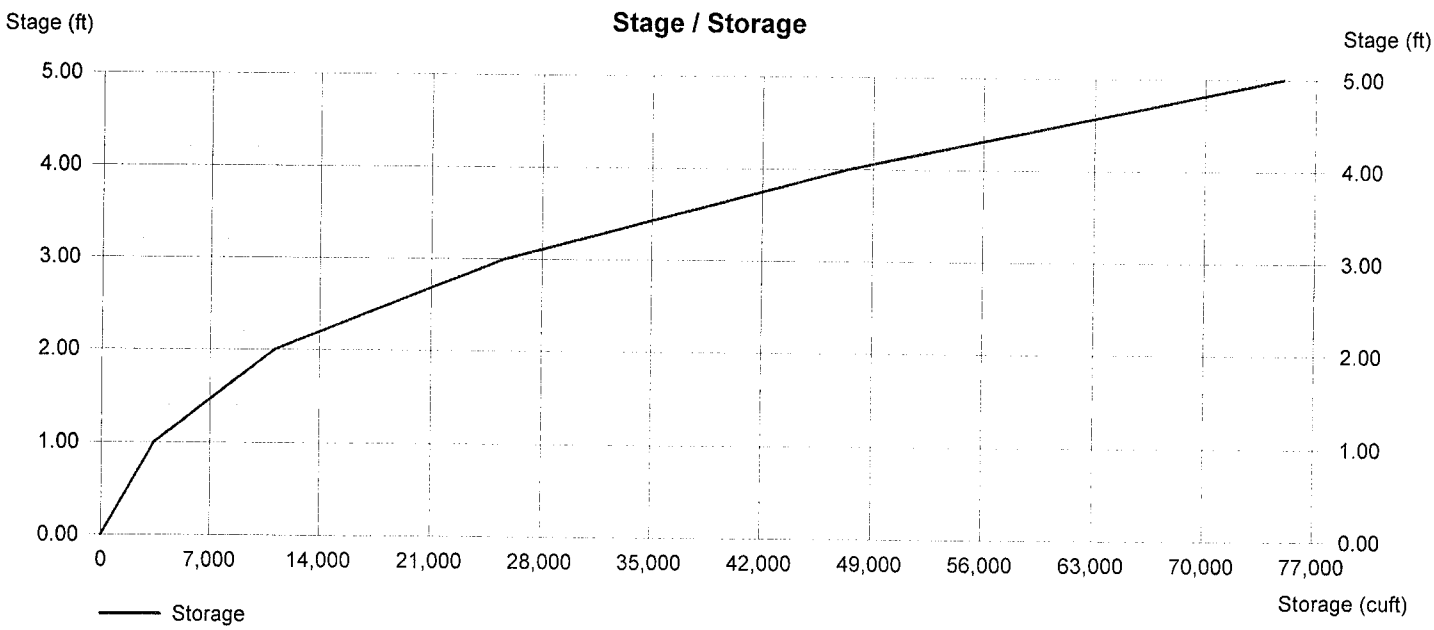
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 128.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:23 PM

Pond No. 4 - BASIN 4

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	128.00	458	0	0
1.00	129.00	1,249	854	854
2.00	130.00	1,995	1,622	2,476

Culvert / Orifice Structures

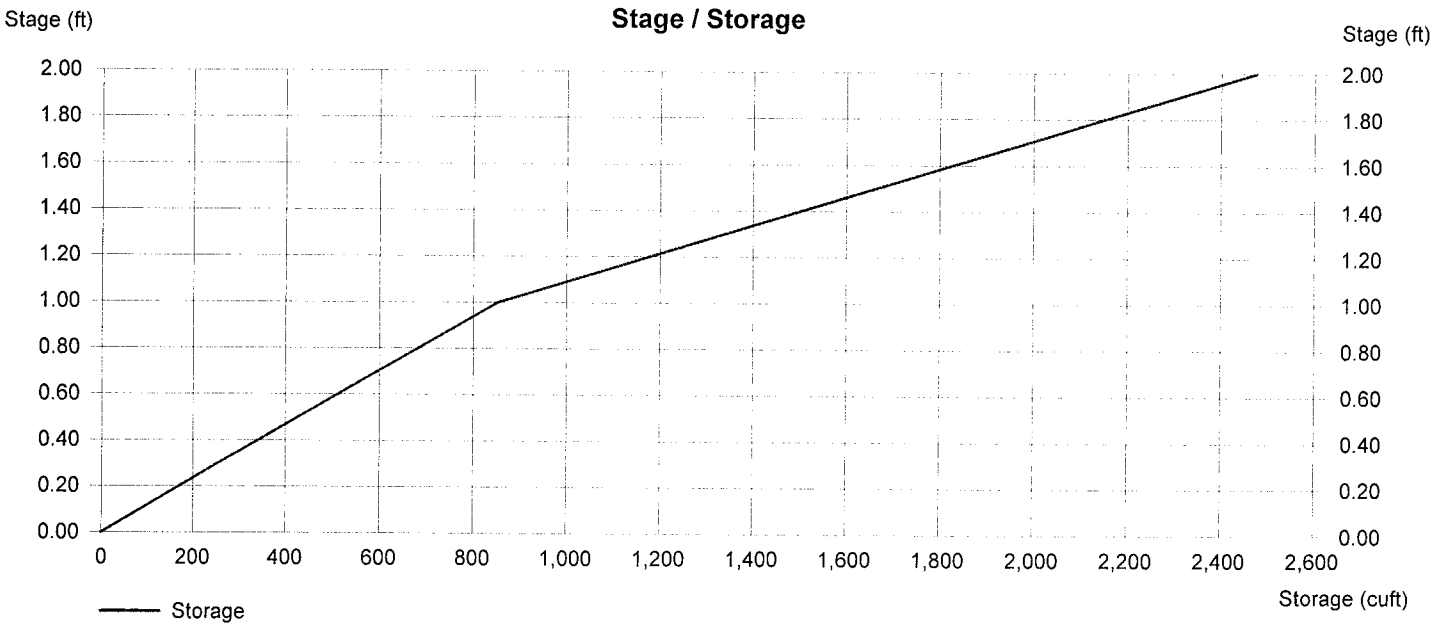
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 129.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Sep 26 2007, 4:23 PM

Pond No. 5 - BASIN 5

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	126.00	1,916	0	0
1.00	127.00	3,905	2,911	2,911
2.00	128.00	7,305	5,605	8,516

Culvert / Orifice Structures

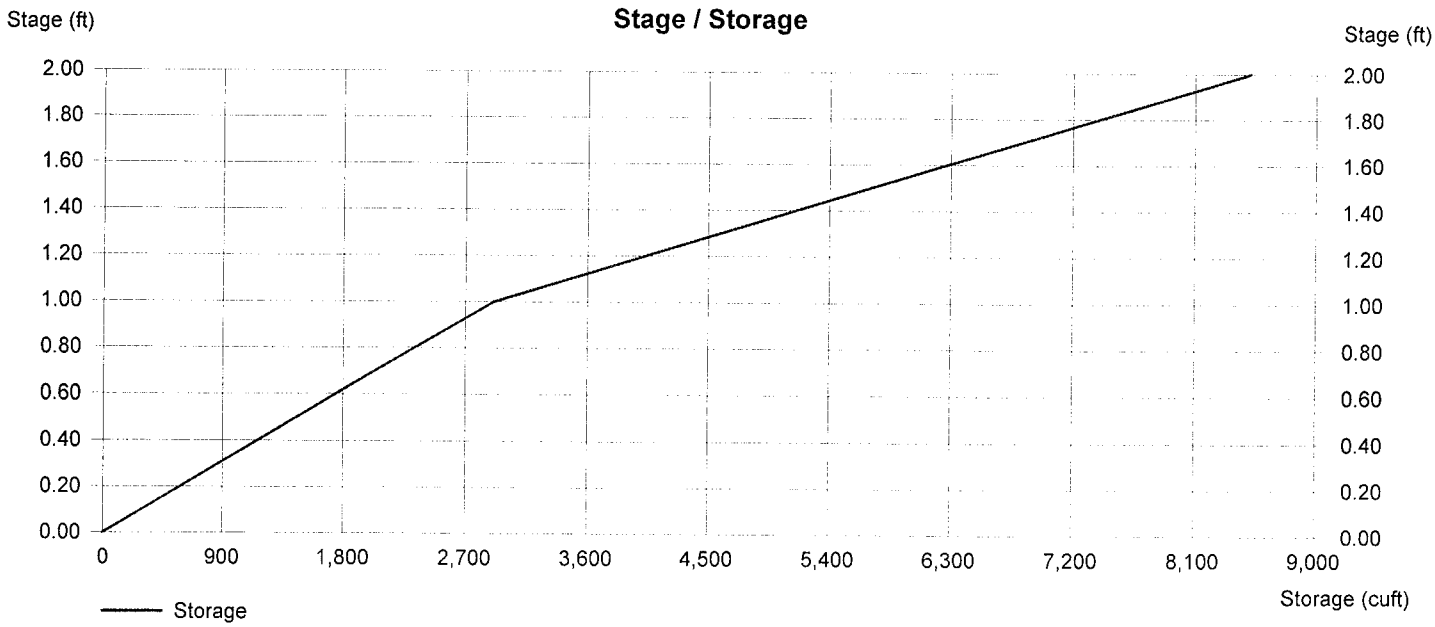
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 127.00	0.00	0.00	0.00
Length (ft)	= 140.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 2.400 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.37	1	730	14,413	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	0.86	1	727	3,257	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	0.00	1	0	0	----	------	------	EW-3
4	Combine	4.17	1	729	17,670	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	0.00	1	890	131	----	------	------	EW-4
6	Reservoir	0.00	1	1064	120	5	118.01	35	EXIST. BASIN
7	Diversion1	0.00	1	1064	76	6	------	------	BASIN INFILTRATION
8	Diversion2	0.00	1	1064	44	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.00	1	0	0	----	------	------	EW-5A
10	SCS Runoff	0.00	1	0	0	----	------	------	E-5B
11	Combine	0.00	1	0	0	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	0.00	1	0	0	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	1.47	1	741	9,576	----	------	------	PW-1A
15	SCS Runoff	0.01	1	825	199	----	------	------	PW-1B
16	Reservoir	0.00	1	1056	185	15	126.02	61	BASIN 5
17	Diversion1	0.00	1	1056	185	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.00	1	0	0	16	------	------	BASIN 5 OUTFLOW
19	Combine	1.47	1	741	9,576	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	0.20	1	957	9,561	19	117.45	3,936	BASIN 2
21	Diversion1	0.20	1	957	9,561	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	0.00	1	749	0	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.00	1	0	0	----	------	------	PW-2
24	Reservoir	0.00	1	0	0	23	118.00	0	BASIN 1
25	Diversion1	0.00	1	0	0	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.00	1	0	0	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	0.00	1	0	0	----	------	------	PW-3
28	SCS Runoff	0.01	1	1337	286	----	------	------	PW-5A
29	Reservoir	0.01	1	1421	273	28	126.03	101	BASIN 3
30	Diversion1	0.01	1	1421	232	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	0.00	1	1421	41	29	------	------	BASIN 3 OUTFLOW
32	Combine	0.00	1	1421	41	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.12	1	734	556	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	0.00	1	774	115	----	------	------	PW-6A
35	Reservoir	0.00	1	1027	102	34	128.04	34	BASIN 4
36	Diversion1	0.01	1	1027	320	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.00	1	0	-217	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.00	1	0	0	----	------	------	PW-6B
39	Combine	0.00	1	0	-217	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	32.36	1	728	117,574	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	8.25	1	726	26,572	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	0.35	1	773	6,744	----	------	------	EW-3
4	Combine	40.12	1	727	150,890	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	1.37	1	730	5,489	----	------	------	EW-4
6	Reservoir	0.20	1	787	5,478	5	118.59	2,202	EXIST. BASIN
7	Diversion1	0.13	1	787	3,484	6	------	------	BASIN INFILTRATION
8	Diversion2	0.07	1	787	1,994	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.00	1	1329	61	----	------	------	EW-5A
10	SCS Runoff	0.02	1	925	502	----	------	------	E-5B
11	Combine	0.02	1	1331	563	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	0.27	1	726	1,943	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	26.00	1	733	110,731	----	------	------	PW-1A
15	SCS Runoff	2.09	1	725	6,726	----	------	------	PW-1B
16	Reservoir	0.21	1	798	6,713	15	126.99	2,879	BASIN 5
17	Diversion1	0.21	1	798	6,713	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.00	1	780	0	16	------	------	BASIN 5 OUTFLOW
19	Combine	26.00	1	733	110,731	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	17.67	1	745	110,685	19	120.82	26,209	BASIN 2
21	Diversion1	0.61	1	745	25,109	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	17.06	1	745	85,575	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.10	1	765	1,177	----	------	------	PW-2
24	Reservoir	0.03	1	954	1,165	23	118.10	368	BASIN 1
25	Diversion1	0.02	1	954	803	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.01	1	954	362	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	0.07	1	893	1,948	----	------	------	PW-3
28	SCS Runoff	5.29	1	743	29,792	----	------	------	PW-5A
29	Reservoir	0.78	1	861	29,778	28	128.14	13,163	BASIN 3
30	Diversion1	0.41	1	1054	19,522	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	0.43	1	861	10,257	29	------	------	BASIN 3 OUTFLOW
32	Combine	17.15	1	745	98,143	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.64	1	733	2,900	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	0.64	1	739	3,224	----	------	------	PW-6A
35	Reservoir	0.09	1	842	3,211	34	129.38	1,466	BASIN 4
36	Diversion1	0.29	1	842	10,398	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.00	1	0	-7,186	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.00	1	0	0	----	------	------	PW-6B
39	Combine	0.00	1	0	-7,186	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	54.24	1	728	199,459	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	13.82	1	725	45,078	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	3.32	1	753	26,655	----	------	------	EW-3
4	Combine	67.90	1	727	271,192	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	2.93	1	729	11,135	----	------	------	EW-4
6	Reservoir	0.37	1	787	11,124	5	119.18	4,985	EXIST. BASIN
7	Diversion1	0.25	1	787	7,214	6	------	------	BASIN INFILTRATION
8	Diversion2	0.12	1	955	3,910	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.12	1	821	2,976	----	------	------	EW-5A
10	SCS Runoff	0.37	1	749	3,697	----	------	------	E-5B
11	Combine	0.46	1	751	6,673	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	2.03	1	723	6,500	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	46.52	1	732	197,584	----	------	------	PW-1A
15	SCS Runoff	4.34	1	725	13,432	----	------	------	PW-1B
16	Reservoir	1.14	1	748	13,419	15	127.41	5,189	BASIN 5
17	Diversion1	0.29	1	748	9,670	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	0.84	1	748	3,749	16	------	------	BASIN 5 OUTFLOW
19	Combine	46.92	1	732	201,333	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	36.14	1	742	201,284	19	121.96	40,874	BASIN 2
21	Diversion1	0.83	1	742	28,330	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	35.31	1	742	172,954	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.50	1	755	3,761	----	------	------	PW-2
24	Reservoir	0.11	1	864	3,749	23	118.36	1,341	BASIN 1
25	Diversion1	0.08	1	864	2,583	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.04	1	864	1,166	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	1.27	1	748	10,882	----	------	------	PW-3
28	SCS Runoff	12.18	1	741	63,557	----	------	------	PW-5A
29	Reservoir	4.46	1	770	63,541	28	128.89	24,007	BASIN 3
30	Diversion1	0.41	1	1255	20,600	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	4.41	1	770	42,941	29	------	------	BASIN 3 OUTFLOW
32	Combine	37.35	1	743	227,943	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	0.99	1	733	4,576	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	1.30	1	738	6,340	----	------	------	PW-6A
35	Reservoir	1.07	1	749	6,327	34	129.65	1,913	BASIN 4
36	Diversion1	0.34	1	749	14,294	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	0.73	1	749	-7,967	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.01	1	881	248	----	------	------	PW-6B
39	Combine	0.73	1	749	-7,718	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	66.82	1	728	247,842	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	17.03	1	725	56,013	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	6.16	1	750	42,300	----	------	------	EW-3
4	Combine	84.73	1	727	346,155	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	3.90	1	729	14,712	----	------	------	EW-4
6	Reservoir	0.41	1	803	14,701	5	119.47	7,029	EXIST. BASIN
7	Diversion1	0.31	1	803	9,994	6	------	------	BASIN INFILTRATION
8	Diversion2	0.12	1	1112	4,707	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	0.59	1	747	6,318	----	------	------	EW-5A
10	SCS Runoff	0.91	1	743	6,578	----	------	------	E-5B
11	Combine	1.48	1	745	12,896	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	3.47	1	722	9,920	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	58.61	1	732	249,866	----	------	------	PW-1A
15	SCS Runoff	5.73	1	725	17,653	----	------	------	PW-1B
16	Reservoir	2.03	1	742	17,640	15	127.59	6,226	BASIN 5
17	Diversion1	0.33	1	742	10,798	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	1.70	1	742	6,842	16	------	------	BASIN 5 OUTFLOW
19	Combine	59.98	1	732	256,708	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	46.06	1	742	256,658	19	122.40	47,966	BASIN 2
21	Diversion1	0.90	1	742	29,844	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	45.16	1	742	226,814	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	0.83	1	752	5,675	----	------	------	PW-2
24	Reservoir	0.18	1	841	5,663	23	118.57	2,141	BASIN 1
25	Diversion1	0.12	1	841	3,902	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.06	1	841	1,762	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	2.78	1	743	18,500	----	------	------	PW-3
28	SCS Runoff	16.61	1	740	85,373	----	------	------	PW-5A
29	Reservoir	7.00	1	766	85,353	28	129.24	30,830	BASIN 3
30	Diversion1	0.41	1	1360	20,843	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	7.00	1	766	64,510	29	------	------	BASIN 3 OUTFLOW
32	Combine	51.46	1	744	311,586	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	1.19	1	733	5,545	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	1.71	1	737	8,289	----	------	------	PW-6A
35	Reservoir	1.61	1	743	8,277	34	129.71	2,005	BASIN 4
36	Diversion1	0.35	1	743	15,703	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	1.26	1	743	-7,426	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.04	1	744	595	----	------	------	PW-6B
39	Combine	1.30	1	743	-6,832	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	93.47	1	728	352,671	----	------	------	EW-1 (PT. 1)
2	SCS Runoff	23.83	1	725	79,704	----	------	------	EW-2 (PT. 2)
3	SCS Runoff	13.92	1	746	83,057	----	------	------	EW-3
4	Combine	122.31	1	727	515,433	1, 2, 3	------	------	EXIST. TOTAL TO RIVER (PT. 3)
5	SCS Runoff	6.07	1	729	22,821	----	------	------	EW-4
6	Reservoir	0.55	1	820	22,810	5	120.08	11,767	EXIST. BASIN
7	Diversion1	0.41	1	952	16,360	6	------	------	BASIN INFILTRATION
8	Diversion2	0.17	1	820	6,450	6	------	------	BASIN OUTFLOW (PT.4)
9	SCS Runoff	2.66	1	737	16,624	----	------	------	EW-5A
10	SCS Runoff	2.74	1	737	14,642	----	------	------	E-5B
11	Combine	5.40	1	737	31,266	9, 10	------	------	E-5A + E-5B (PT. 5)
12	SCS Runoff	7.07	1	722	18,593	----	------	------	EW-6 (PT. 6)
14	SCS Runoff	84.51	1	732	364,479	----	------	------	PW-1A
15	SCS Runoff	8.80	1	725	27,183	----	------	------	PW-1B
16	Reservoir	4.41	1	733	27,170	15	127.96	8,308	BASIN 5
17	Diversion1	0.40	1	733	12,902	16	------	------	BASIN 5 INFILTRATION
18	Diversion2	4.01	1	733	14,267	16	------	------	BASIN 5 OUTFLOW
19	Combine	88.51	1	732	378,746	14, 18	------	------	TOTAL TO BASIN 2
20	Reservoir	68.86	1	741	378,695	19	123.35	64,513	BASIN 2
21	Diversion1	1.03	1	741	32,718	20	------	------	BASIN 2 INFILTRATION
22	Diversion2	67.83	1	741	345,977	20	------	------	BASIN 2 OUTFLOW (PT. 1)
23	SCS Runoff	1.68	1	749	10,491	----	------	------	PW-2
24	Reservoir	0.36	1	815	10,479	23	119.08	4,292	BASIN 1
25	Diversion1	0.23	1	815	7,115	24	------	------	BASIN 1 INFILTRATION
26	Diversion2	0.13	1	815	3,363	24	------	------	BASIN 1 OUTFLOW (PT. 2)
27	SCS Runoff	7.45	1	737	39,243	----	------	------	PW-3
28	SCS Runoff	26.66	1	740	135,508	----	------	------	PW-5A
29	Reservoir	9.44	1	769	135,483	28	130.13	50,907	BASIN 3
30	Diversion1	0.41	1	1486	20,743	29	------	------	BASIN 3 INFILTRATION

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
31	Diversion2	9.44	1	769	114,739	29	------	------	BASIN 3 OUTFLOW
32	Combine	82.82	1	741	503,323	22, 26, 27, 31	------	------	PROP. TOTAL TO RIVER (PT. 3)
33	SCS Runoff	1.60	1	733	7,617	----	------	------	PW-5B (PT. 5)
34	SCS Runoff	2.62	1	737	12,672	----	------	------	PW-6A
35	Reservoir	2.58	1	739	12,660	34	129.79	2,139	BASIN 4
36	Diversion1	0.37	1	739	18,289	35	------	------	BASIN 4 INFILTRATION
37	Diversion2	2.21	1	739	-5,629	35	------	------	BASIN 4 OUTFLOW
38	SCS Runoff	0.28	1	728	1,726	----	------	------	PW-6B
39	Combine	2.44	1	739	-3,903	37, 38	------	------	TOTAL TO PT. 6

Hydrograph Plot

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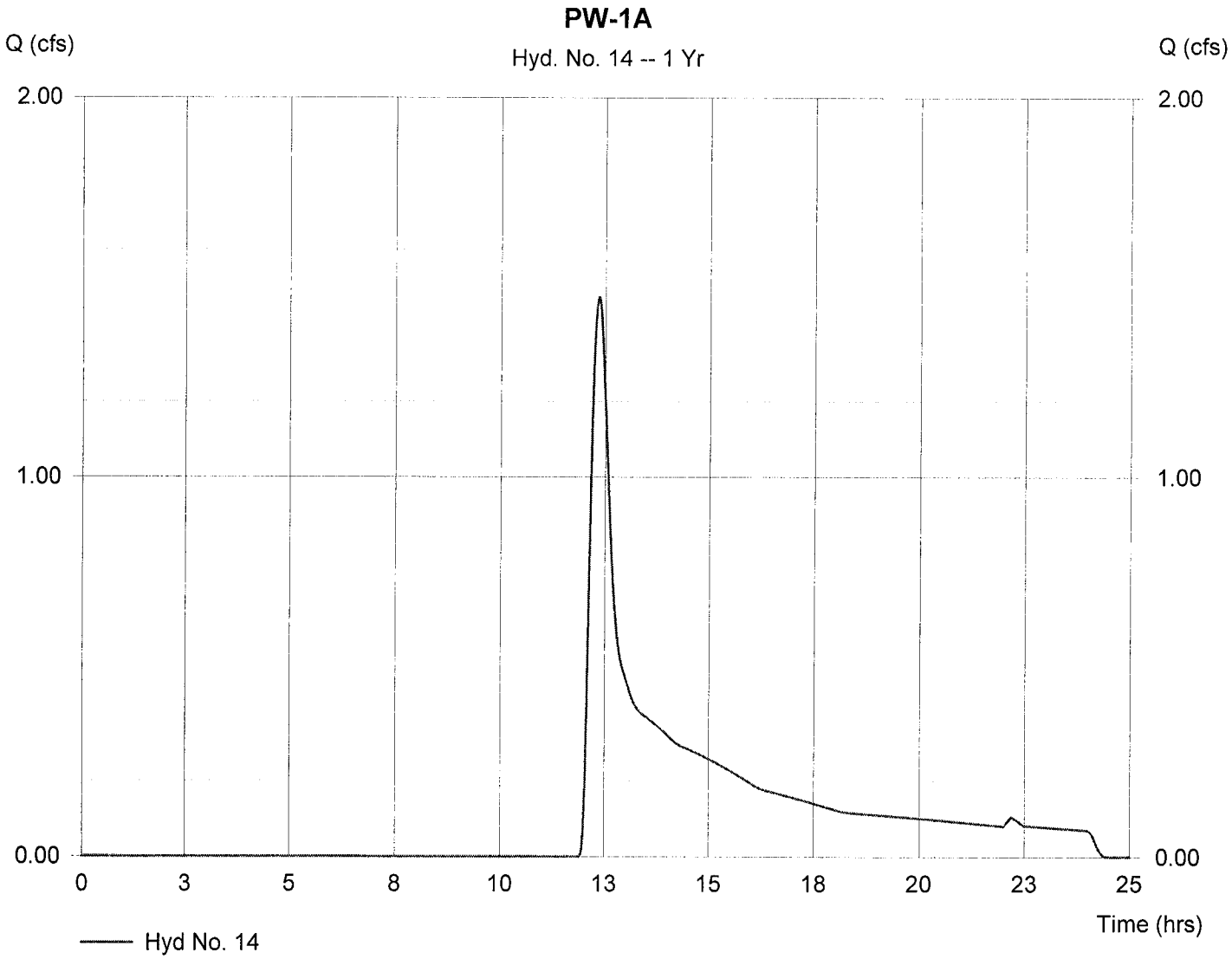
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Hyd. No. 14

PW-1A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.47 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 20.200 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.50 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,576 cuft



Hydrograph Plot

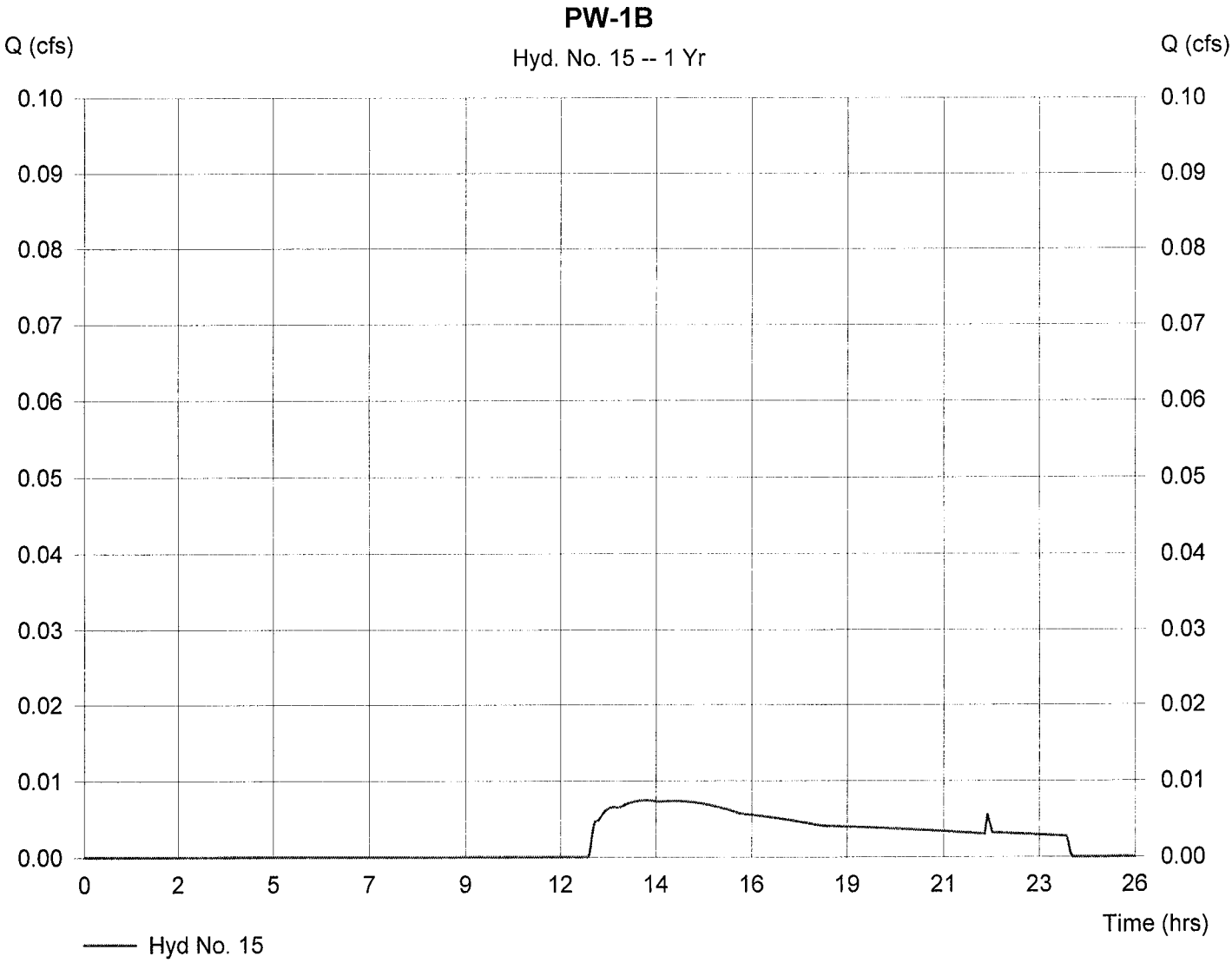
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Hyd. No. 15

PW-1B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.01 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 1.750 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 199 cuft



Hydrograph Plot

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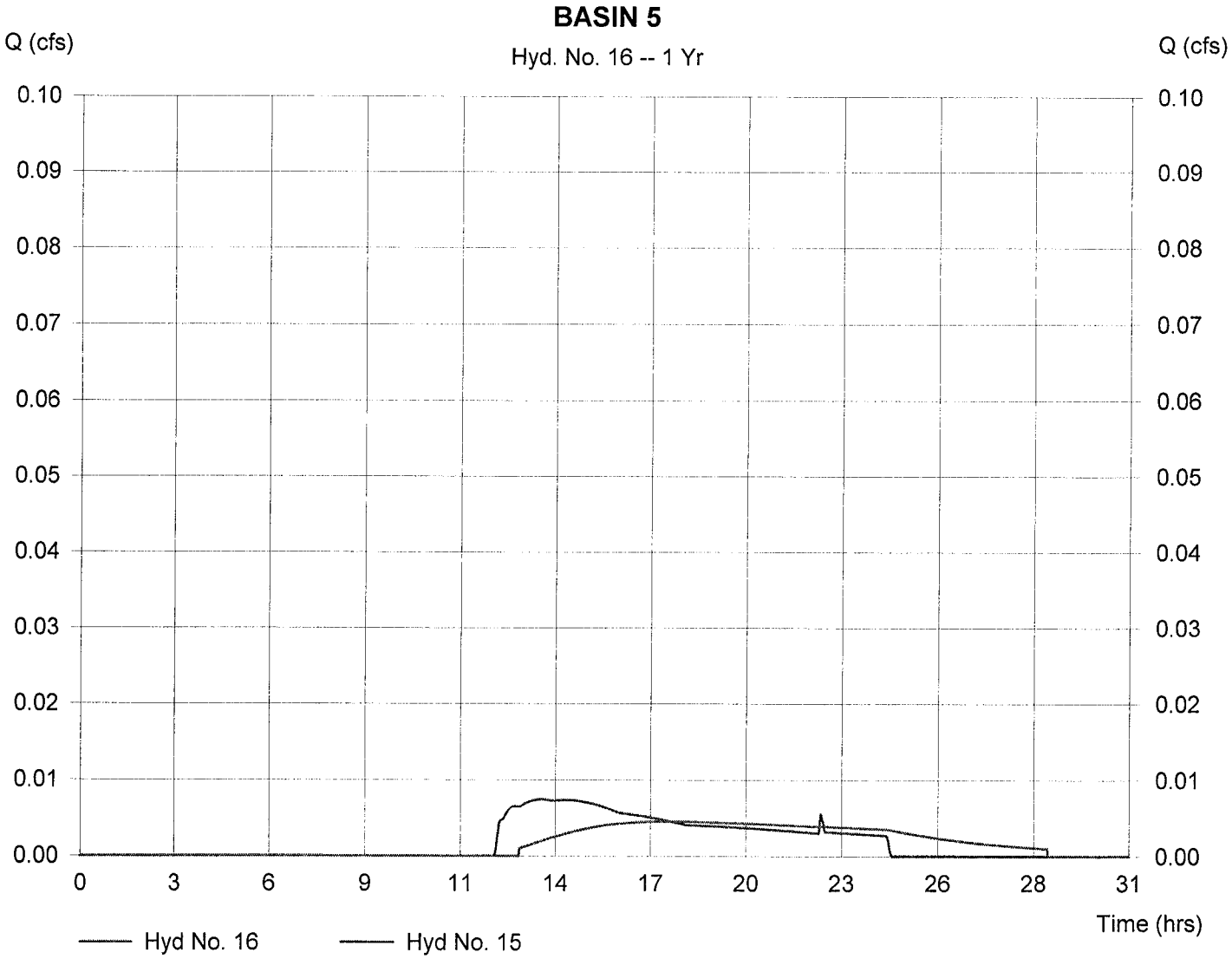
Hyd. No. 16

BASIN 5

Hydrograph type	= Reservoir	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 15	Max. Elevation	= 126.02 ft
Reservoir name	= BASIN 5	Max. Storage	= 61 cuft

Storage Indication method used.

Hydrograph Volume = 185 cuft



Hydrograph Plot

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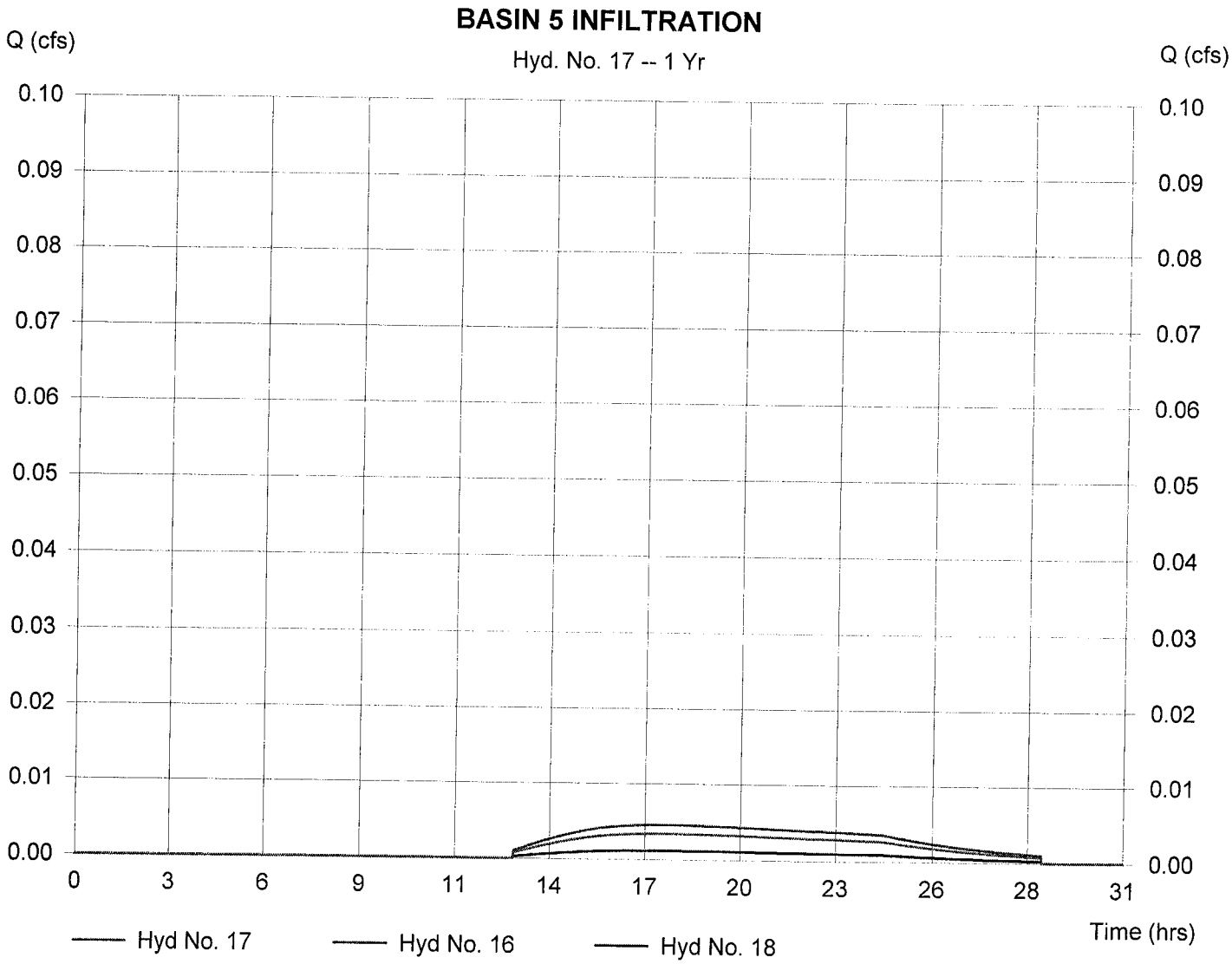
Hyd. No. 17

BASIN 5 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 1 yrs
Inflow hydrograph = 16
Diversion method = Pond - BASIN 5

Peak discharge = 0.00 cfs
Time interval = 1 min
2nd diverted hyd. = 18
Pond structure = Exfiltration

Hydrograph Volume = 138 cuft



Hydrograph Plot

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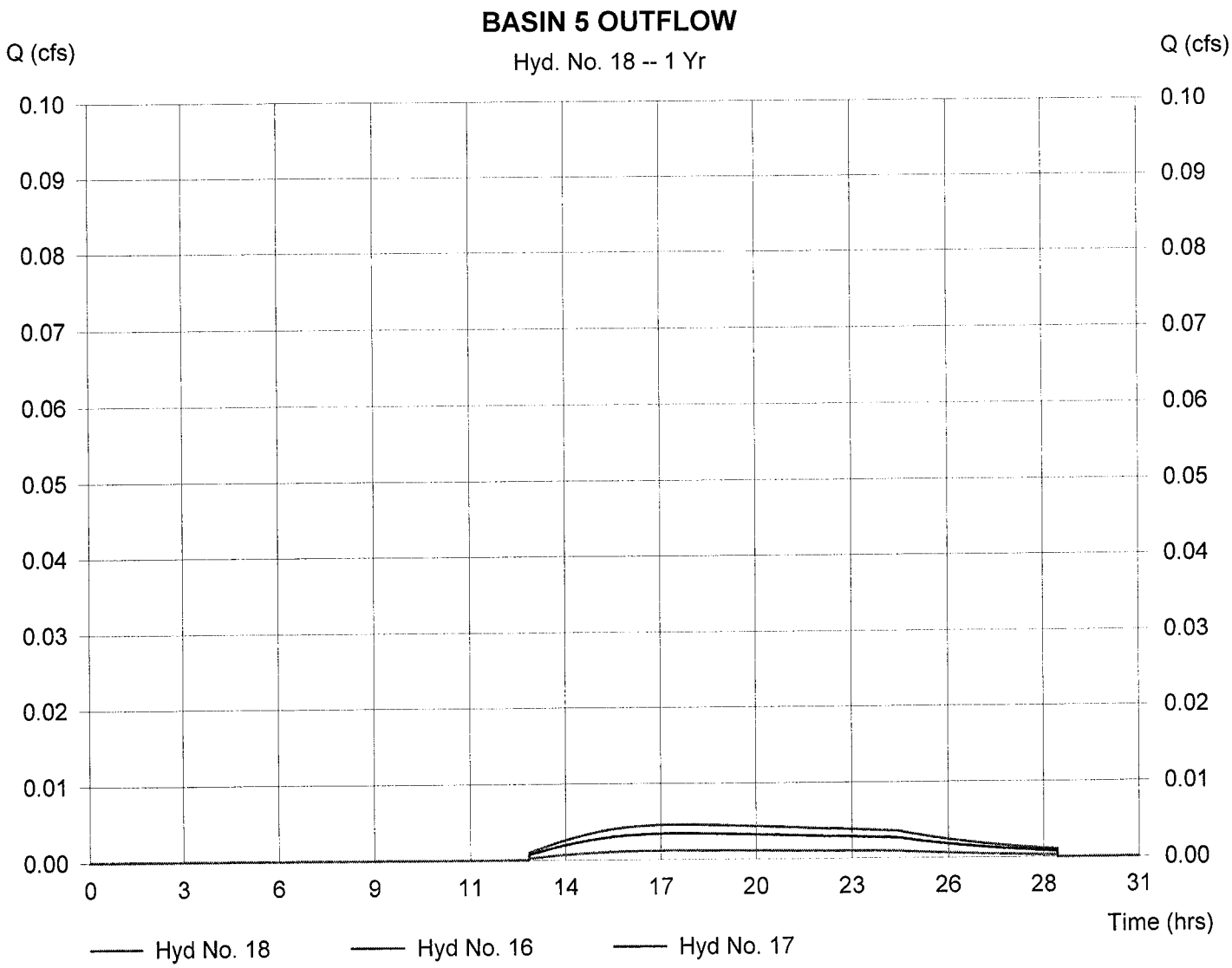
Hyd. No. 18

BASIN 5 OUTFLOW

Hydrograph type = Diversion2
Storm frequency = 1 yrs
Inflow hydrograph = 16
Diversion method = Pond - BASIN 5

Peak discharge = 0.00 cfs
Time interval = 1 min
2nd diverted hyd. = 17
Pond structure = Exfiltration

Hydrograph Volume = 47 cuft



Hydrograph Plot

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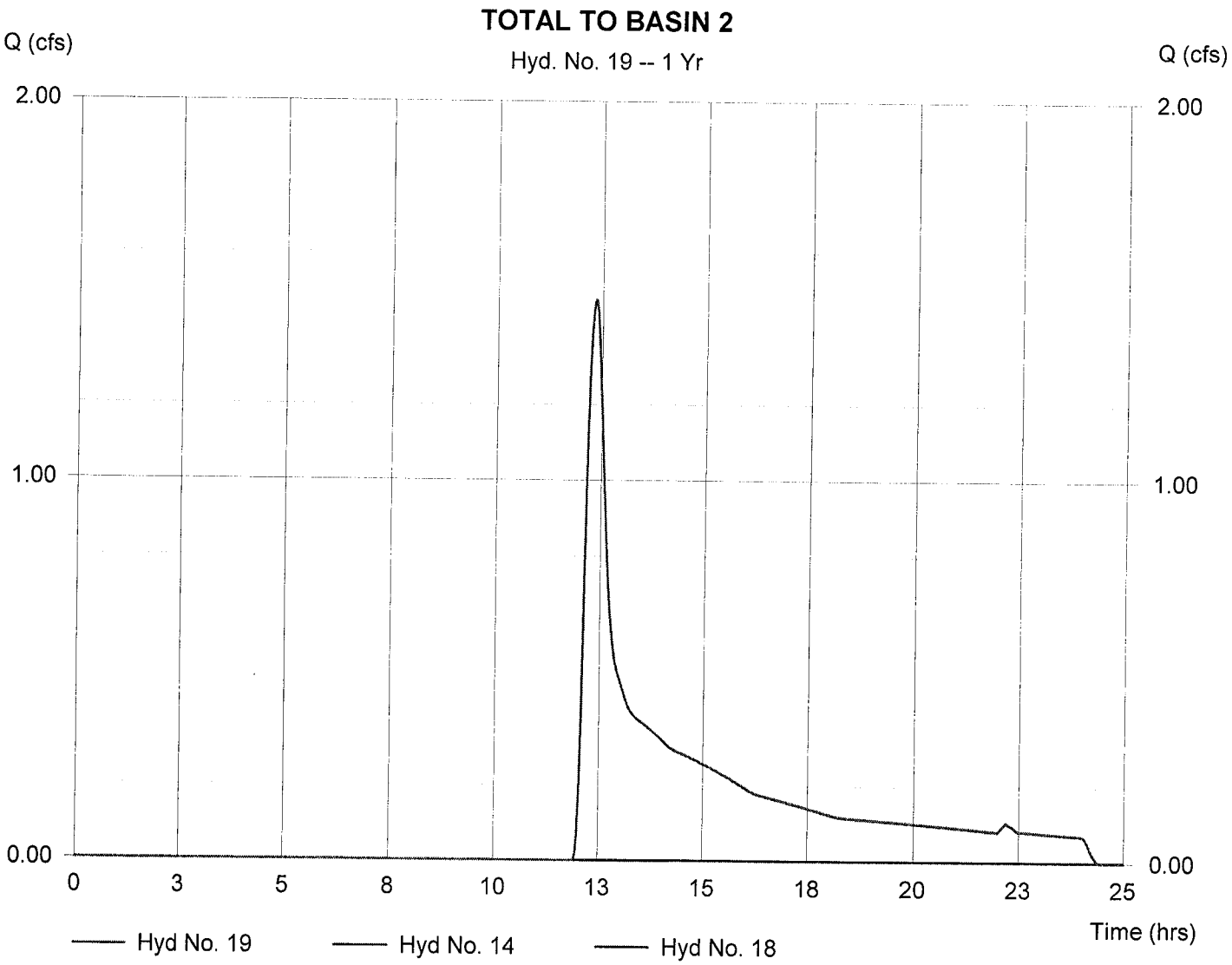
Hyd. No. 19

TOTAL TO BASIN 2

Hydrograph type = Combine
Storm frequency = 1 yrs
Inflow hyds. = 14, 18

Peak discharge = 1.47 cfs
Time interval = 1 min

Hydrograph Volume = 9,622 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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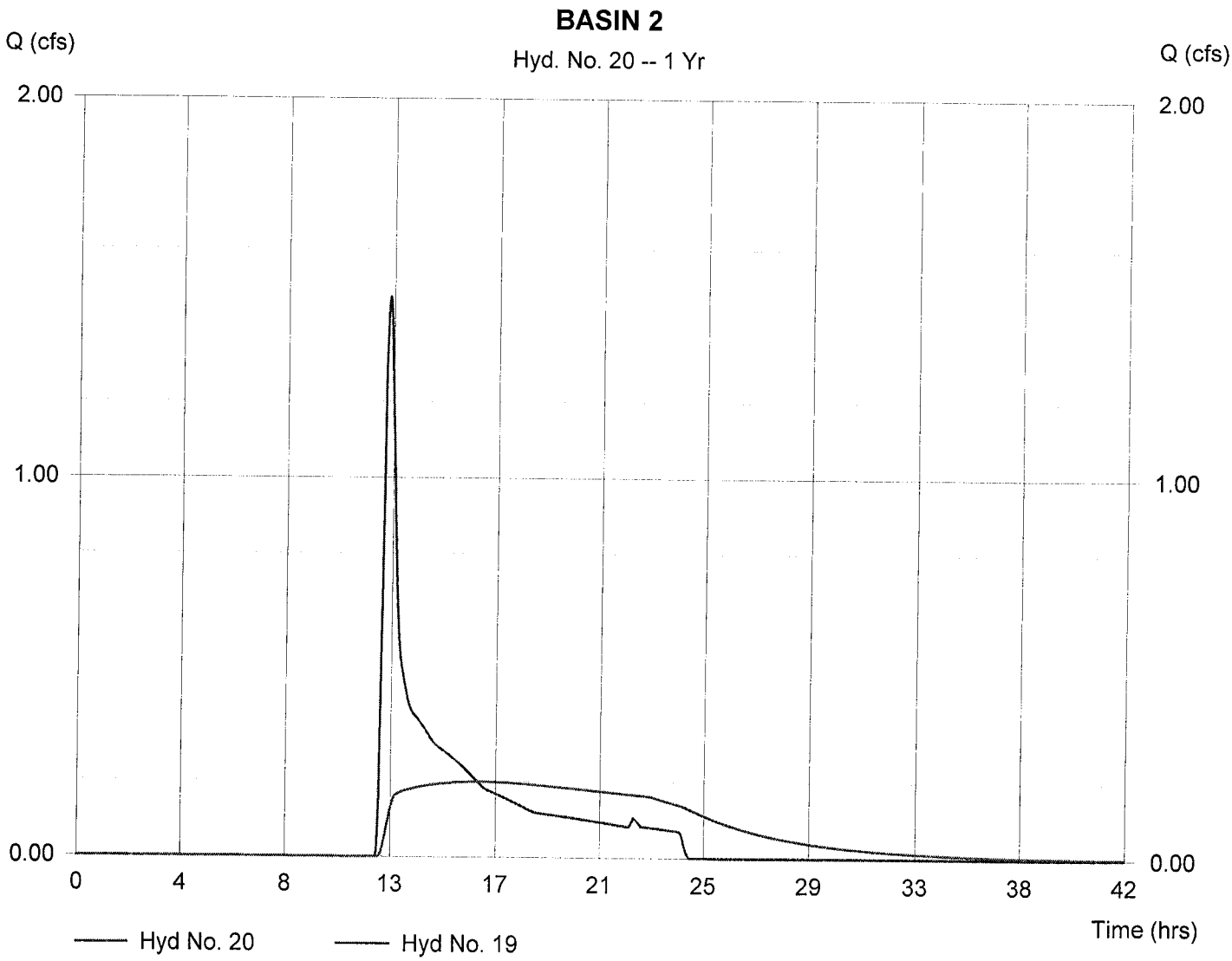
Hyd. No. 20

BASIN 2

Hydrograph type	= Reservoir	Peak discharge	= 0.20 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 19	Max. Elevation	= 117.45 ft
Reservoir name	= BASIN 2	Max. Storage	= 3,943 cuft

Storage Indication method used.

Hydrograph Volume = 9,608 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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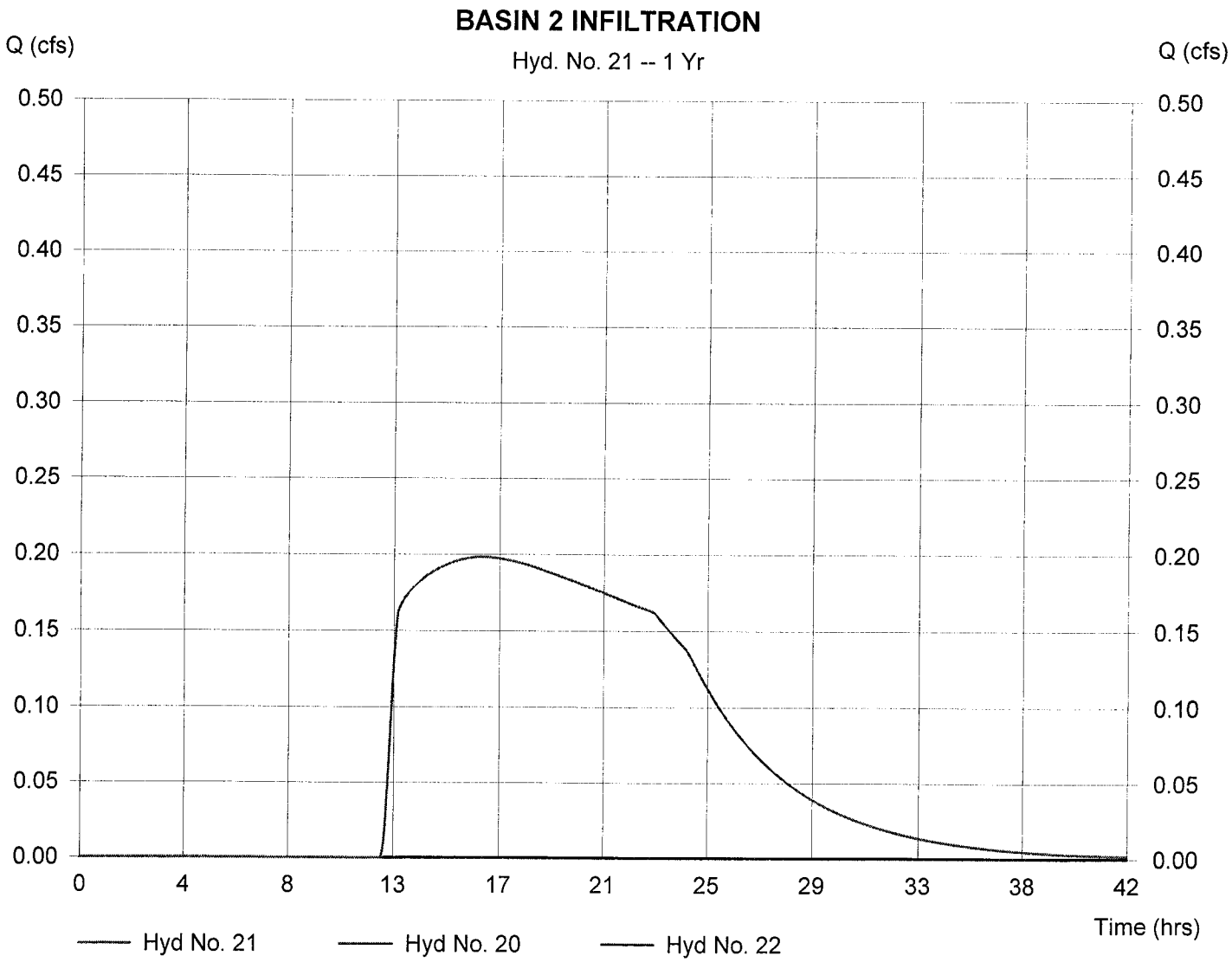
Hyd. No. 21

BASIN 2 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 1 yrs
Inflow hydrograph = 20
Diversion method = Pond - BASIN 2

Peak discharge = 0.20 cfs
Time interval = 1 min
2nd diverted hyd. = 22
Pond structure = Exfiltration

Hydrograph Volume = 9,608 cuft



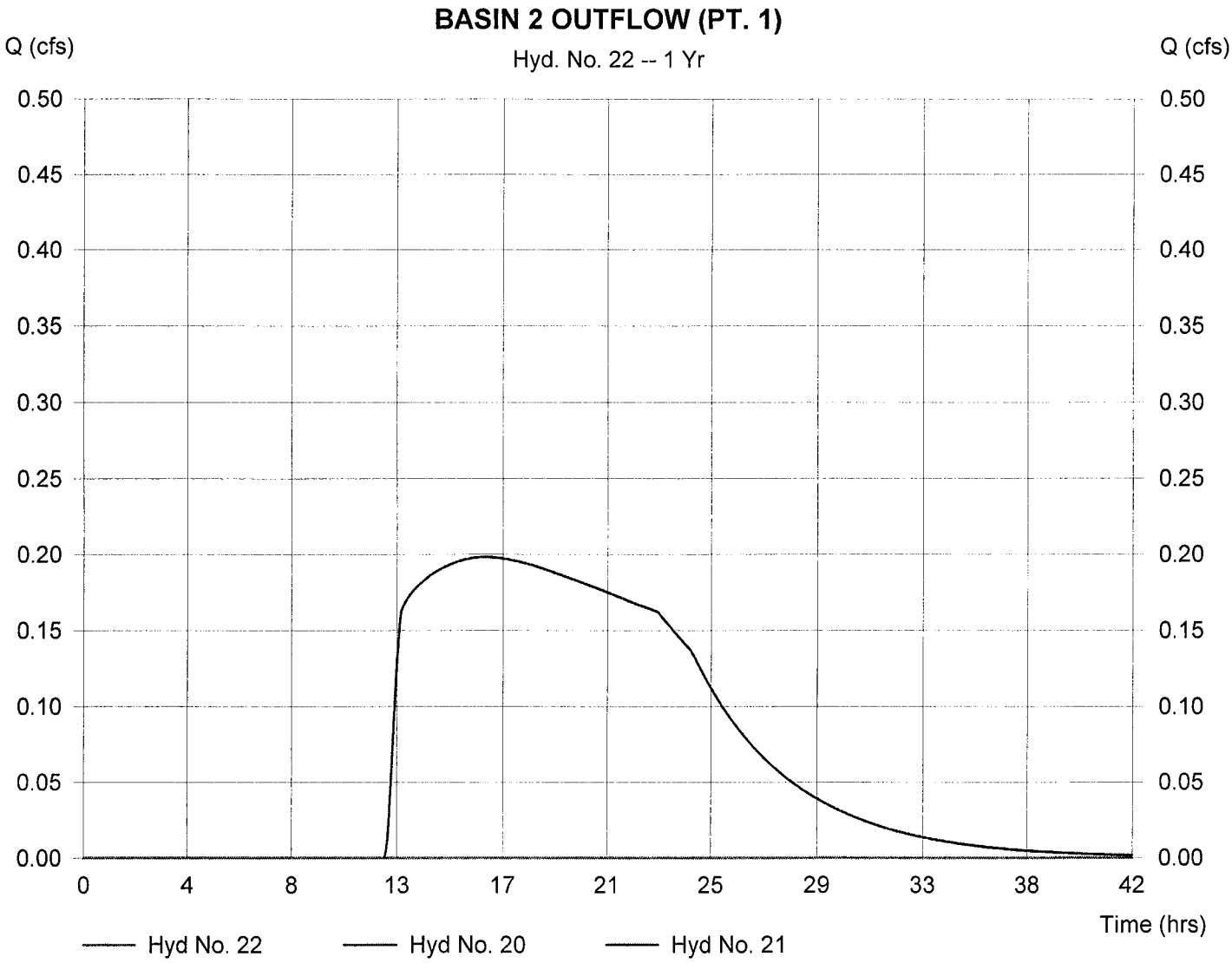
Hydrograph Plot

Hyd. No. 22

BASIN 2 OUTFLOW (PT. 1)

Hydrograph type	= Diversion2	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 21
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 0 cuft



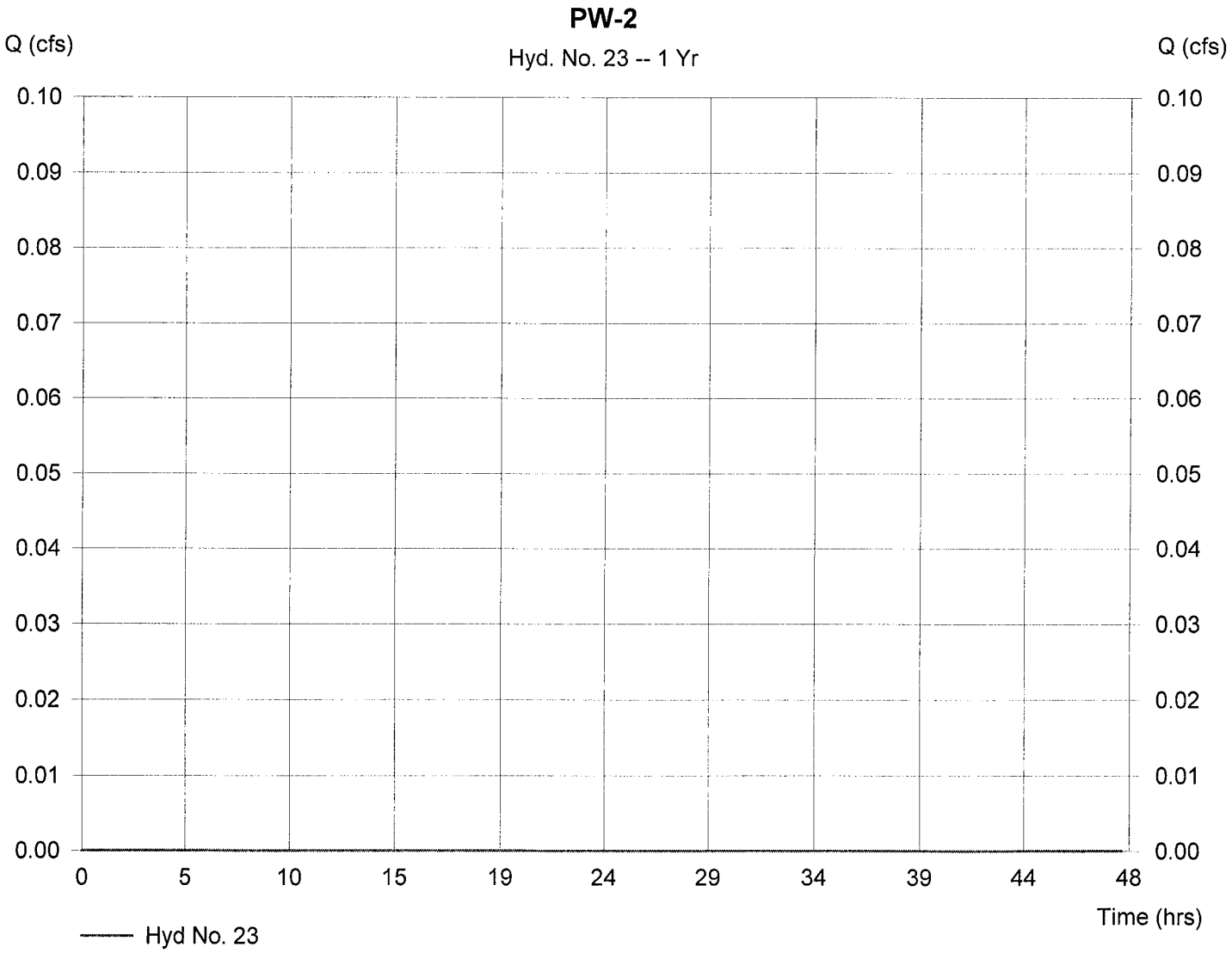
Hydrograph Plot

Hyd. No. 23

PW-2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 1.310 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.50 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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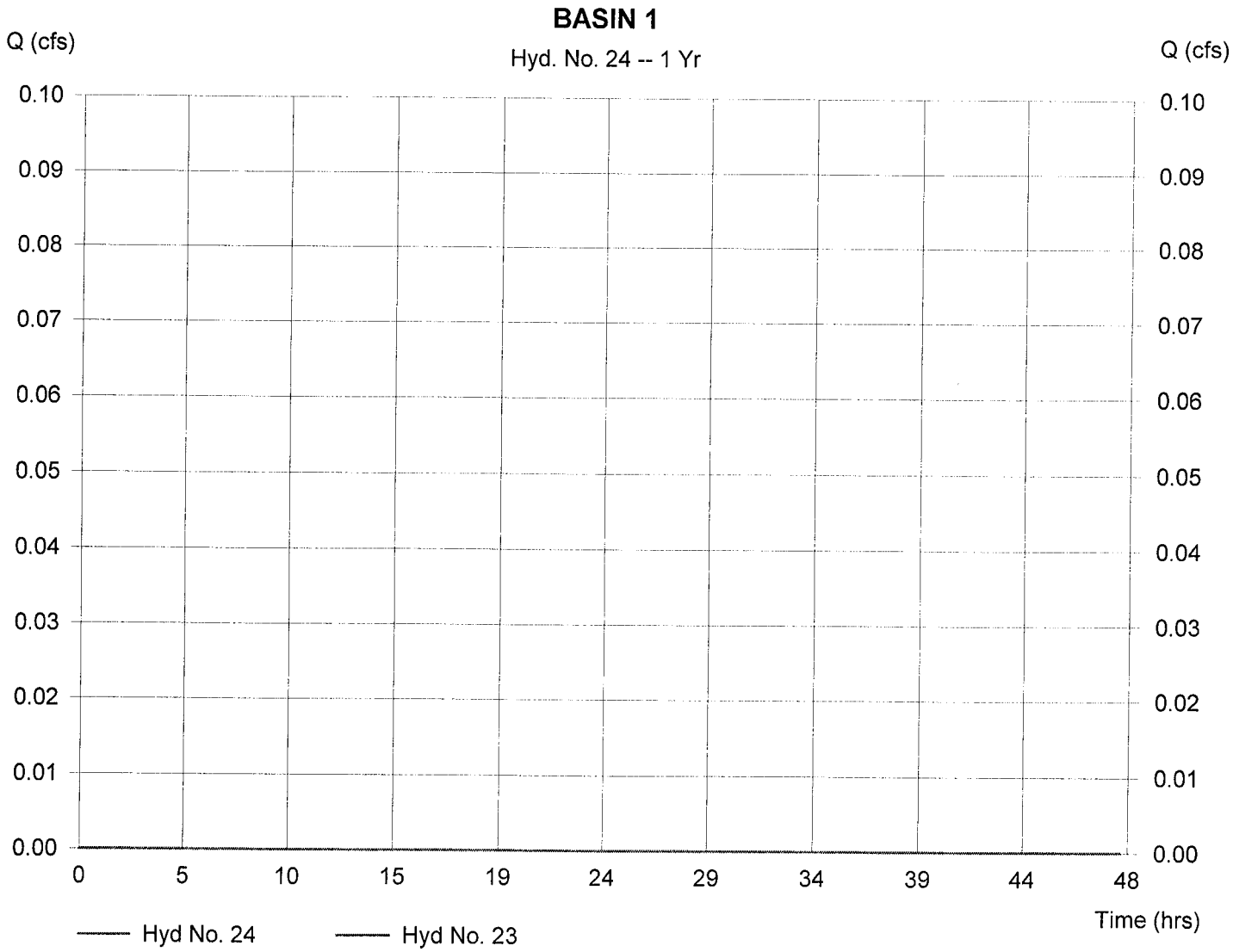
Hyd. No. 24

BASIN 1

Hydrograph type	= Reservoir	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 118.00 ft
Reservoir name	= UPGRADED BASIN	Max. Storage	= 0 cuft

Storage Indication method used.

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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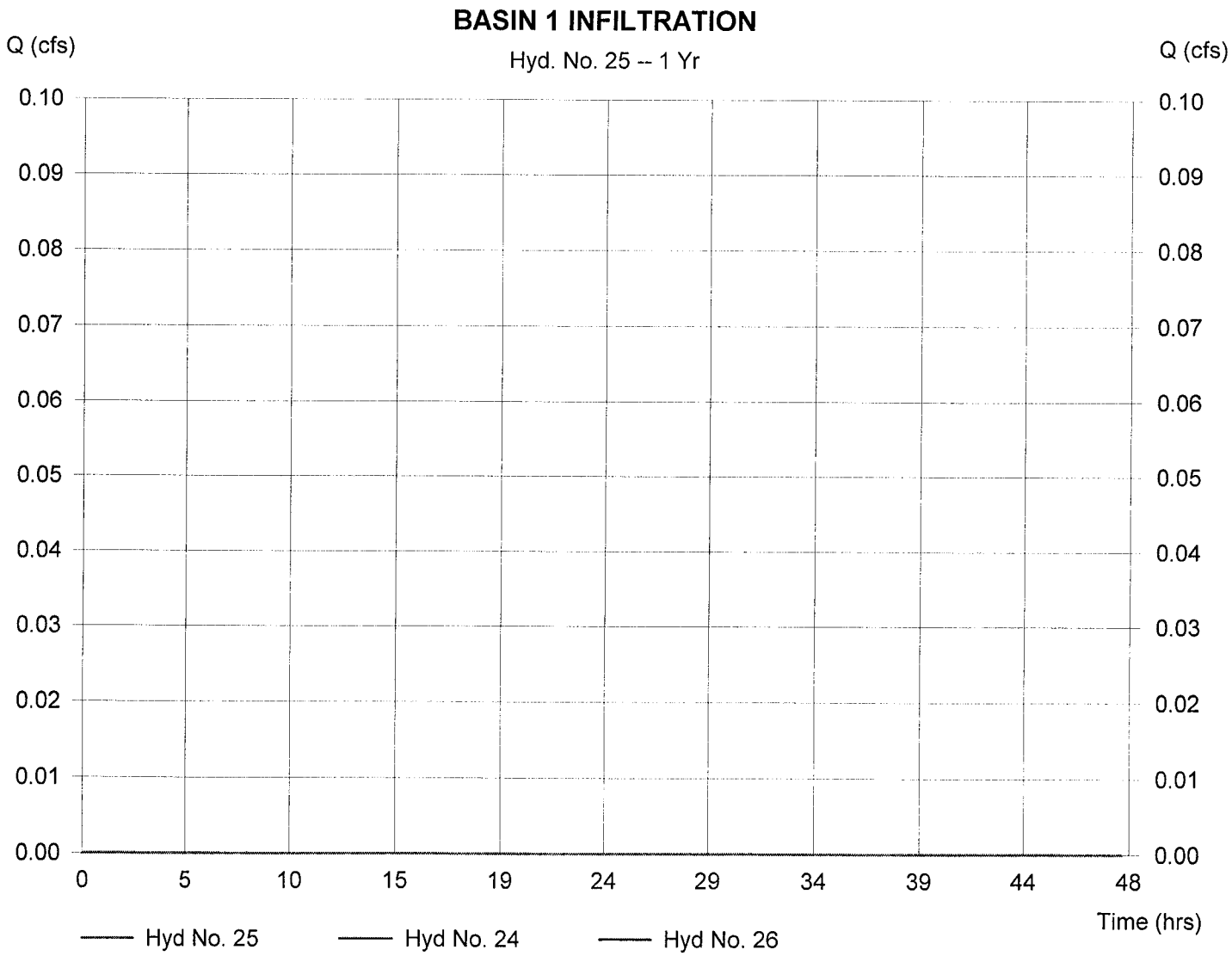
Hyd. No. 25

BASIN 1 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 1 yrs
Inflow hydrograph = 24
Diversion method = Pond - UPGRADED BASIN

Peak discharge = 0.00 cfs
Time interval = 1 min
2nd diverted hyd. = 26
Pond structure = Exfiltration

Hydrograph Volume = 0 cuft



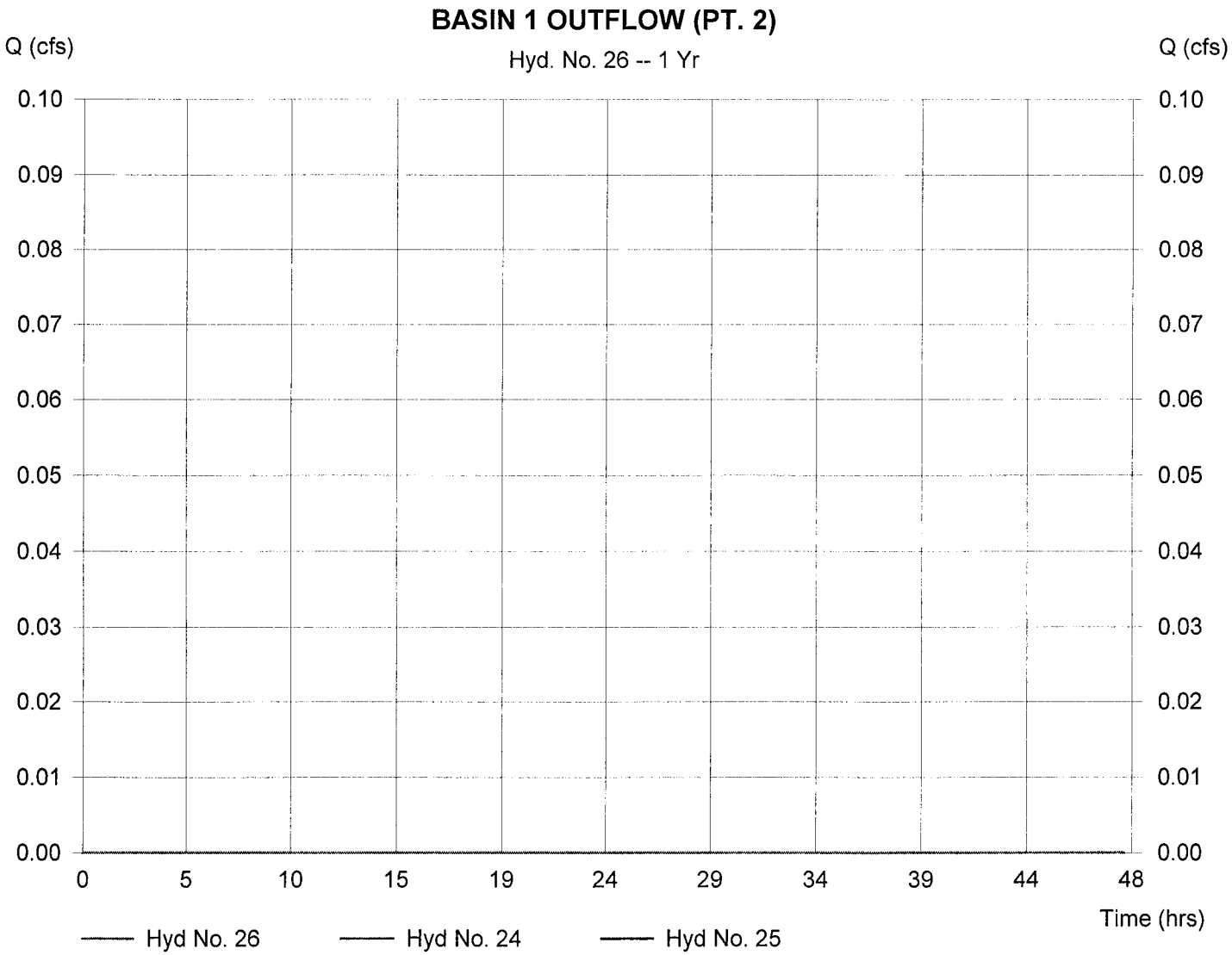
Hydrograph Plot

Hyd. No. 26

BASIN 1 OUTFLOW (PT. 2)

Hydrograph type	= Diversion2	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 24	2nd diverted hyd.	= 25
Diversion method	= Pond - UPGRADED BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

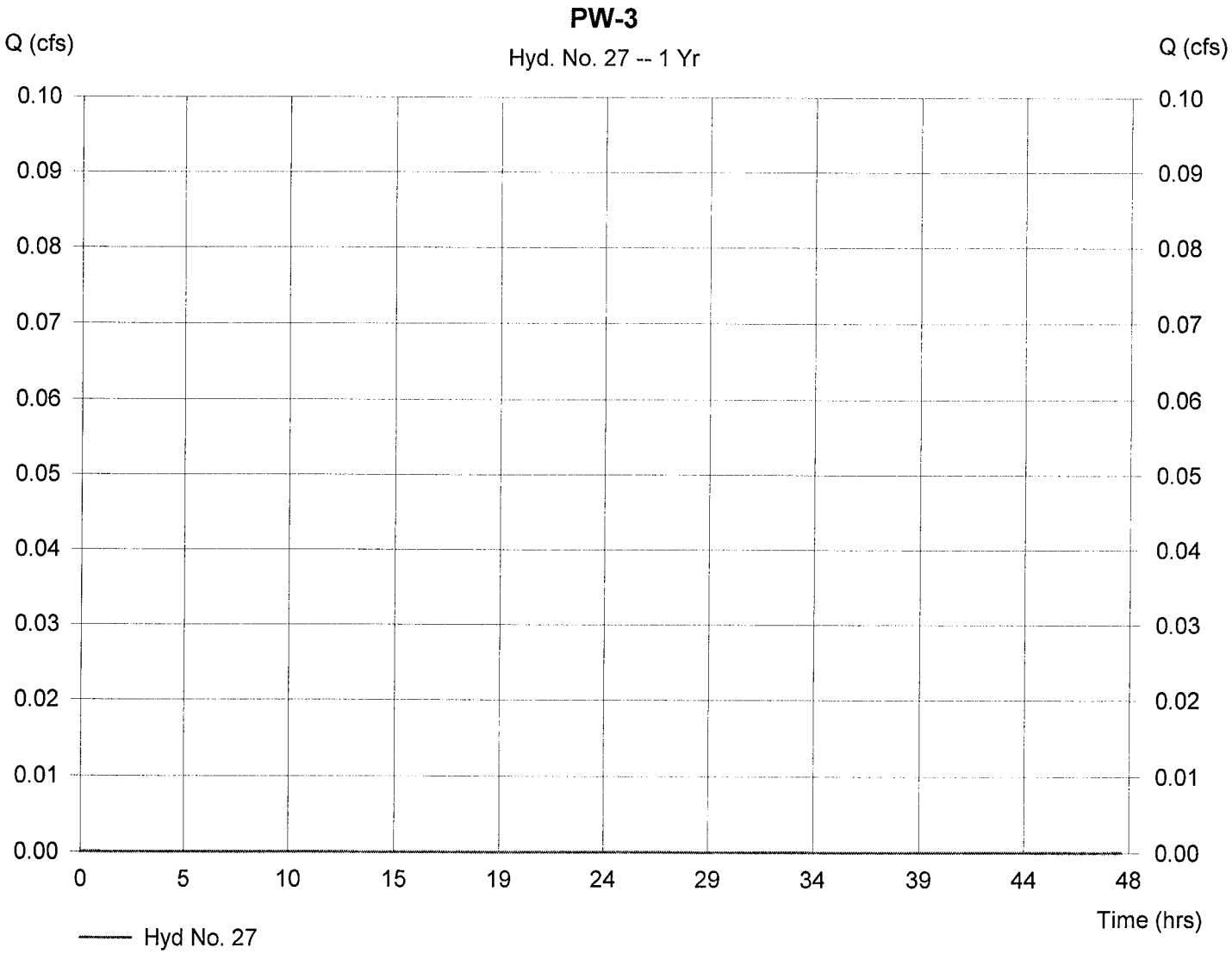
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Hyd. No. 27

PW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 7.250 ac	Curve number	= 48
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.80 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

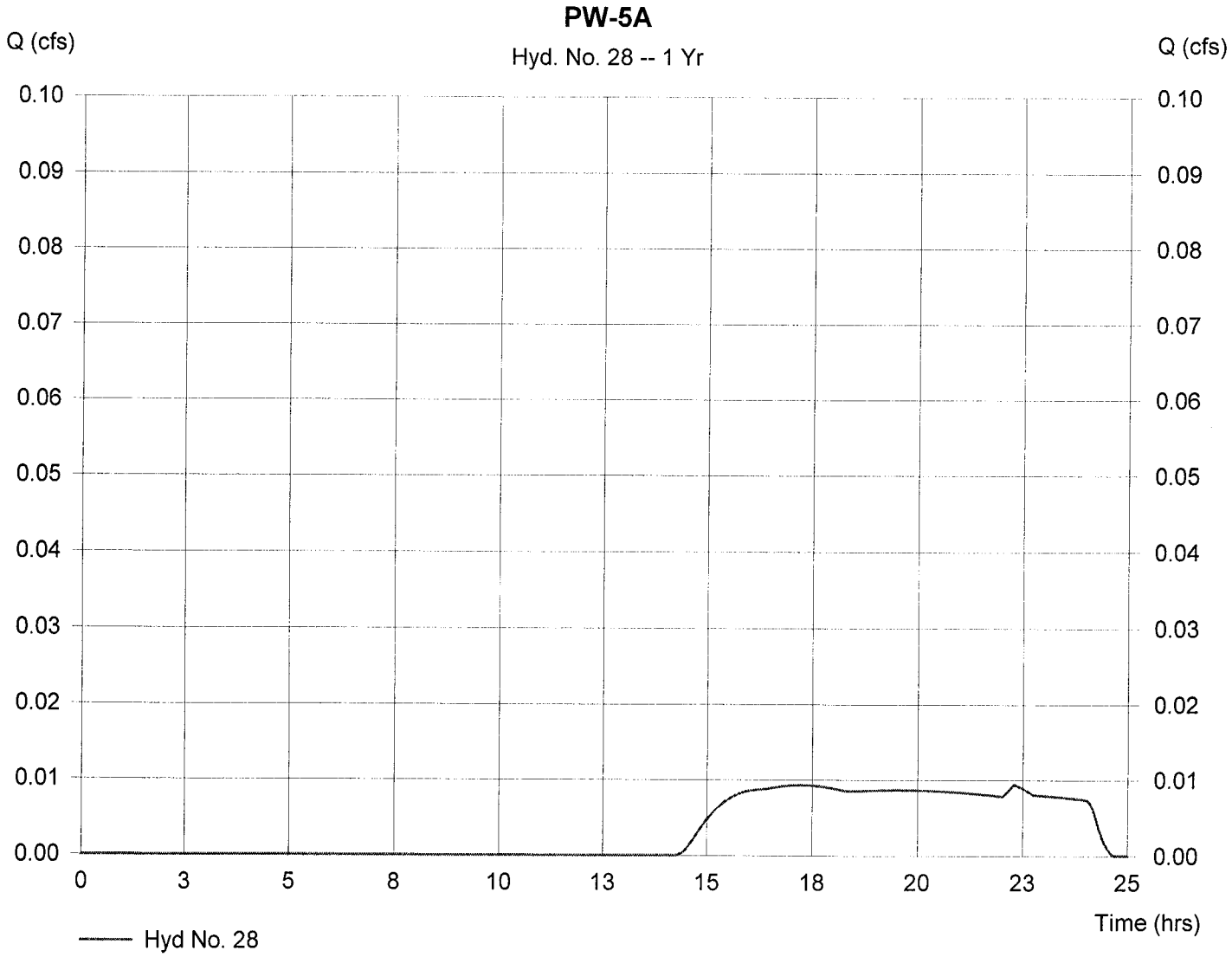
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Hyd. No. 28

PW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.01 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 10.100 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.30 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 286 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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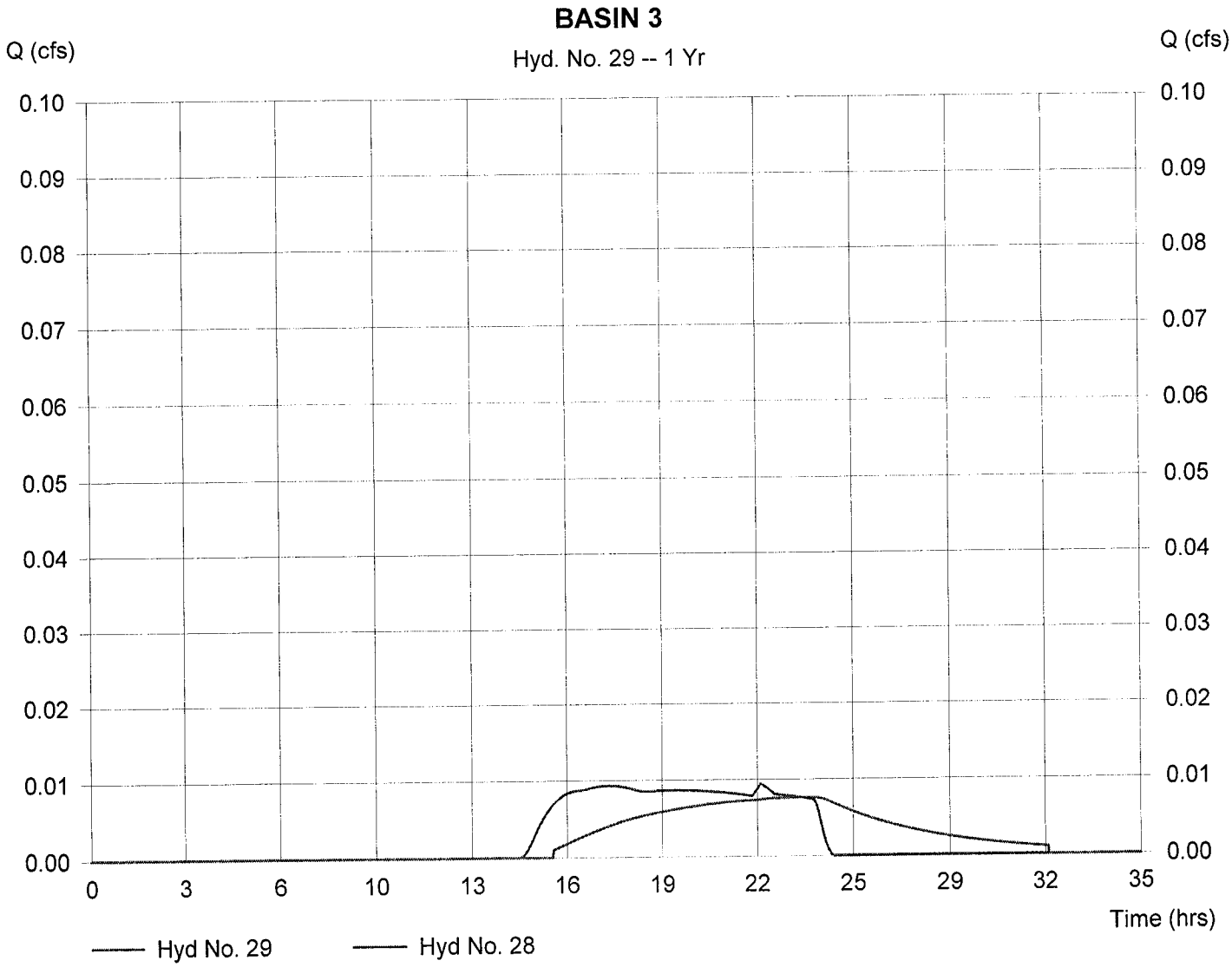
Hyd. No. 29

BASIN 3

Hydrograph type	= Reservoir	Peak discharge	= 0.01 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 28	Max. Elevation	= 126.03 ft
Reservoir name	= BASIN 3	Max. Storage	= 101 cuft

Storage Indication method used.

Hydrograph Volume = 273 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

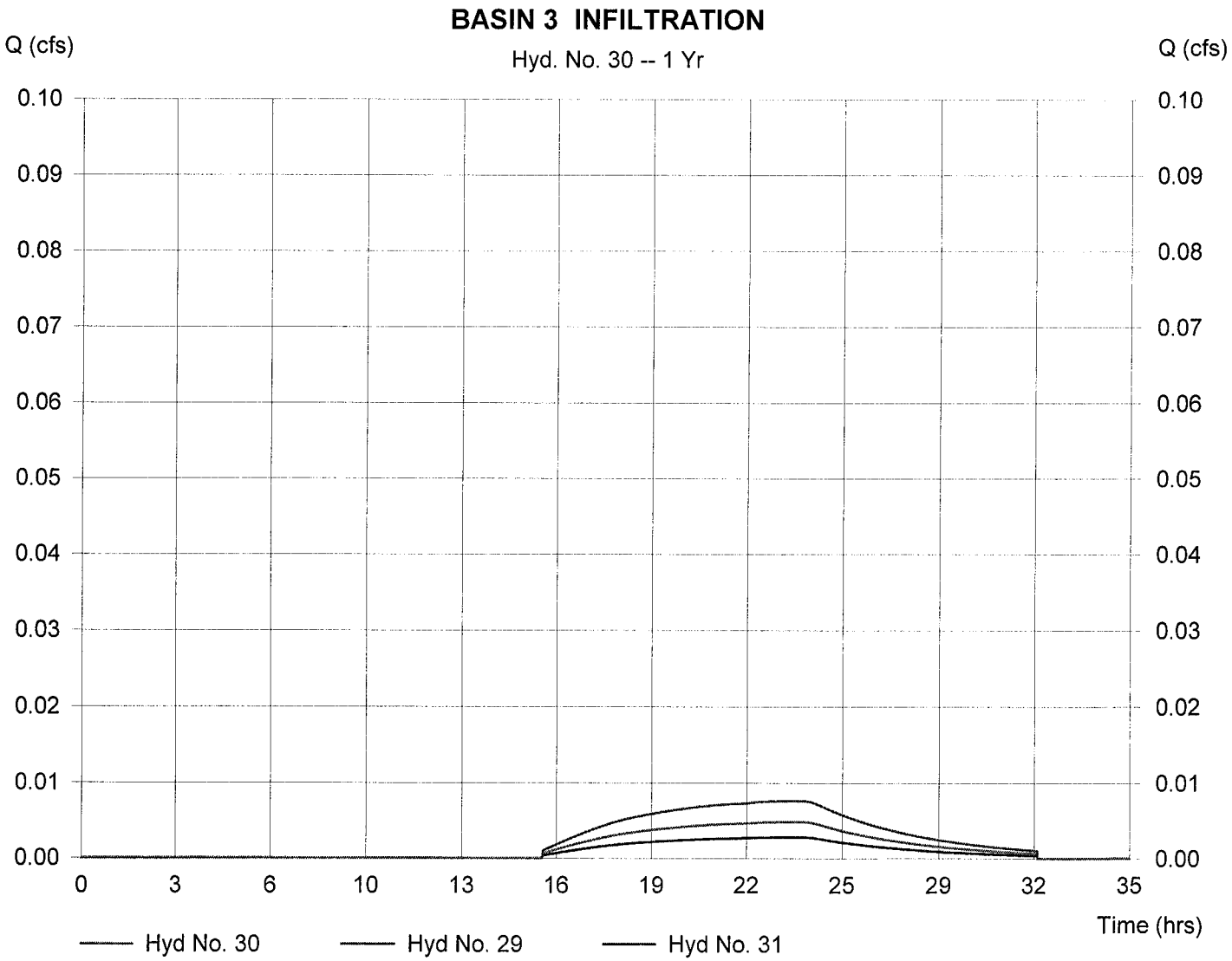
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Hyd. No. 30

BASIN 3 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 31
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 173 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

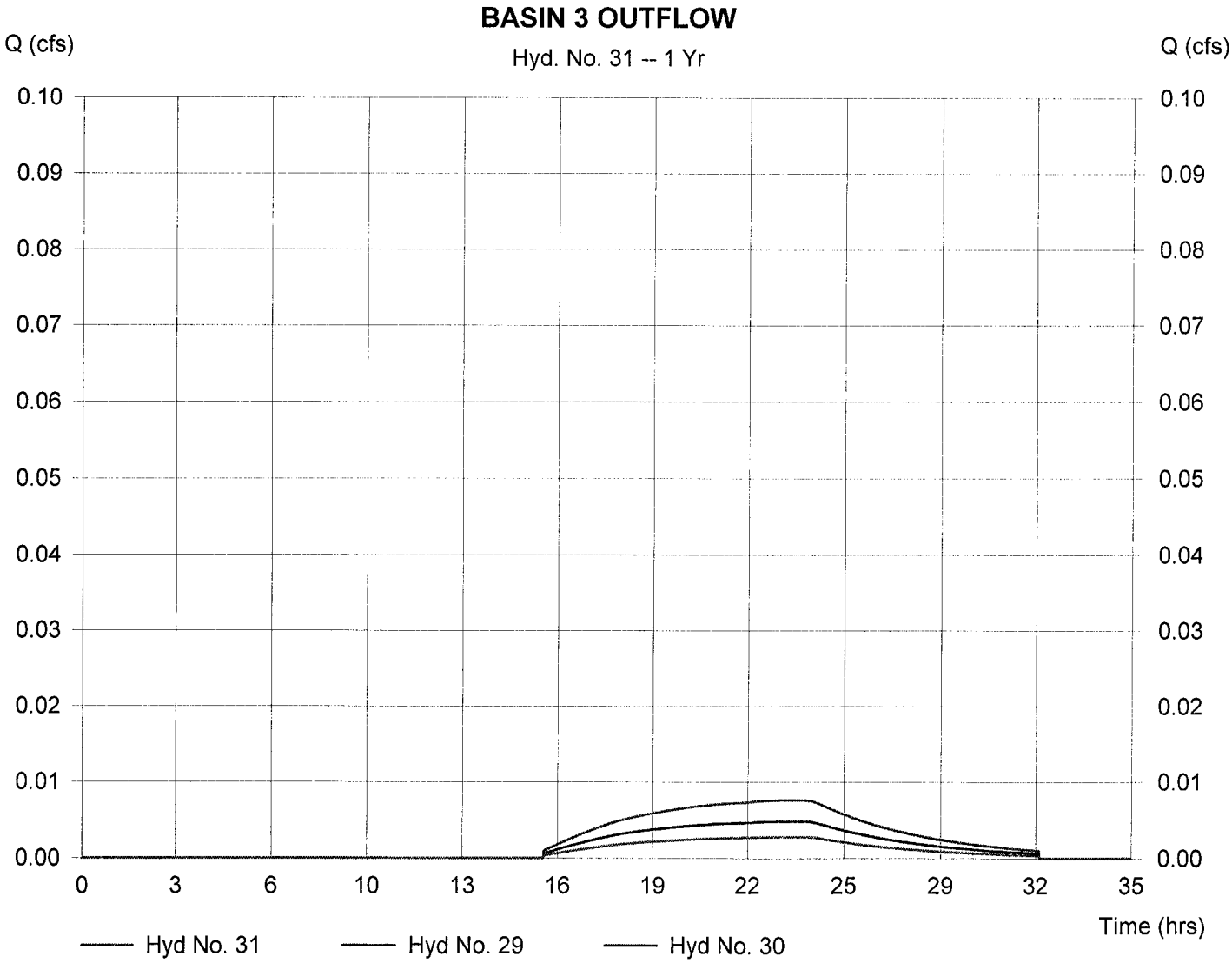
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 31

BASIN 3 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 30
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 100 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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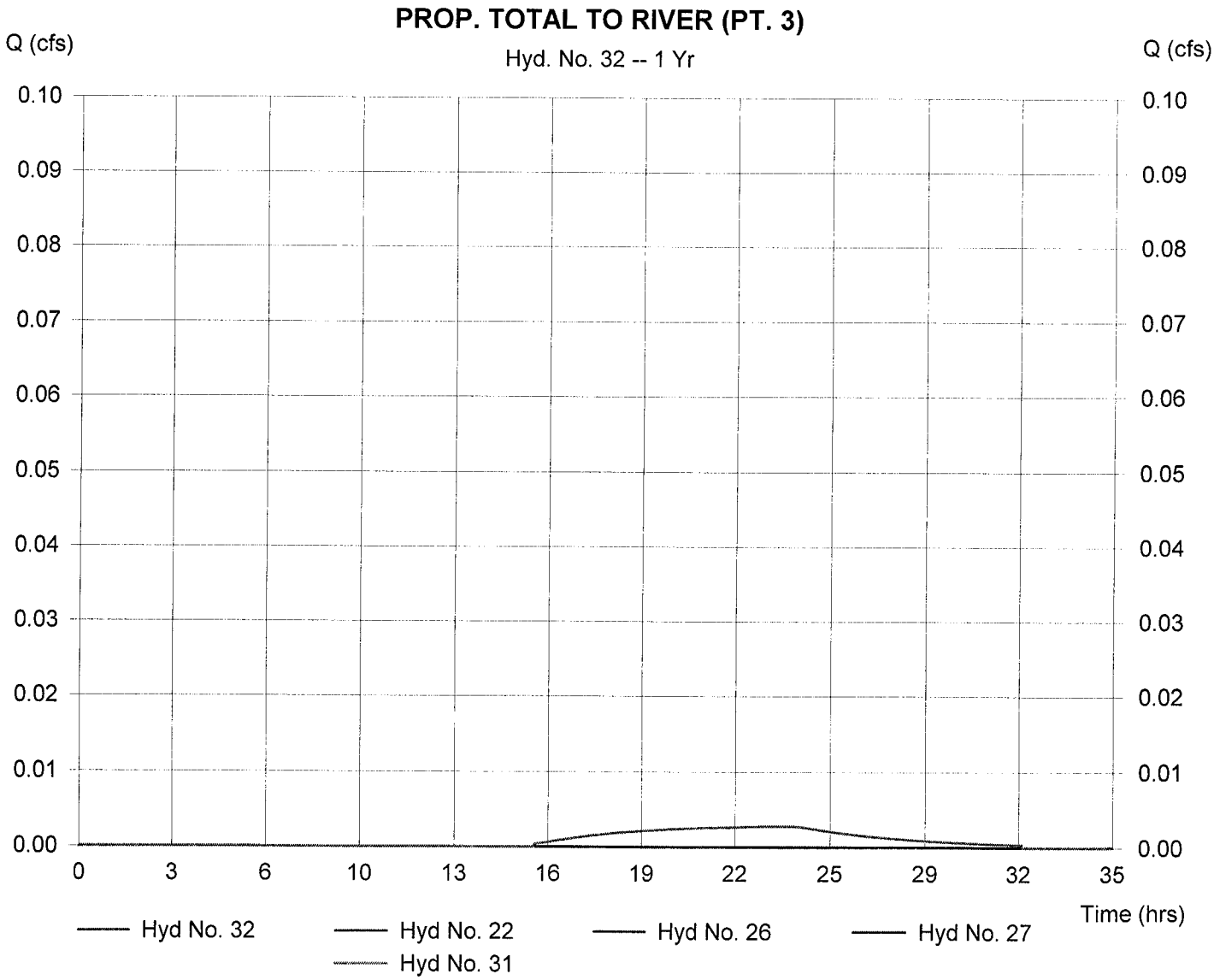
Hyd. No. 32

PROP. TOTAL TO RIVER (PT. 3)

Hydrograph type = Combine
Storm frequency = 1 yrs
Inflow hyds. = 22, 26, 27, 31

Peak discharge = 0.00 cfs
Time interval = 1 min

Hydrograph Volume = 100 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

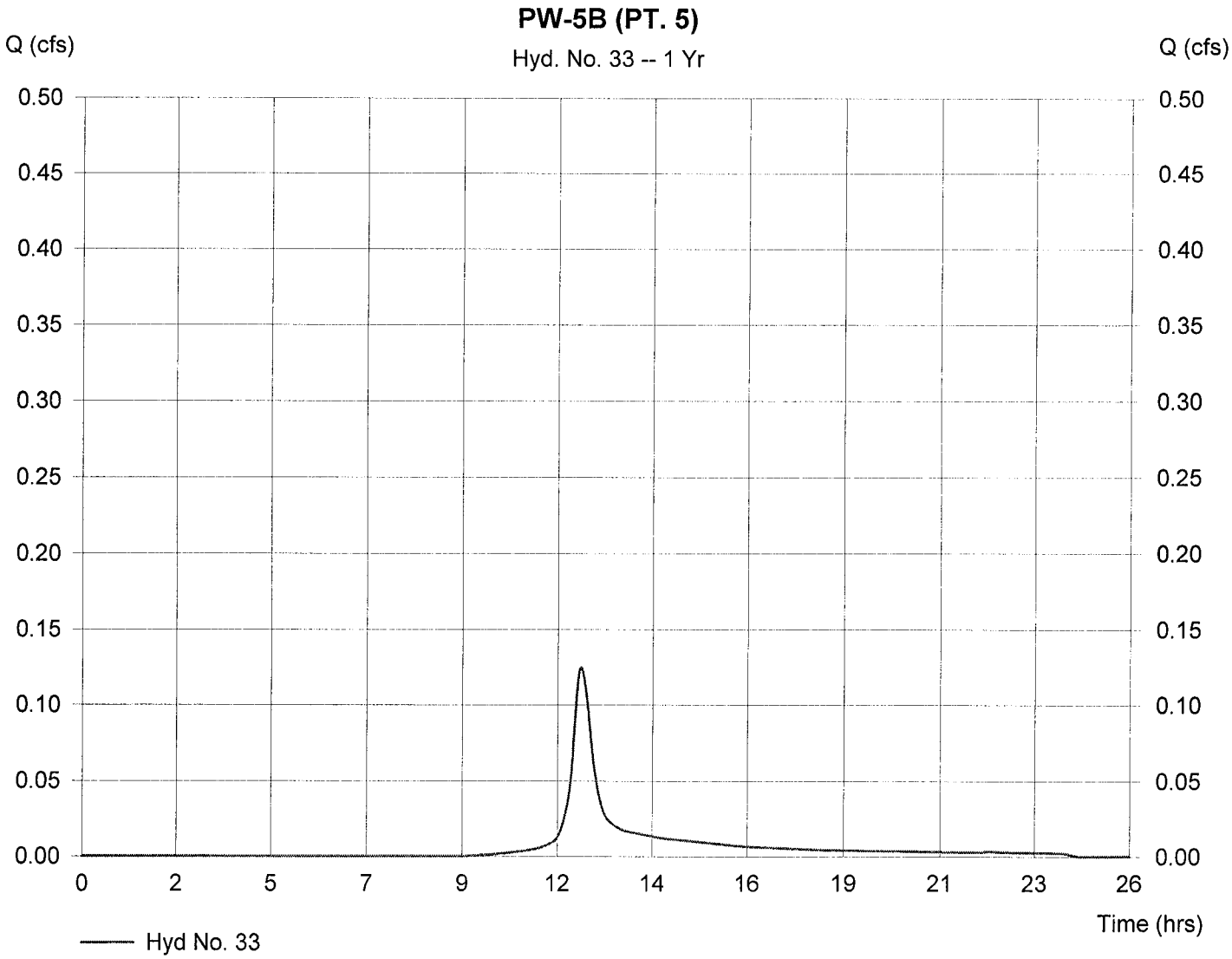
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Hyd. No. 33

PW-5B (PT. 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.12 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 0.340 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.10 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 556 cuft



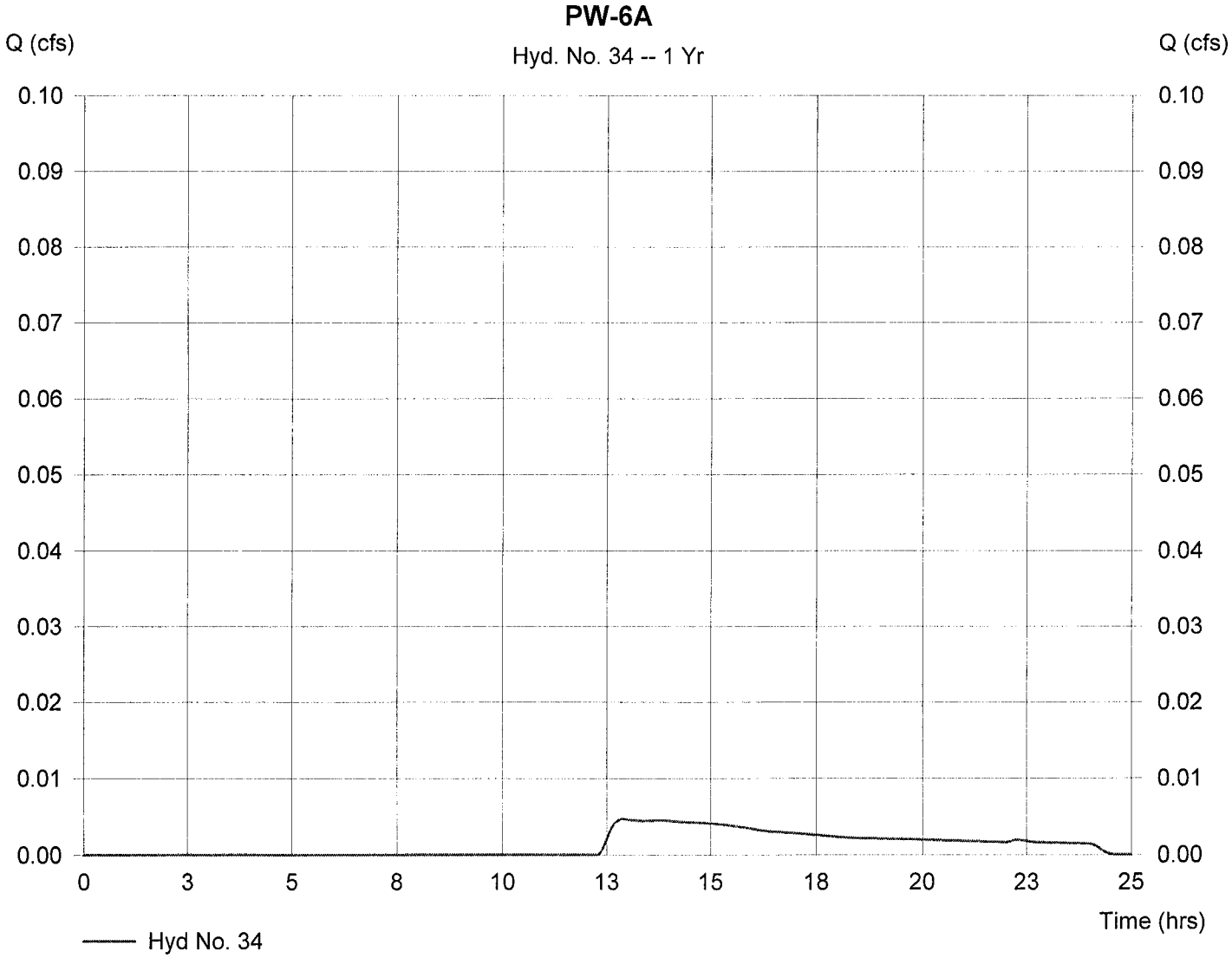
Hydrograph Plot

Hyd. No. 34

PW-6A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 0.820 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.70 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 115 cuft



Hydrograph Plot

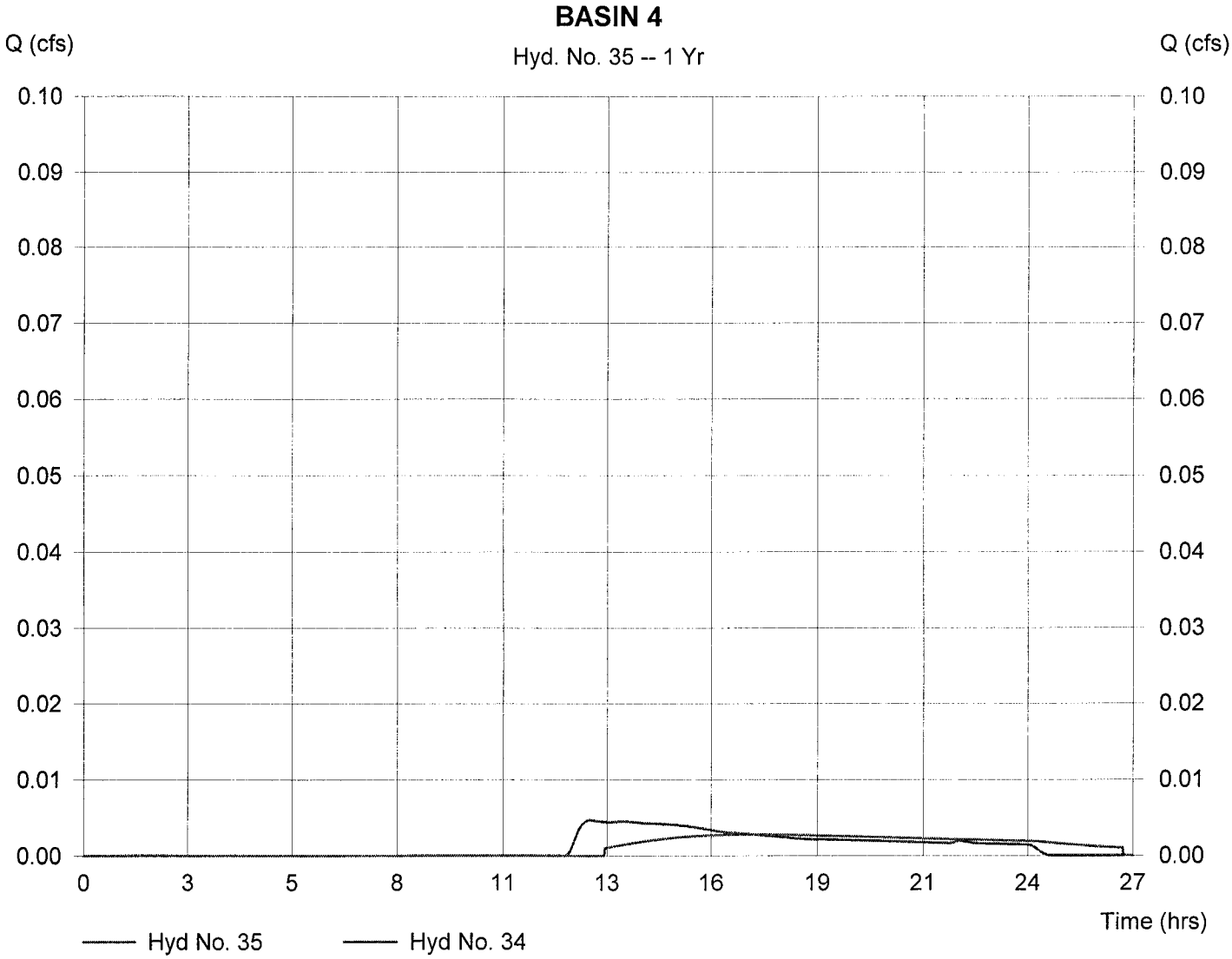
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Hyd. No. 35

BASIN 4

Hydrograph type	= Reservoir	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hyd. No.	= 34	Max. Elevation	= 128.04 ft
Reservoir name	= BASIN 4	Max. Storage	= 34 cuft

Storage Indication method used. | Hydrograph Volume = 102 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

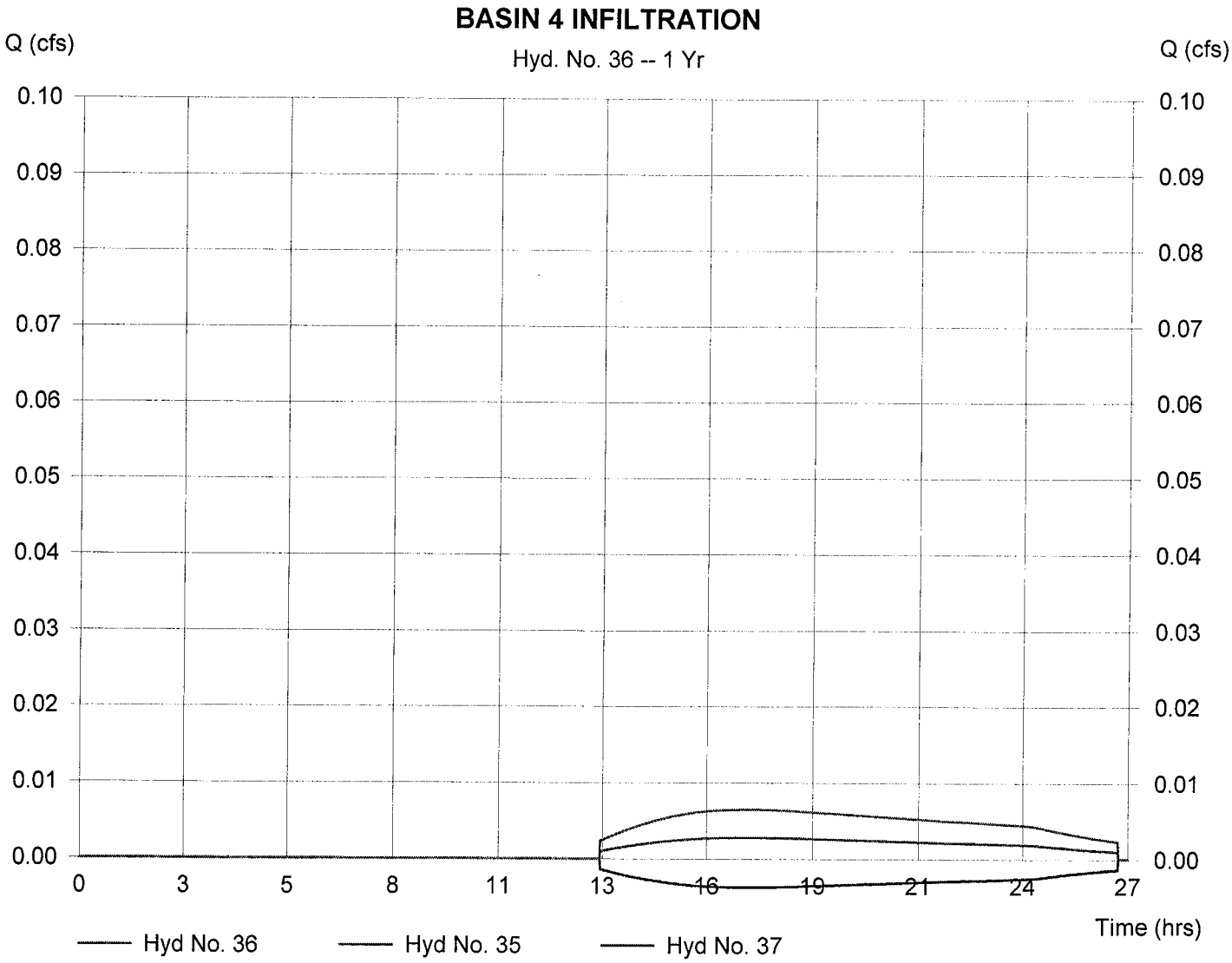
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 36

BASIN 4 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.01 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 37
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = 239 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

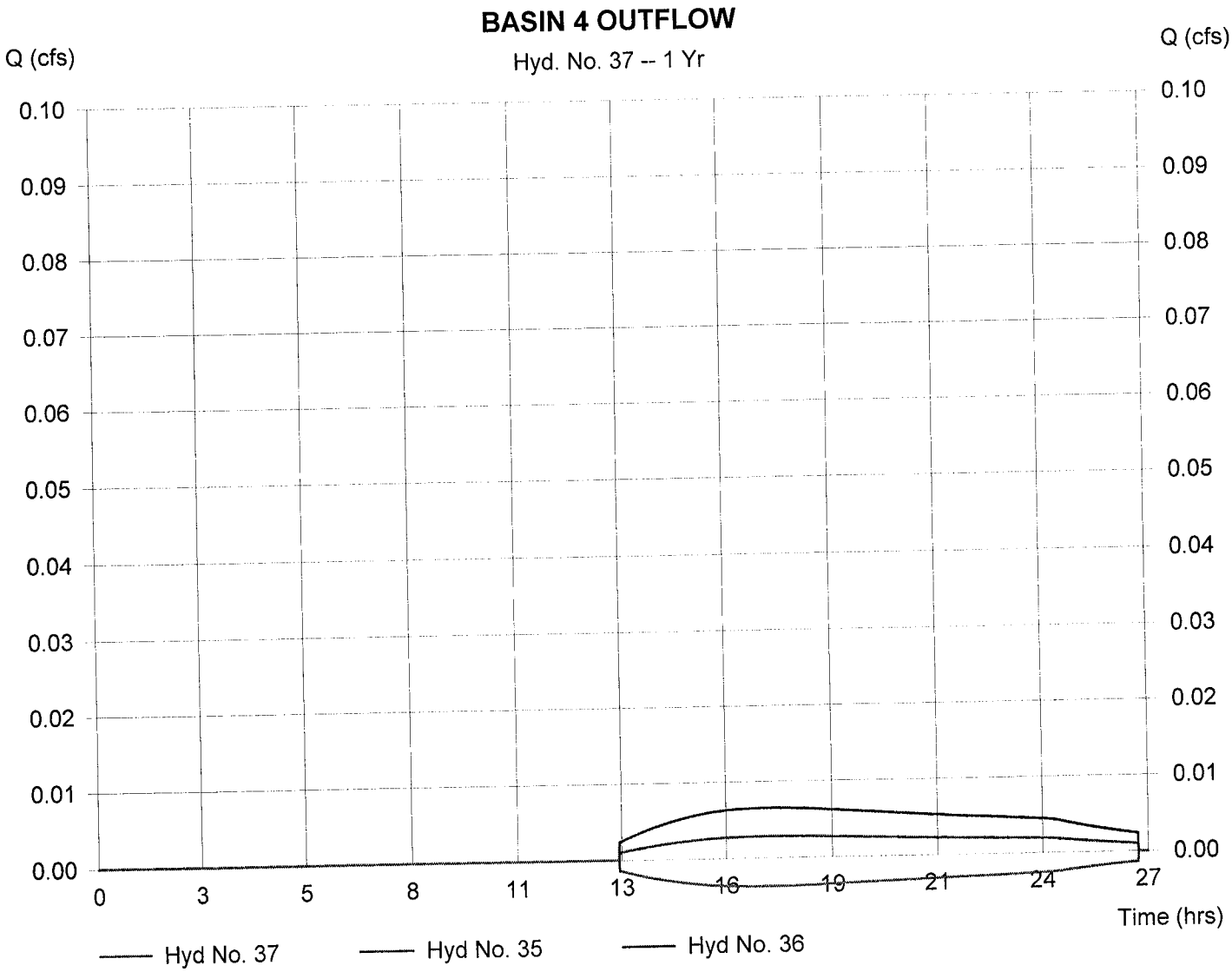
Hyd. No. 37

BASIN 4 OUTFLOW

Hydrograph type = Diversion2
Storm frequency = 1 yrs
Inflow hydrograph = 35
Diversion method = Pond - BASIN 4

Peak discharge = 0.00 cfs
Time interval = 1 min
2nd diverted hyd. = 36
Pond structure = Exfiltration

Hydrograph Volume = -136 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

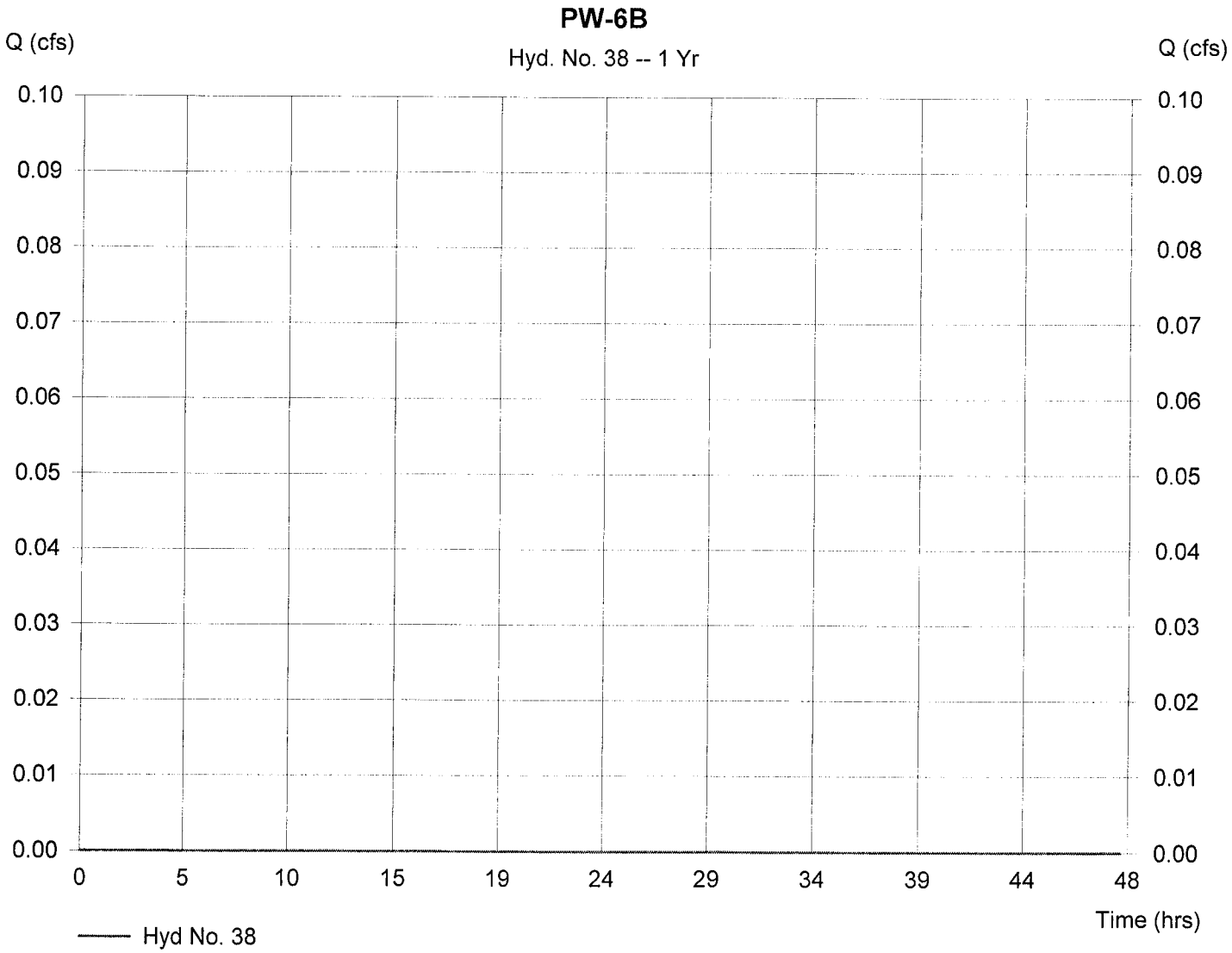
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 38

PW-6B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 0.600 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

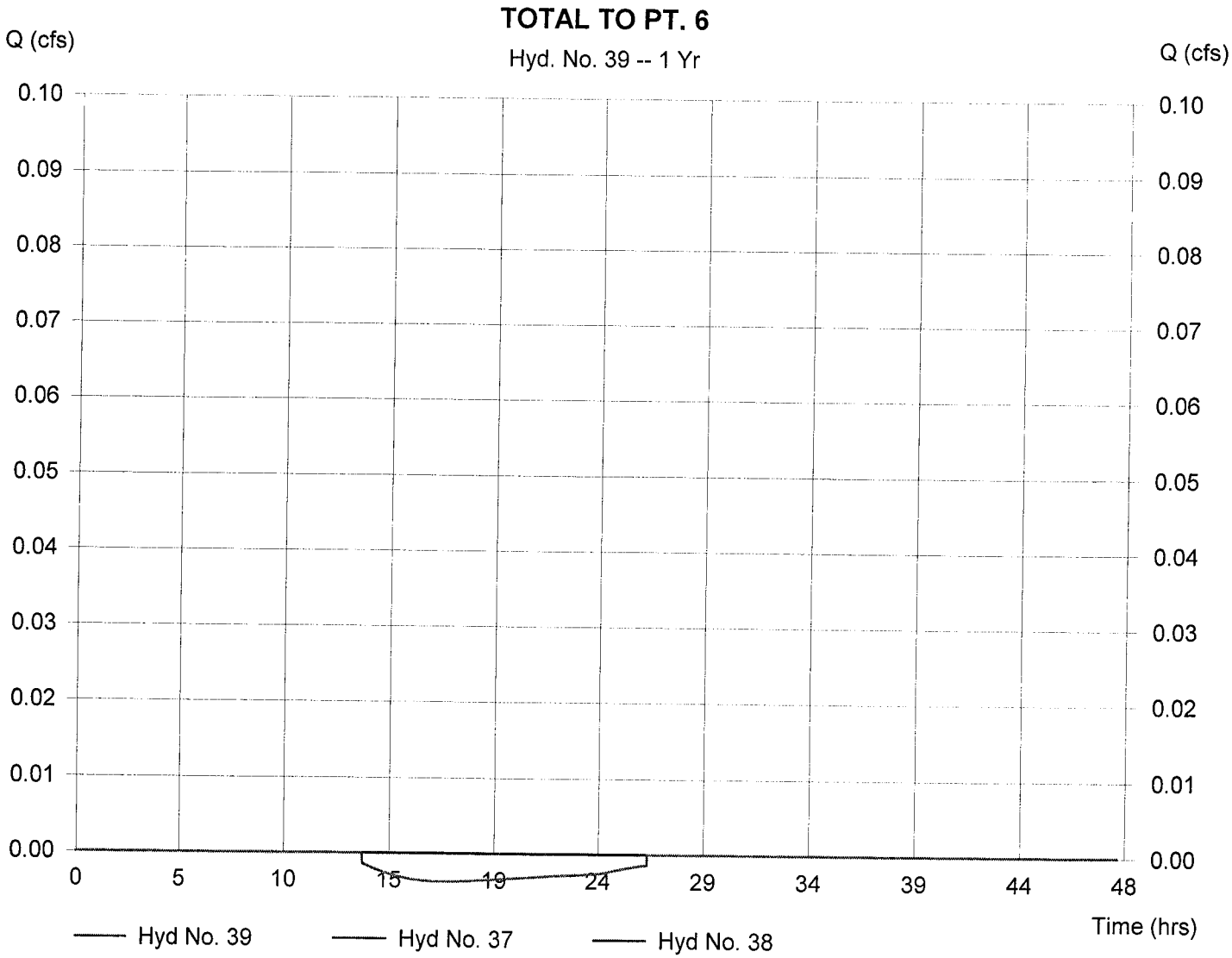
Hyd. No. 39

TOTAL TO PT. 6

Hydrograph type = Combine
Storm frequency = 1 yrs
Inflow hyds. = 37, 38

Peak discharge = 0.00 cfs
Time interval = 1 min

Hydrograph Volume = -136 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

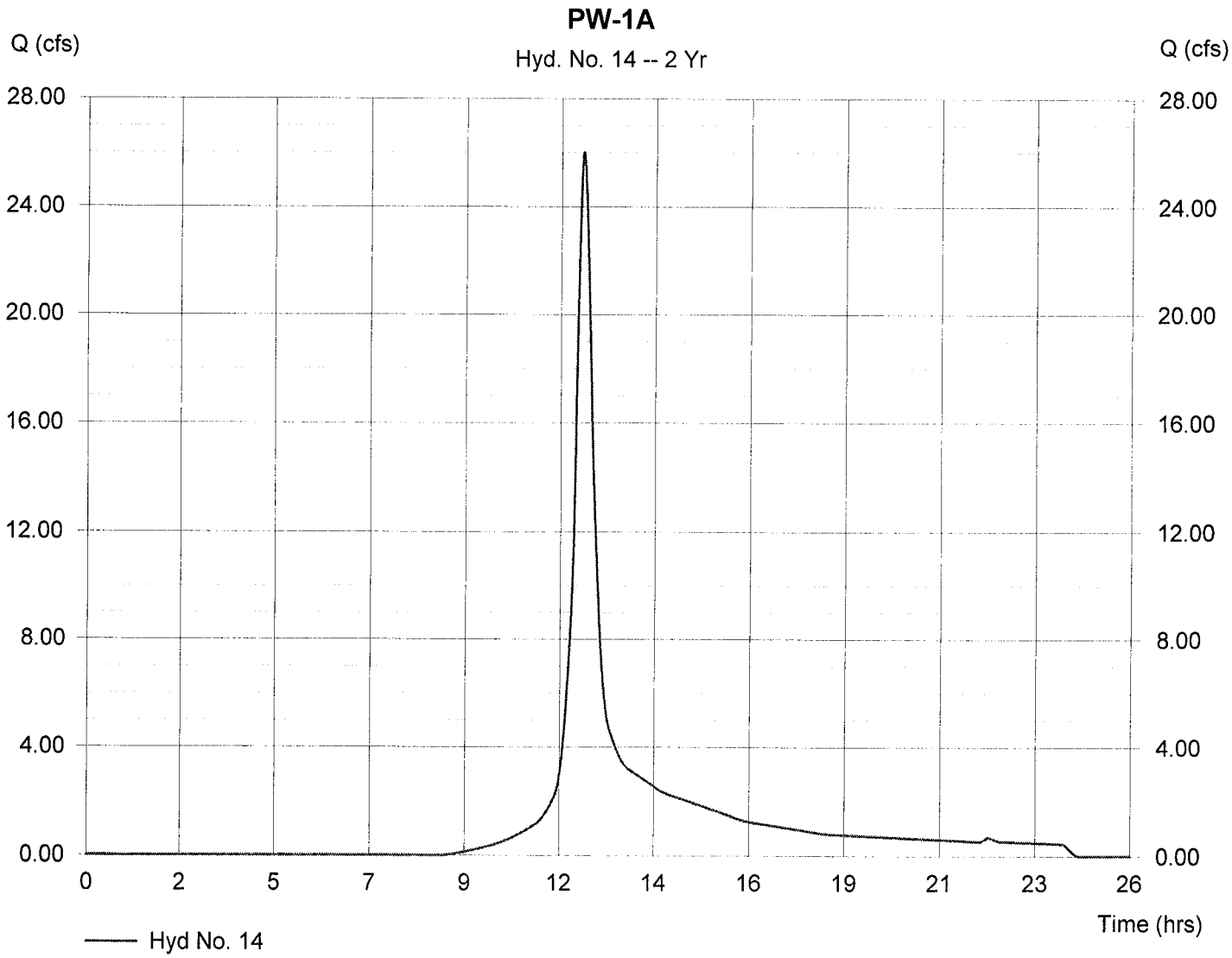
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 14

PW-1A

Hydrograph type	= SCS Runoff	Peak discharge	= 26.00 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 20.200 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.50 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 110,731 cuft



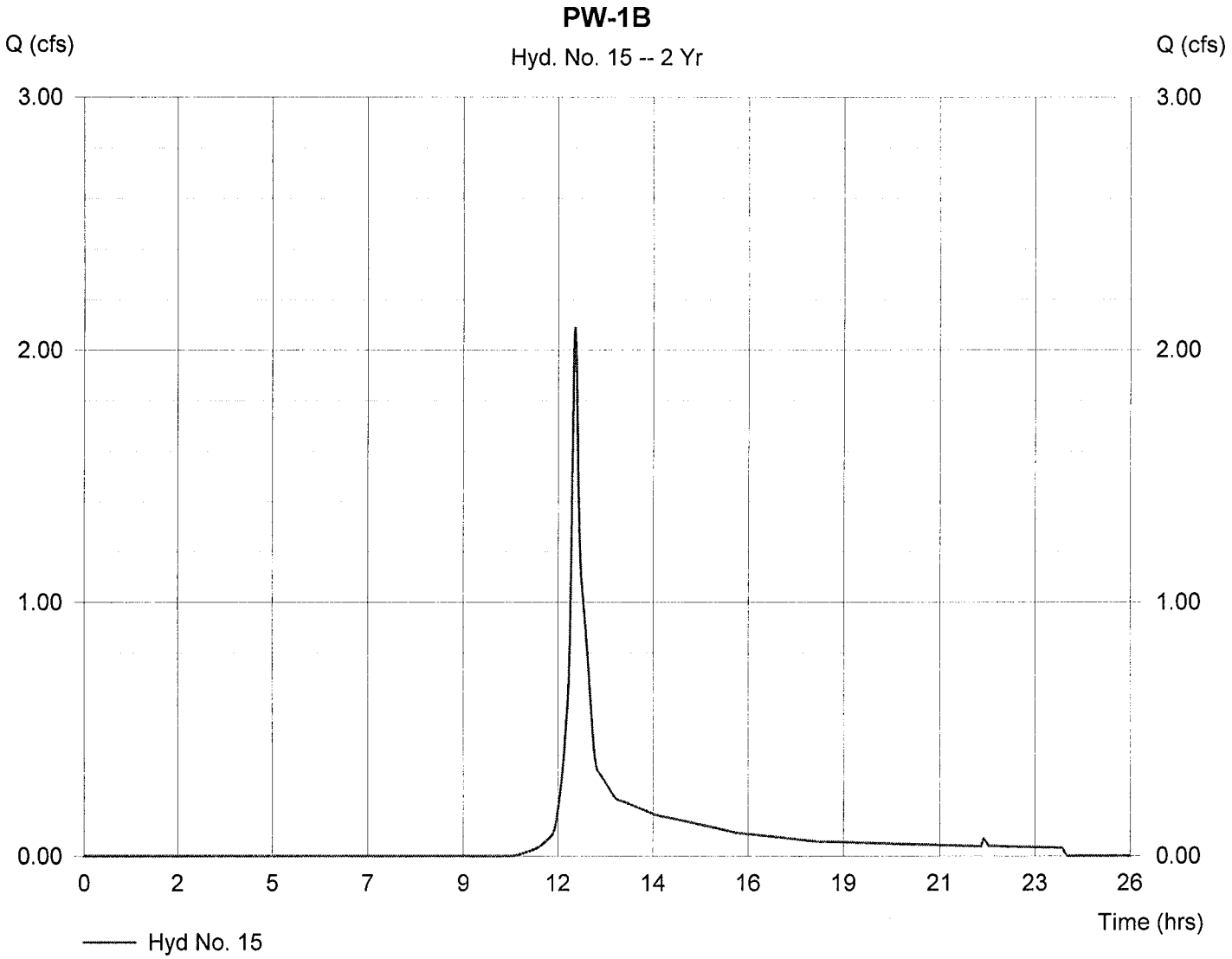
Hydrograph Plot

Hyd. No. 15

PW-1B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.09 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 1.750 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,726 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

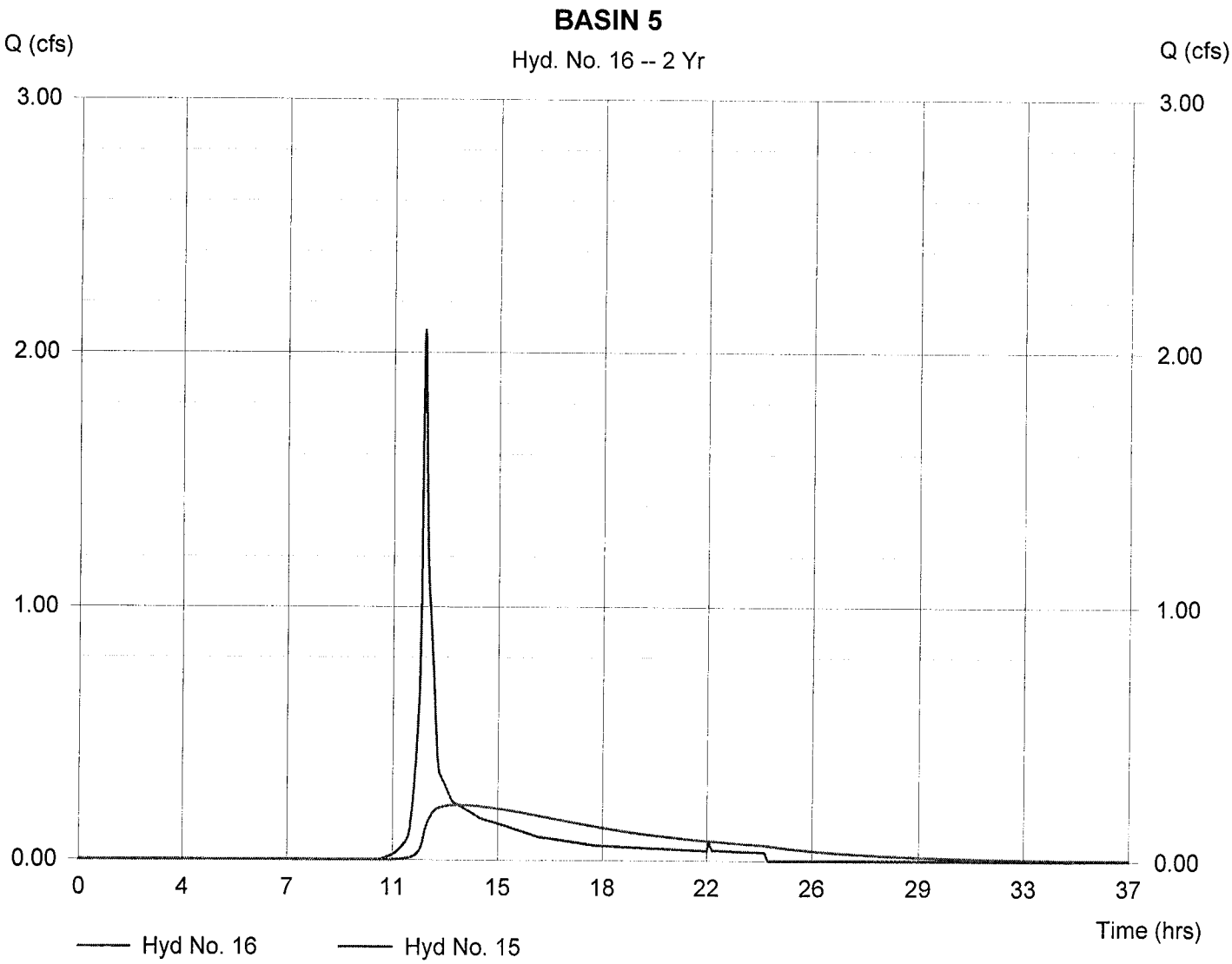
Hyd. No. 16

BASIN 5

Hydrograph type	= Reservoir	Peak discharge	= 0.21 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 15	Max. Elevation	= 126.99 ft
Reservoir name	= BASIN 5	Max. Storage	= 2,879 cuft

Storage Indication method used.

Hydrograph Volume = 6,713 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

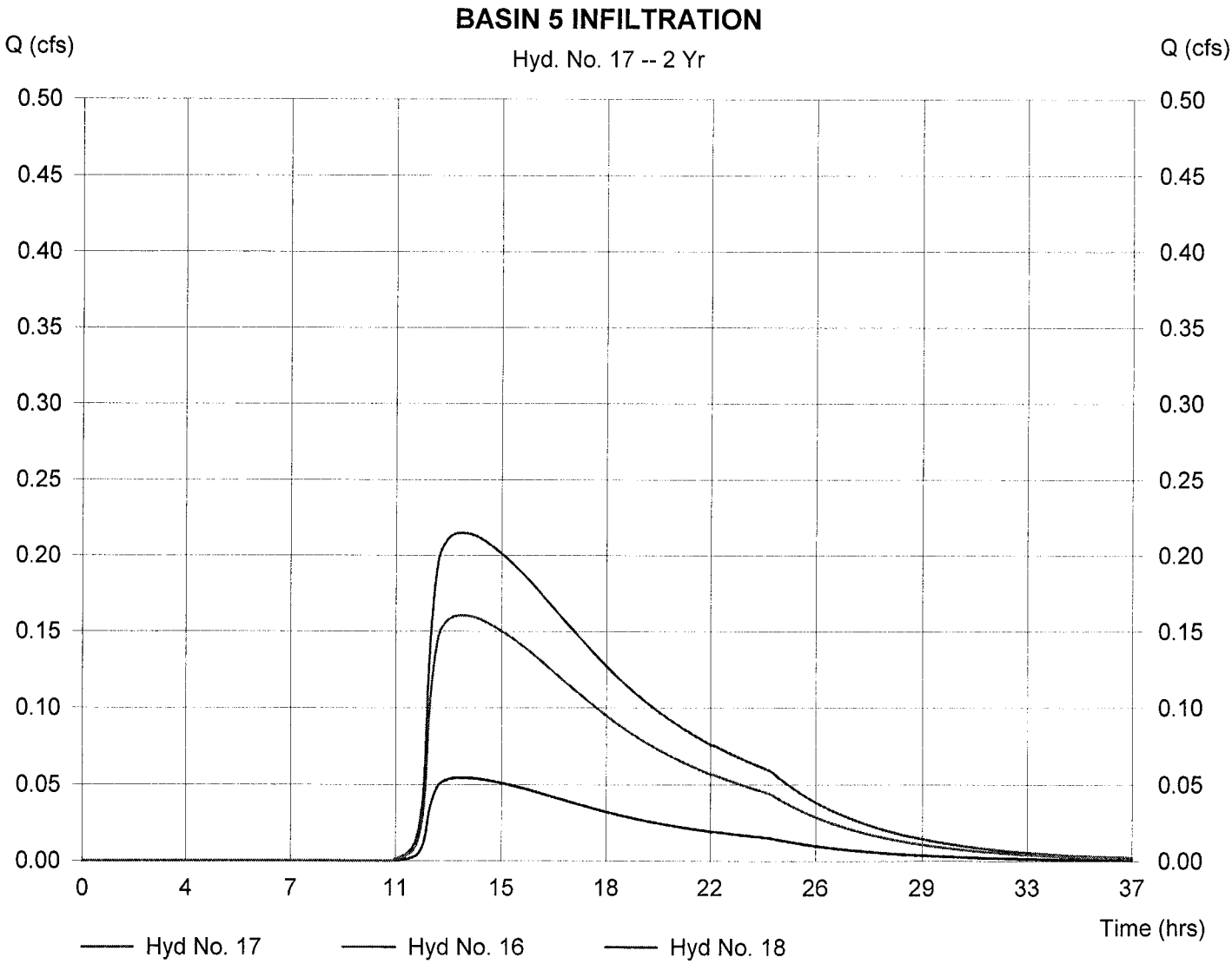
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 17

BASIN 5 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.16 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 16	2nd diverted hyd.	= 18
Diversion method	= Pond - BASIN 5	Pond structure	= Exfiltration

Hydrograph Volume = 5,011 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

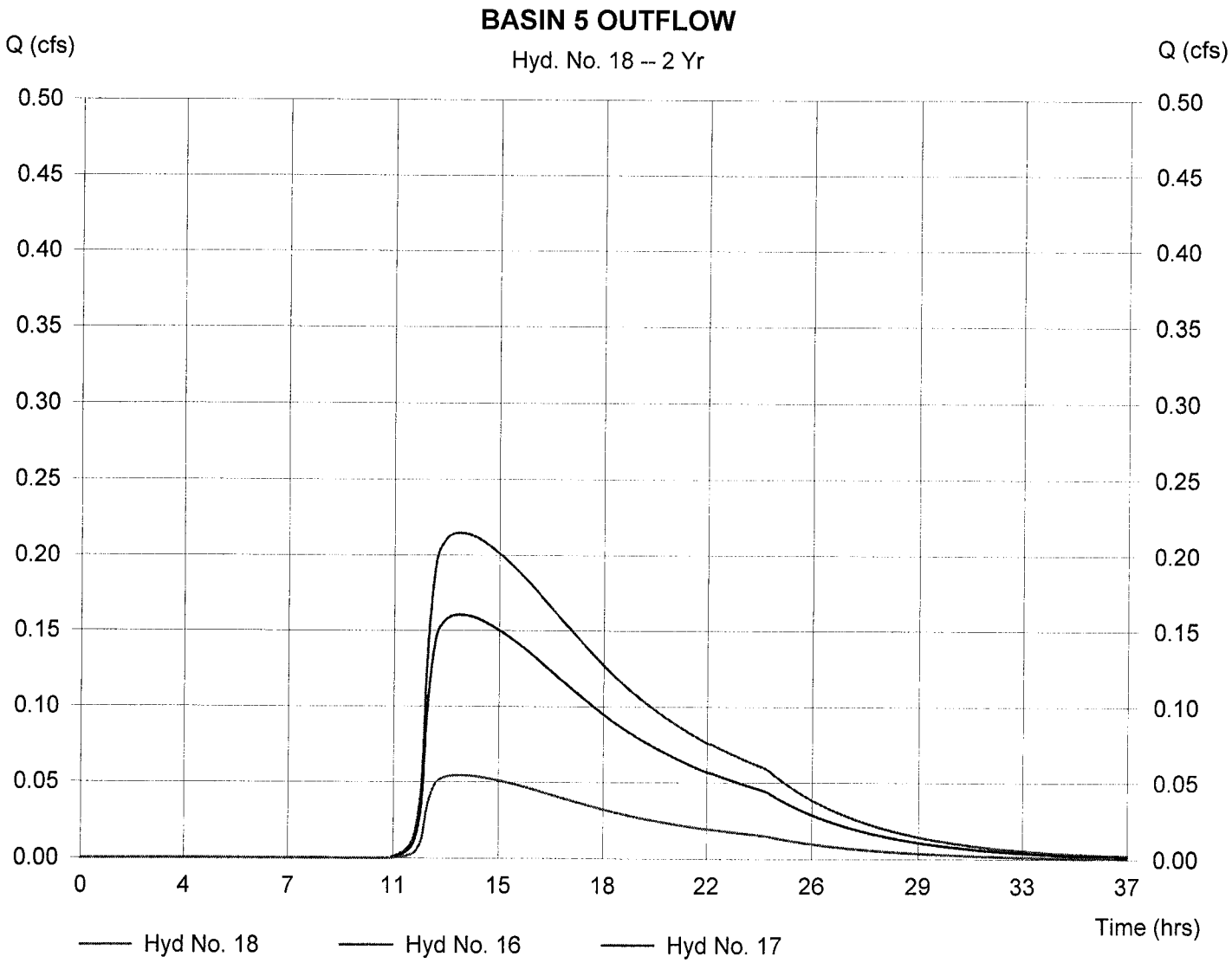
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 18

BASIN 5 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.05 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 16	2nd diverted hyd.	= 17
Diversion method	= Pond - BASIN 5	Pond structure	= Exfiltration

Hydrograph Volume = 1,702 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

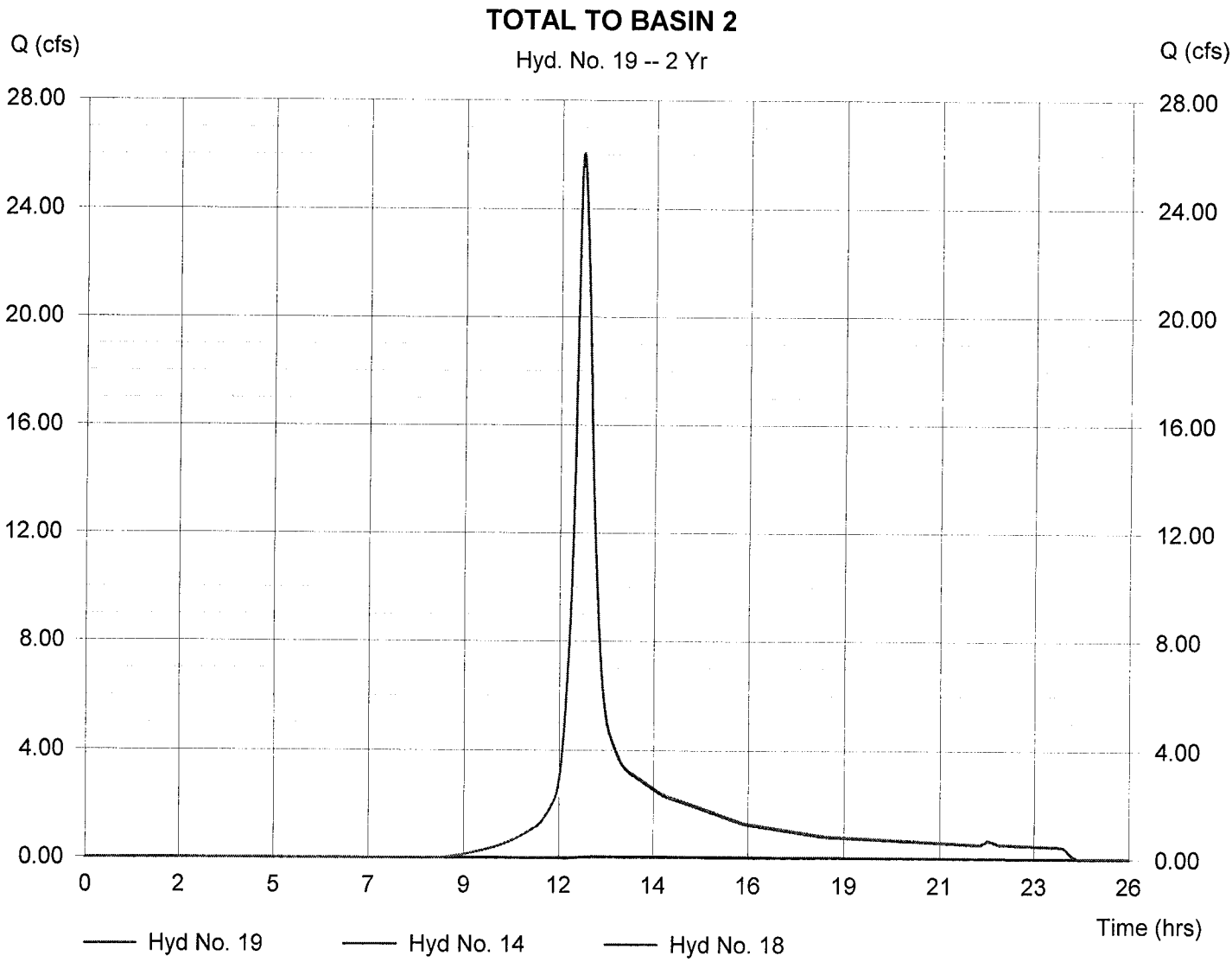
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 19

TOTAL TO BASIN 2

Hydrograph type	= Combine	Peak discharge	= 26.04 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 14, 18		

Hydrograph Volume = 112,433 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

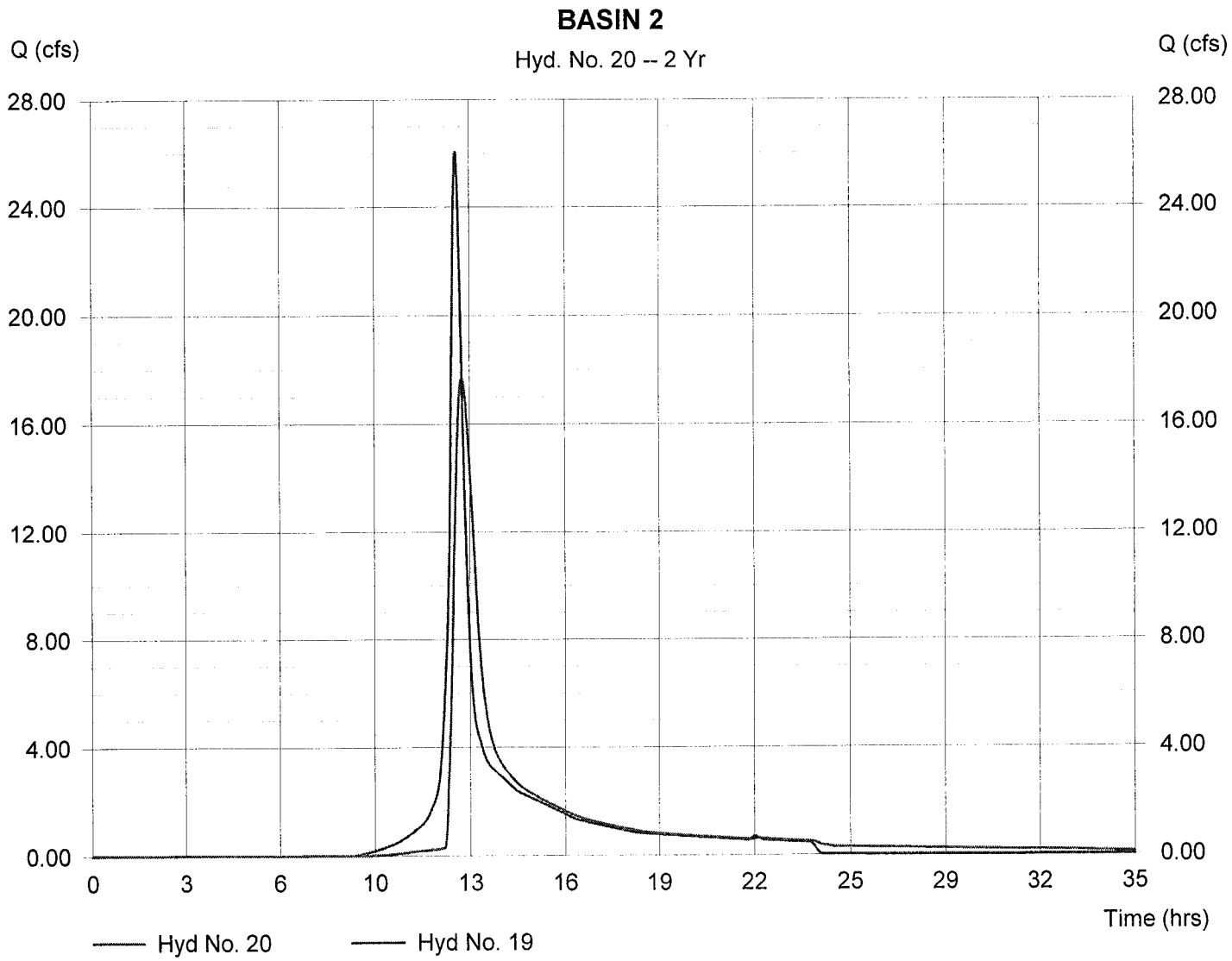
Hyd. No. 20

BASIN 2

Hydrograph type	= Reservoir	Peak discharge	= 17.69 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 19	Max. Elevation	= 120.82 ft
Reservoir name	= BASIN 2	Max. Storage	= 26,243 cuft

Storage Indication method used.

Hydrograph Volume = 112,384 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

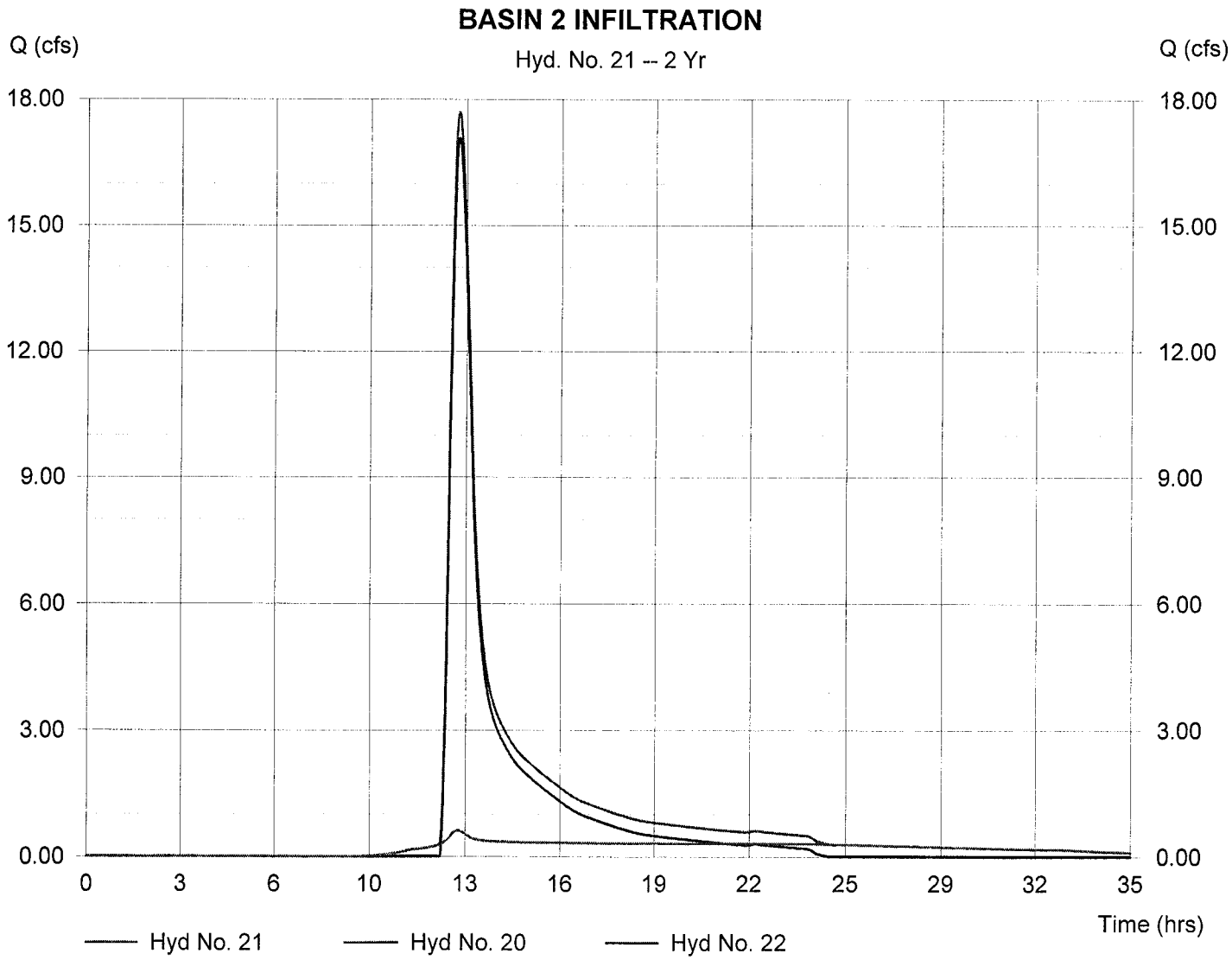
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 21

BASIN 2 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.61 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 22
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 25,345 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

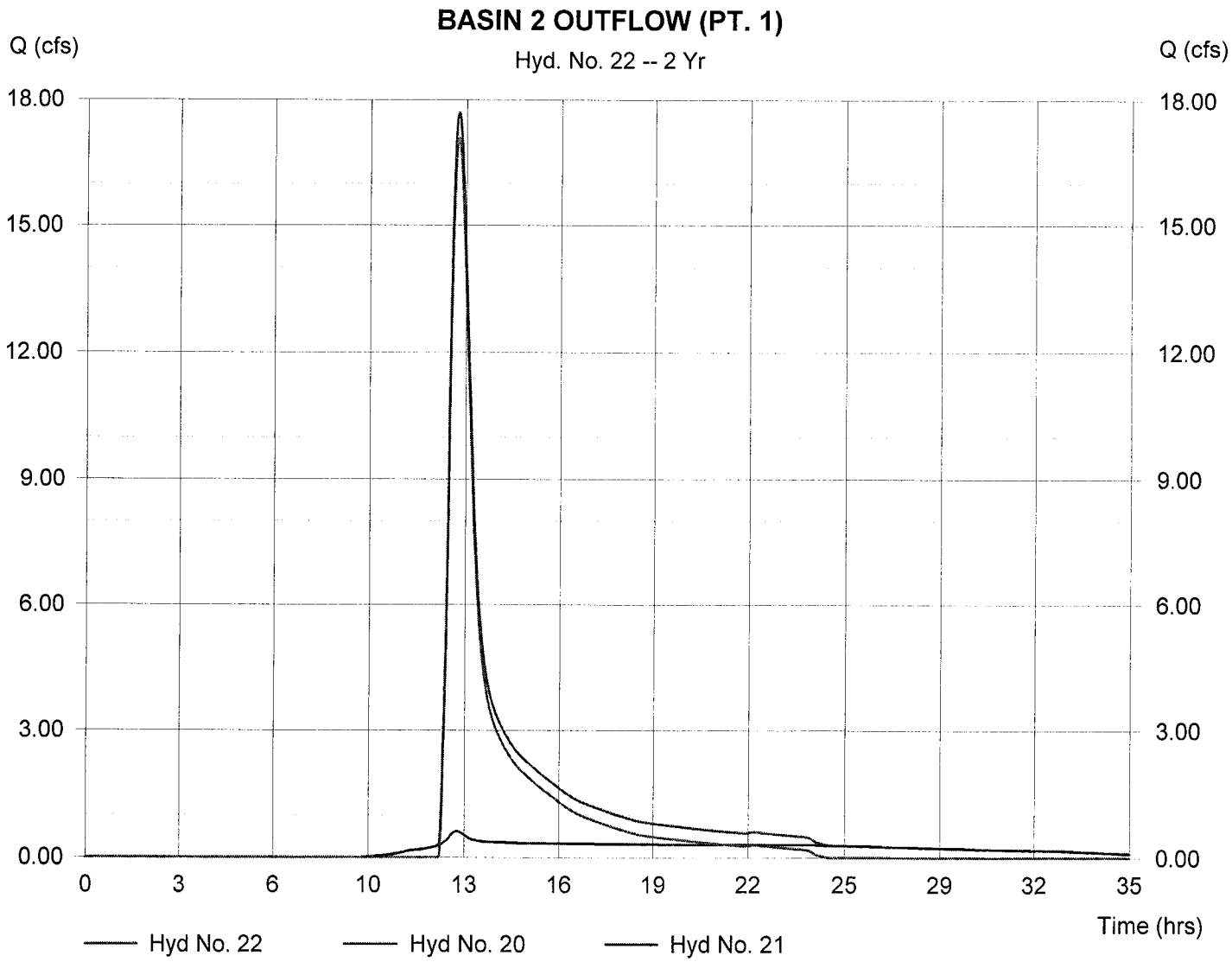
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 22

BASIN 2 OUTFLOW (PT. 1)

Hydrograph type	= Diversion2	Peak discharge	= 17.08 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 21
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 87,039 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

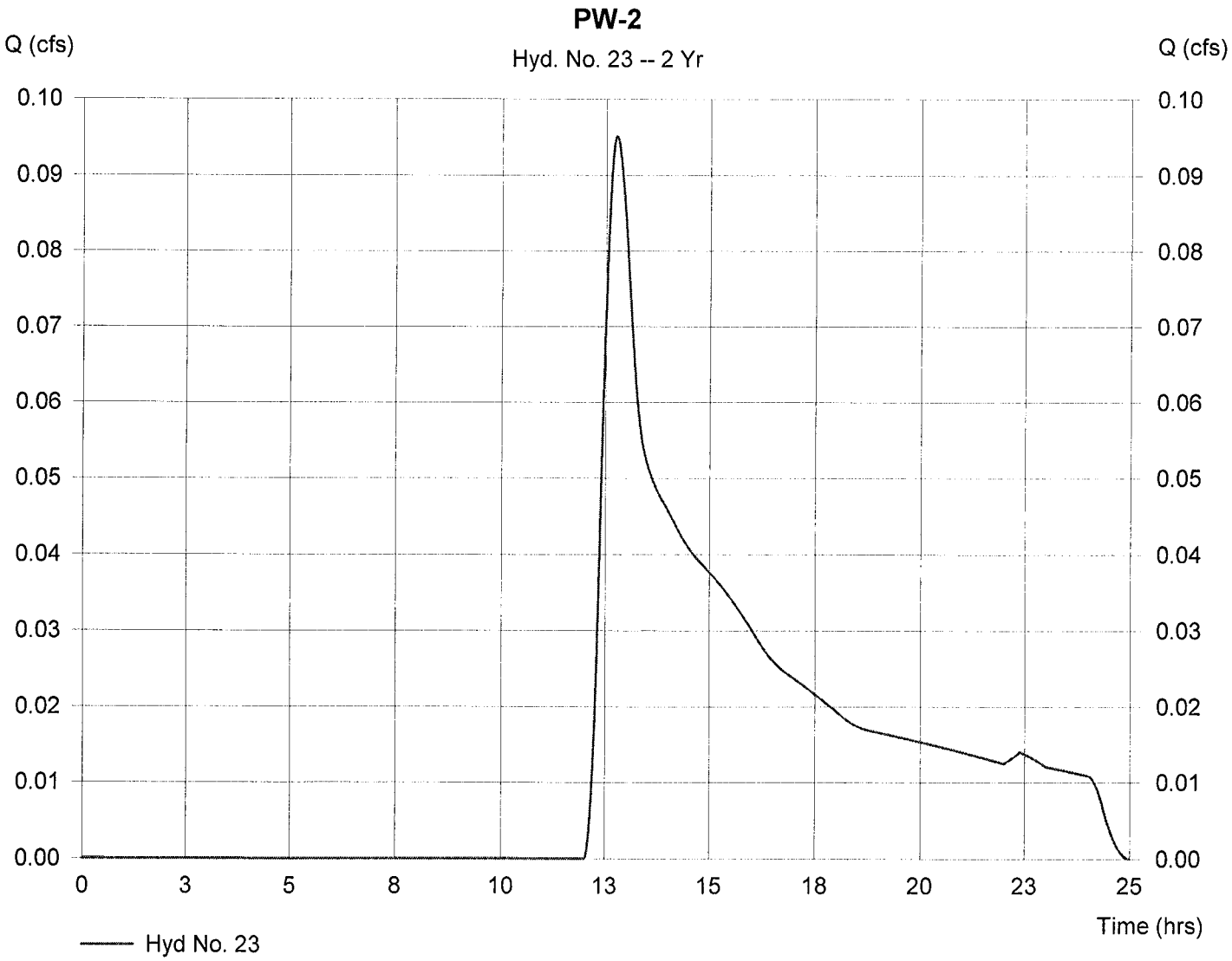
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 23

PW-2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.10 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 1.310 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.50 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,177 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

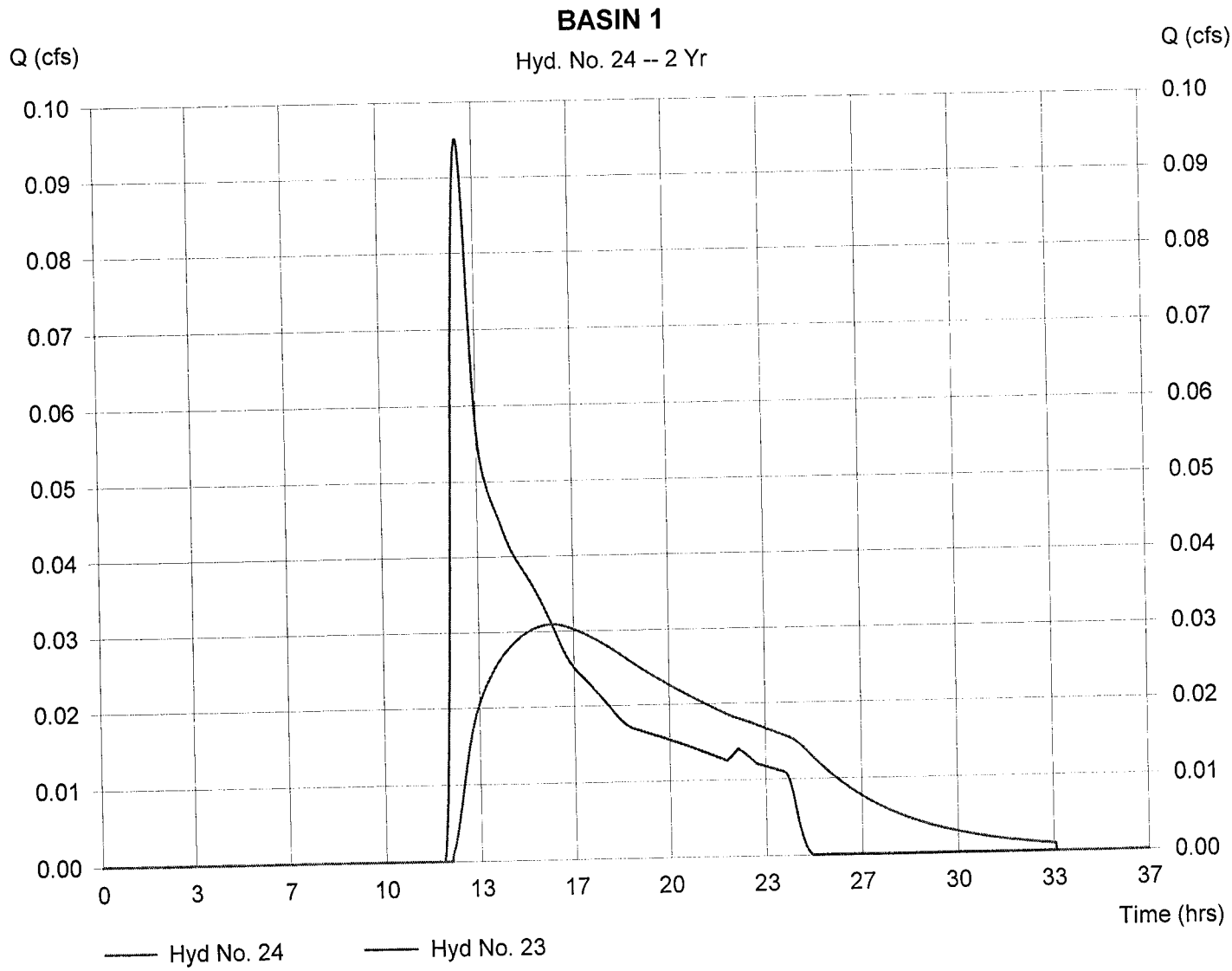
Hyd. No. 24

BASIN 1

Hydrograph type	= Reservoir	Peak discharge	= 0.03 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 118.10 ft
Reservoir name	= UPGRADED BASIN	Max. Storage	= 368 cuft

Storage Indication method used.

Hydrograph Volume = 1,165 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

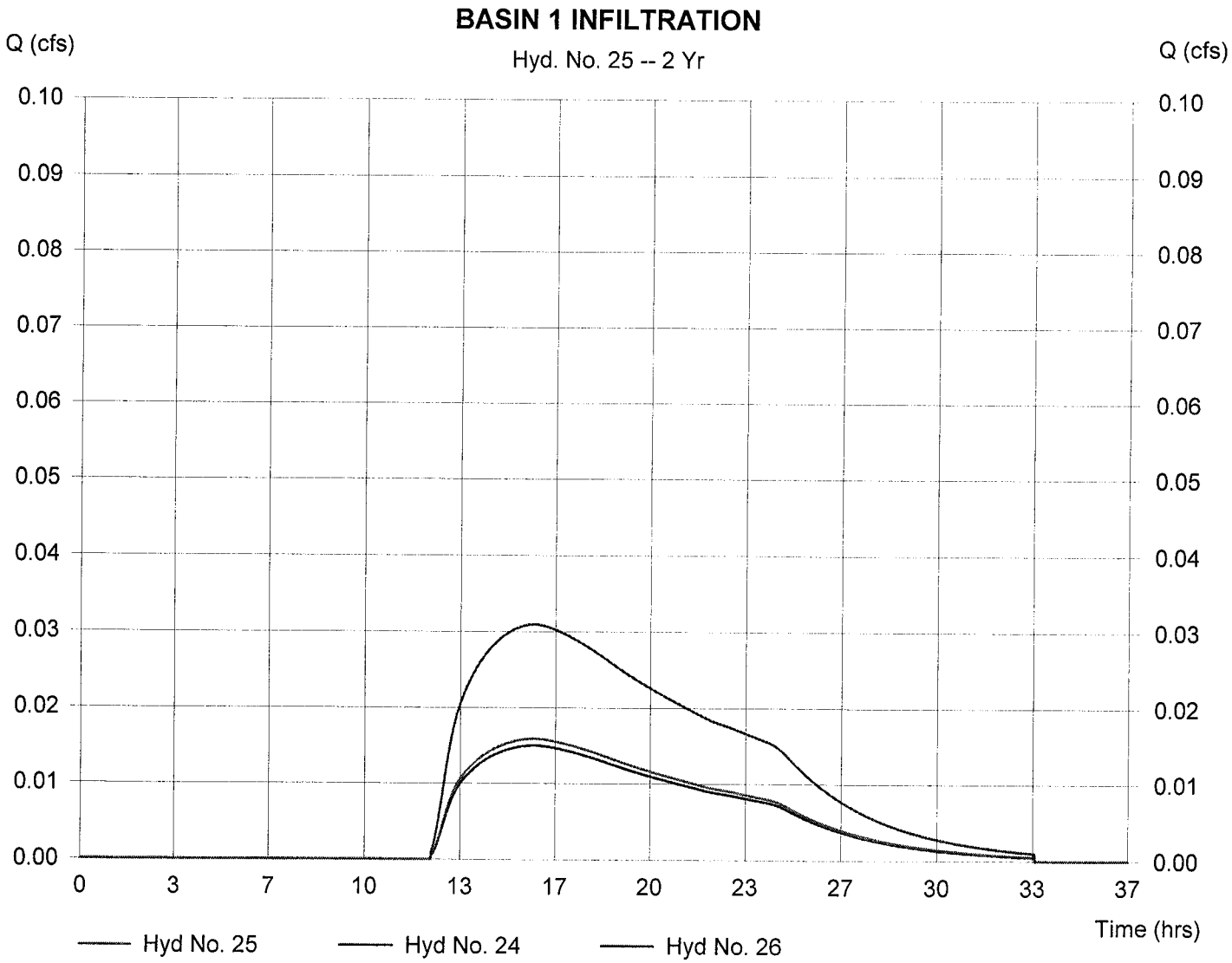
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 25

BASIN 1 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.02 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 24	2nd diverted hyd.	= 26
Diversion method	= Pond - UPGRADED BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 599 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

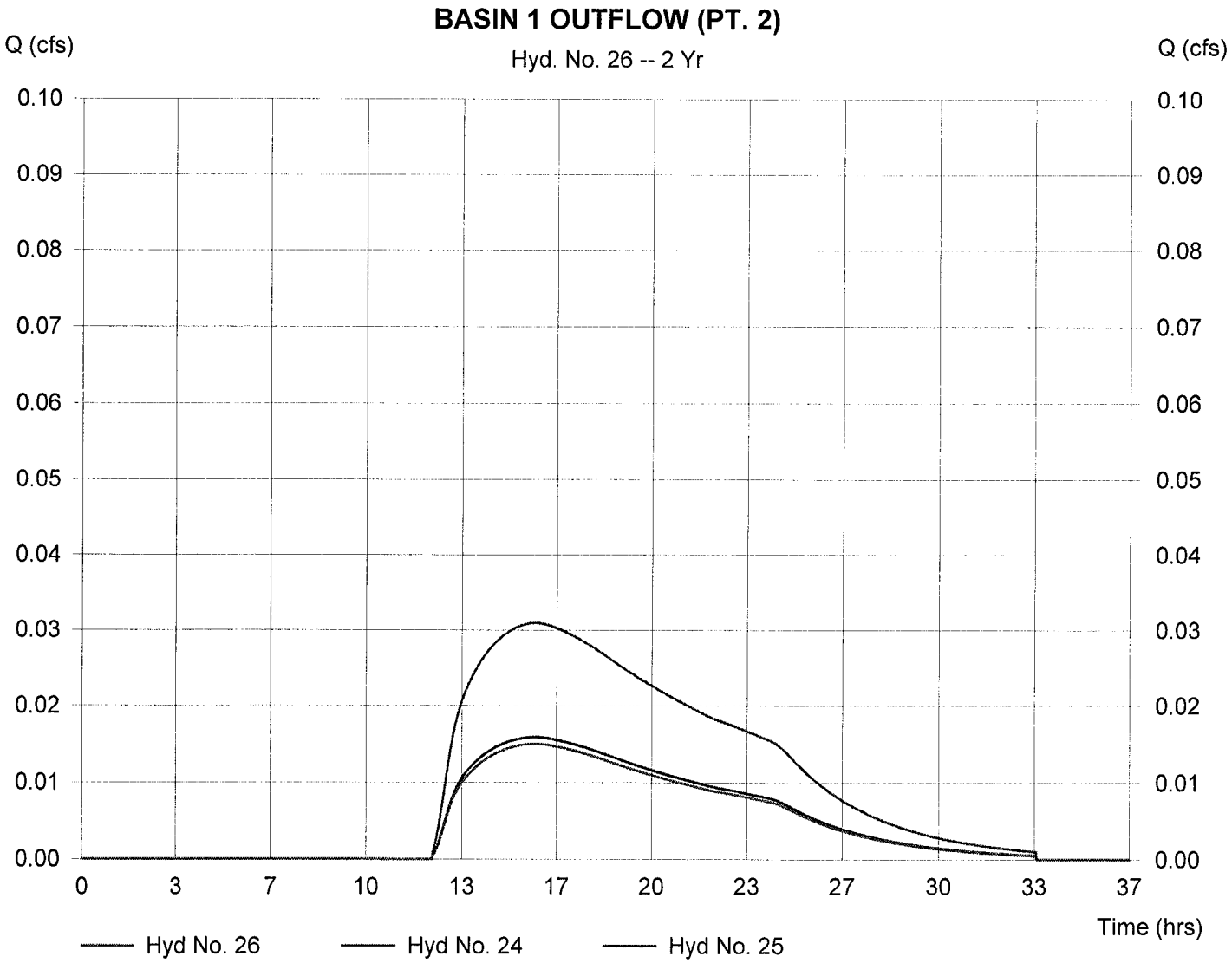
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 26

BASIN 1 OUTFLOW (PT. 2)

Hydrograph type	= Diversion2	Peak discharge	= 0.02 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 24	2nd diverted hyd.	= 25
Diversion method	= Pond - UPGRADED BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 566 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

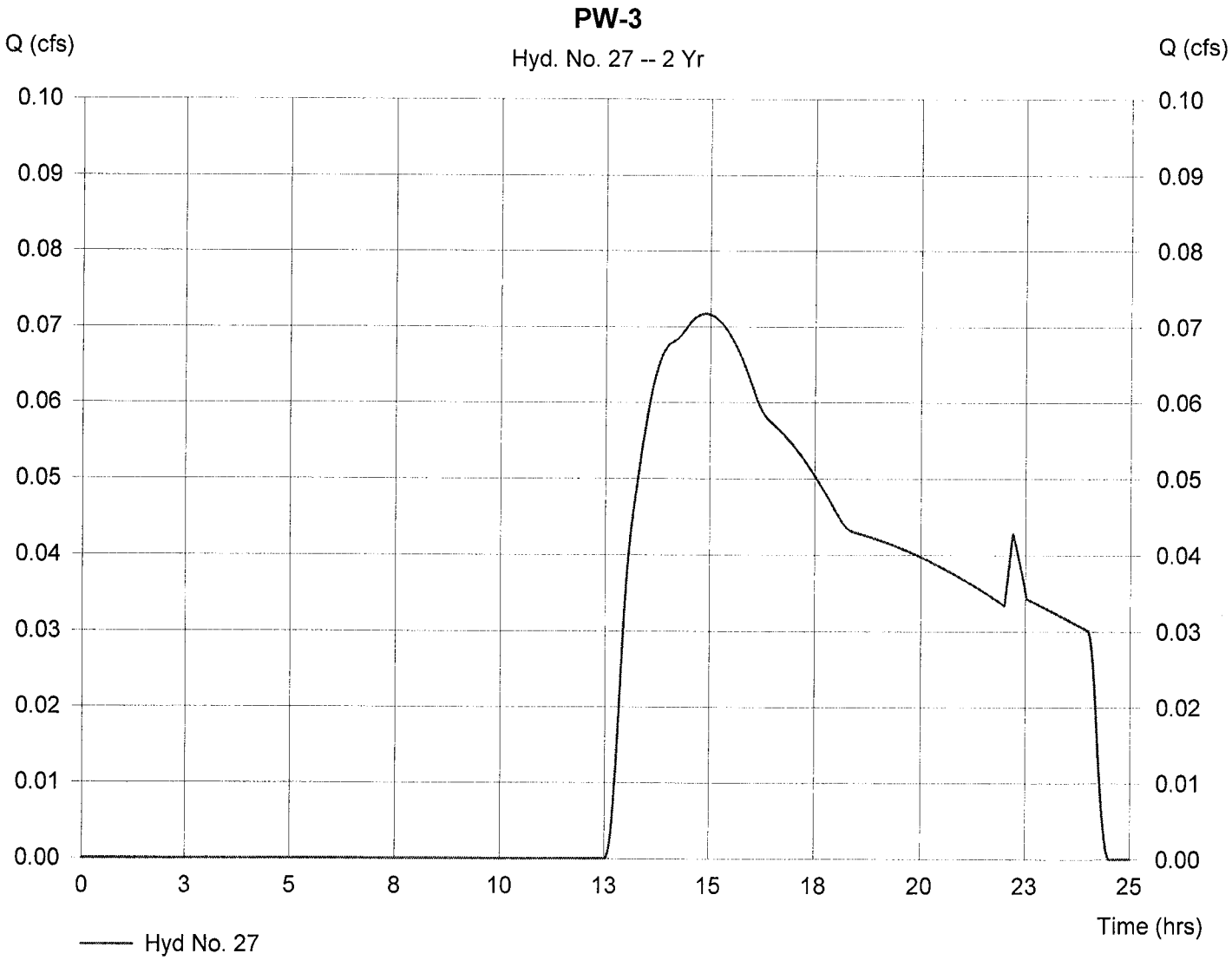
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 27

PW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.07 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 7.250 ac	Curve number	= 48
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.80 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,948 cuft



Hydrograph Plot

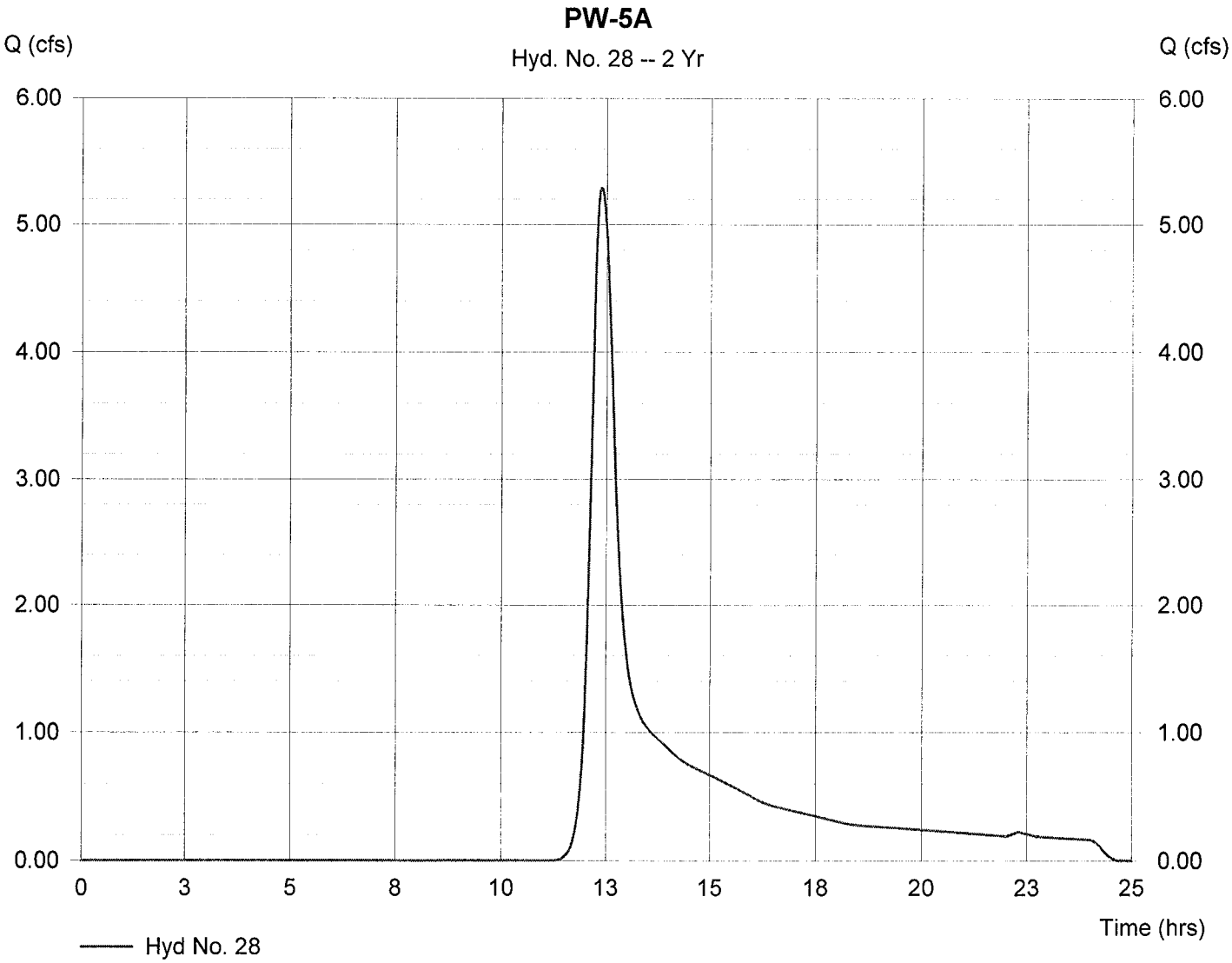
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 28

PW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.29 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 10.100 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.30 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 29,792 cuft



Hydrograph Plot

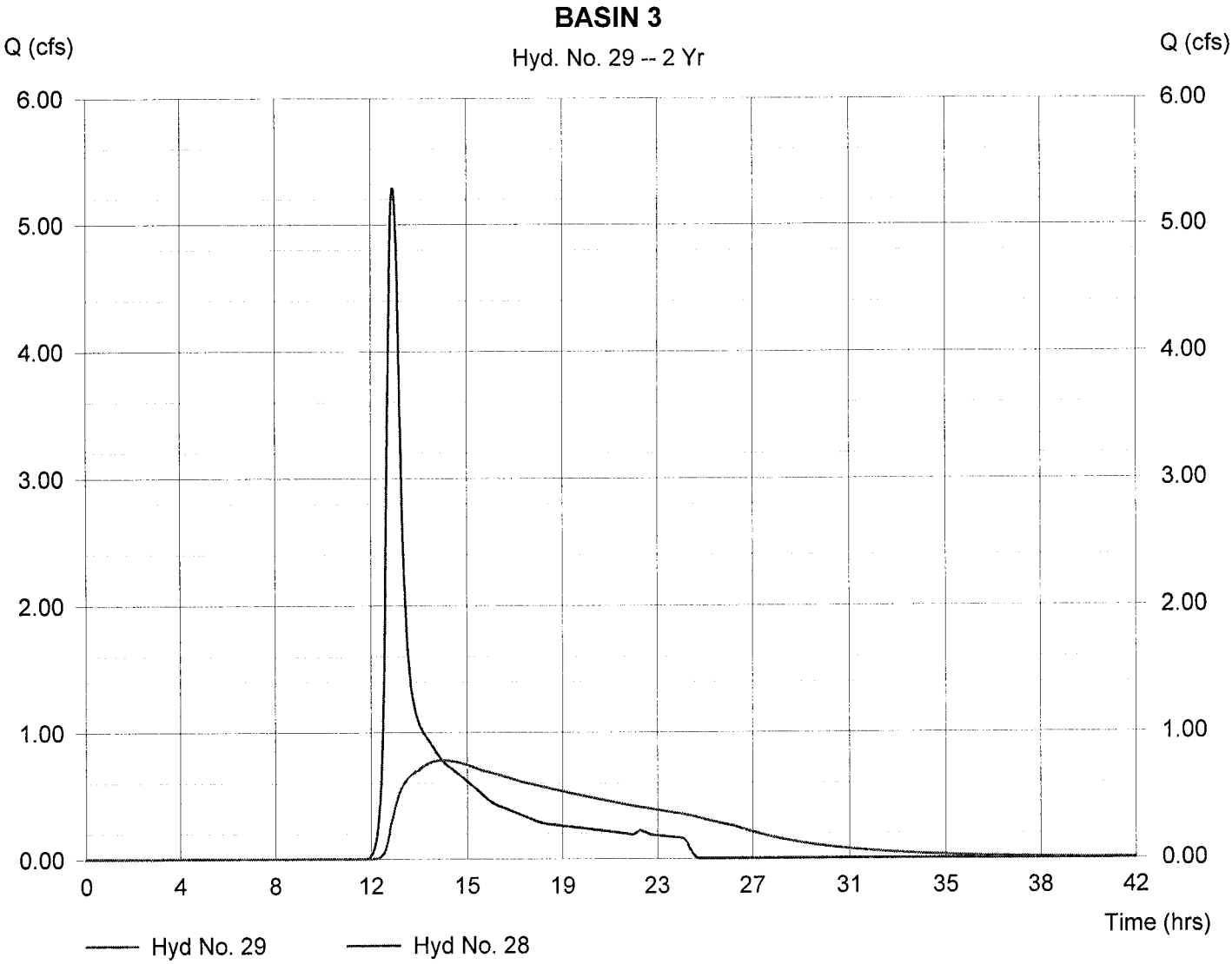
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 29

BASIN 3

Hydrograph type	= Reservoir	Peak discharge	= 0.78 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 28	Max. Elevation	= 128.14 ft
Reservoir name	= BASIN 3	Max. Storage	= 13,163 cuft

Storage Indication method used. | Hydrograph Volume = 29,778 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

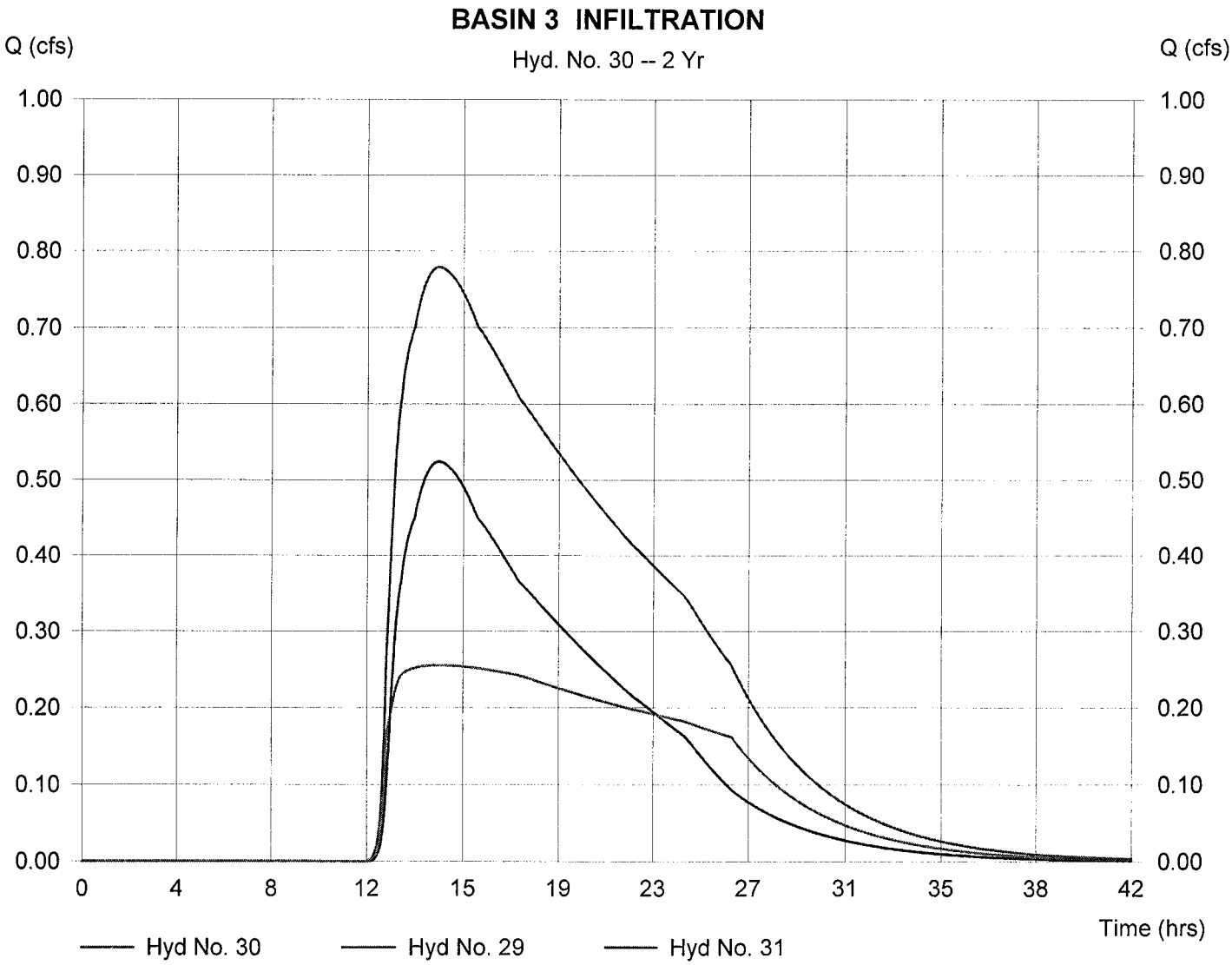
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 30

BASIN 3 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.26 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 31
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 13,159 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

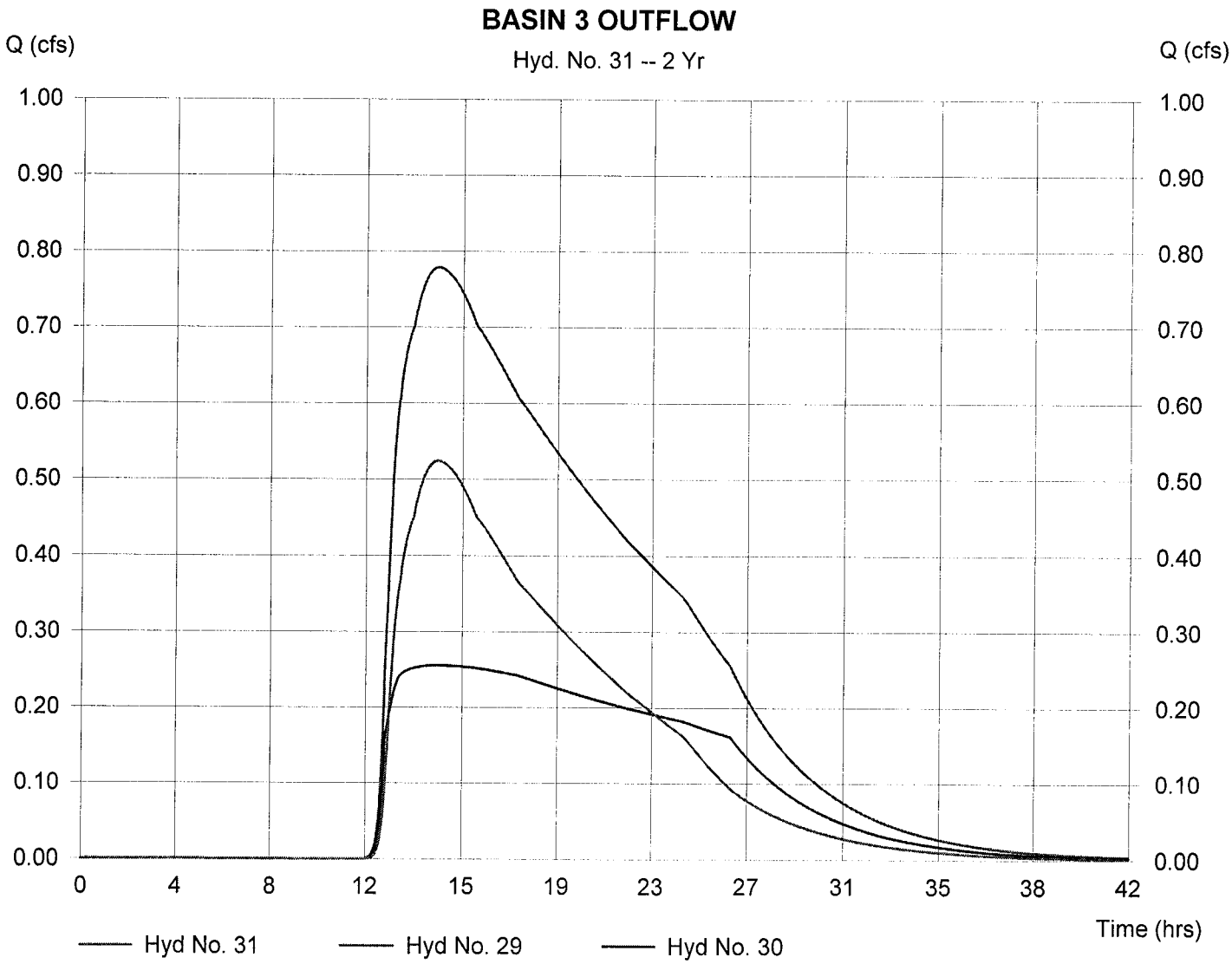
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 31

BASIN 3 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.52 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 30
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 16,620 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

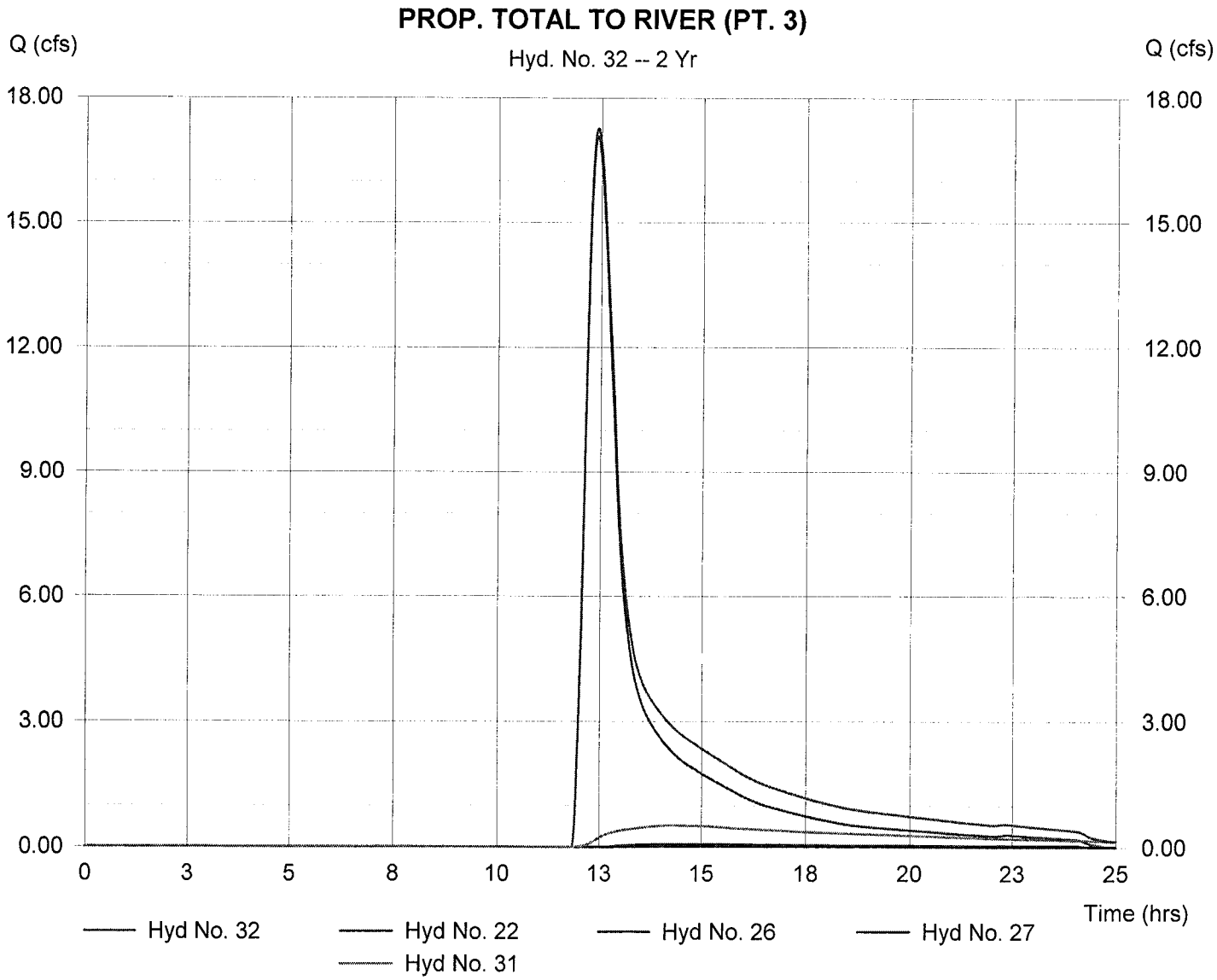
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 32

PROP. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 17.26 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 22, 26, 27, 31		

Hydrograph Volume = 106,173 cuft



Hydrograph Plot

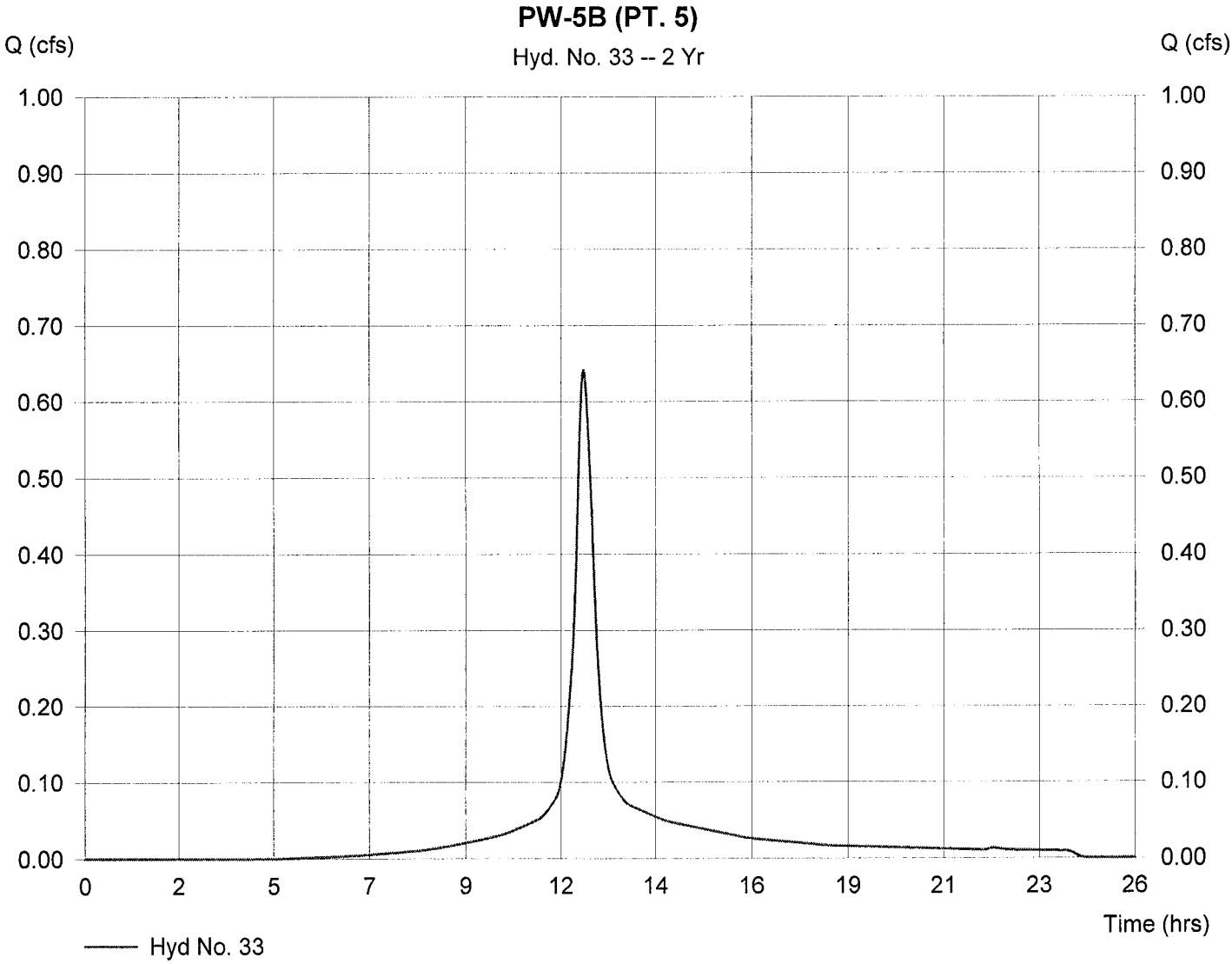
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 33

PW-5B (PT. 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.64 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.340 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.10 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,900 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

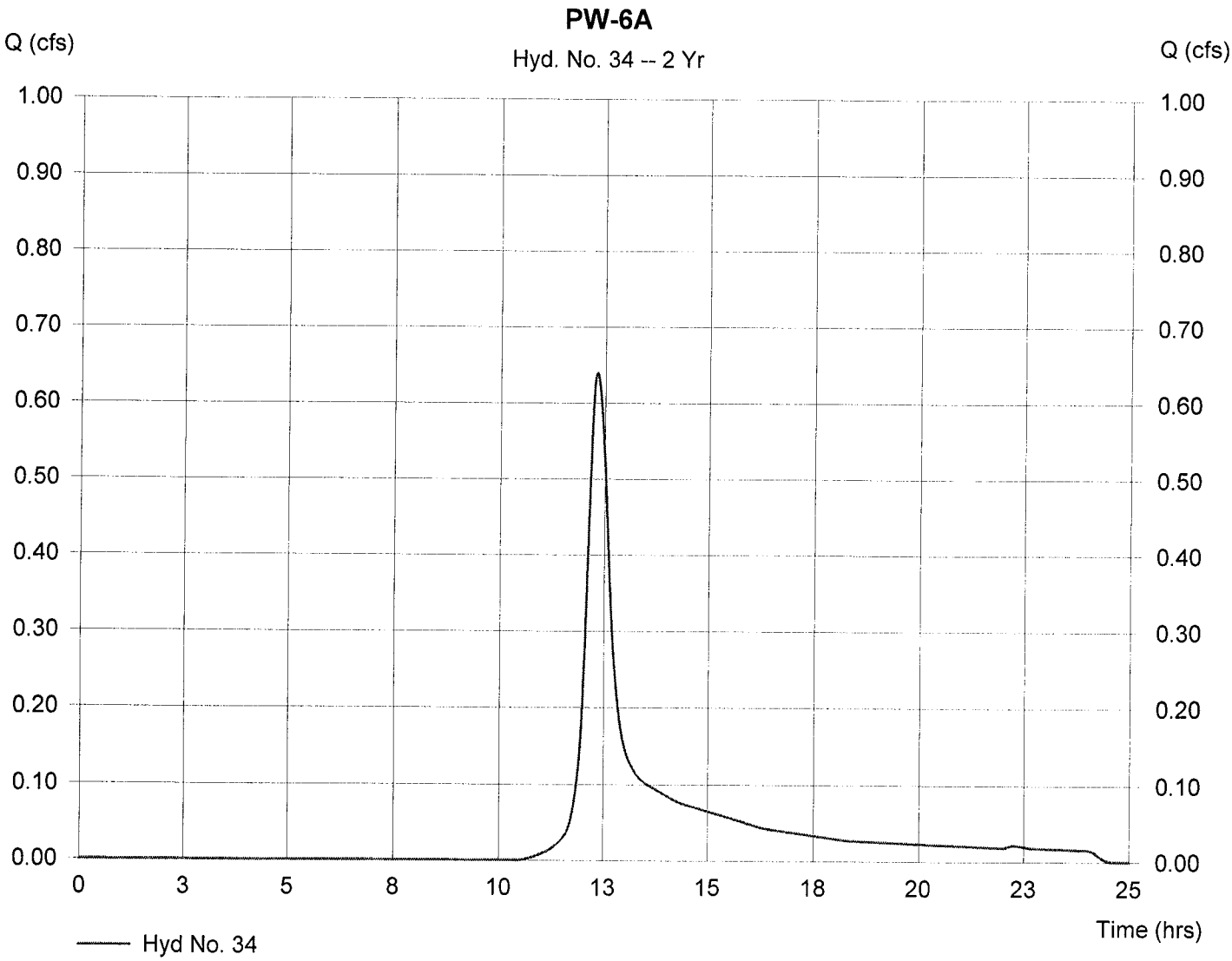
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 34

PW-6A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.64 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.820 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.70 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,224 cuft



Hydrograph Plot

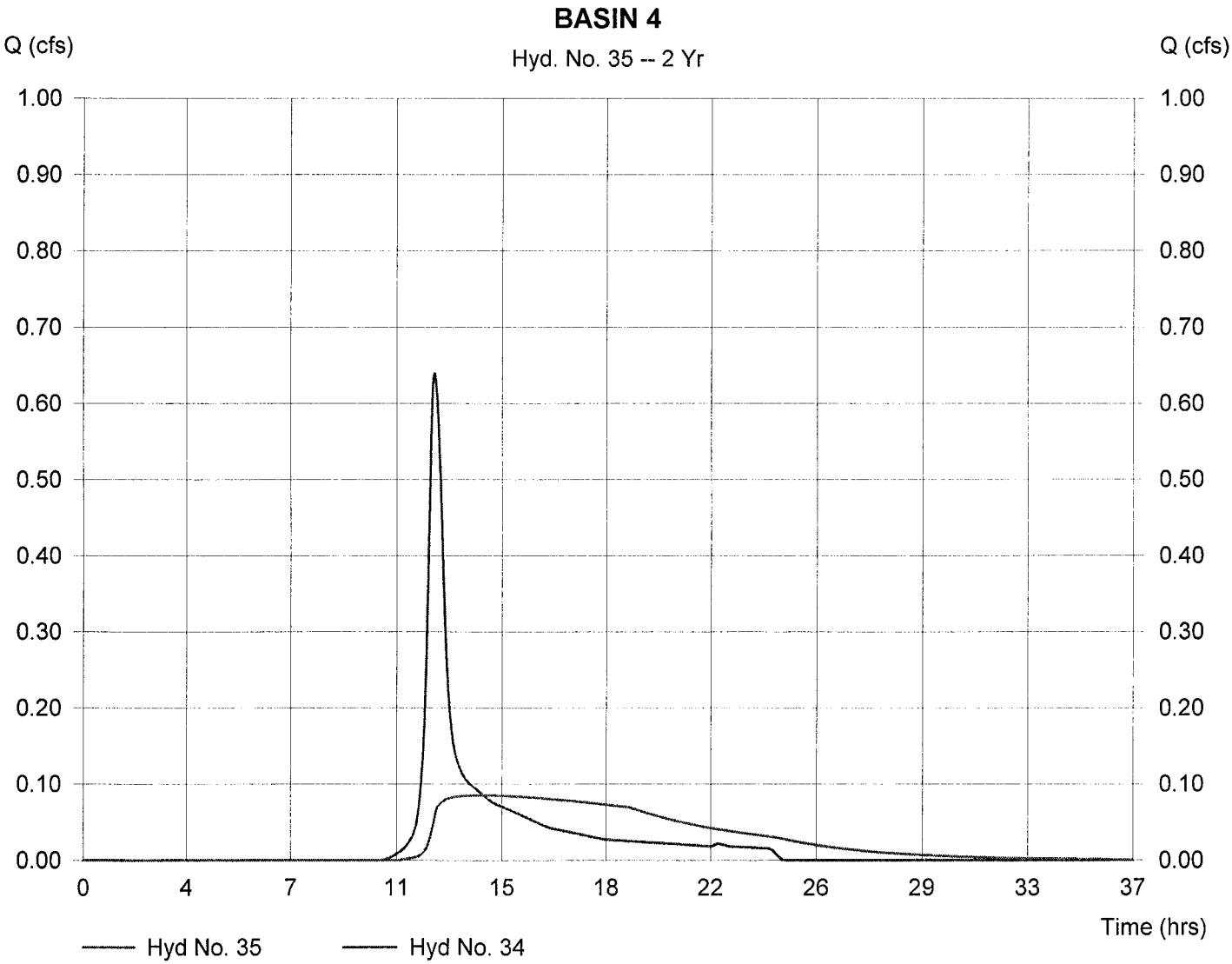
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 35

BASIN 4

Hydrograph type	= Reservoir	Peak discharge	= 0.09 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 34	Max. Elevation	= 129.38 ft
Reservoir name	= BASIN 4	Max. Storage	= 1,466 cuft

Storage Indication method used. | Hydrograph Volume = 3,211 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

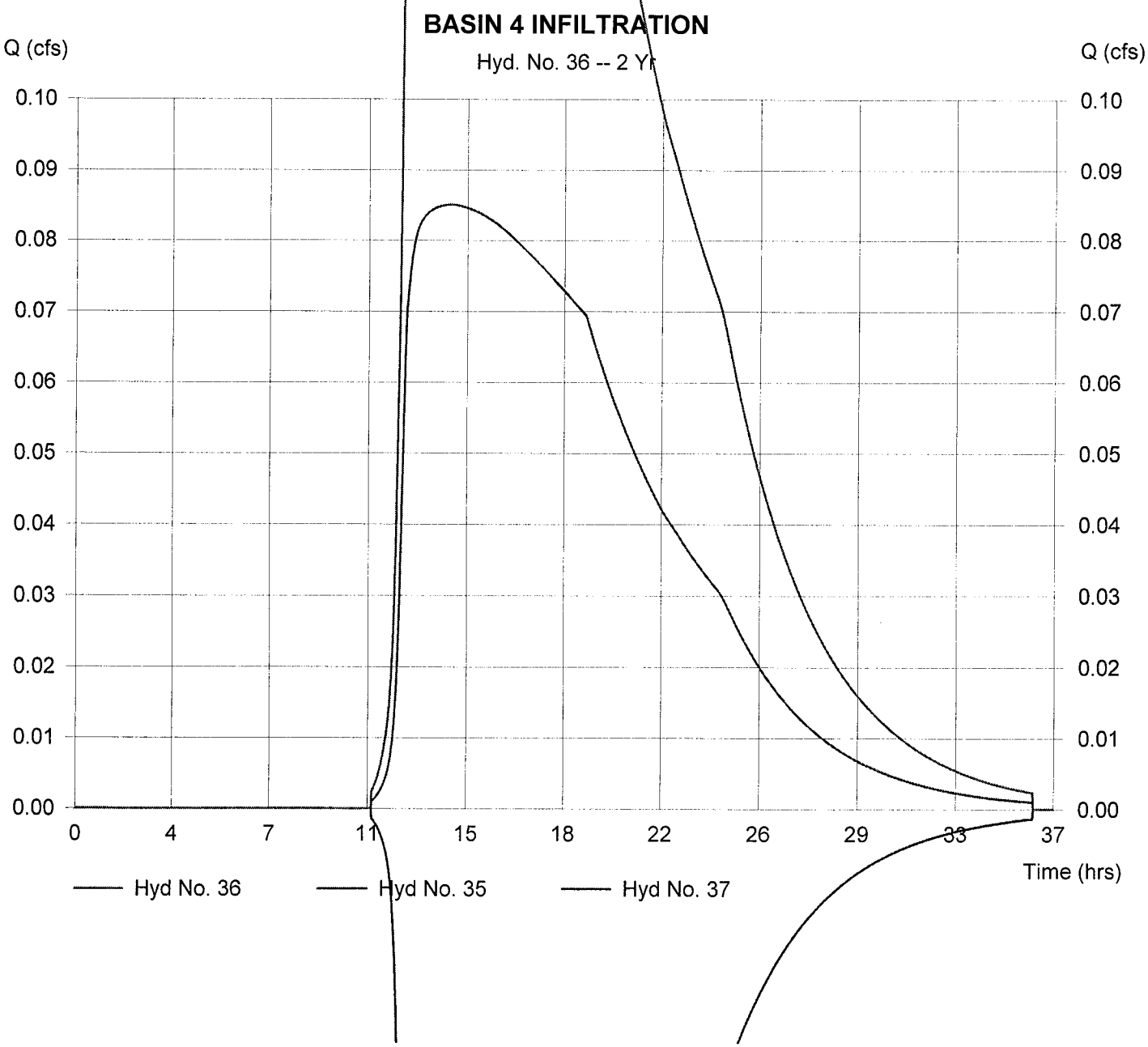
Hyd. No. 36

BASIN 4 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 2 yrs
Inflow hydrograph = 35
Diversion method = Pond - BASIN 4

Peak discharge = 0.19 cfs
Time interval = 1 min
2nd diverted hyd. = 37
Pond structure = Exfiltration

Hydrograph Volume = 7,395 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

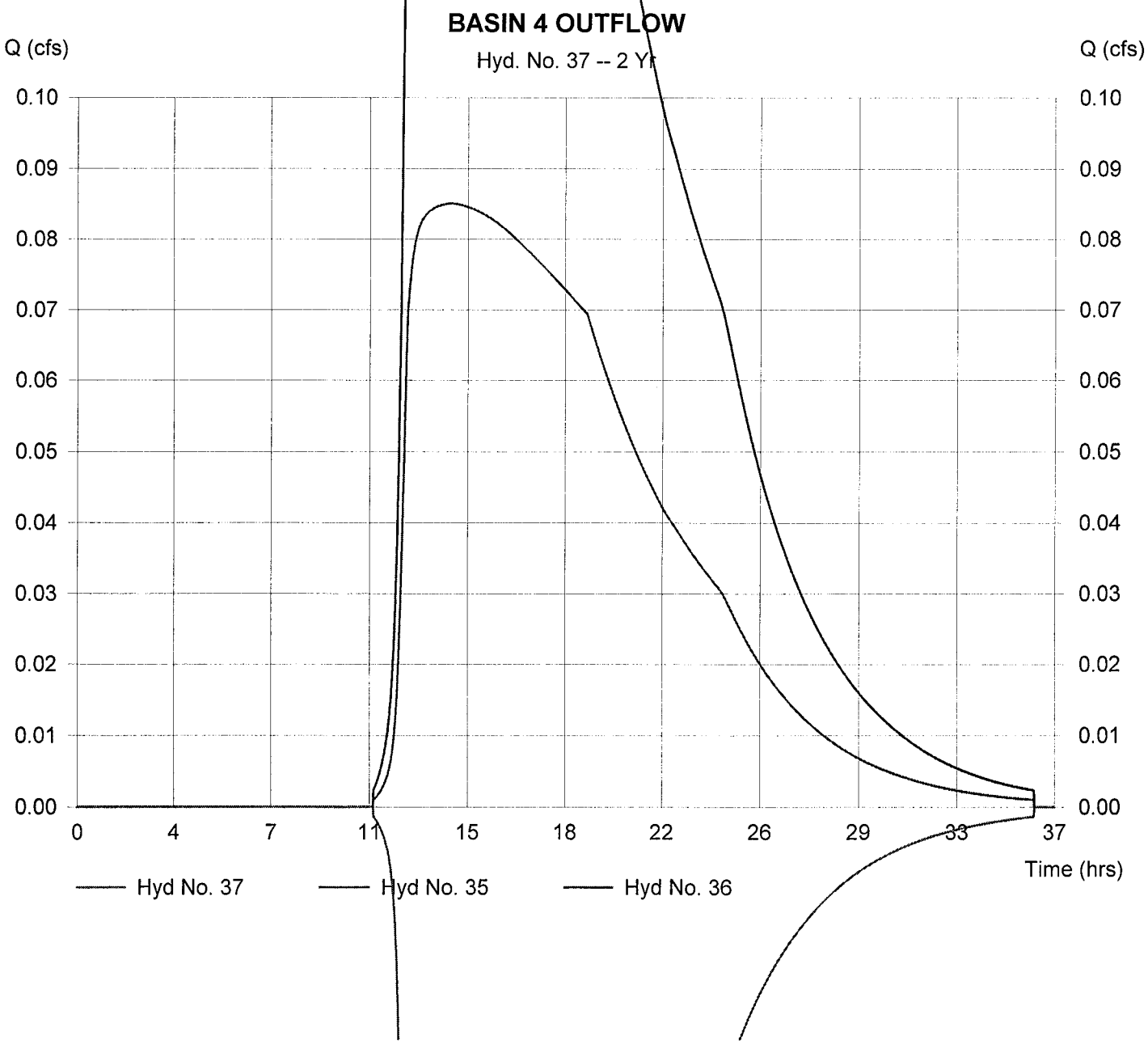
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 37

BASIN 4 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.00 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 36
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = -4,184 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

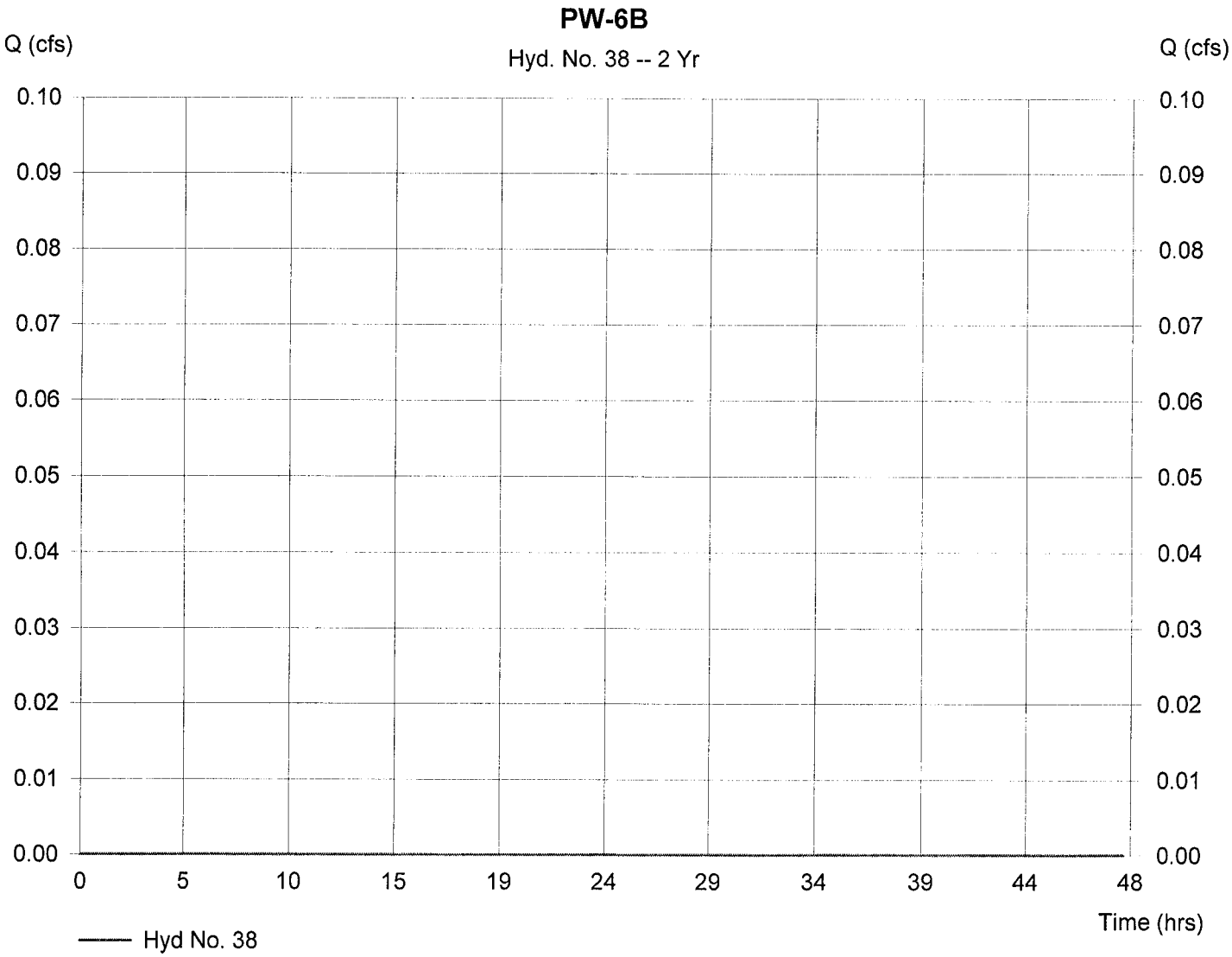
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 38

PW-6B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.00 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.600 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 0 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

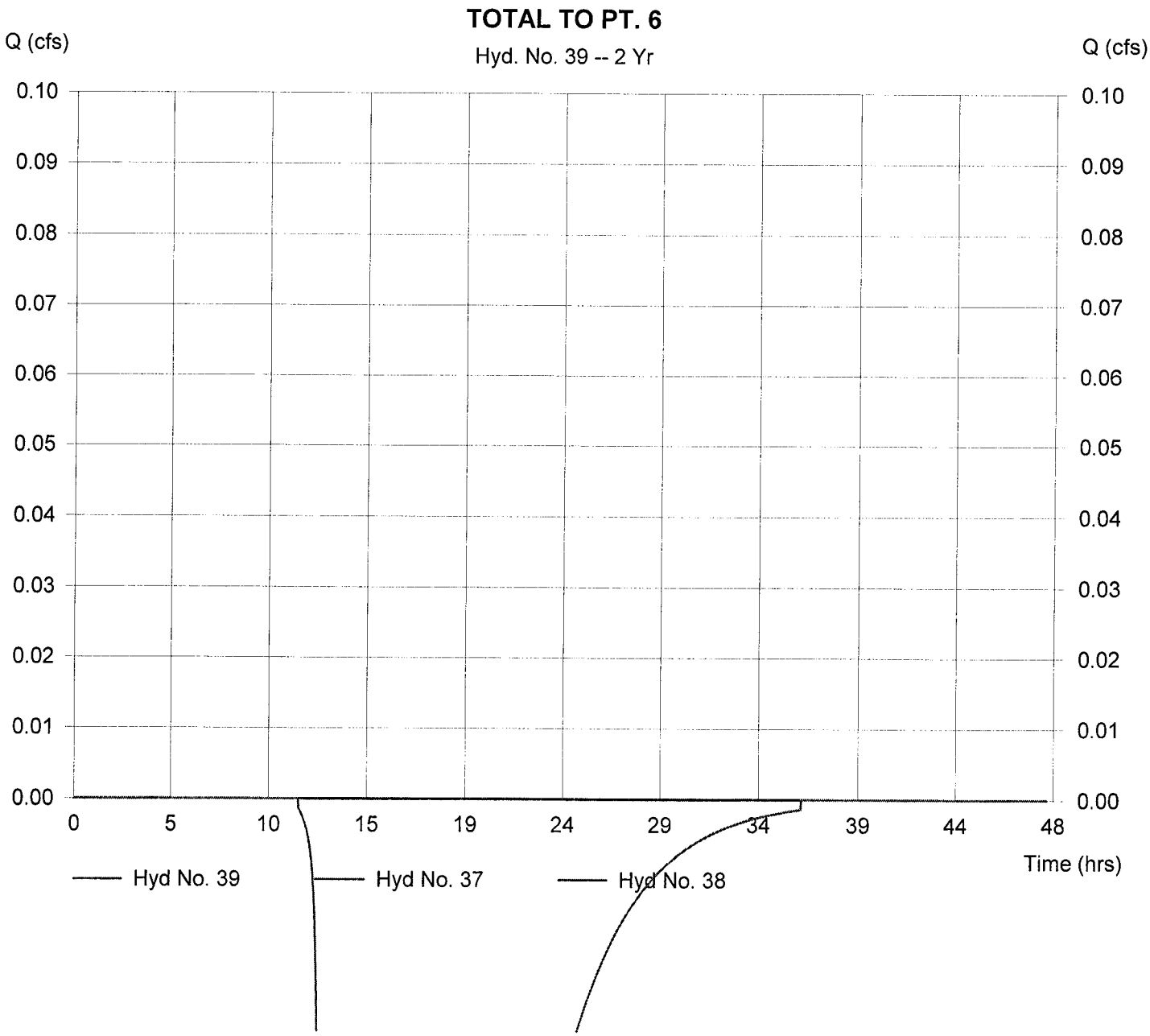
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 39

TOTAL TO PT. 6

Hydrograph type	= Combine	Peak discharge	= 0.00 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 37, 38		

Hydrograph Volume = -4,184 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

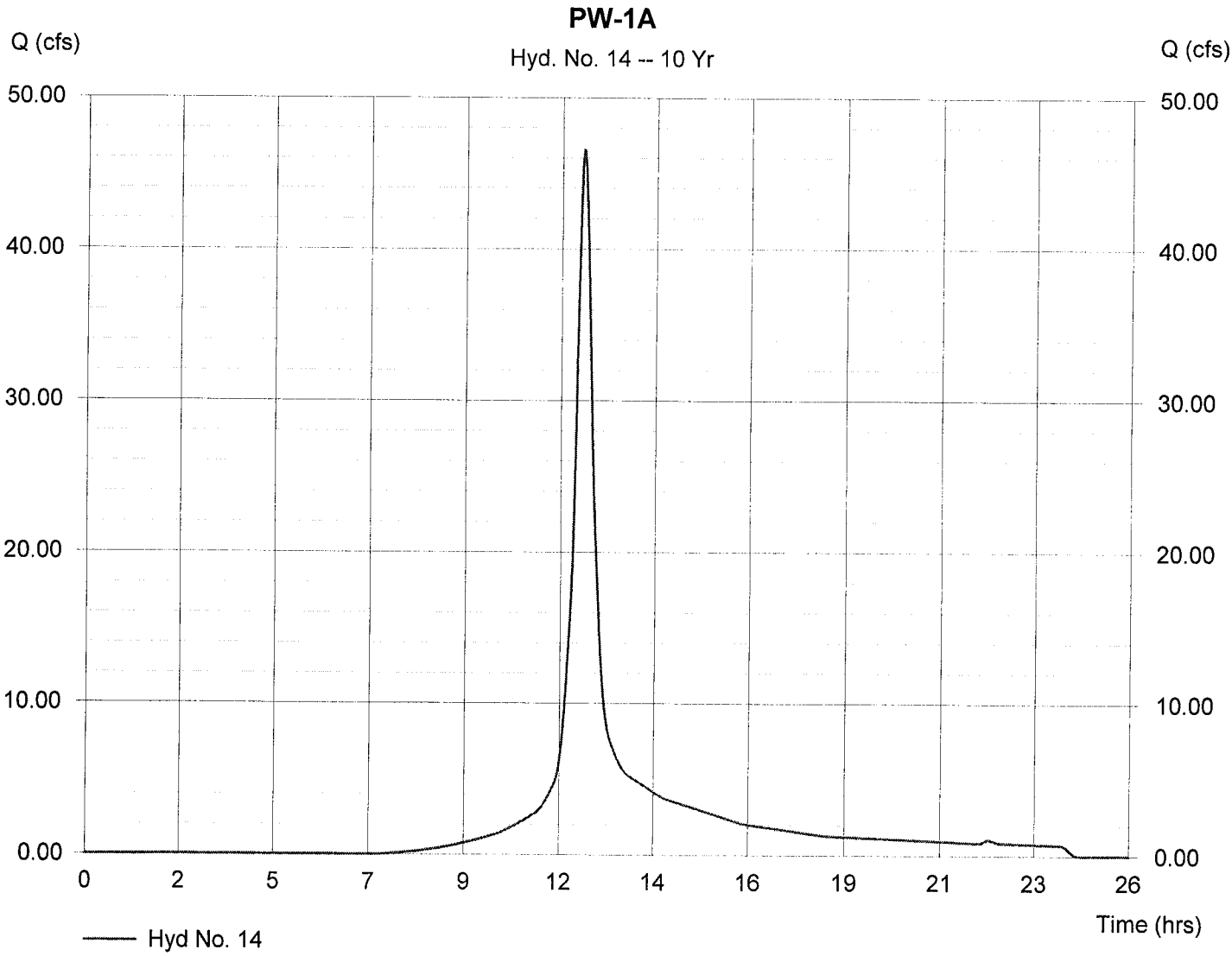
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 14

PW-1A

Hydrograph type	= SCS Runoff	Peak discharge	= 46.52 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 20.200 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.50 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 197,584 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

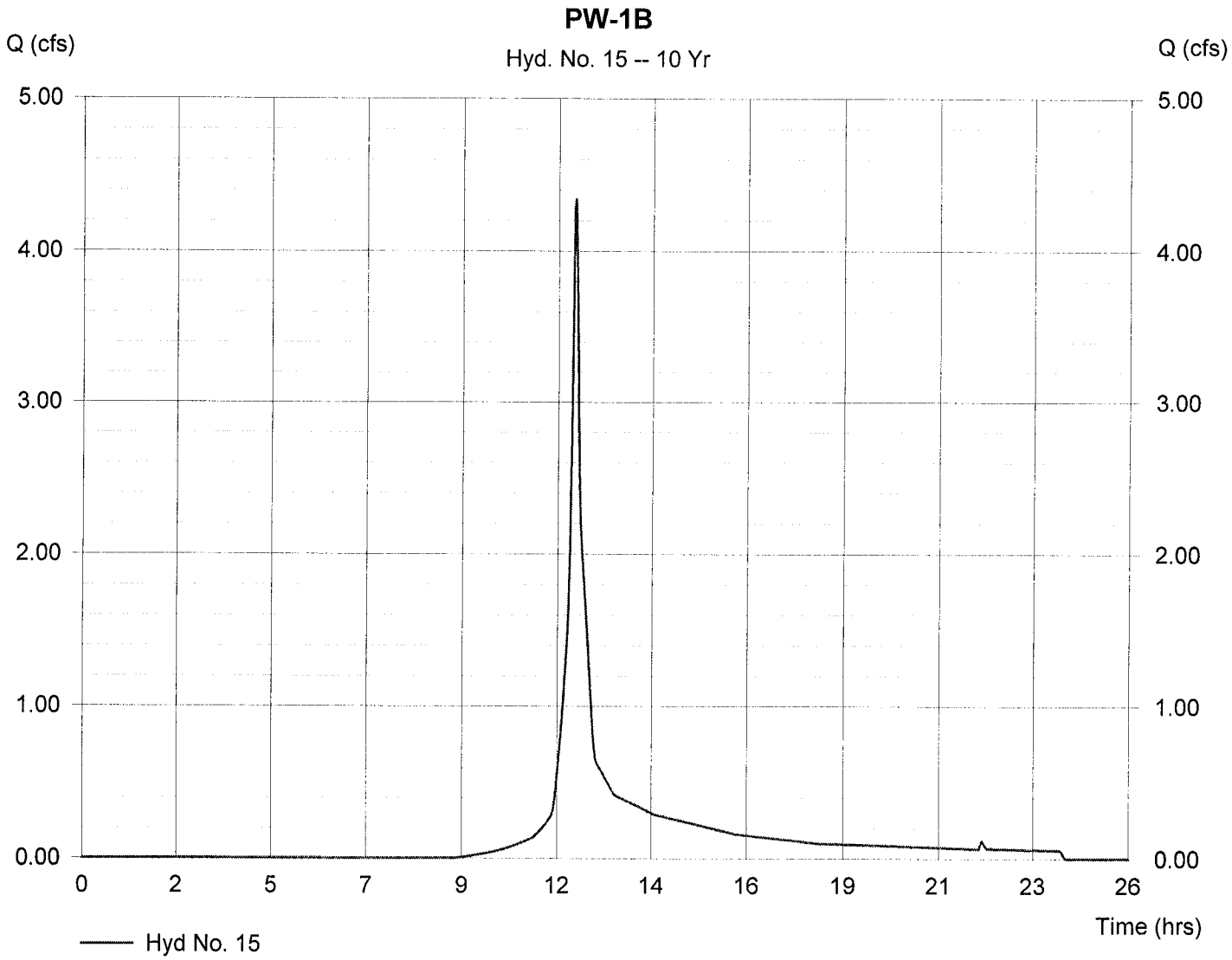
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 15

PW-1B

Hydrograph type	= SCS Runoff	Peak discharge	= 4.34 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.750 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 13,432 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

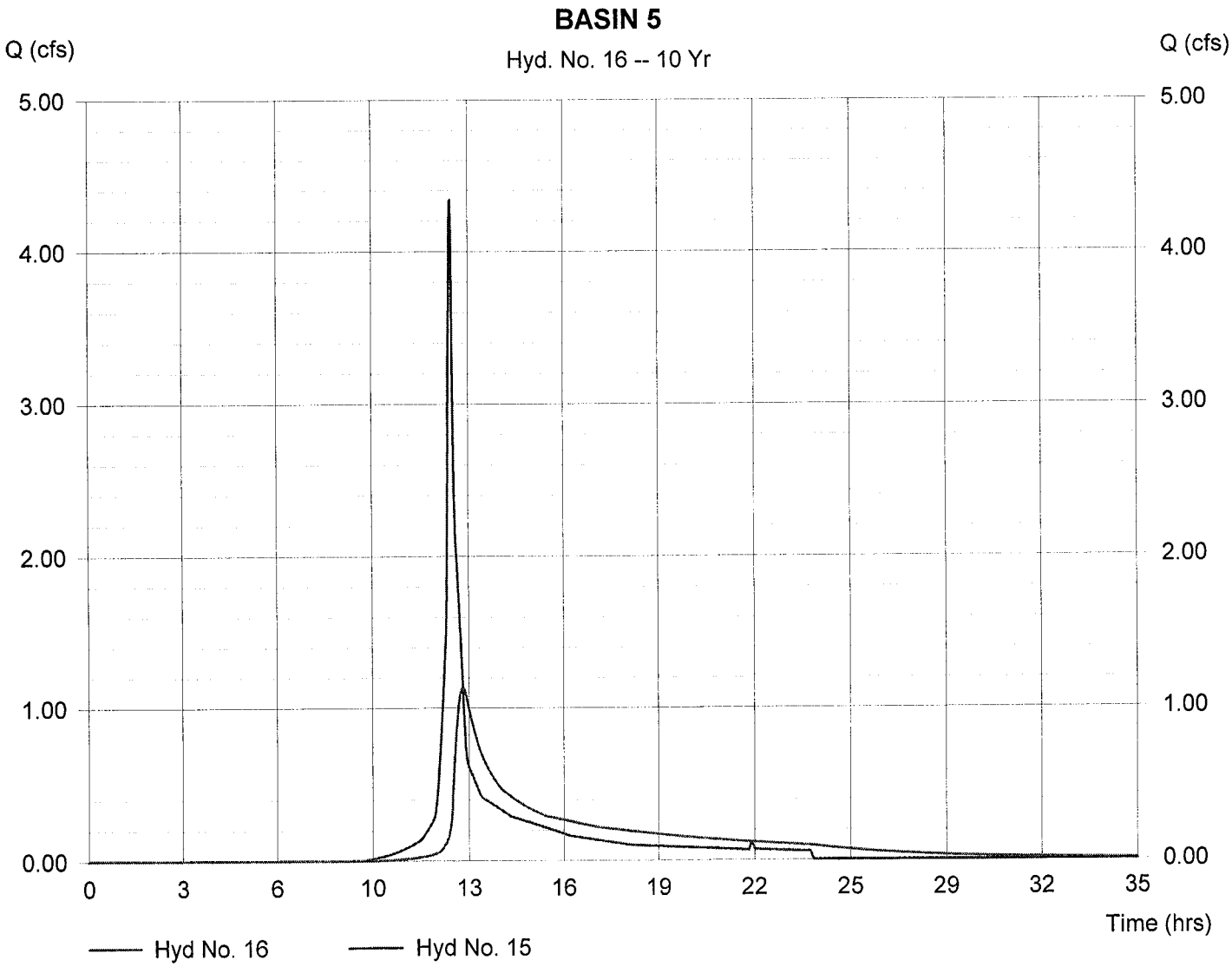
Hyd. No. 16

BASIN 5

Hydrograph type	= Reservoir	Peak discharge	= 1.14 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 15	Max. Elevation	= 127.41 ft
Reservoir name	= BASIN 5	Max. Storage	= 5,189 cuft

Storage Indication method used.

Hydrograph Volume = 13,419 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

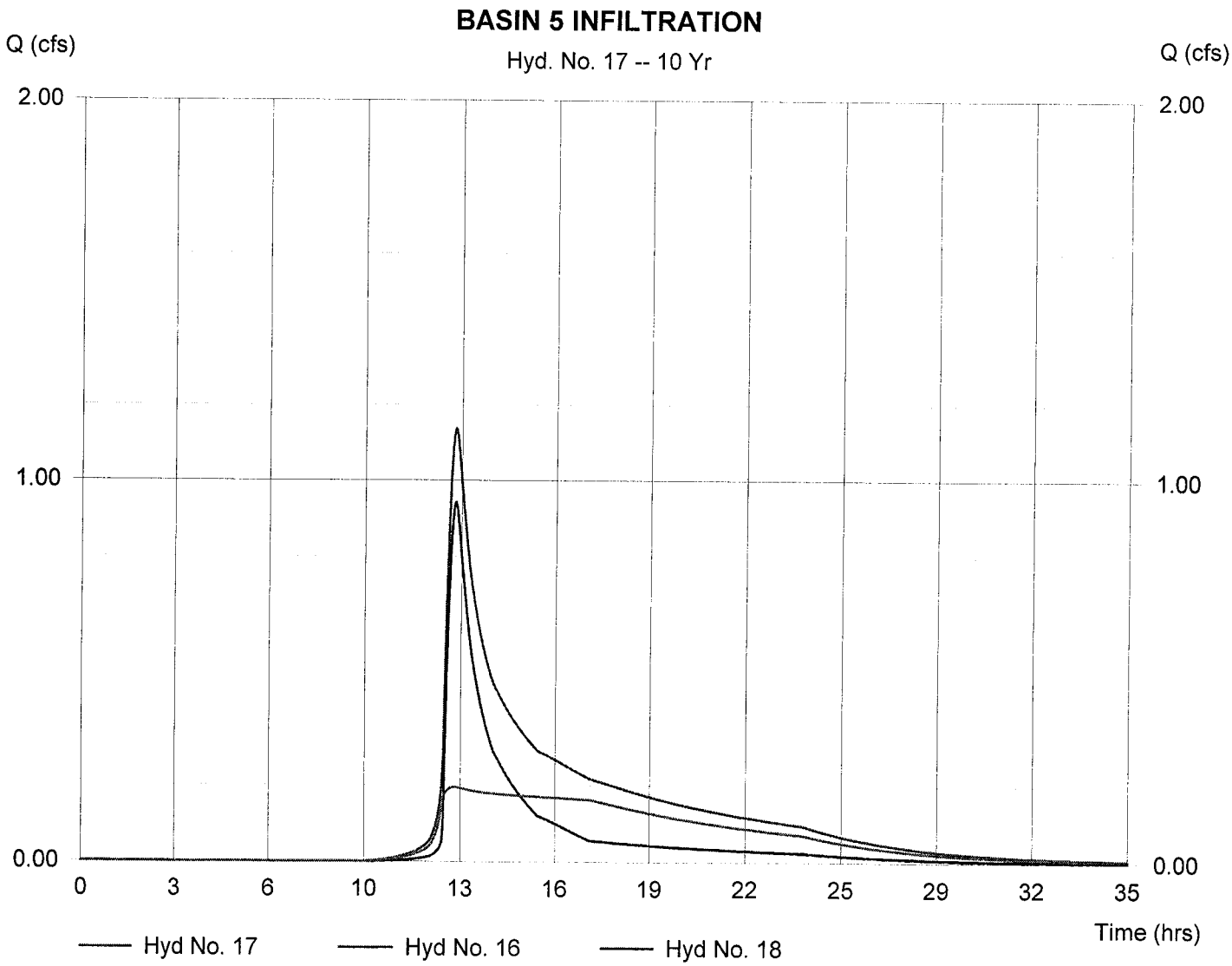
Hyd. No. 17

BASIN 5 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 10 yrs
Inflow hydrograph = 16
Diversion method = Pond - BASIN 5

Peak discharge = 0.19 cfs
Time interval = 1 min
2nd diverted hyd. = 18
Pond structure = Exfiltration

Hydrograph Volume = 7,044 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

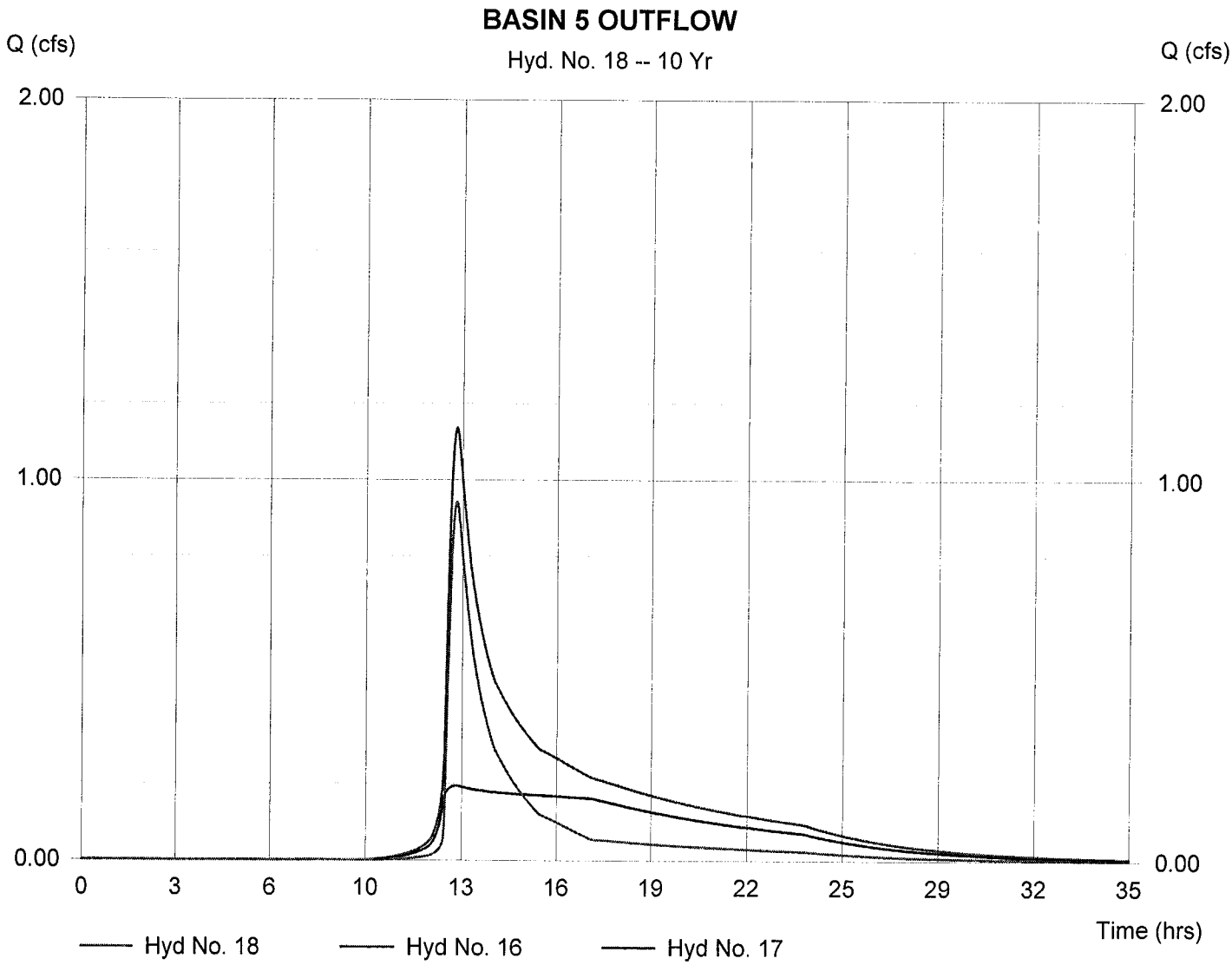
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 18

BASIN 5 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.94 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 16	2nd diverted hyd.	= 17
Diversion method	= Pond - BASIN 5	Pond structure	= Exfiltration

Hydrograph Volume = 6,375 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

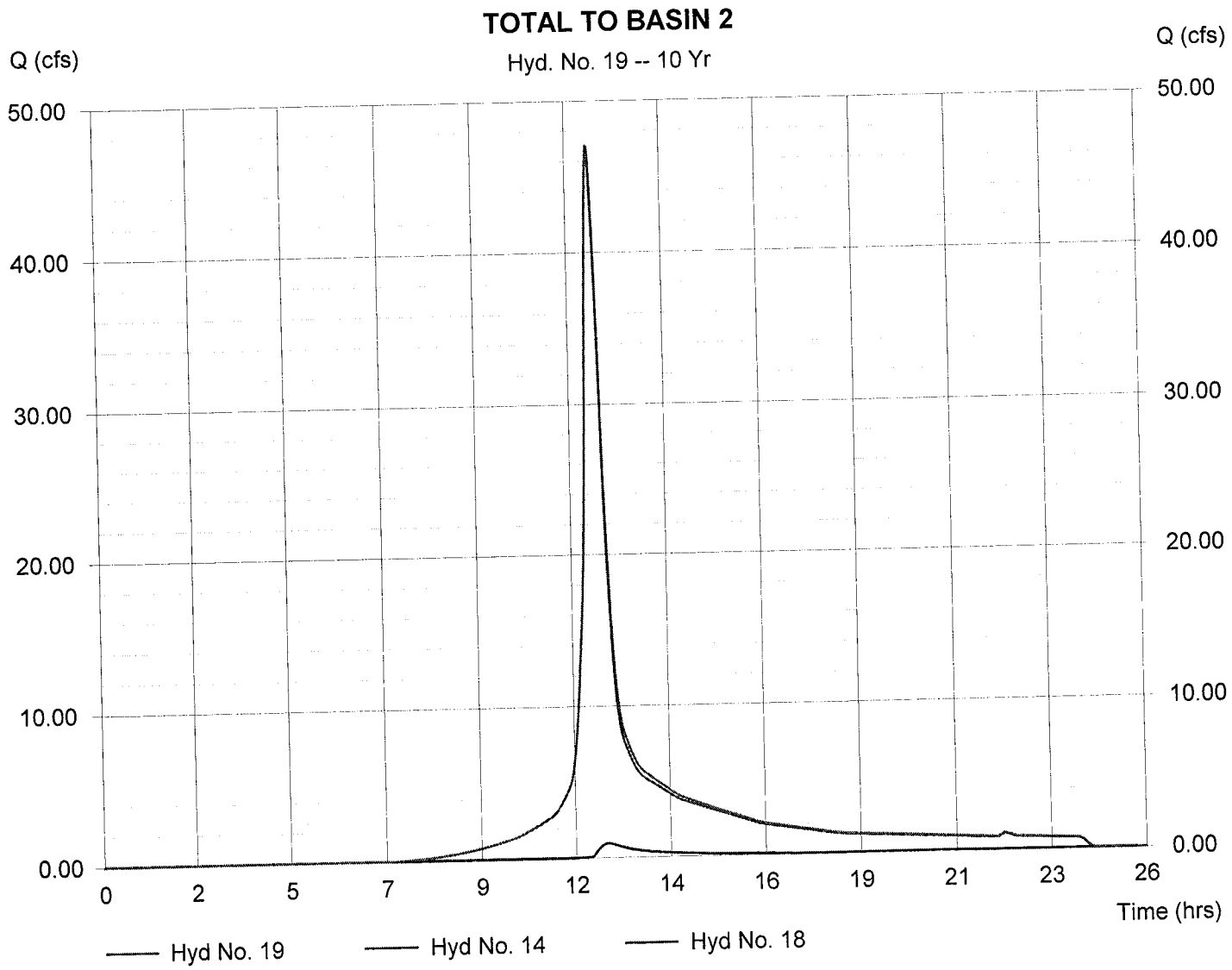
Hyd. No. 19

TOTAL TO BASIN 2

Hydrograph type = Combine
Storm frequency = 10 yrs
Inflow hyds. = 14, 18

Peak discharge = 47.01 cfs
Time interval = 1 min

Hydrograph Volume = 203,959 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

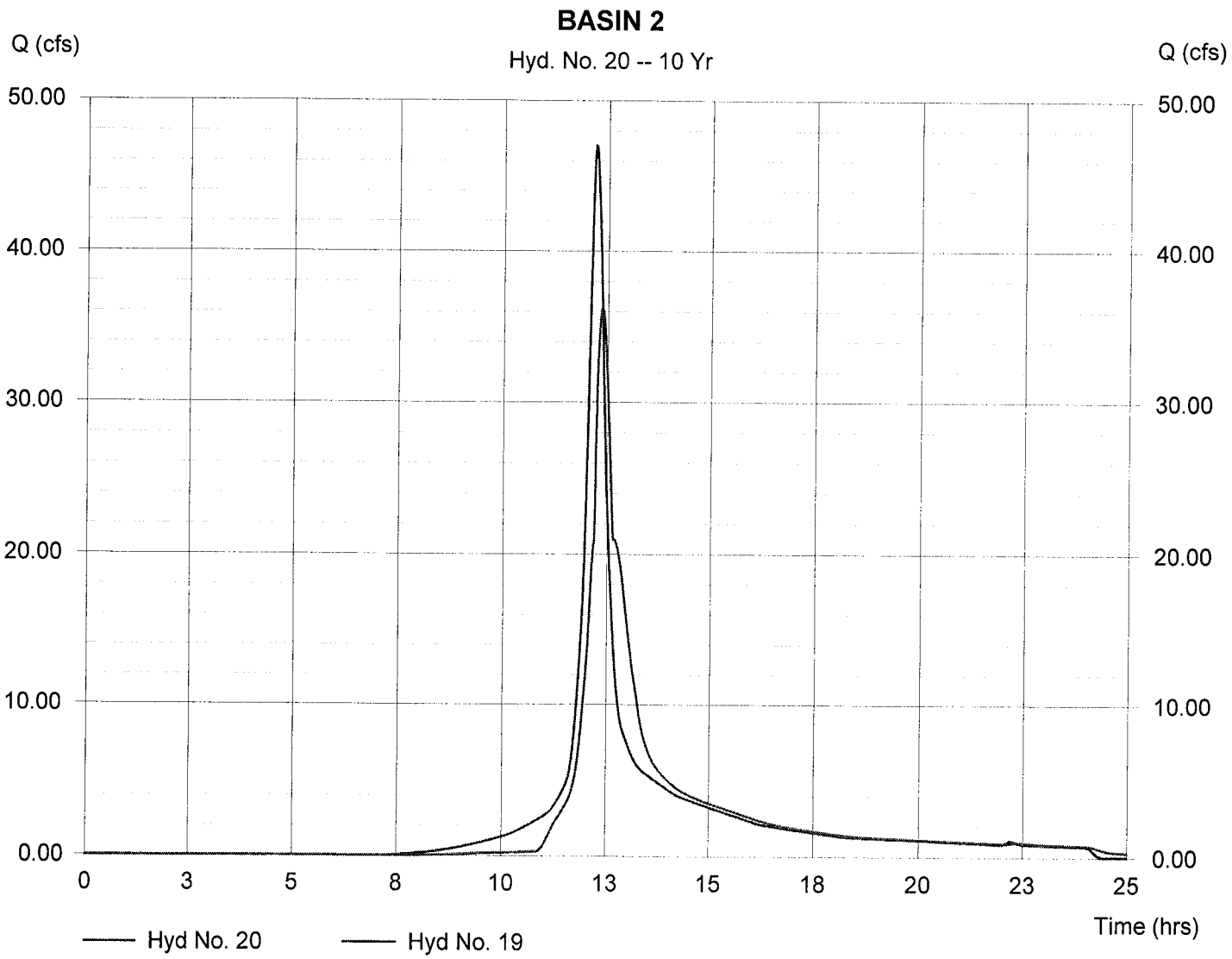
Hyd. No. 20

BASIN 2

Hydrograph type	= Reservoir	Peak discharge	= 36.23 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 19	Max. Elevation	= 121.97 ft
Reservoir name	= BASIN 2	Max. Storage	= 40,920 cuft

Storage Indication method used.

Hydrograph Volume = 203,904 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

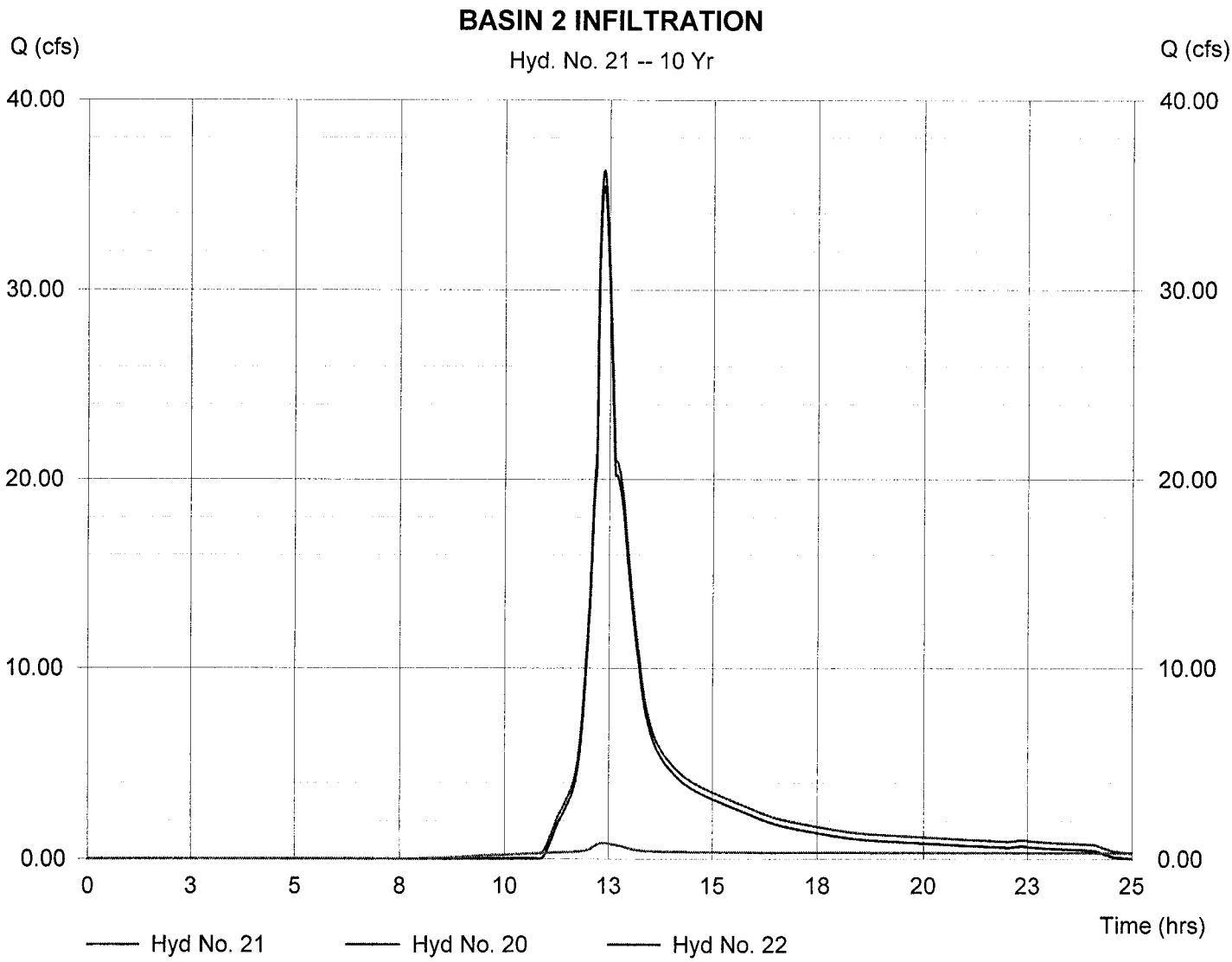
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 21

BASIN 2 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.83 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 22
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 28,667 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

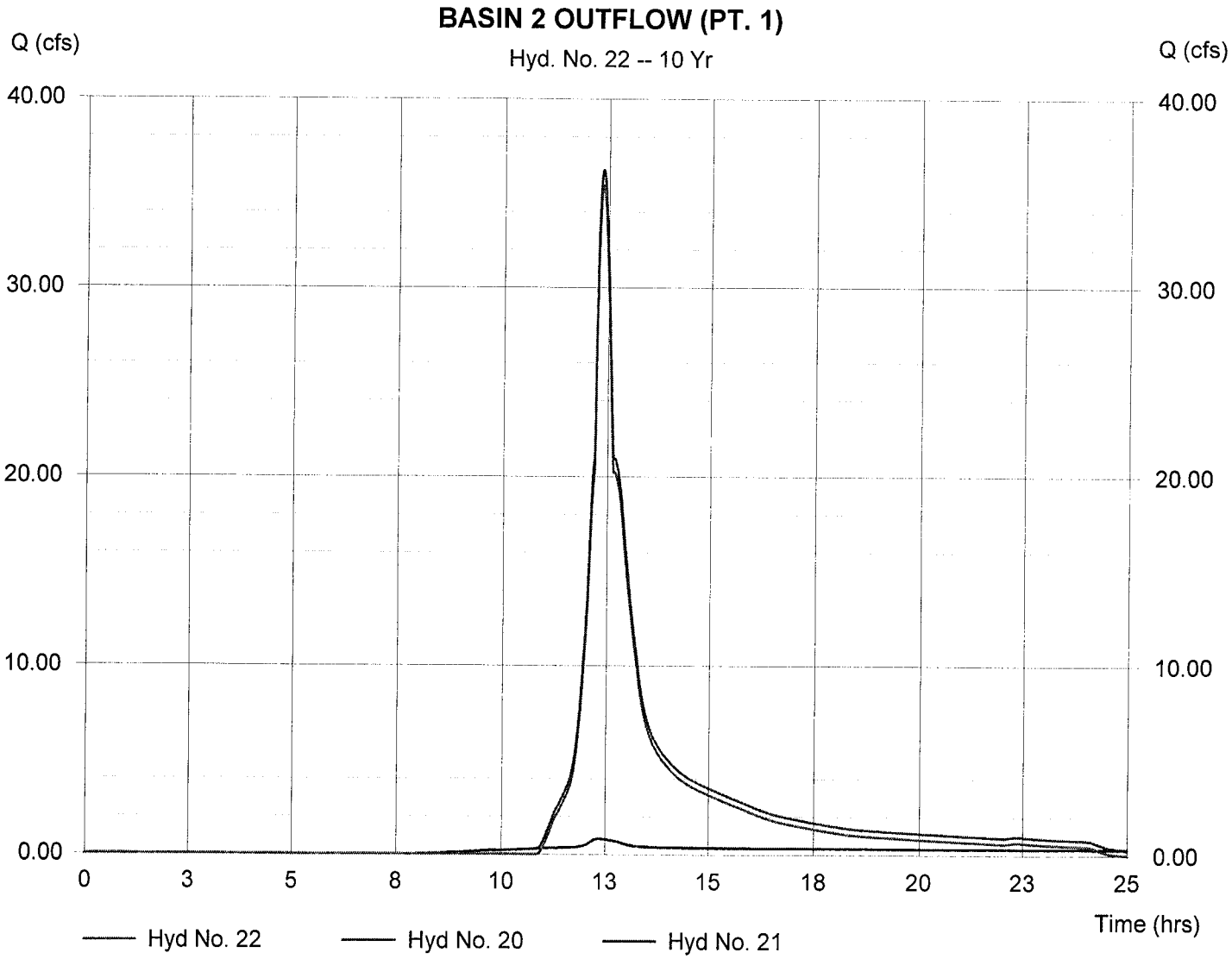
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Hyd. No. 22

BASIN 2 OUTFLOW (PT. 1)

Hydrograph type	= Diversion2	Peak discharge	= 35.40 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 21
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 175,237 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

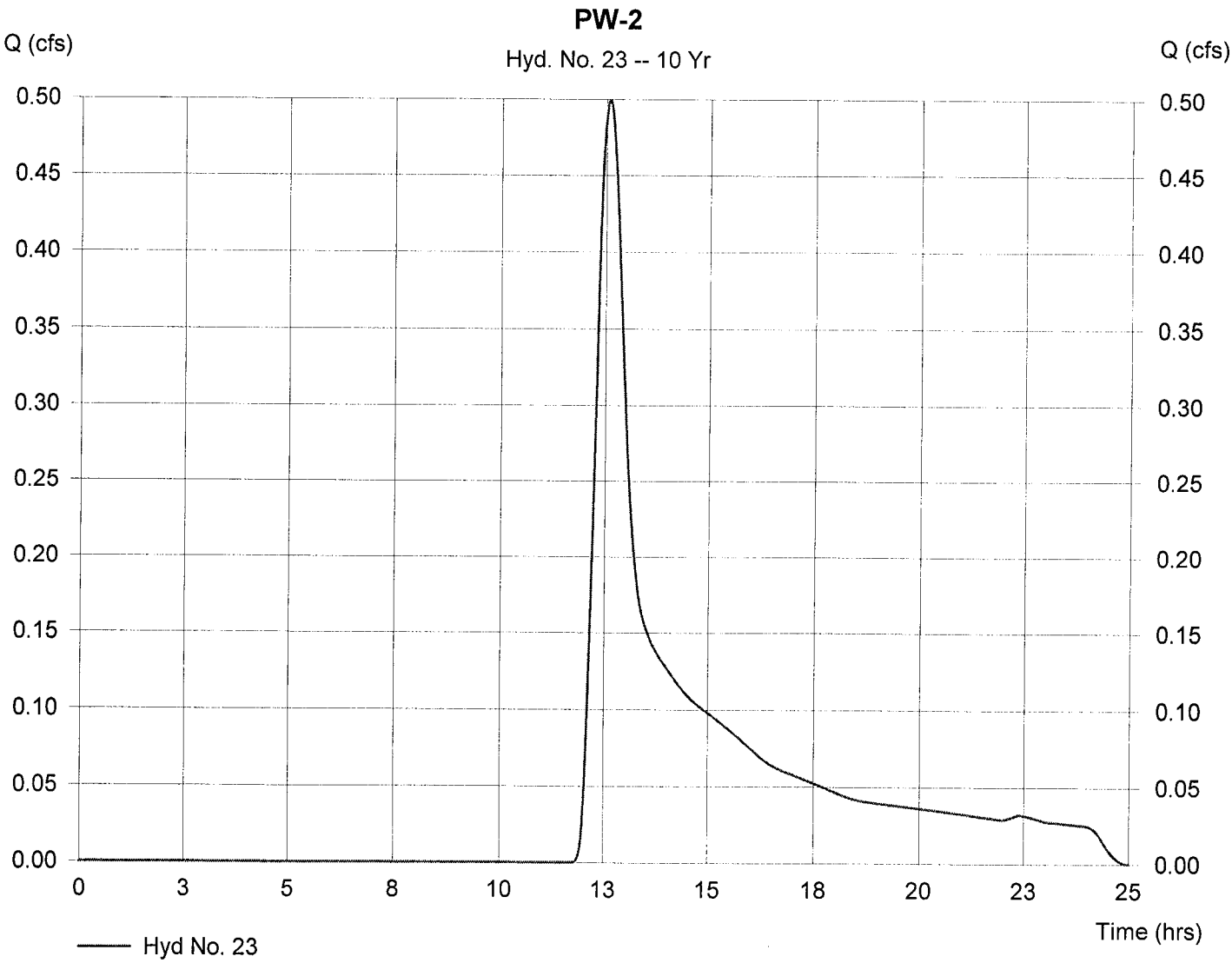
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 23

PW-2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.50 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.310 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.50 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,761 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

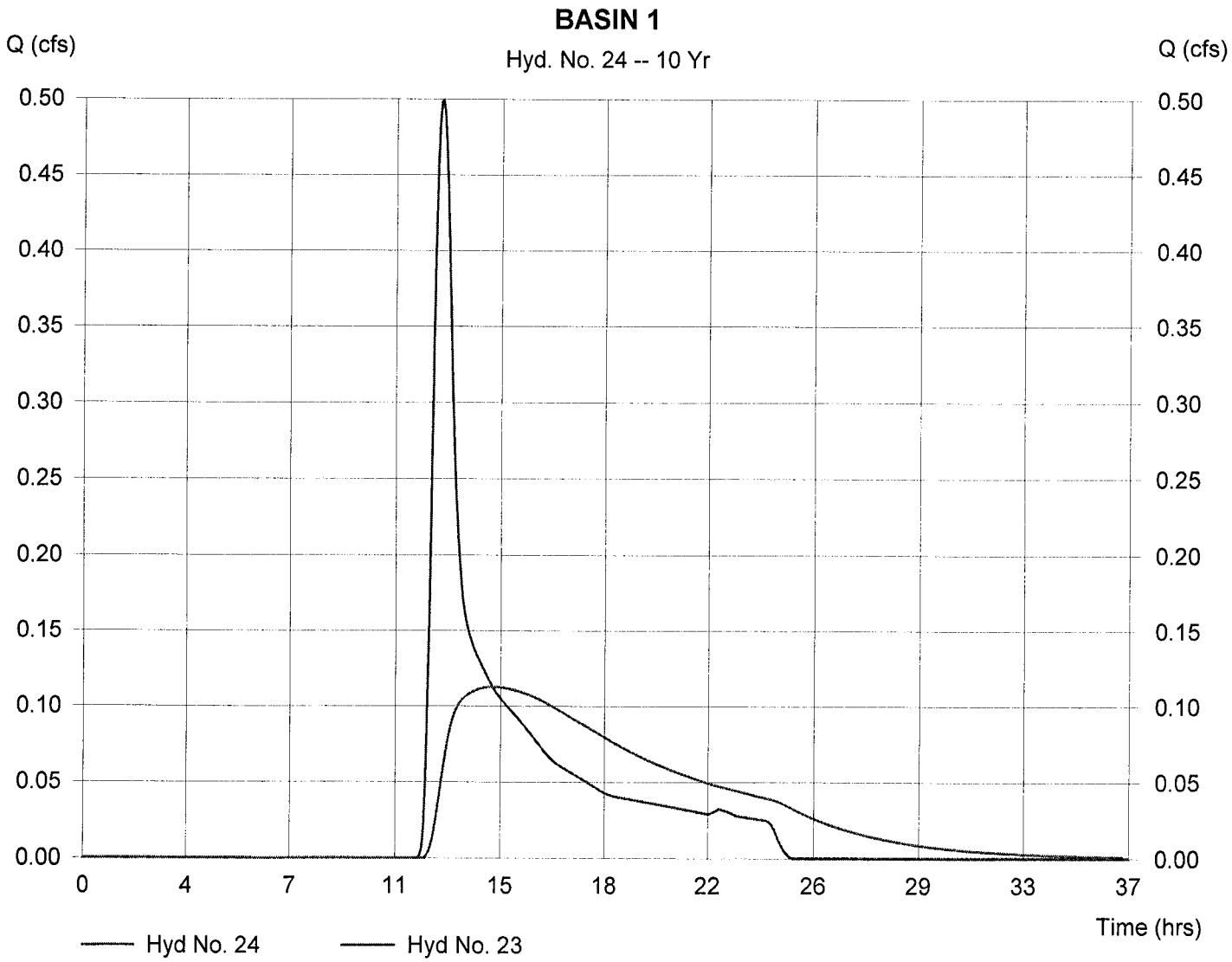
Hyd. No. 24

BASIN 1

Hydrograph type	= Reservoir	Peak discharge	= 0.11 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 118.36 ft
Reservoir name	= UPGRADED BASIN	Max. Storage	= 1,341 cuft

Storage Indication method used.

Hydrograph Volume = 3,749 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

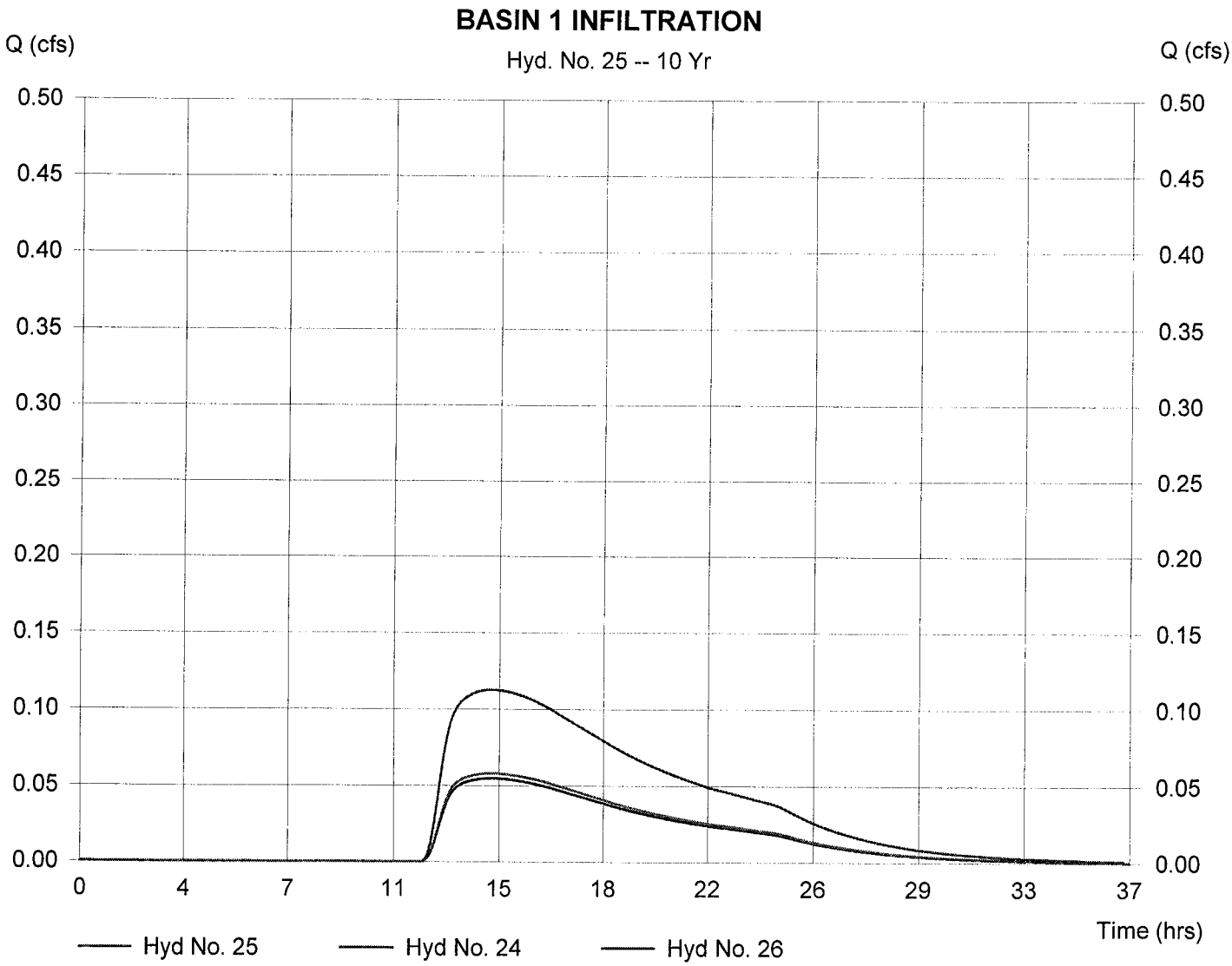
Hyd. No. 25

BASIN 1 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 10 yrs
Inflow hydrograph = 24
Diversion method = Pond - UPGRADED BASIN

Peak discharge = 0.06 cfs
Time interval = 1 min
2nd diverted hyd. = 26
Pond structure = Exfiltration

Hydrograph Volume = 1,928 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

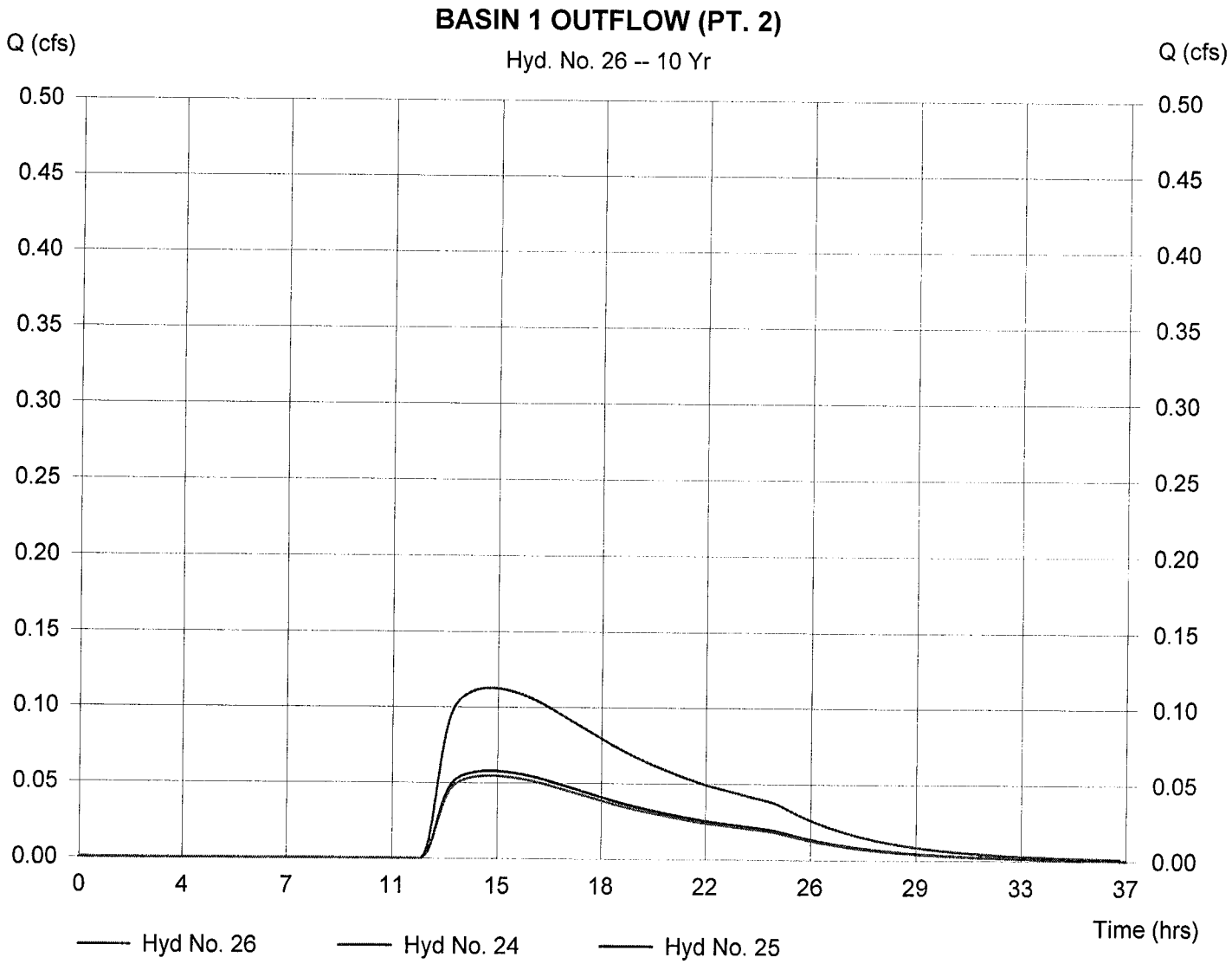
Hyd. No. 26

BASIN 1 OUTFLOW (PT. 2)

Hydrograph type = Diversion2
Storm frequency = 10 yrs
Inflow hydrograph = 24
Diversion method = Pond - UPGRADED BASIN

Peak discharge = 0.05 cfs
Time interval = 1 min
2nd diverted hyd. = 25
Pond structure = Exfiltration

Hydrograph Volume = 1,821 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

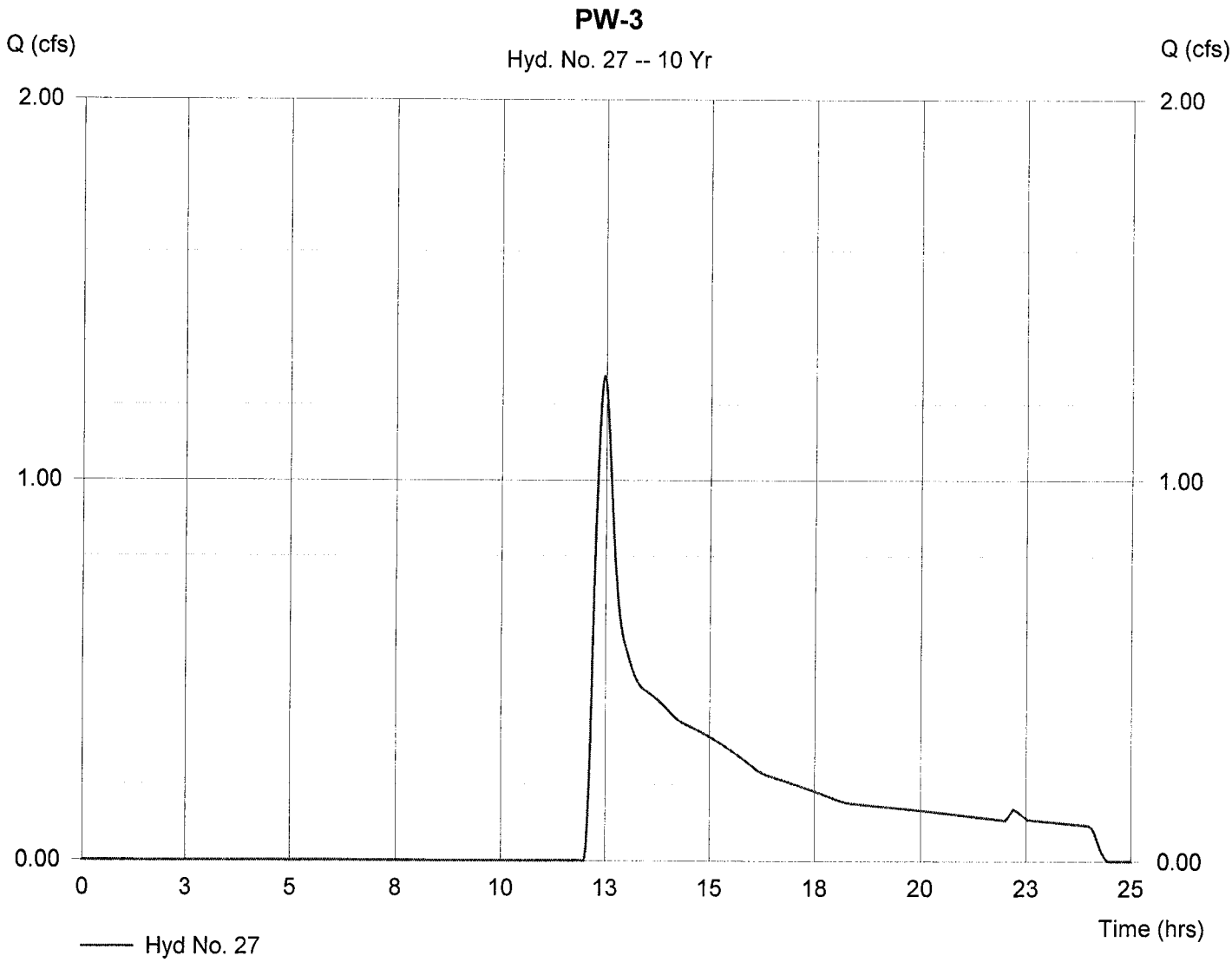
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 27

PW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.27 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 7.250 ac	Curve number	= 48
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.80 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 10,882 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

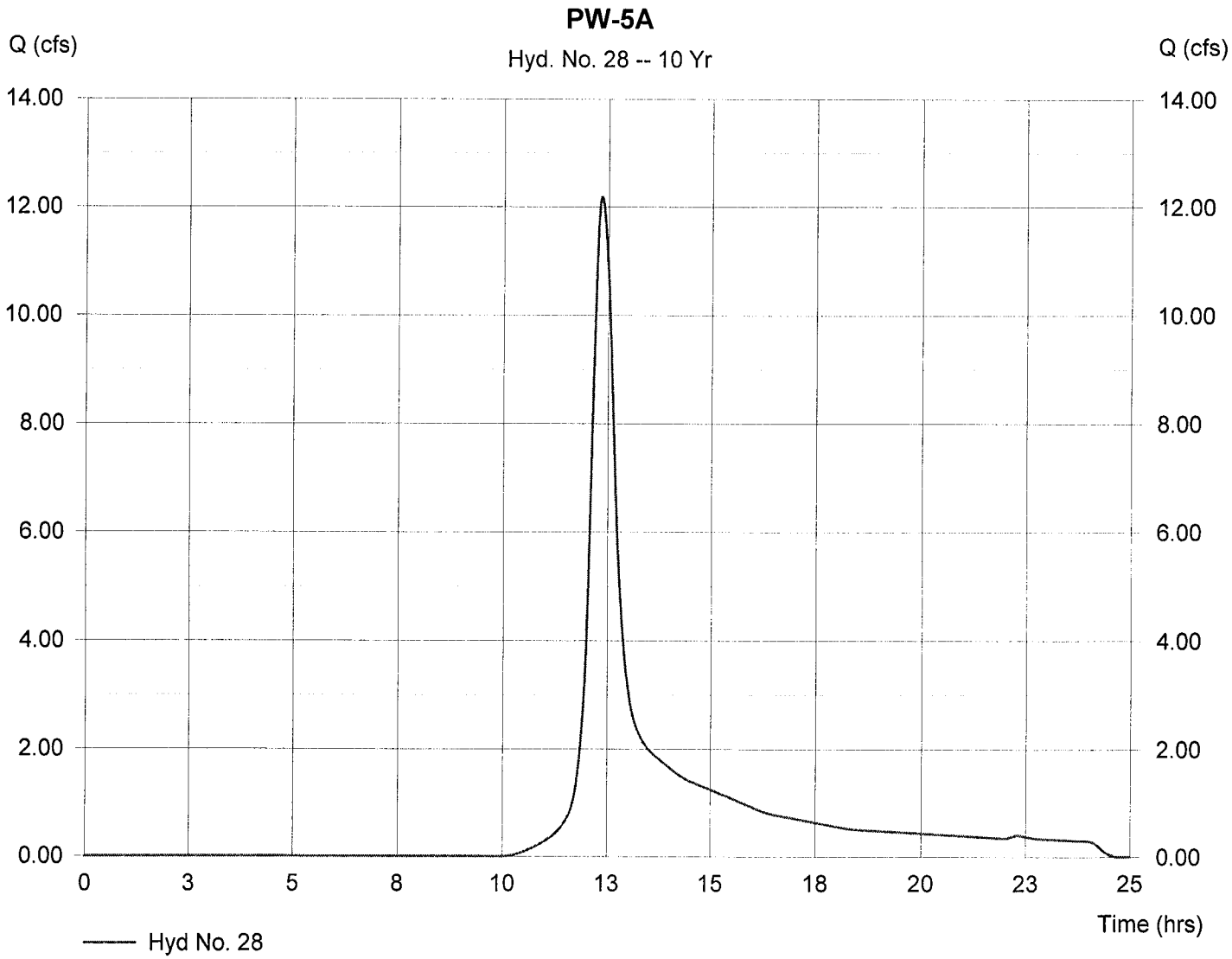
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 28

PW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 12.18 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 10.100 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.30 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 63,557 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

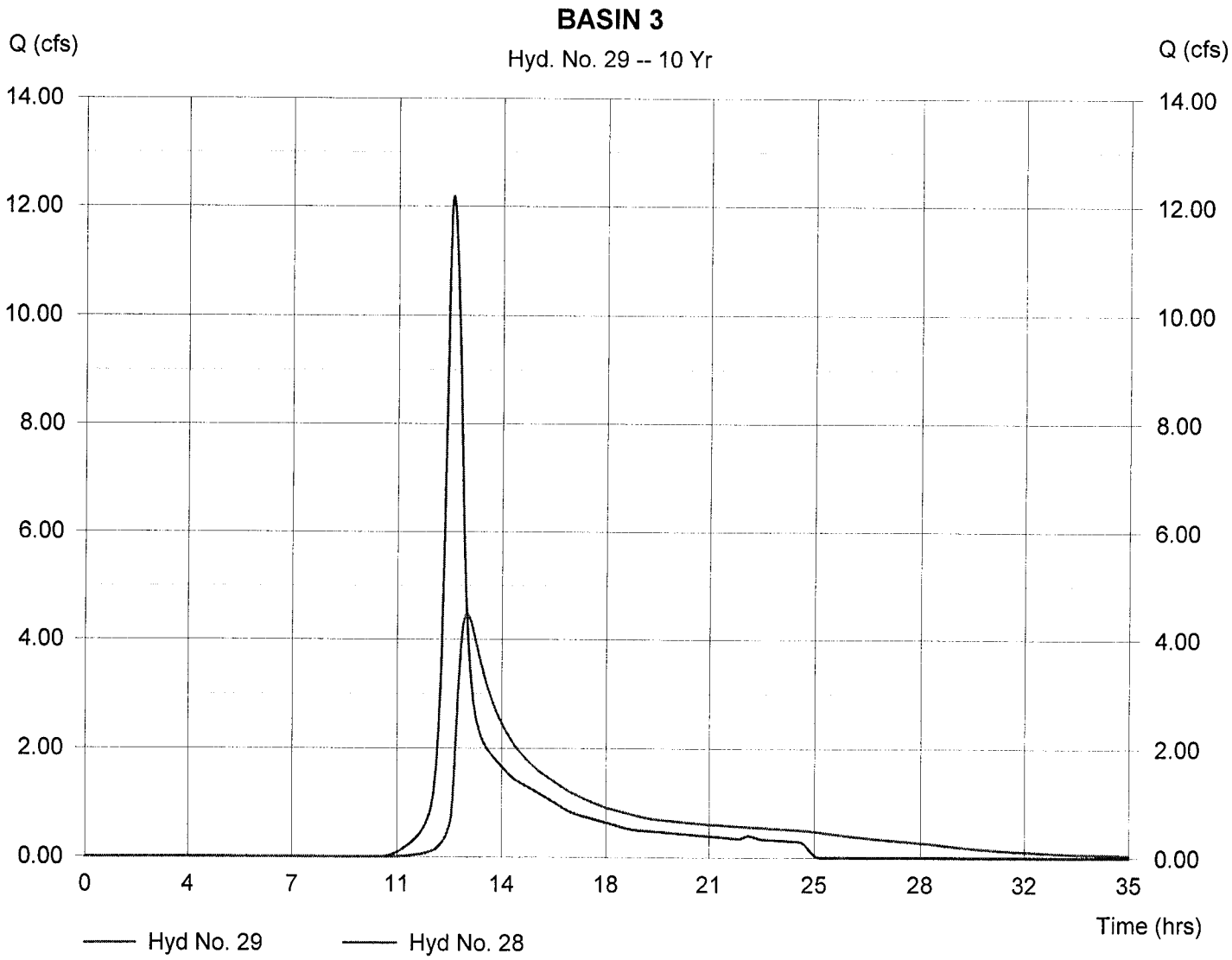
Hyd. No. 29

BASIN 3

Hydrograph type	= Reservoir	Peak discharge	= 4.46 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 28	Max. Elevation	= 128.89 ft
Reservoir name	= BASIN 3	Max. Storage	= 24,007 cuft

Storage Indication method used.

Hydrograph Volume = 63,541 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

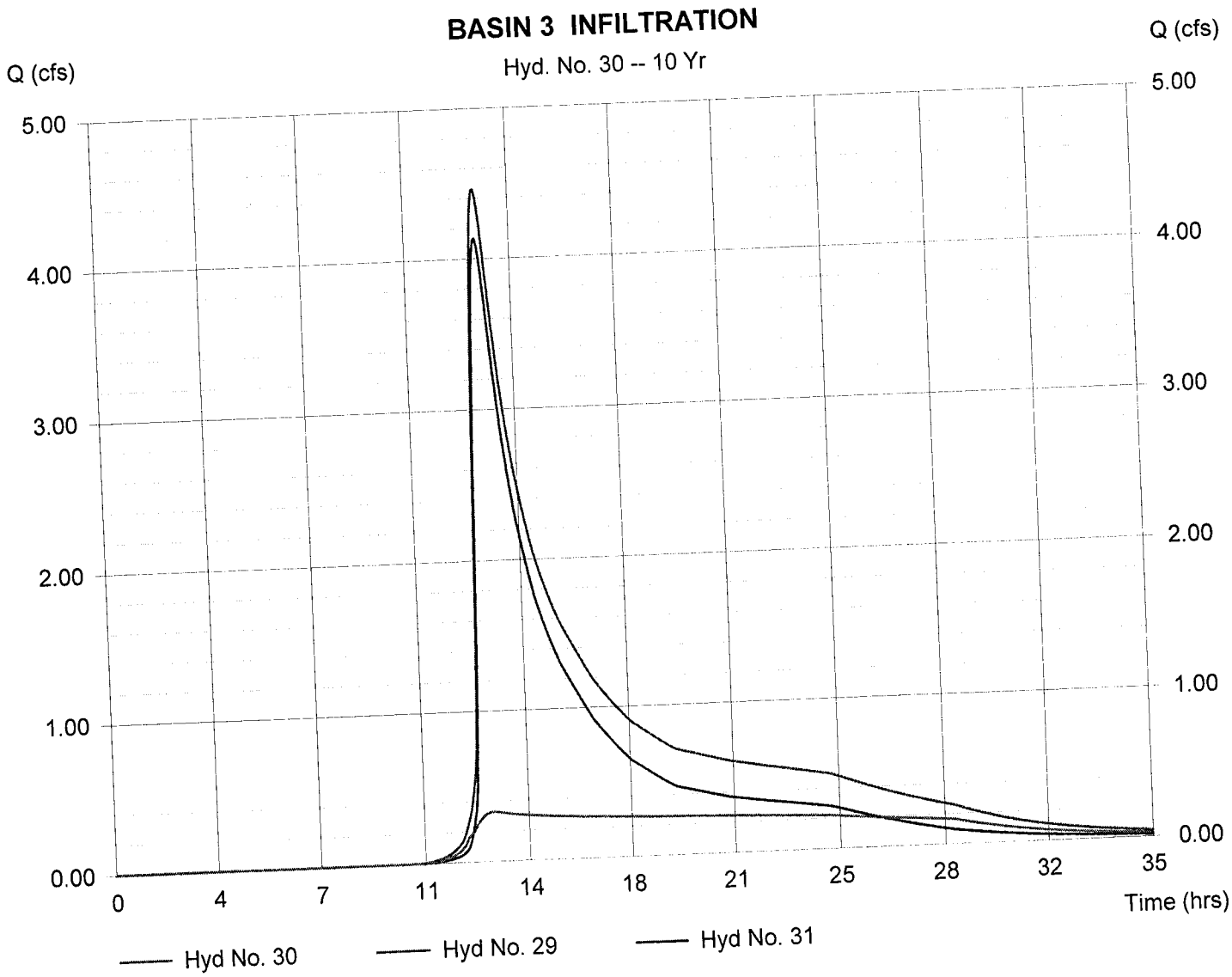
Hyd. No. 30

BASIN 3 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 10 yrs
Inflow hydrograph = 29
Diversion method = Pond - BASIN 3

Peak discharge = 0.33 cfs
Time interval = 1 min
2nd diverted hyd. = 31
Pond structure = Exfiltration

Hydrograph Volume = 16,540 cuft



Hydrograph Plot

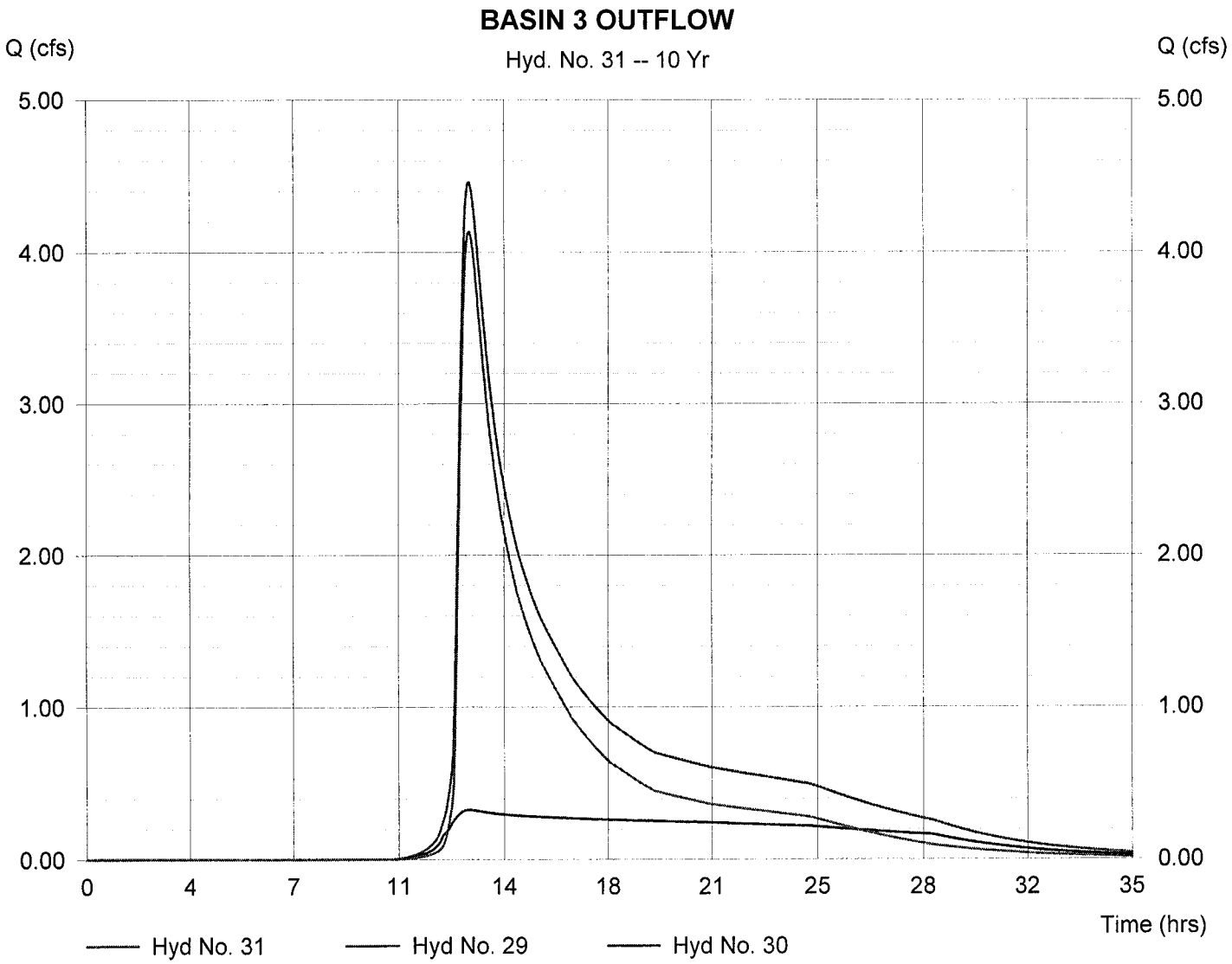
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 31

BASIN 3 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 4.13 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 30
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 47,001 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

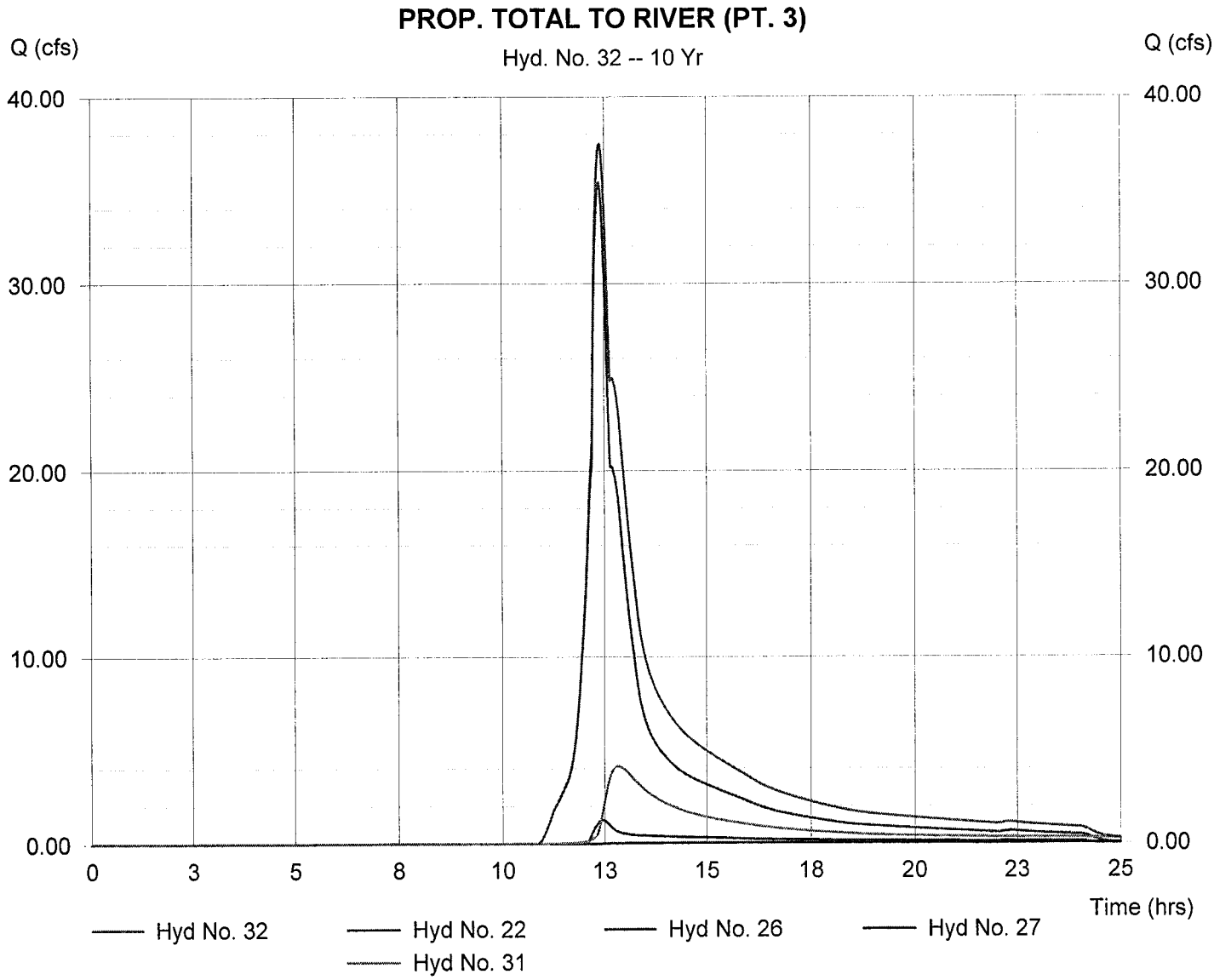
Hyd. No. 32

PROP. TOTAL TO RIVER (PT. 3)

Hydrograph type = Combine
Storm frequency = 10 yrs
Inflow hyds. = 22, 26, 27, 31

Peak discharge = 37.46 cfs
Time interval = 1 min

Hydrograph Volume = 234,941 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

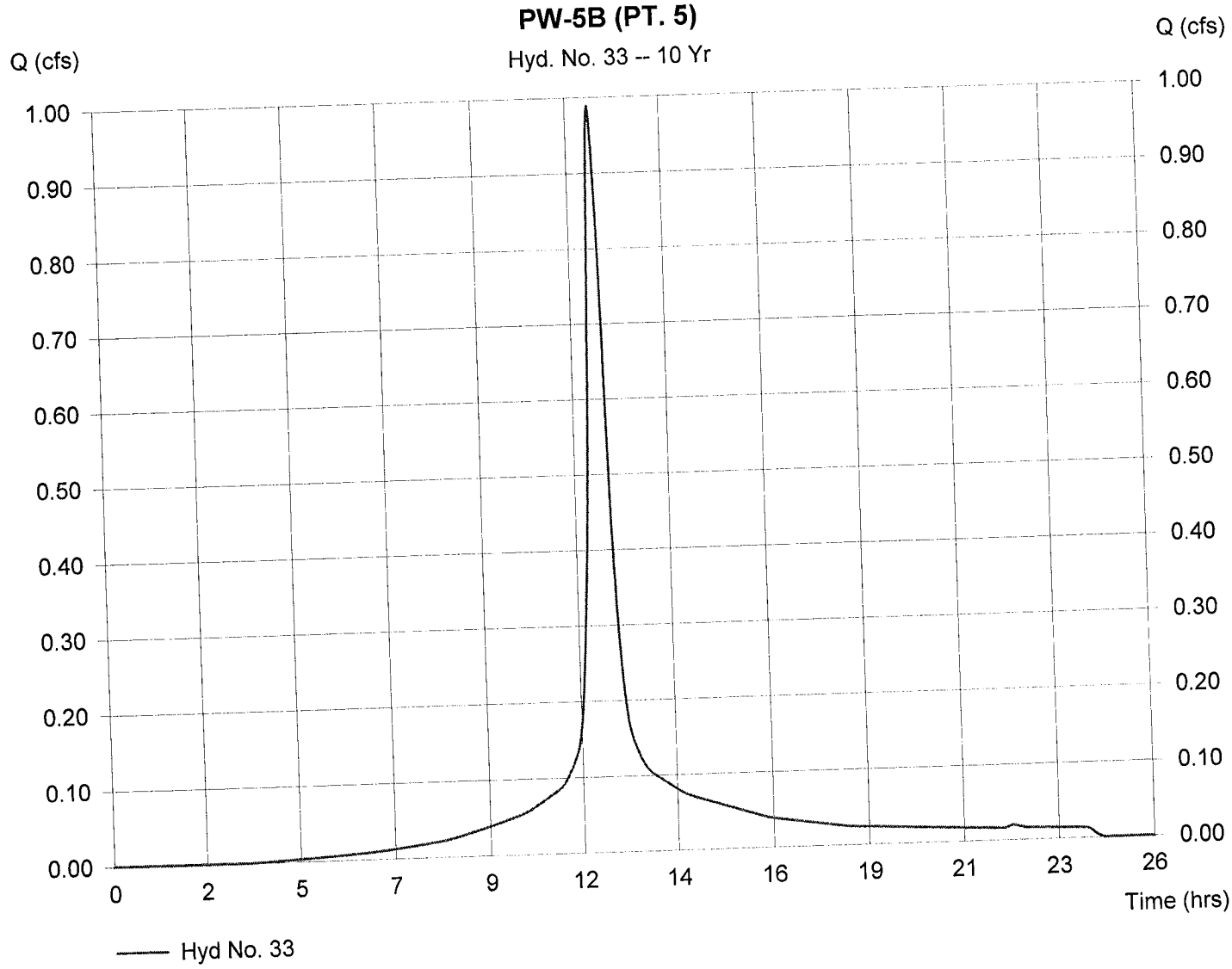
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 33

PW-5B (PT. 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.99 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.340 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.10 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,576 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

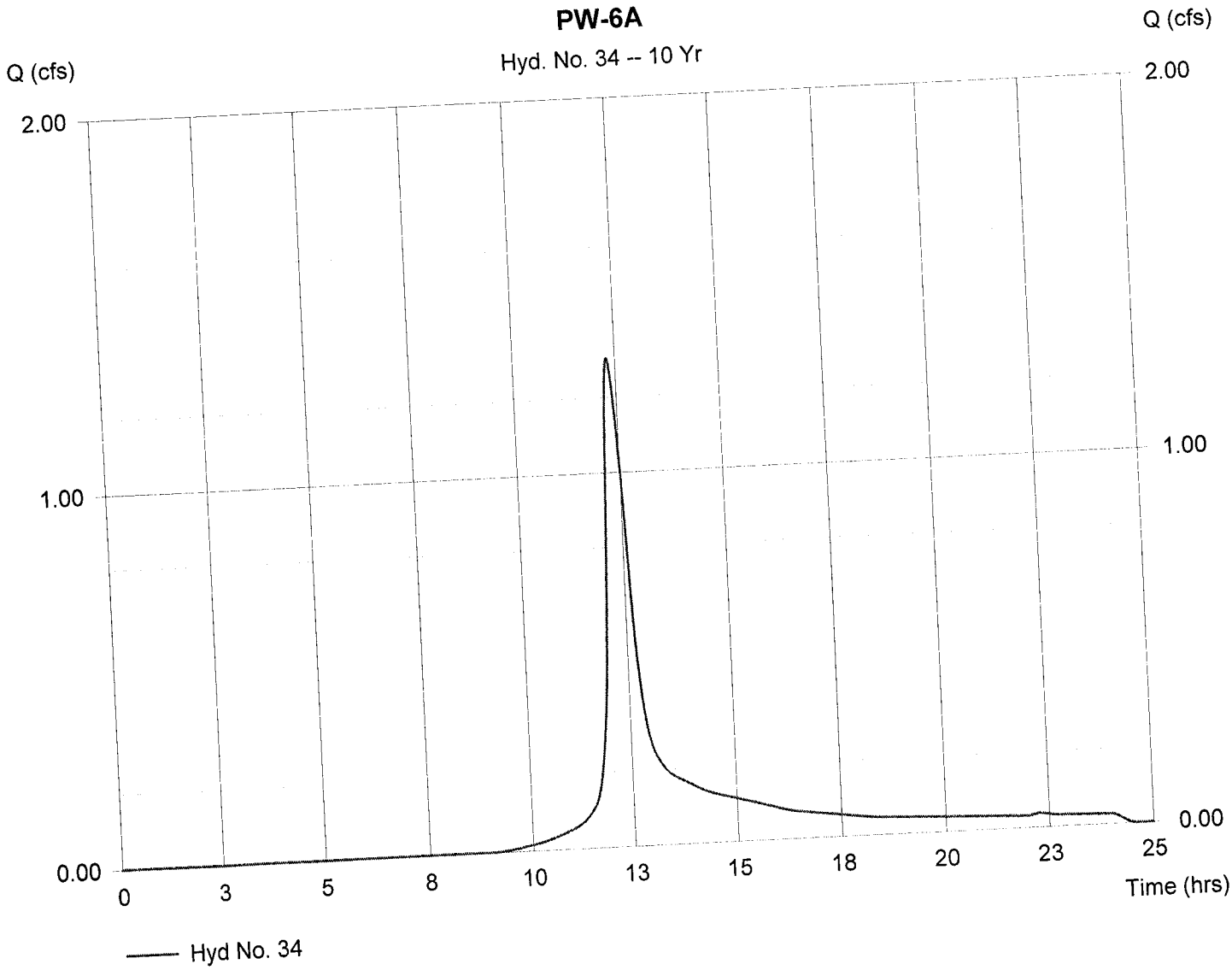
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 34

PW-6A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.30 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.820 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.70 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,340 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:32 PM

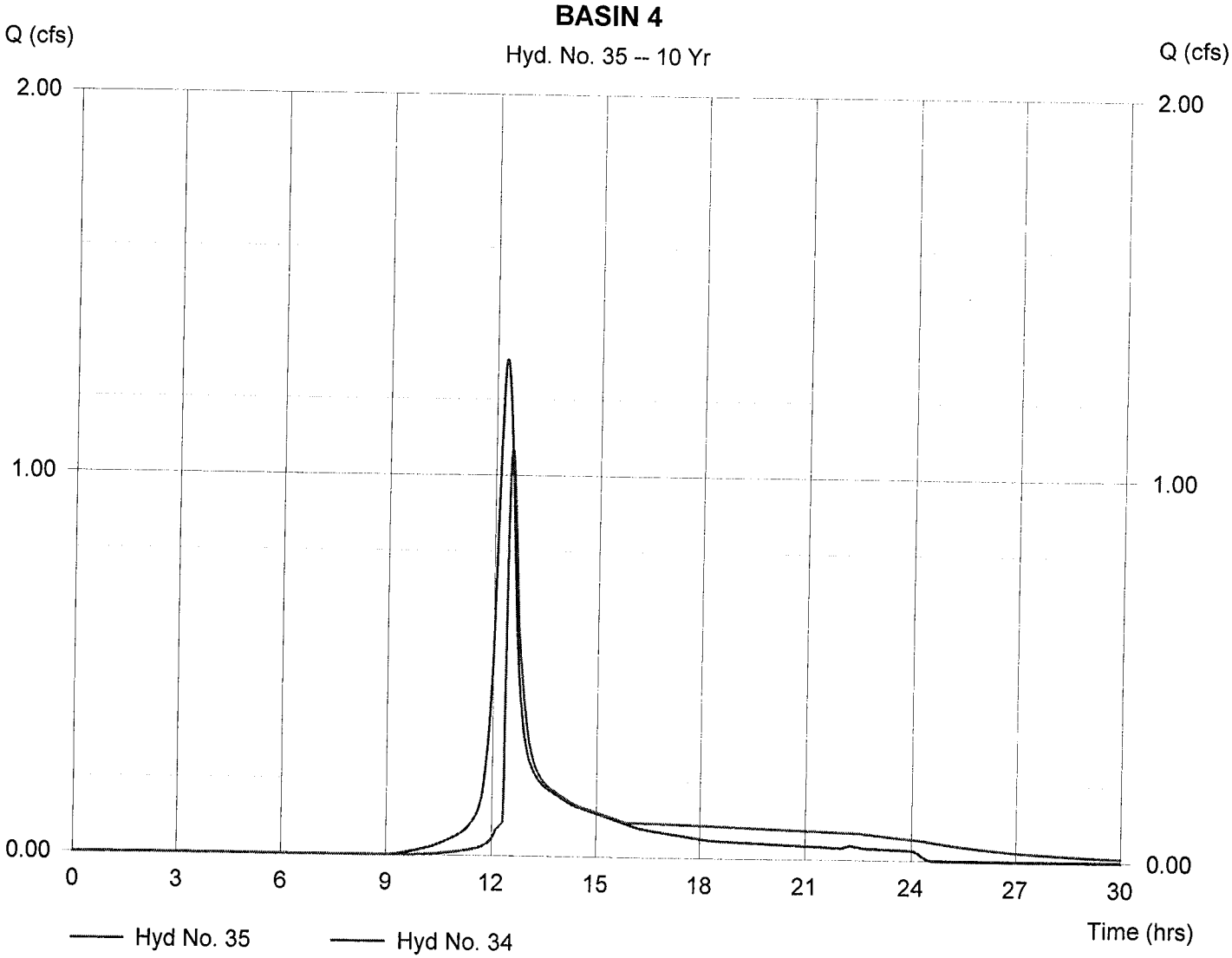
Hyd. No. 35

BASIN 4

Hydrograph type	= Reservoir	Peak discharge	= 1.07 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 34	Max. Elevation	= 129.65 ft
Reservoir name	= BASIN 4	Max. Storage	= 1,913 cuft

Storage Indication method used.

Hydrograph Volume = 6,327 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

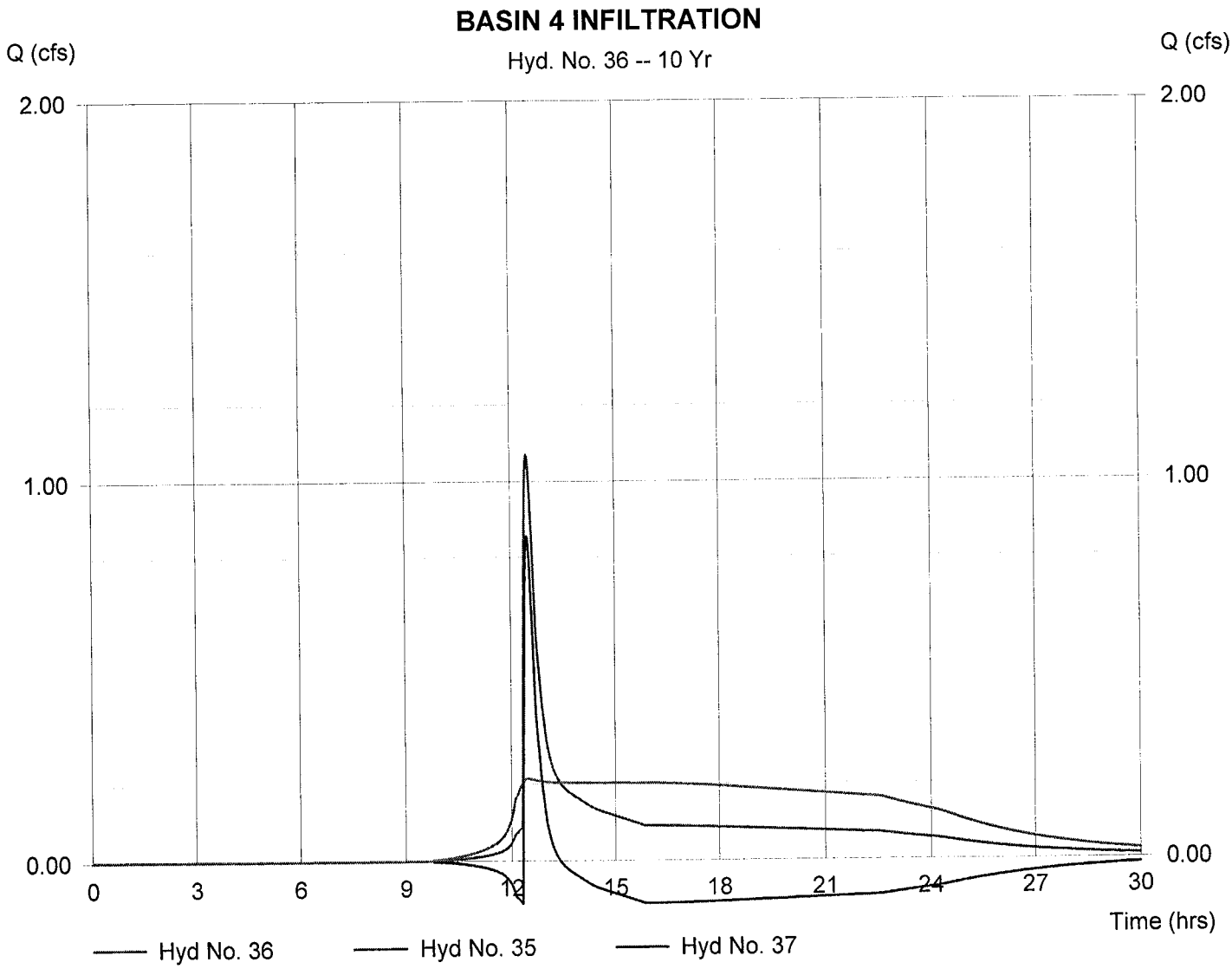
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 36

BASIN 4 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.21 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 37
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = 9,838 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

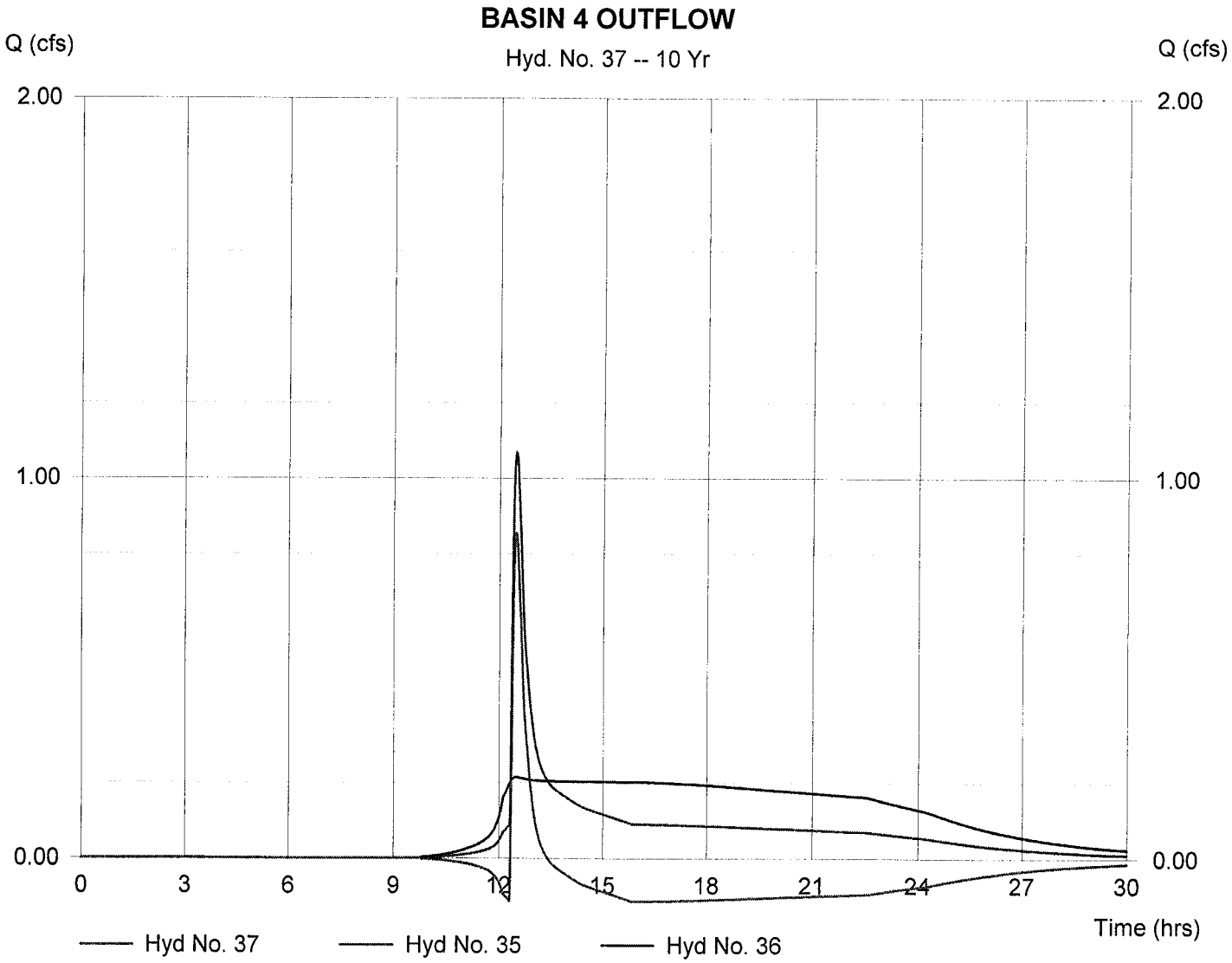
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 37

BASIN 4 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 0.85 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 36
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = -3,511 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

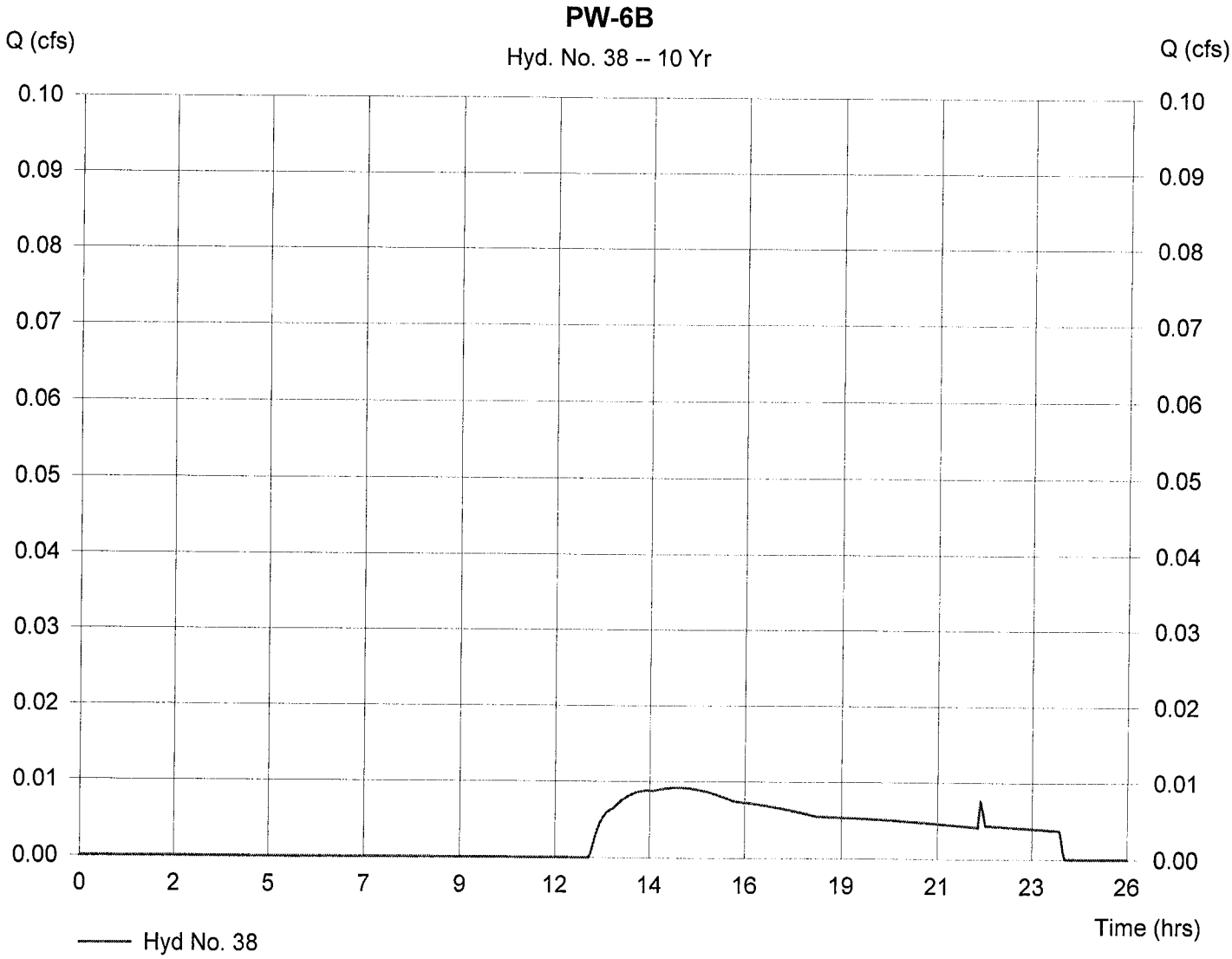
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 38

PW-6B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.01 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.600 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 248 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

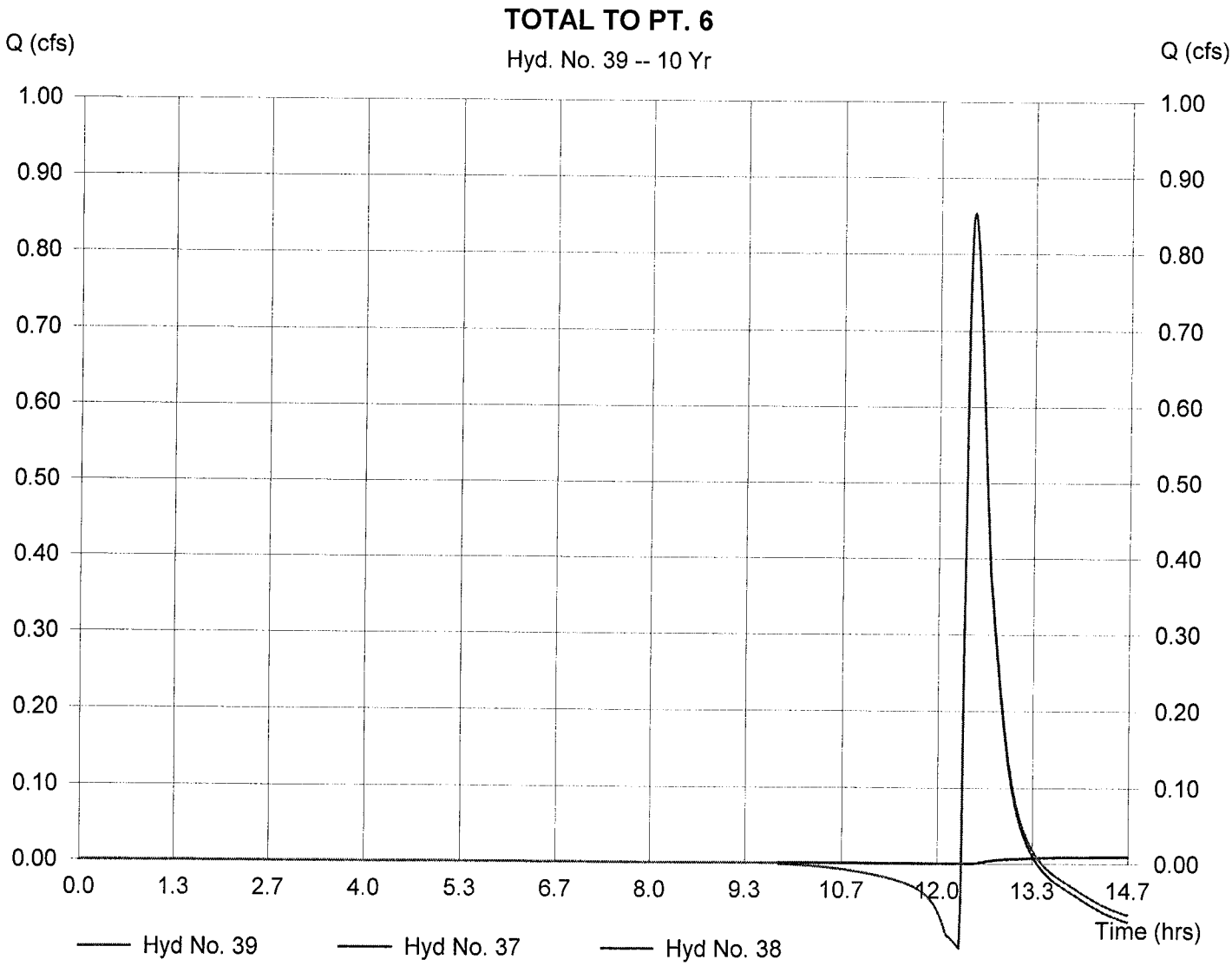
Wednesday, Oct 3 2007, 6:32 PM

Hyd. No. 39

TOTAL TO PT. 6

Hydrograph type	= Combine	Peak discharge	= 0.85 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyds.	= 37, 38		

Hydrograph Volume = -3,263 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

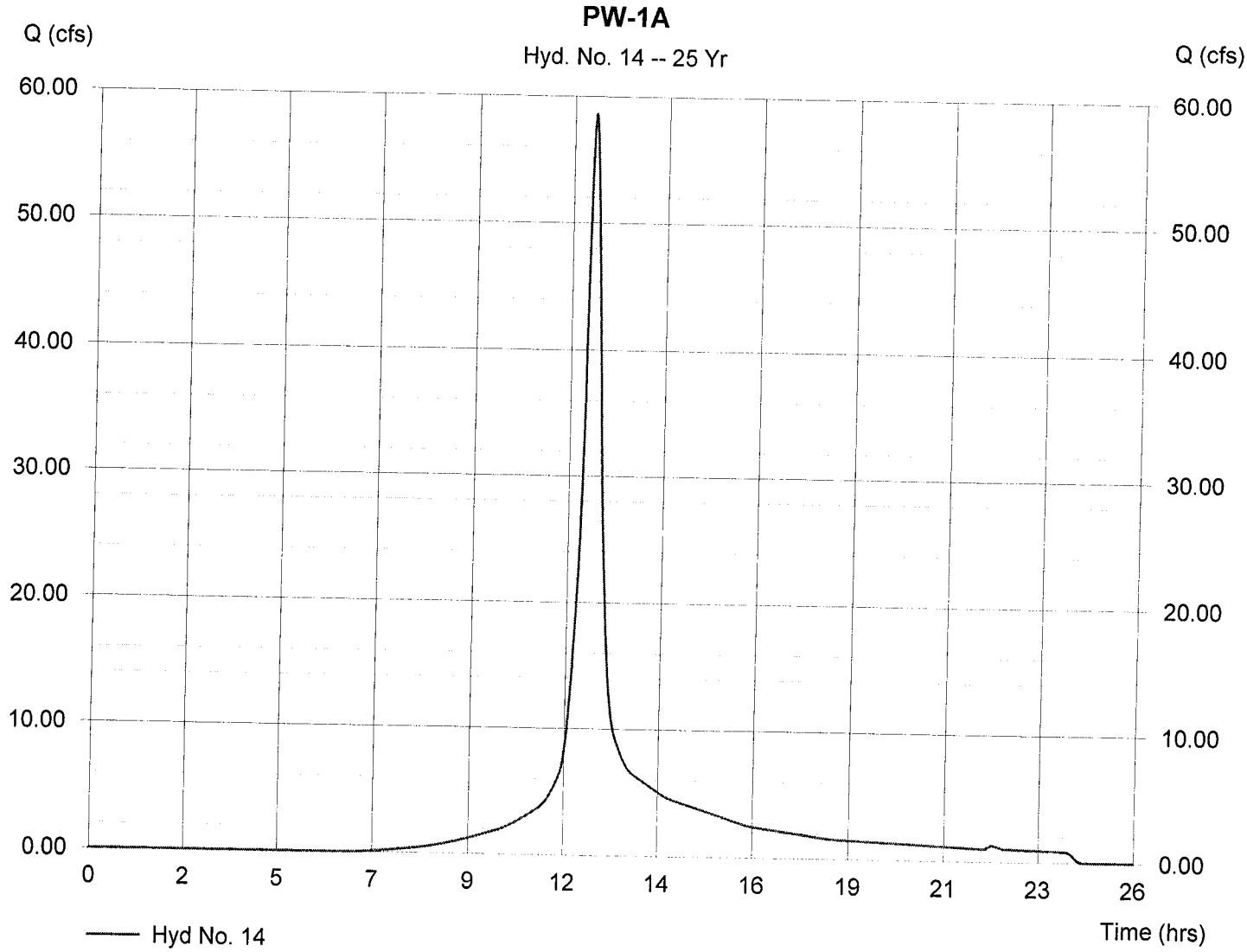
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 14

PW-1A

Hydrograph type	= SCS Runoff	Peak discharge	= 58.61 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 20.200 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.50 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 249,866 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

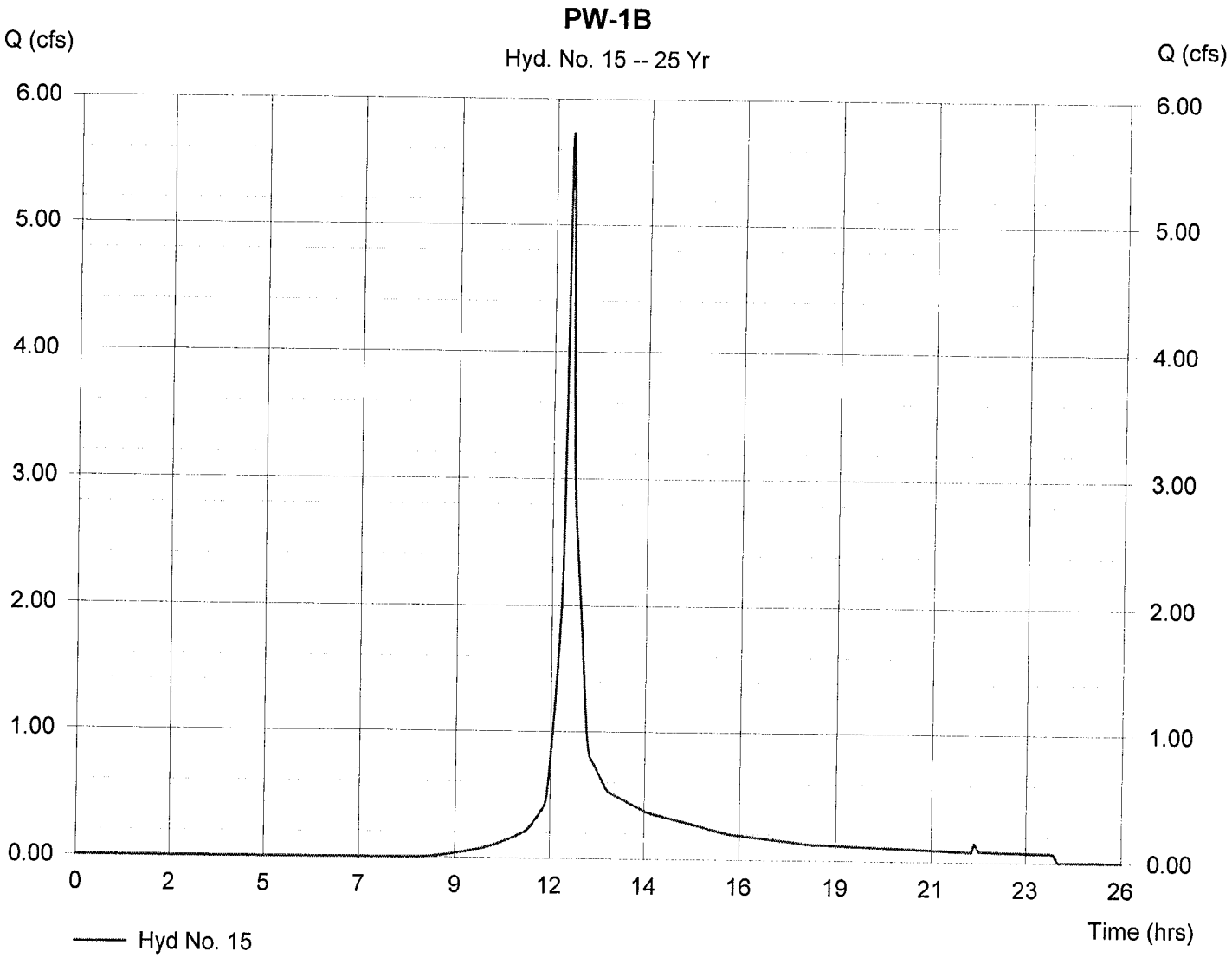
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 15

PW-1B

Hydrograph type	= SCS Runoff	Peak discharge	= 5.73 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 1.750 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 17,653 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

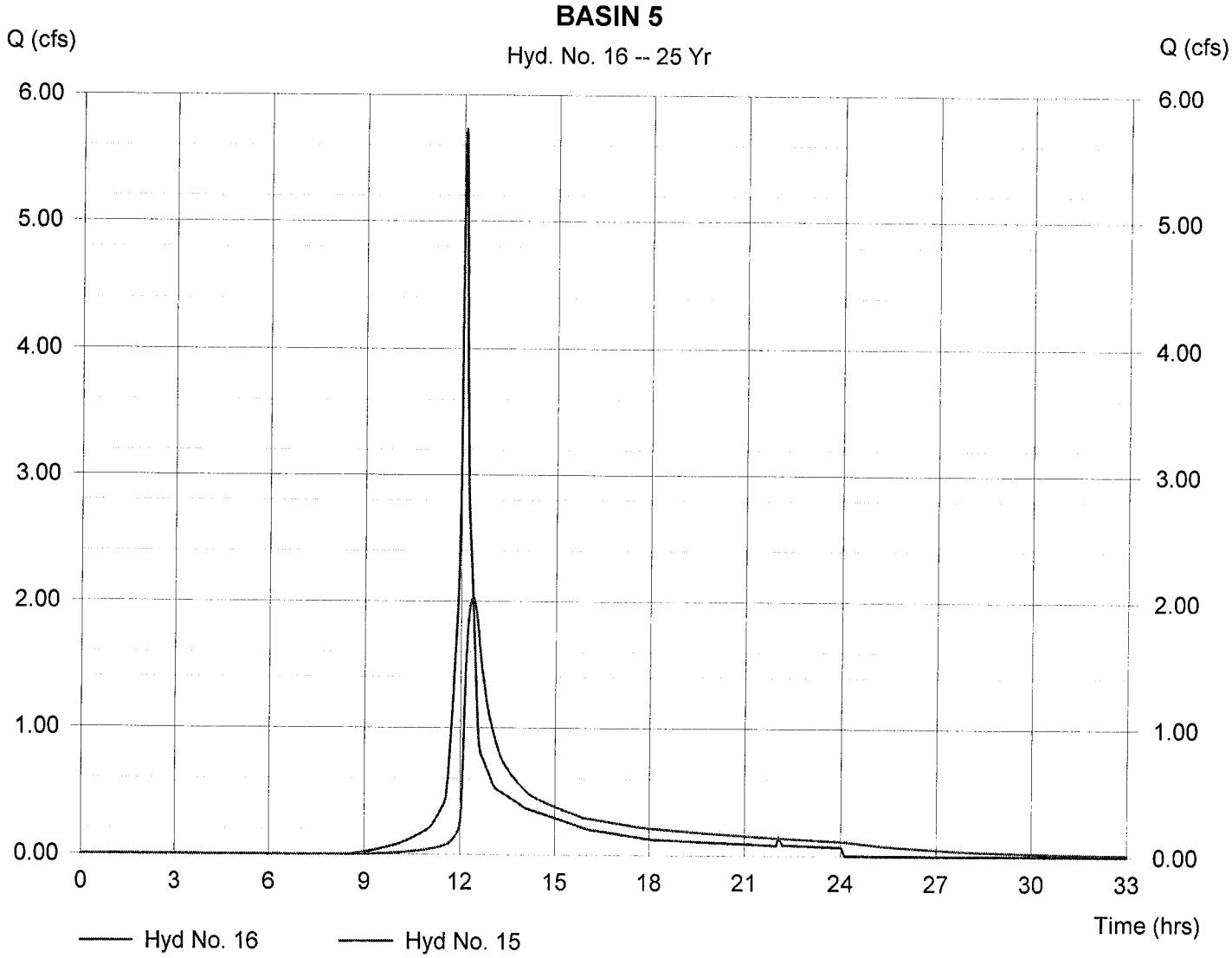
Hyd. No. 16

BASIN 5

Hydrograph type	= Reservoir	Peak discharge	= 2.03 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 15	Max. Elevation	= 127.59 ft
Reservoir name	= BASIN 5	Max. Storage	= 6,226 cuft

Storage Indication method used.

Hydrograph Volume = 17,640 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

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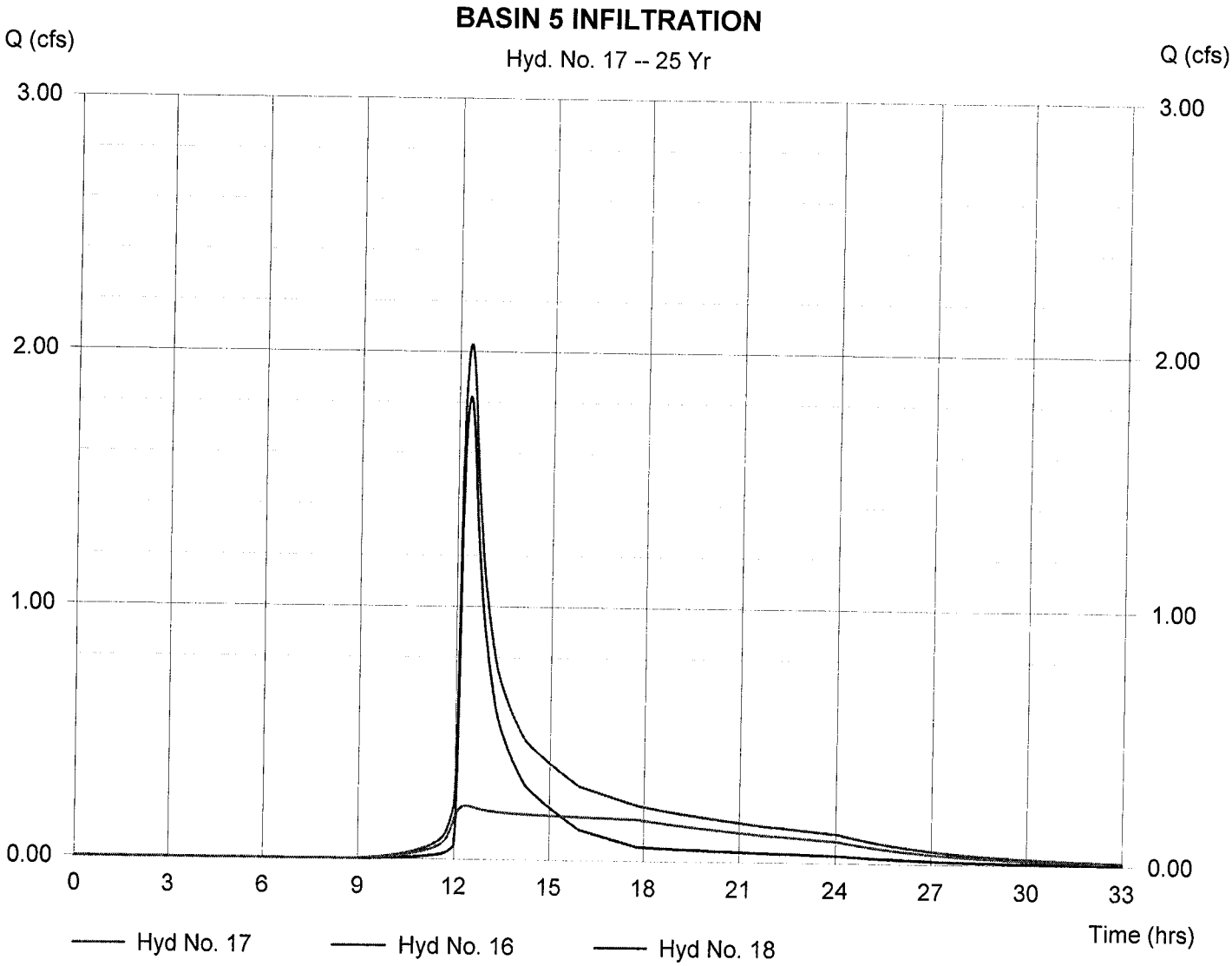
Hyd. No. 17

BASIN 5 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 25 yrs
Inflow hydrograph = 16
Diversion method = Pond - BASIN 5

Peak discharge = 0.21 cfs
Time interval = 1 min
2nd diverted hyd. = 18
Pond structure = Exfiltration

Hydrograph Volume = 7,812 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

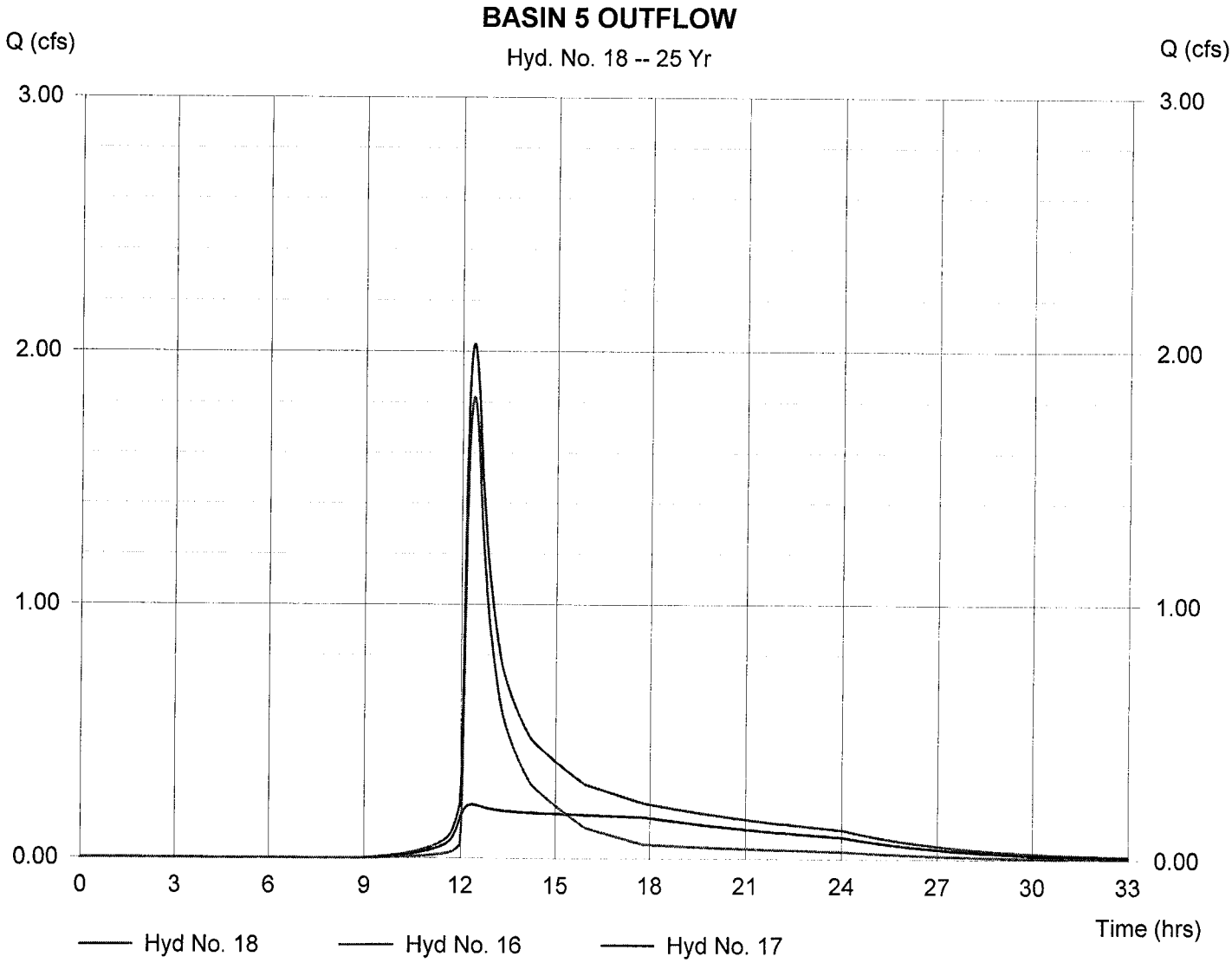
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 18

BASIN 5 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 1.82 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 16	2nd diverted hyd.	= 17
Diversion method	= Pond - BASIN 5	Pond structure	= Exfiltration

Hydrograph Volume = 9,827 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

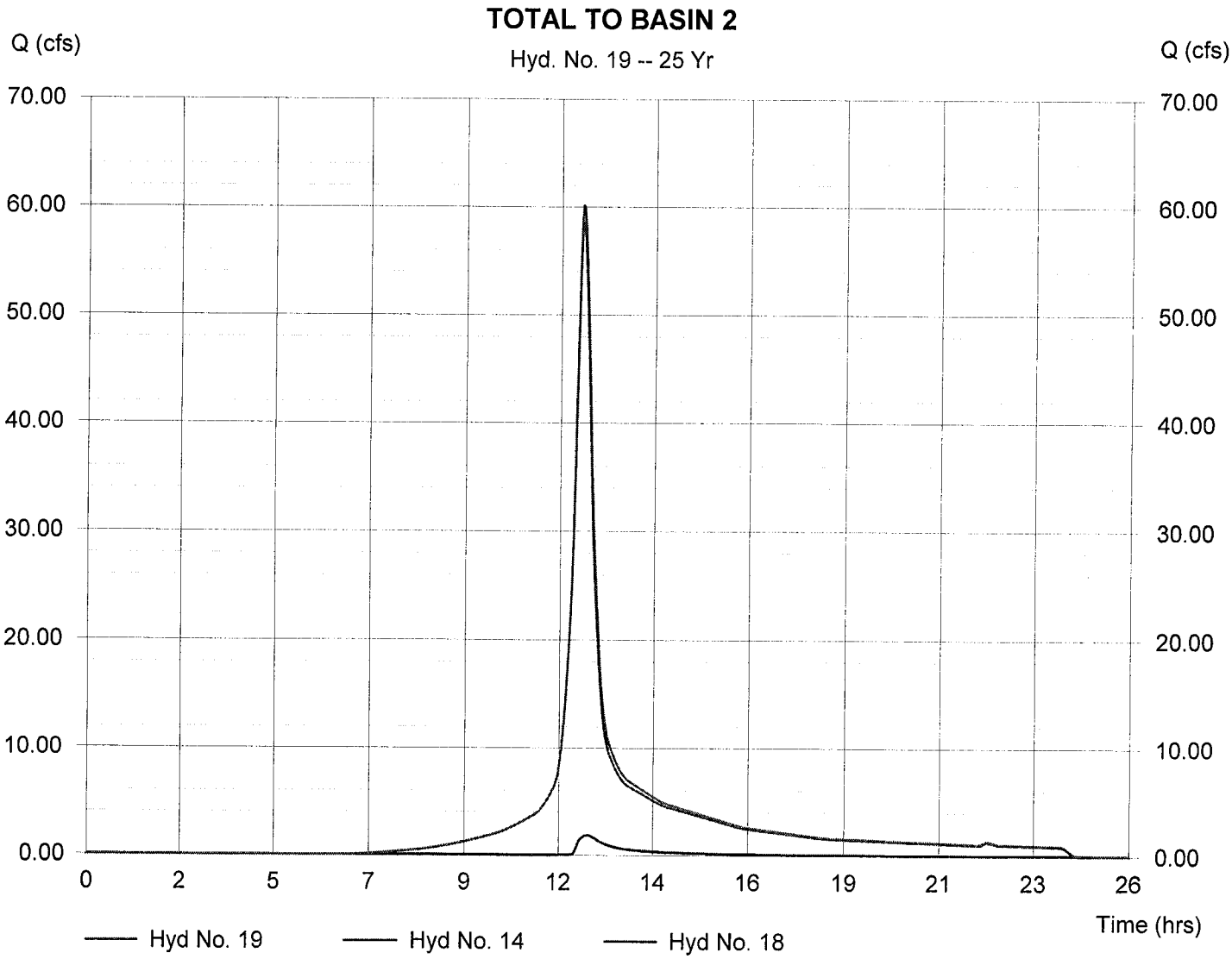
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 19

TOTAL TO BASIN 2

Hydrograph type	= Combine	Peak discharge	= 60.09 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyds.	= 14, 18		

Hydrograph Volume = 259,694 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

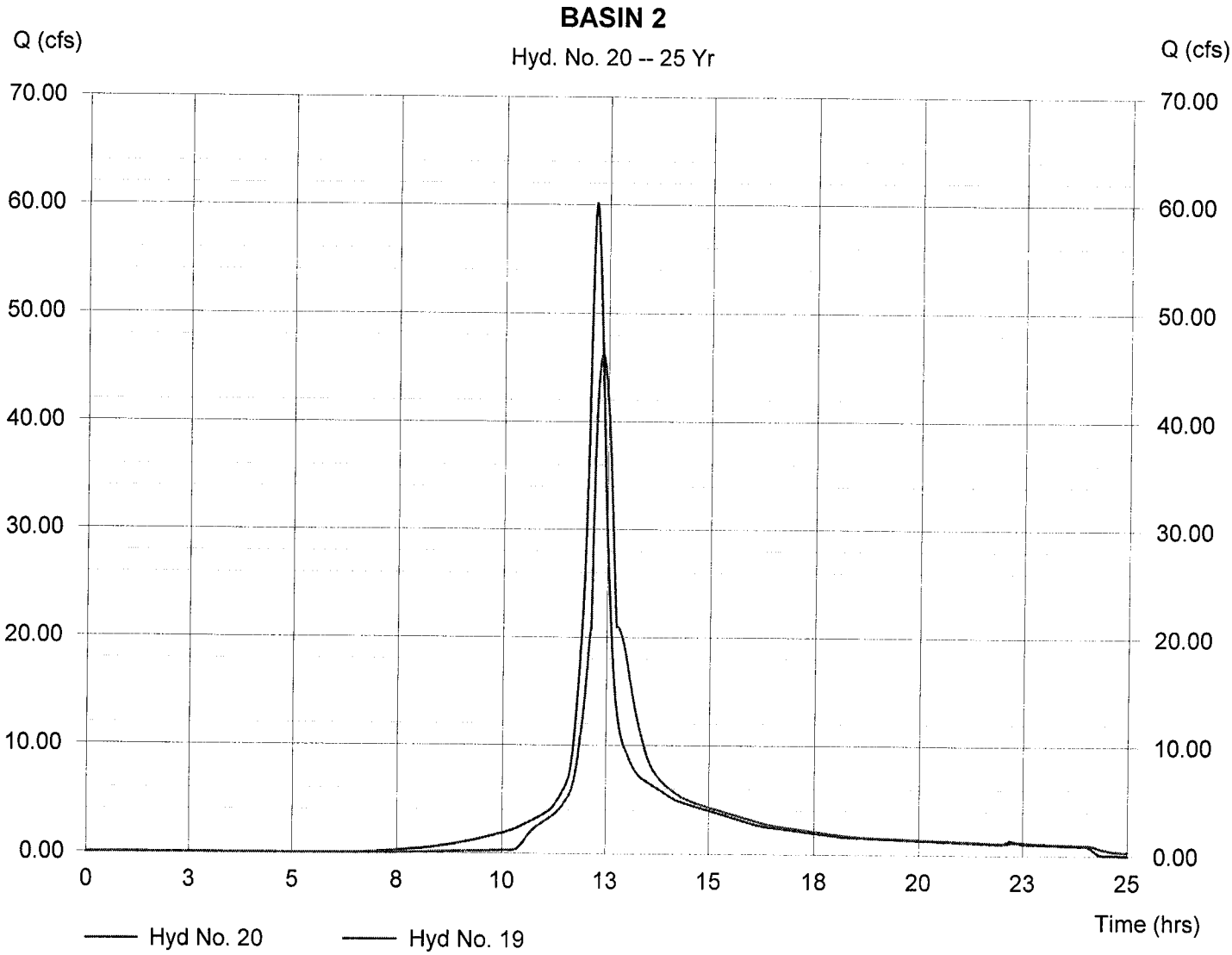
Hyd. No. 20

BASIN 2

Hydrograph type	= Reservoir	Peak discharge	= 46.15 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 19	Max. Elevation	= 122.41 ft
Reservoir name	= BASIN 2	Max. Storage	= 48,041 cuft

Storage Indication method used.

Hydrograph Volume = 259,637 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

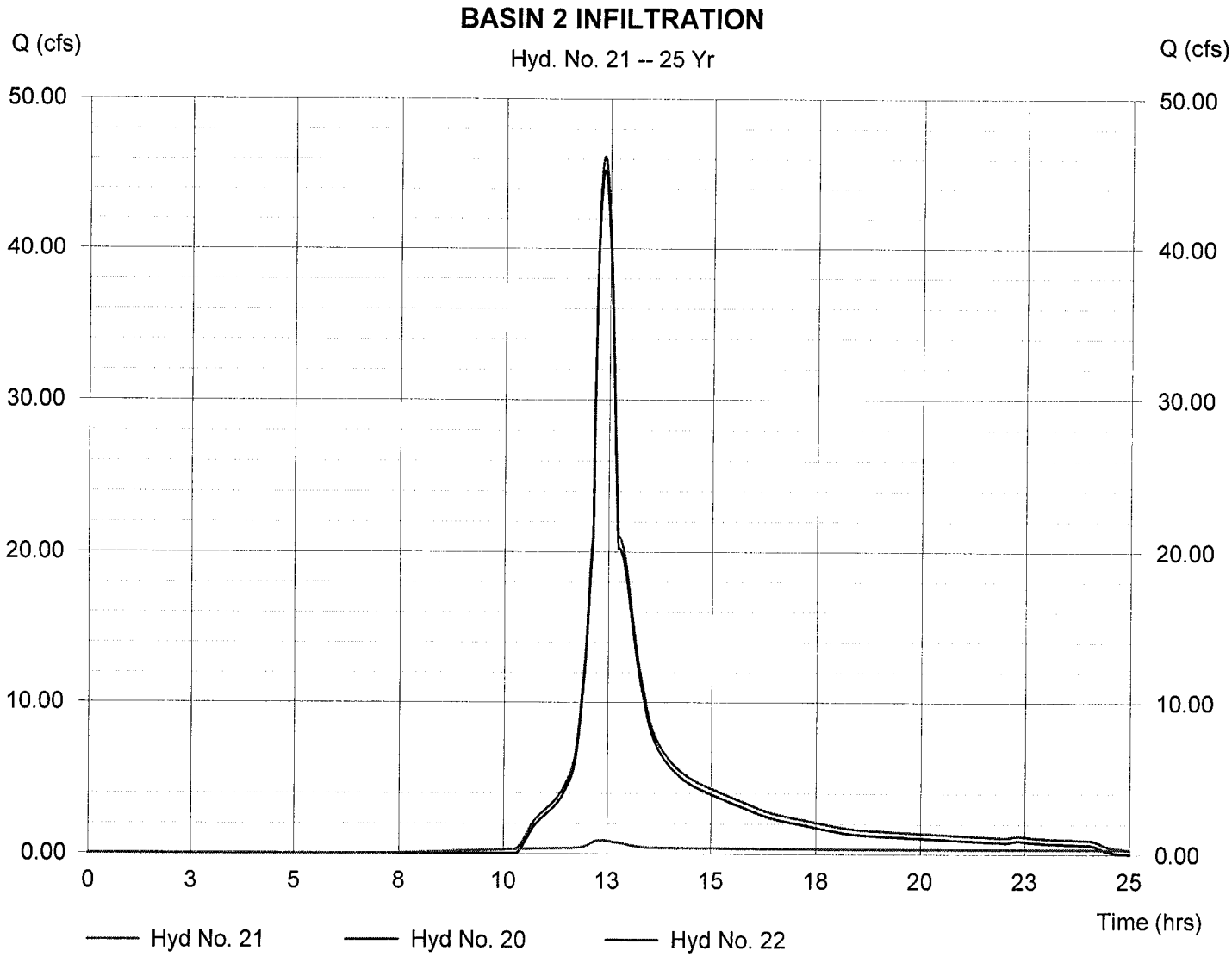
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Hyd. No. 21

BASIN 2 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.90 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 22
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 30,232 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

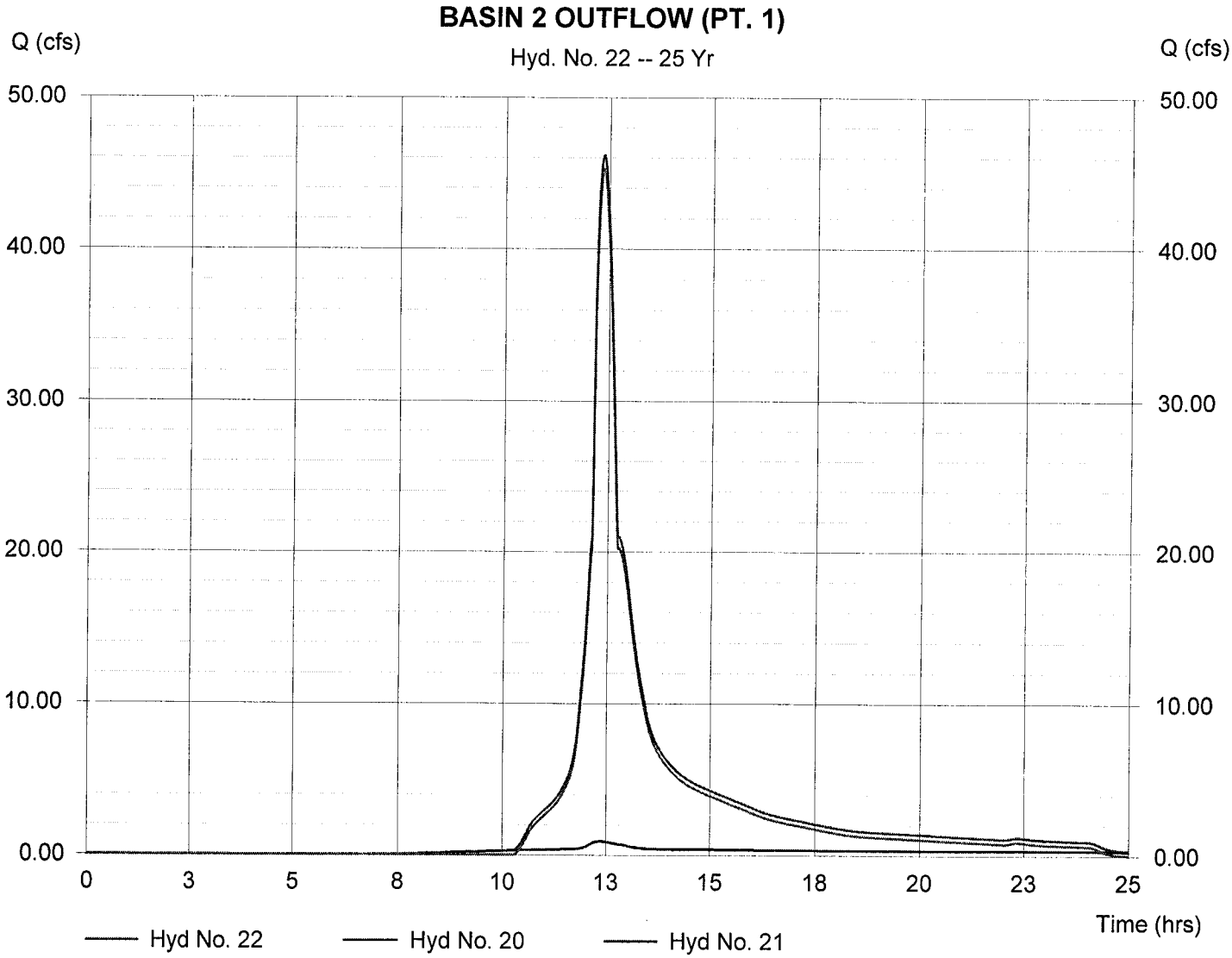
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 22

BASIN 2 OUTFLOW (PT. 1)

Hydrograph type	= Diversion2	Peak discharge	= 45.25 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 21
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 229,406 cuft



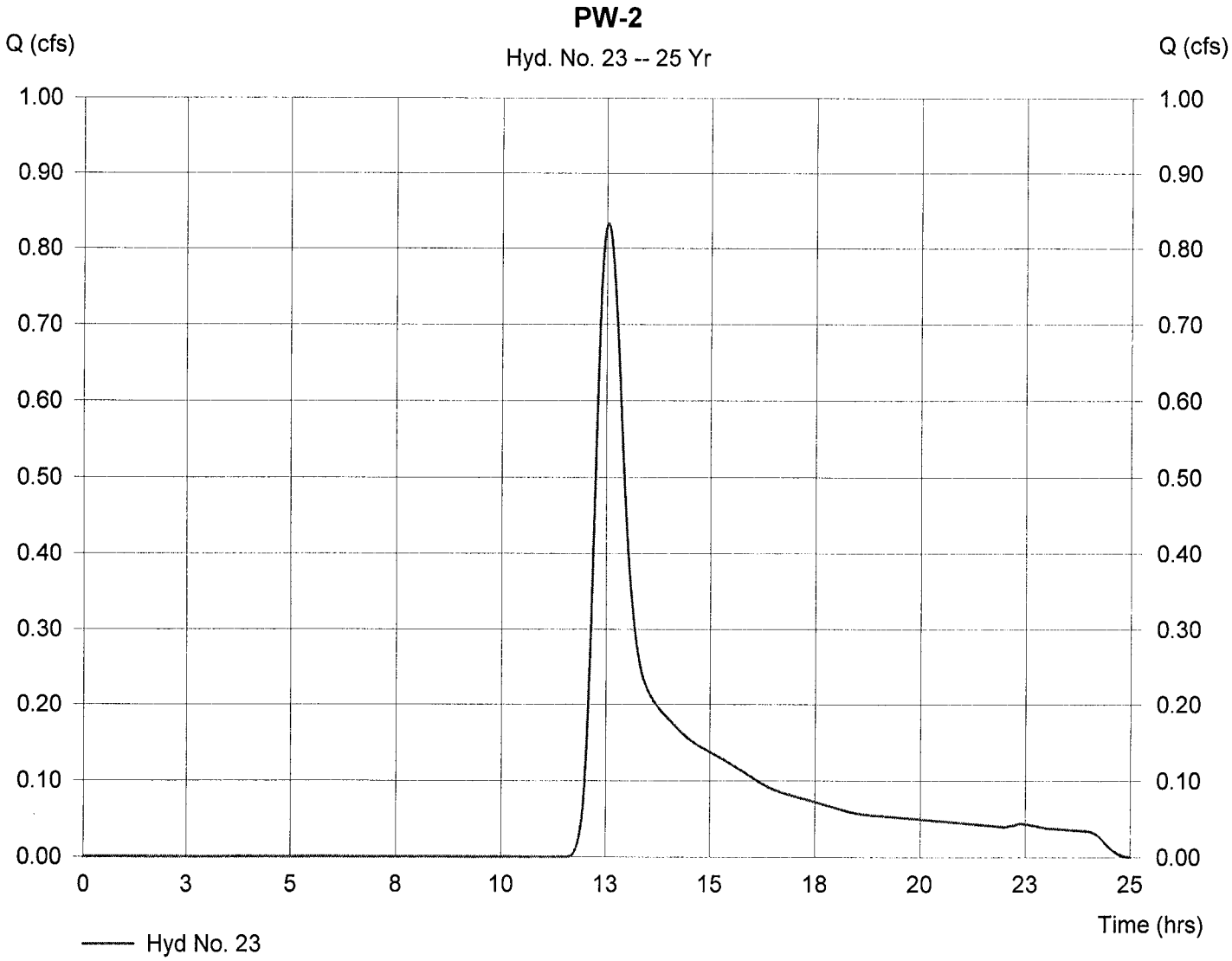
Hydrograph Plot

Hyd. No. 23

PW-2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.83 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 1.310 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.50 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,675 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

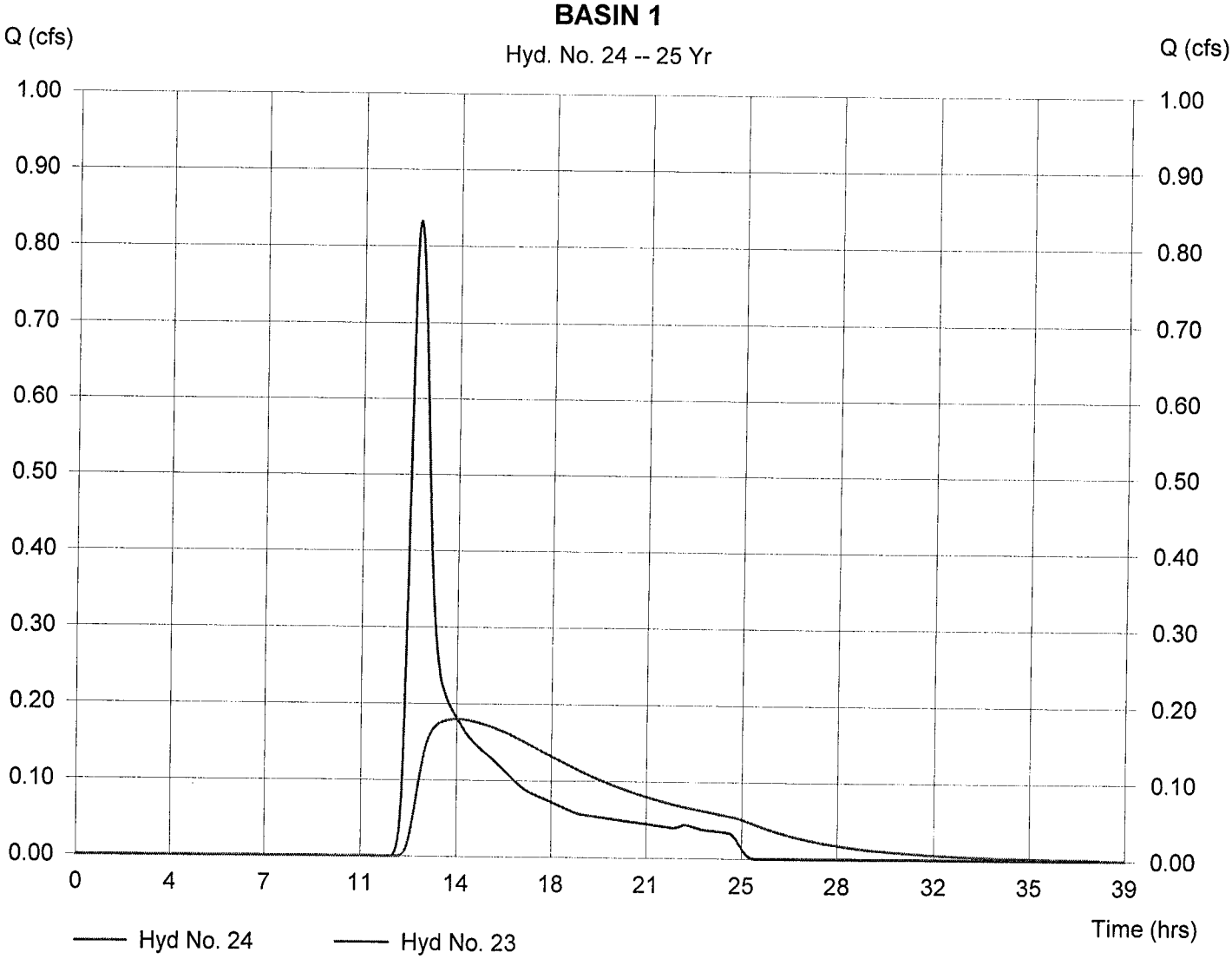
Hyd. No. 24

BASIN 1

Hydrograph type	= Reservoir	Peak discharge	= 0.18 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 118.57 ft
Reservoir name	= UPGRADED BASIN	Max. Storage	= 2,141 cuft

Storage Indication method used.

Hydrograph Volume = 5,663 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

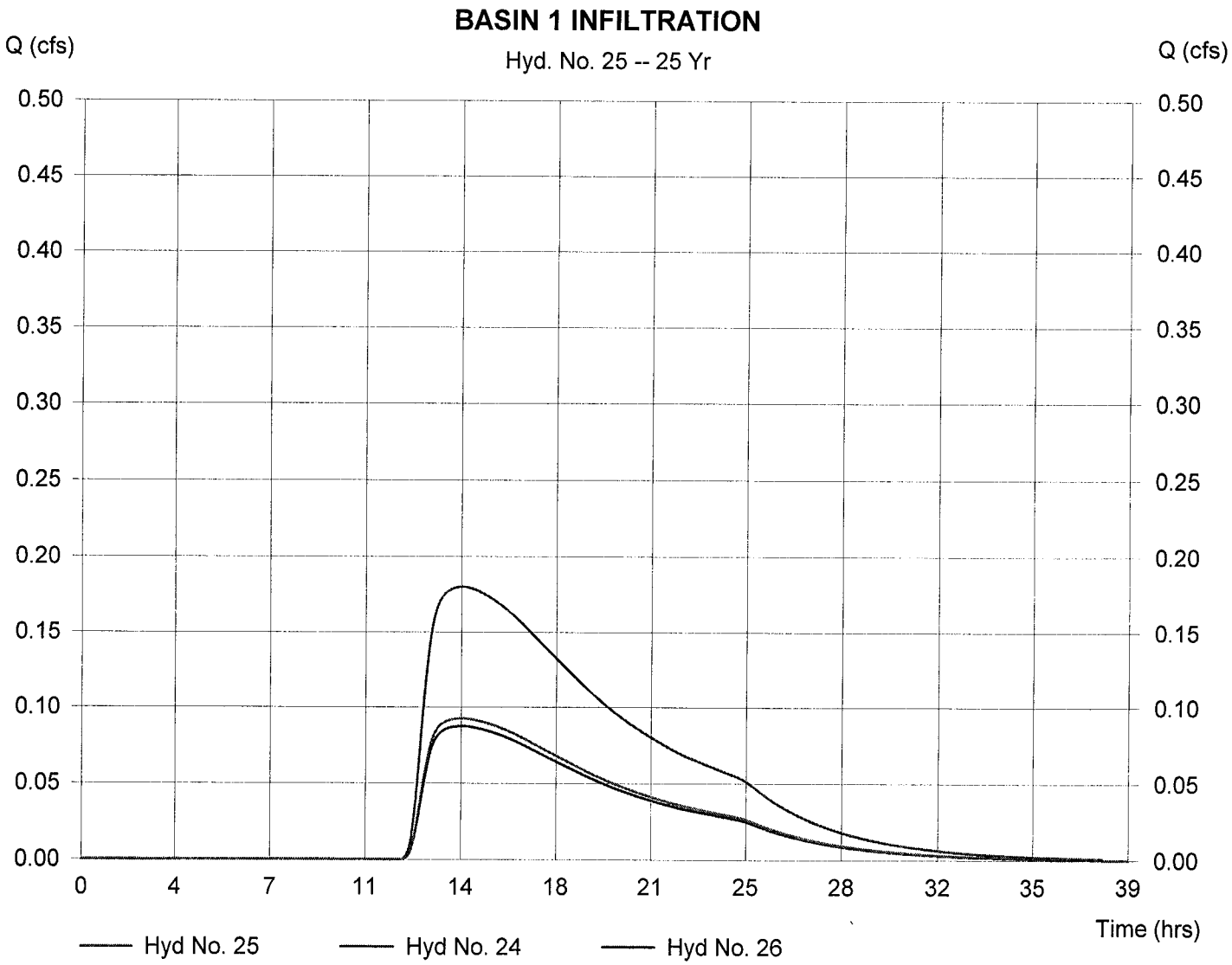
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 25

BASIN 1 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.09 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 24	2nd diverted hyd.	= 26
Diversion method	= Pond - UPGRADED BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 2,913 cuft



Hydrograph Plot

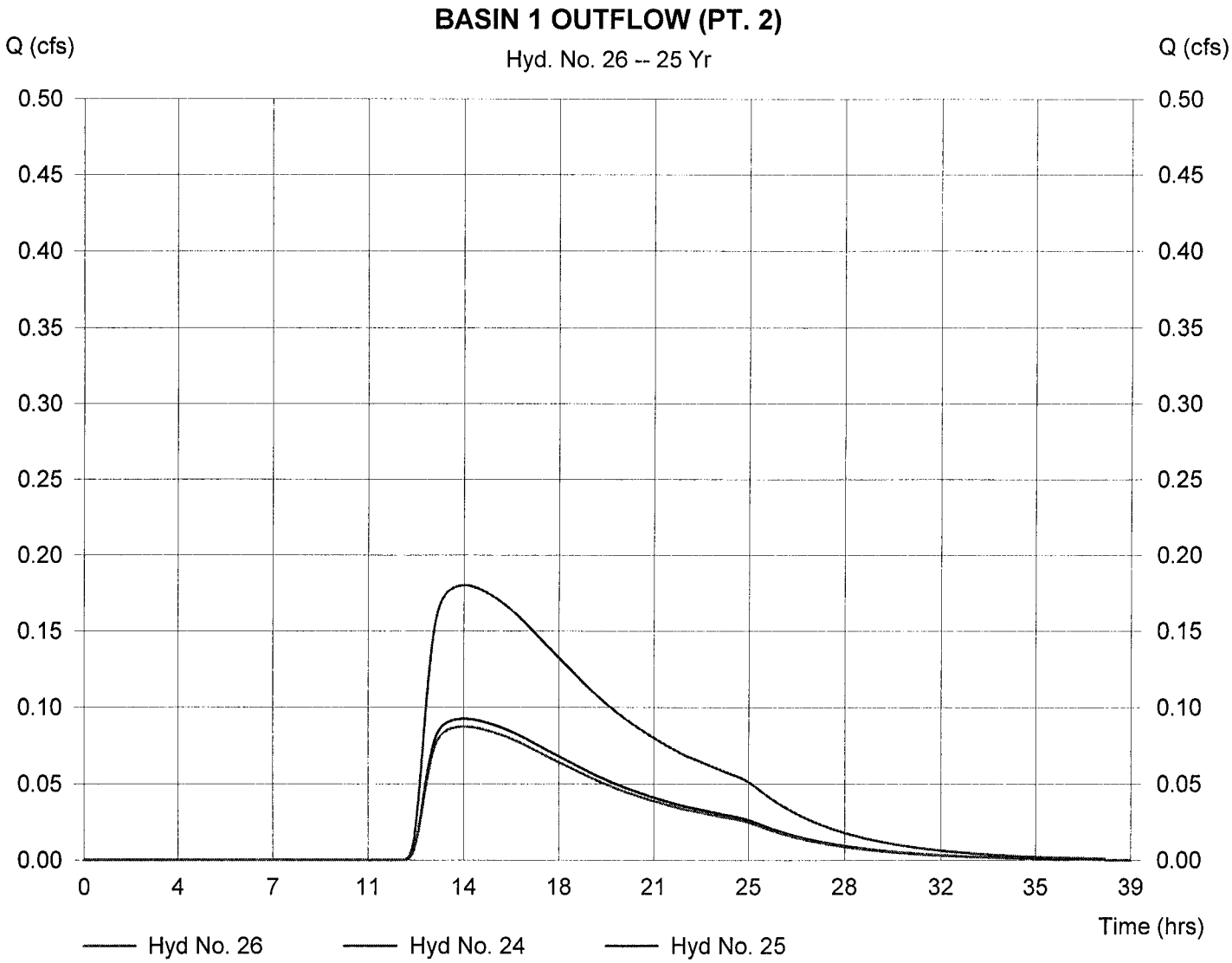
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 26

BASIN 1 OUTFLOW (PT. 2)

Hydrograph type	= Diversion2	Peak discharge	= 0.09 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 24	2nd diverted hyd.	= 25
Diversion method	= Pond - UPGRADED BASIN	Pond structure	= Exfiltration

Hydrograph Volume = 2,751 cuft



Hydrograph Plot

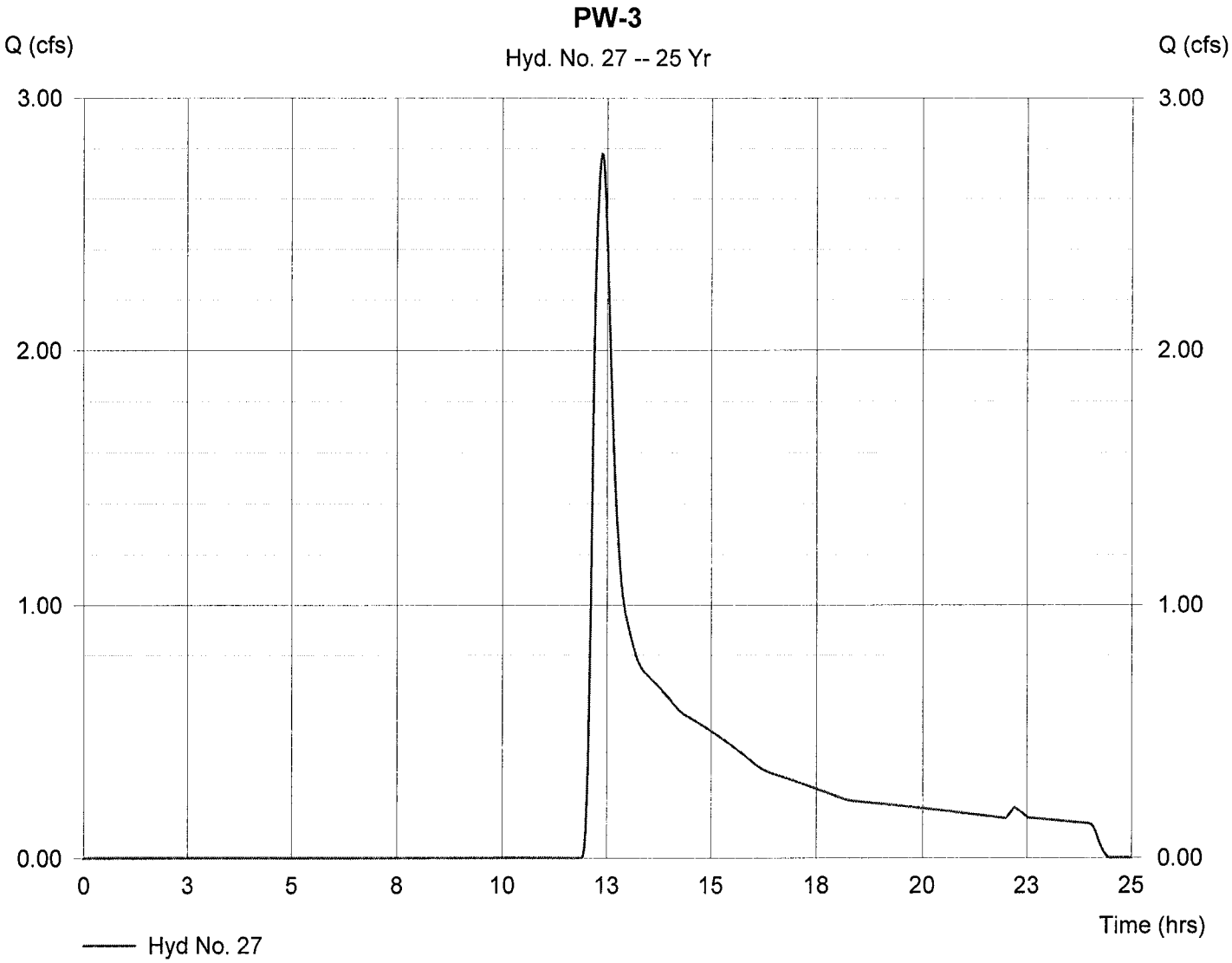
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Hyd. No. 27

PW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.78 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 7.250 ac	Curve number	= 48
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.80 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 18,500 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

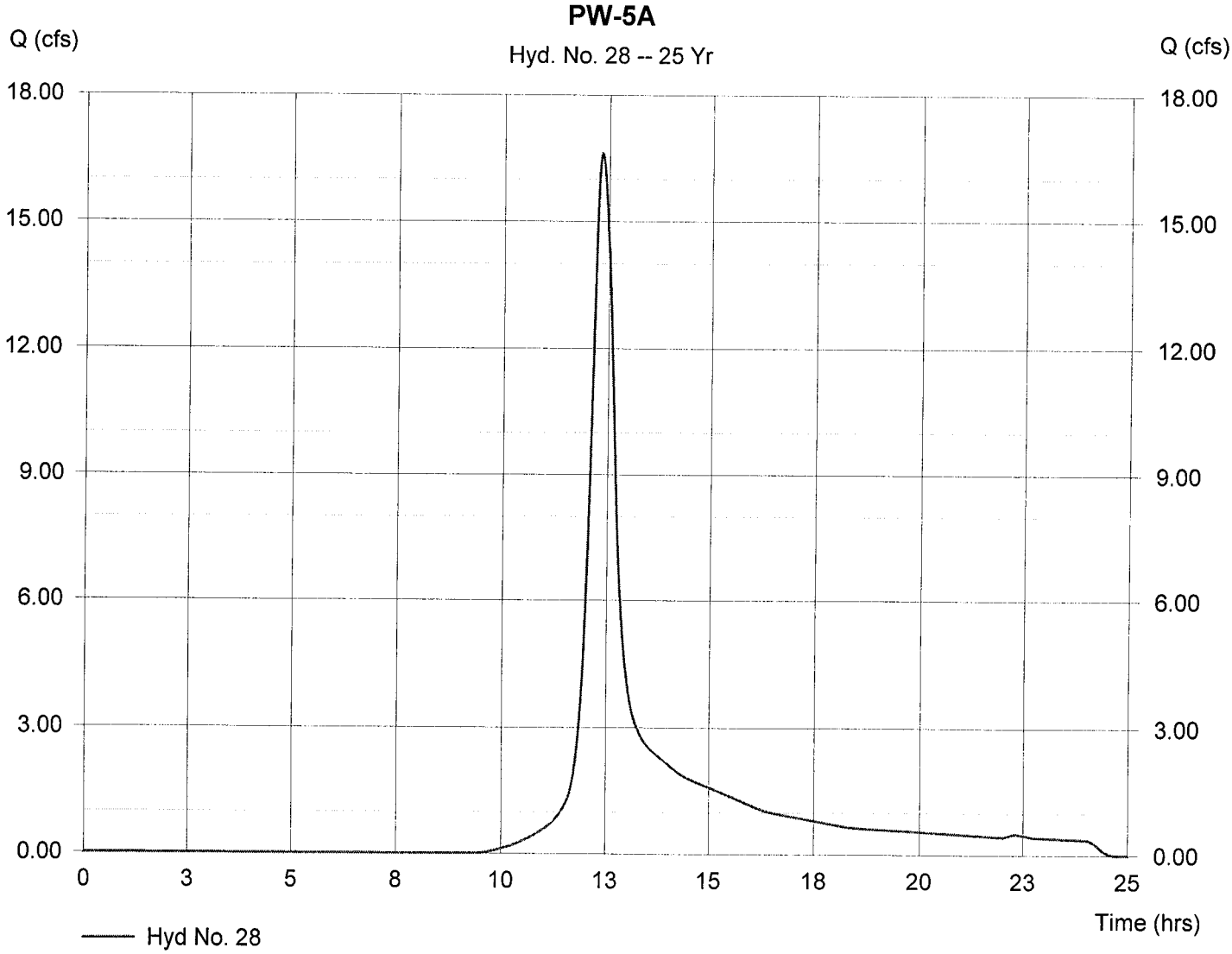
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Hyd. No. 28

PW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 16.61 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 10.100 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.30 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 85,373 cuft



Hydrograph Plot

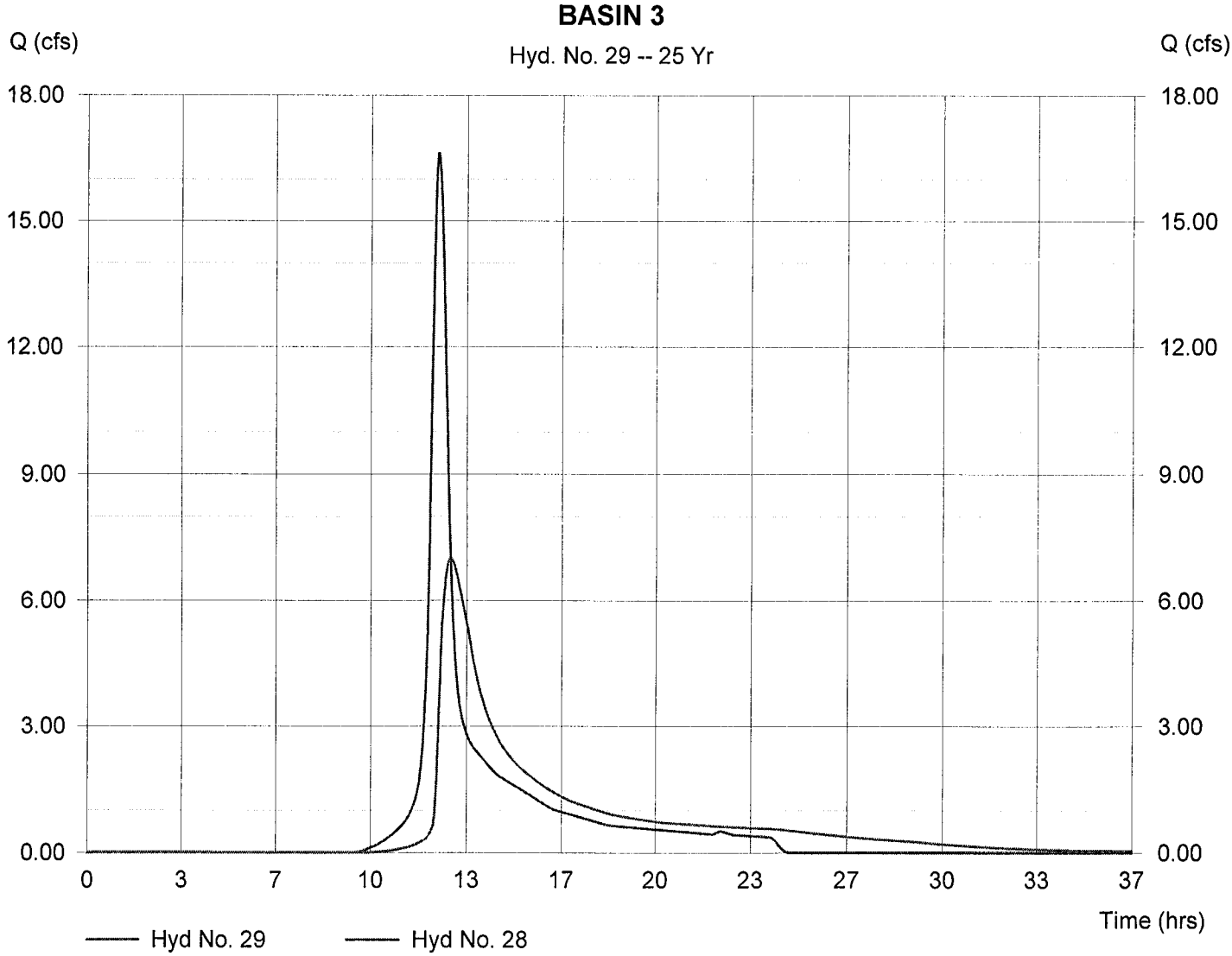
Hydraflow Hydrographs by Intelisolve | Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 29

BASIN 3

Hydrograph type	= Reservoir	Peak discharge	= 7.00 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 28	Max. Elevation	= 129.24 ft
Reservoir name	= BASIN 3	Max. Storage	= 30,830 cuft

Storage Indication method used. | Hydrograph Volume = 85,353 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

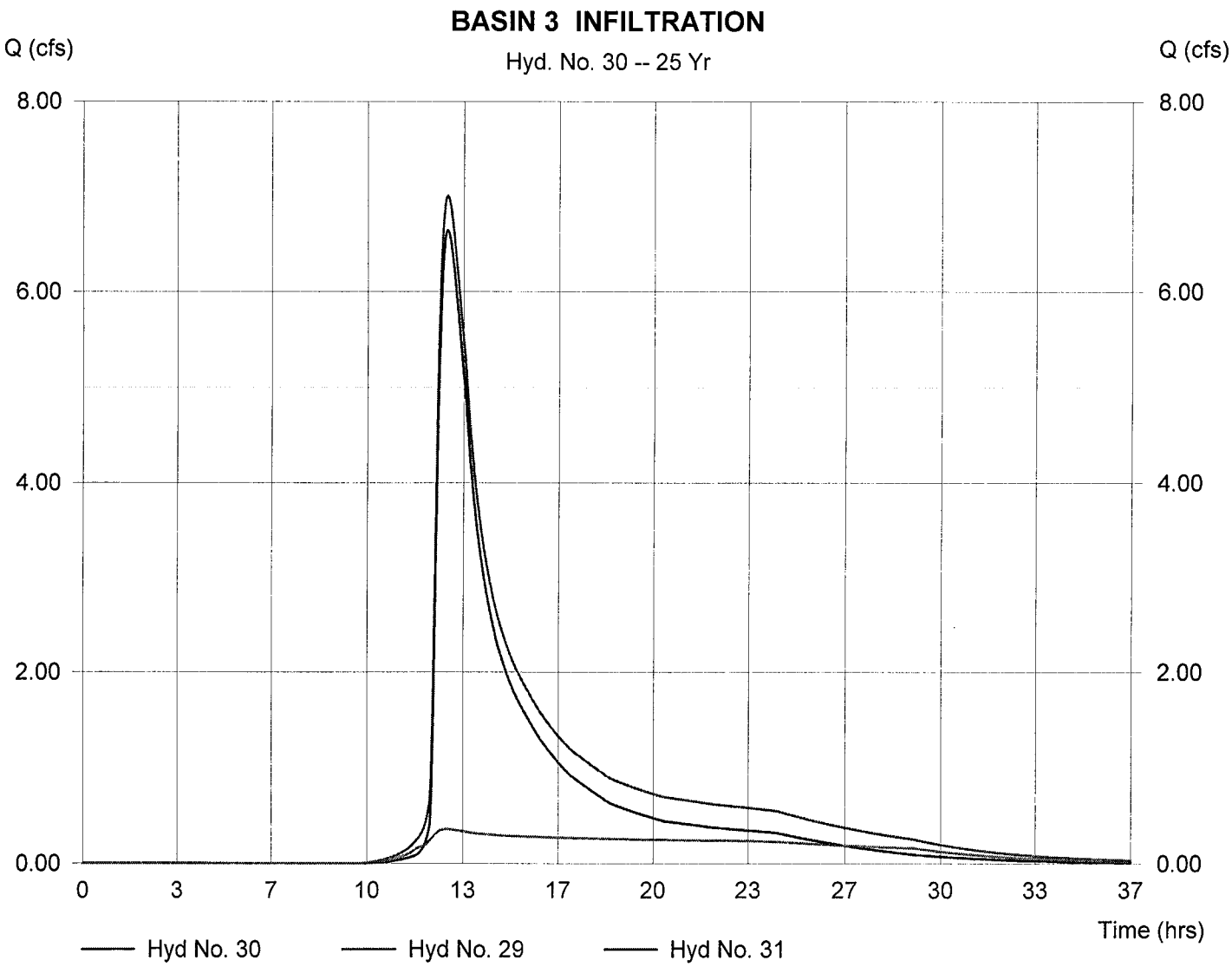
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Hyd. No. 30

BASIN 3 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.36 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 31
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 17,959 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

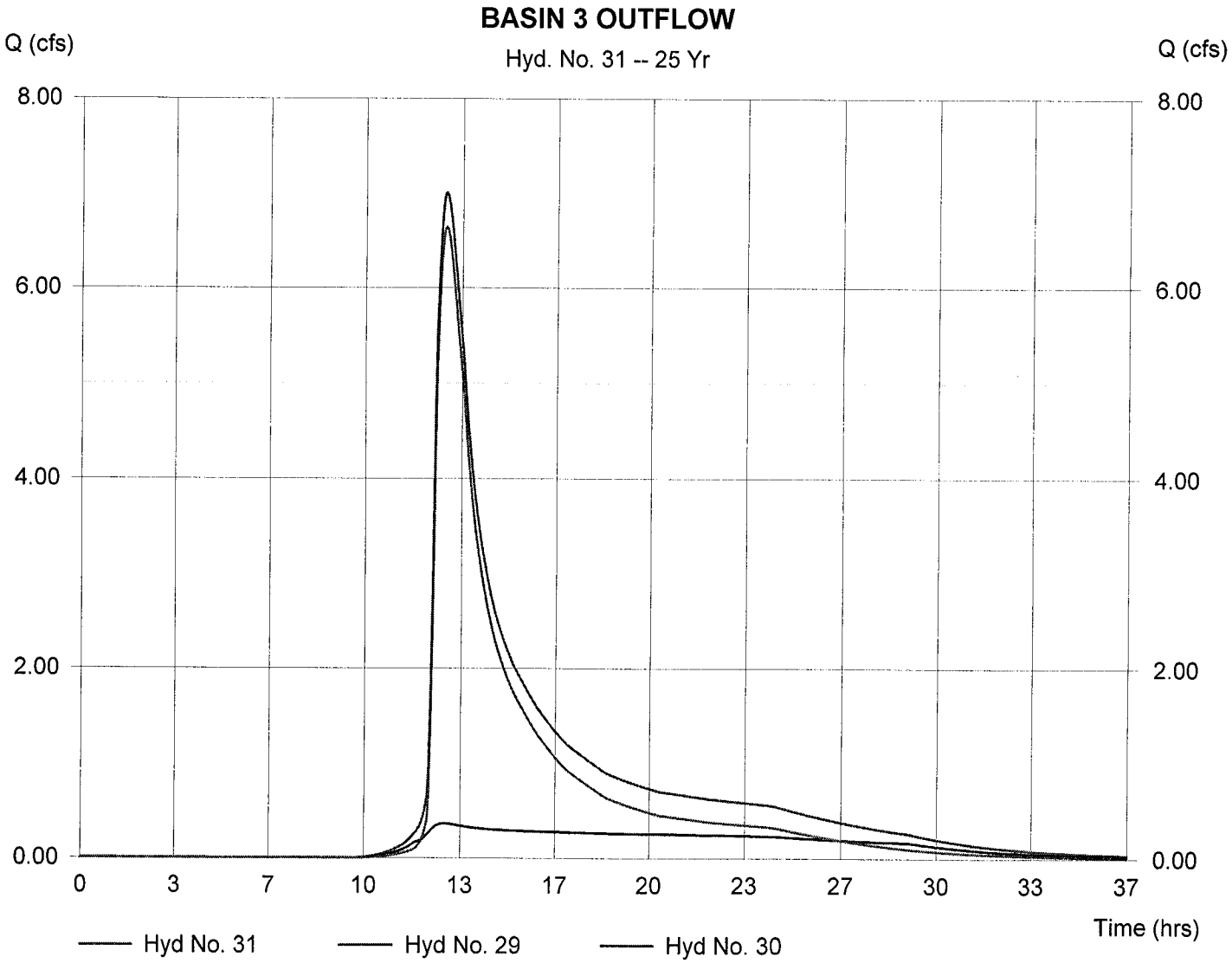
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 31

BASIN 3 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 6.64 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 30
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 67,394 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

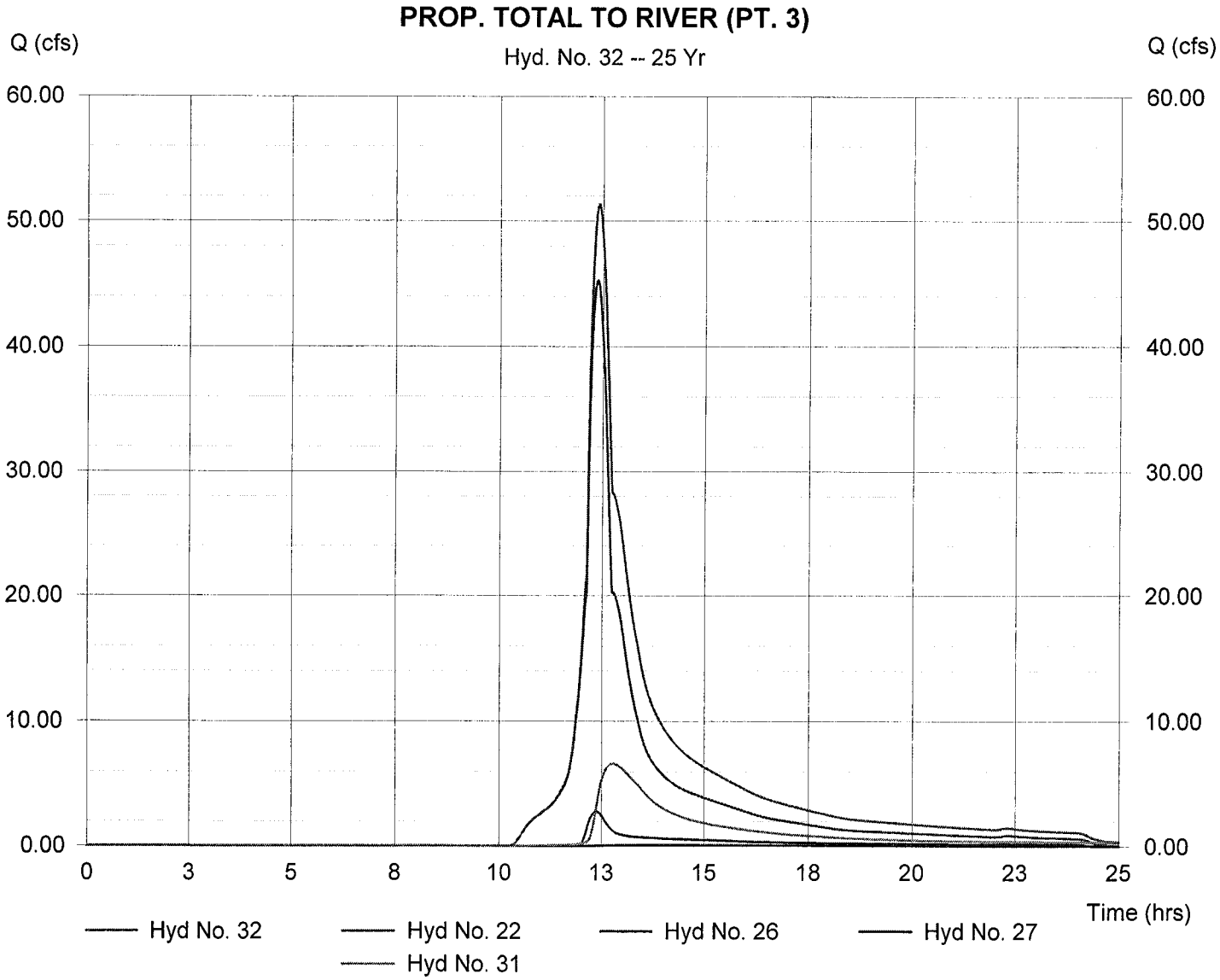
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 32

PROP. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 51.33 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyds.	= 22, 26, 27, 31		

Hydrograph Volume = 318,049 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

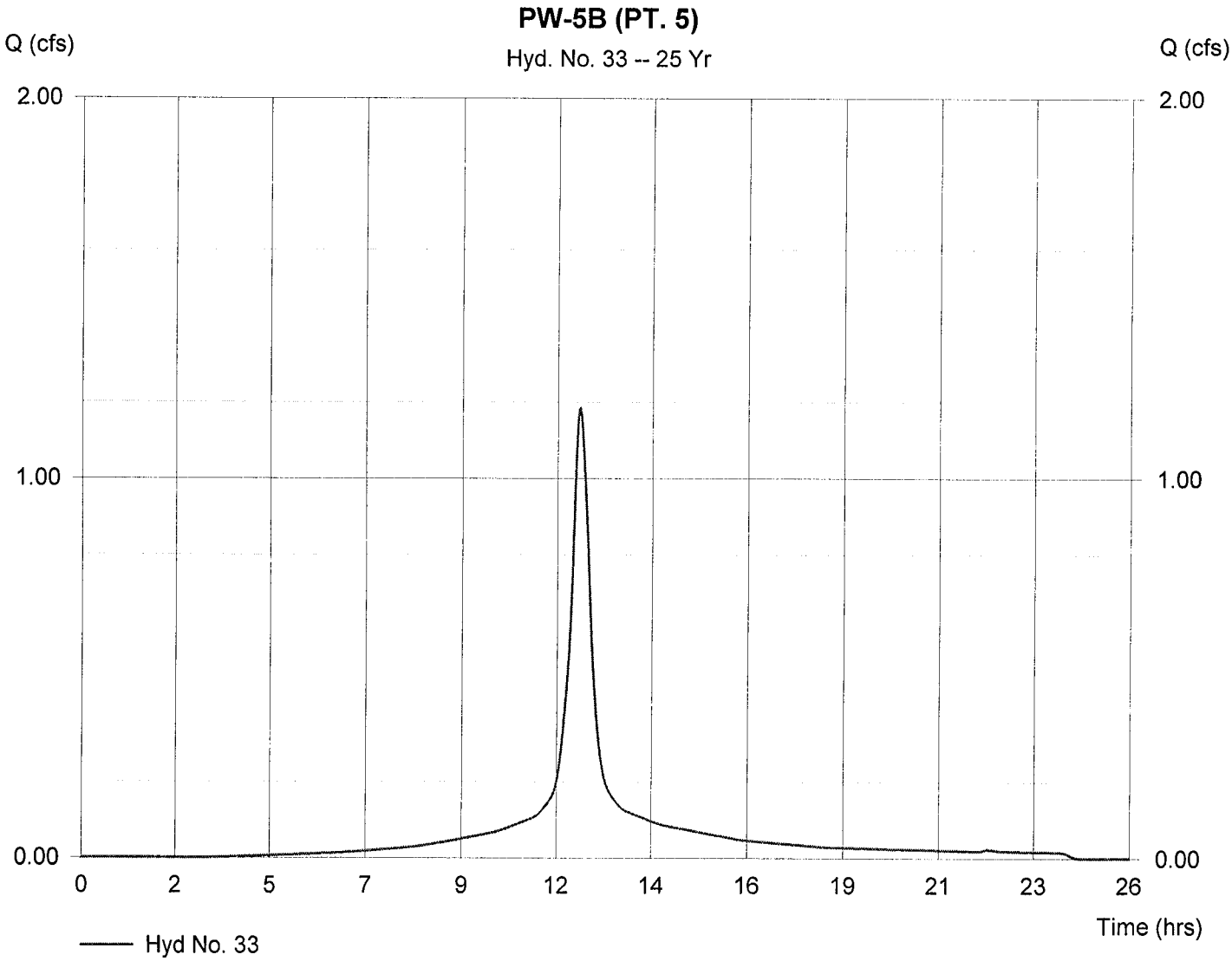
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 33

PW-5B (PT. 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.19 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.340 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.10 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,545 cuft



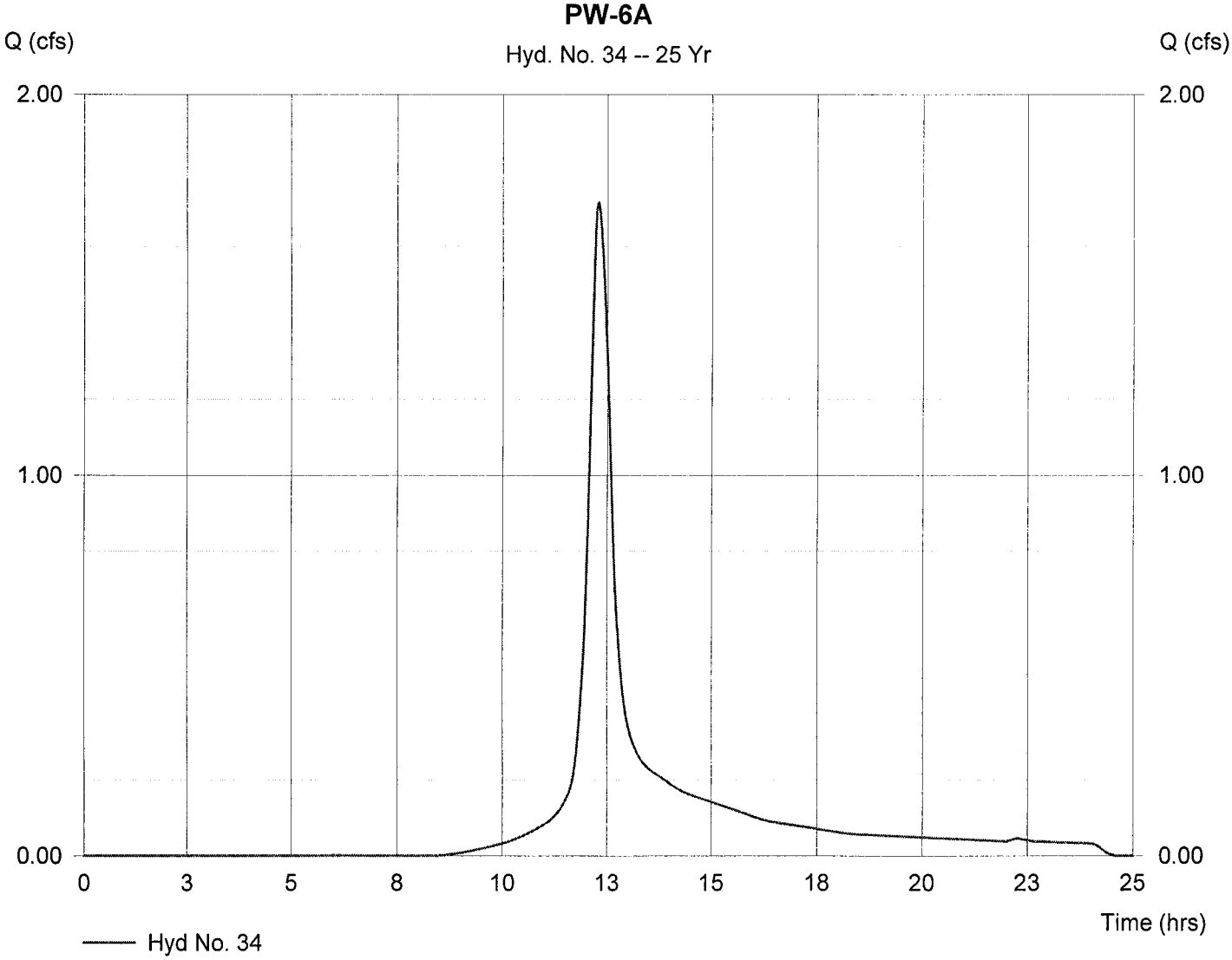
Hydrograph Plot

Hyd. No. 34

PW-6A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.71 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.820 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.70 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 8,289 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

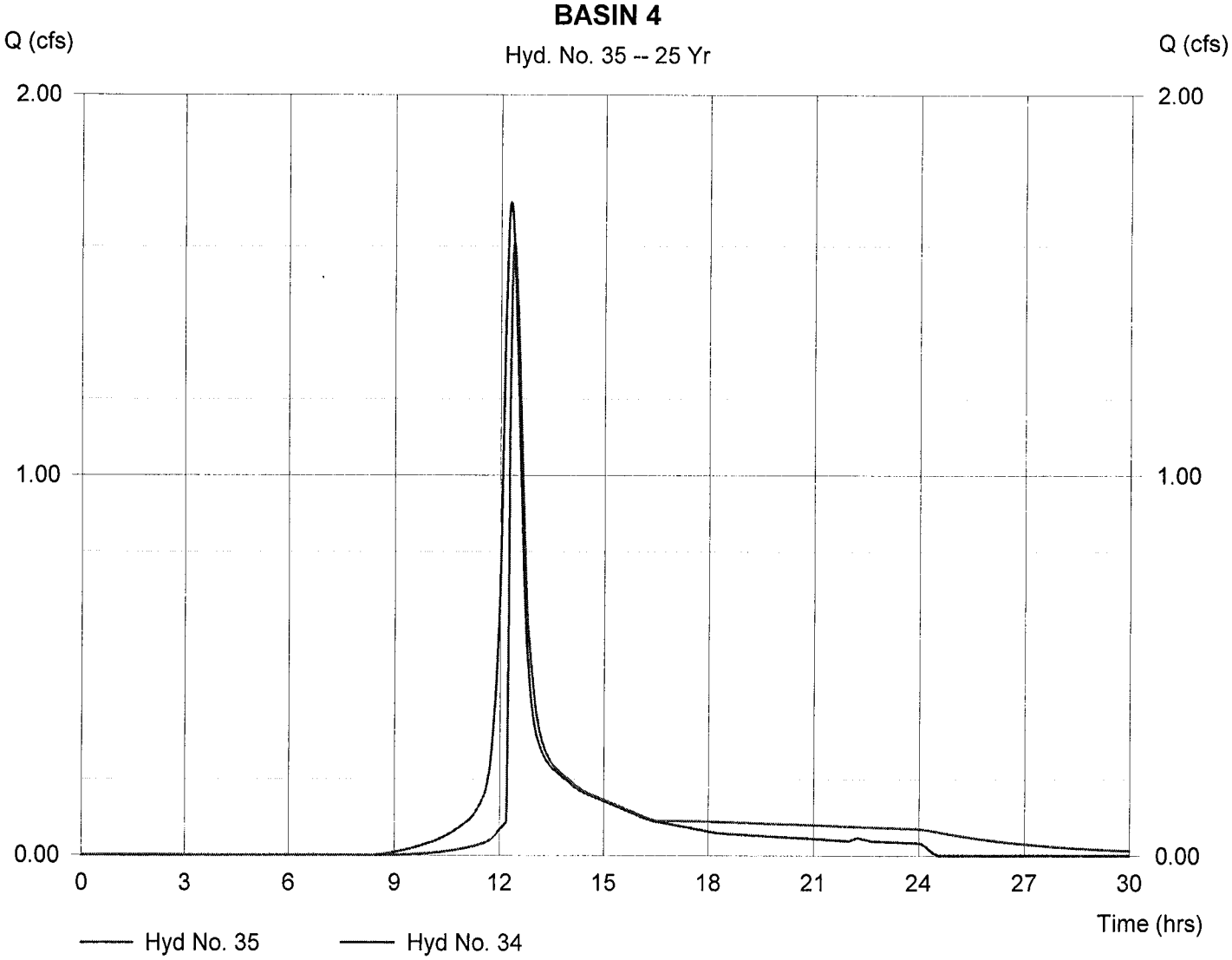
Hyd. No. 35

BASIN 4

Hydrograph type	= Reservoir	Peak discharge	= 1.61 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 34	Max. Elevation	= 129.71 ft
Reservoir name	= BASIN 4	Max. Storage	= 2,005 cuft

Storage Indication method used.

Hydrograph Volume = 8,277 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

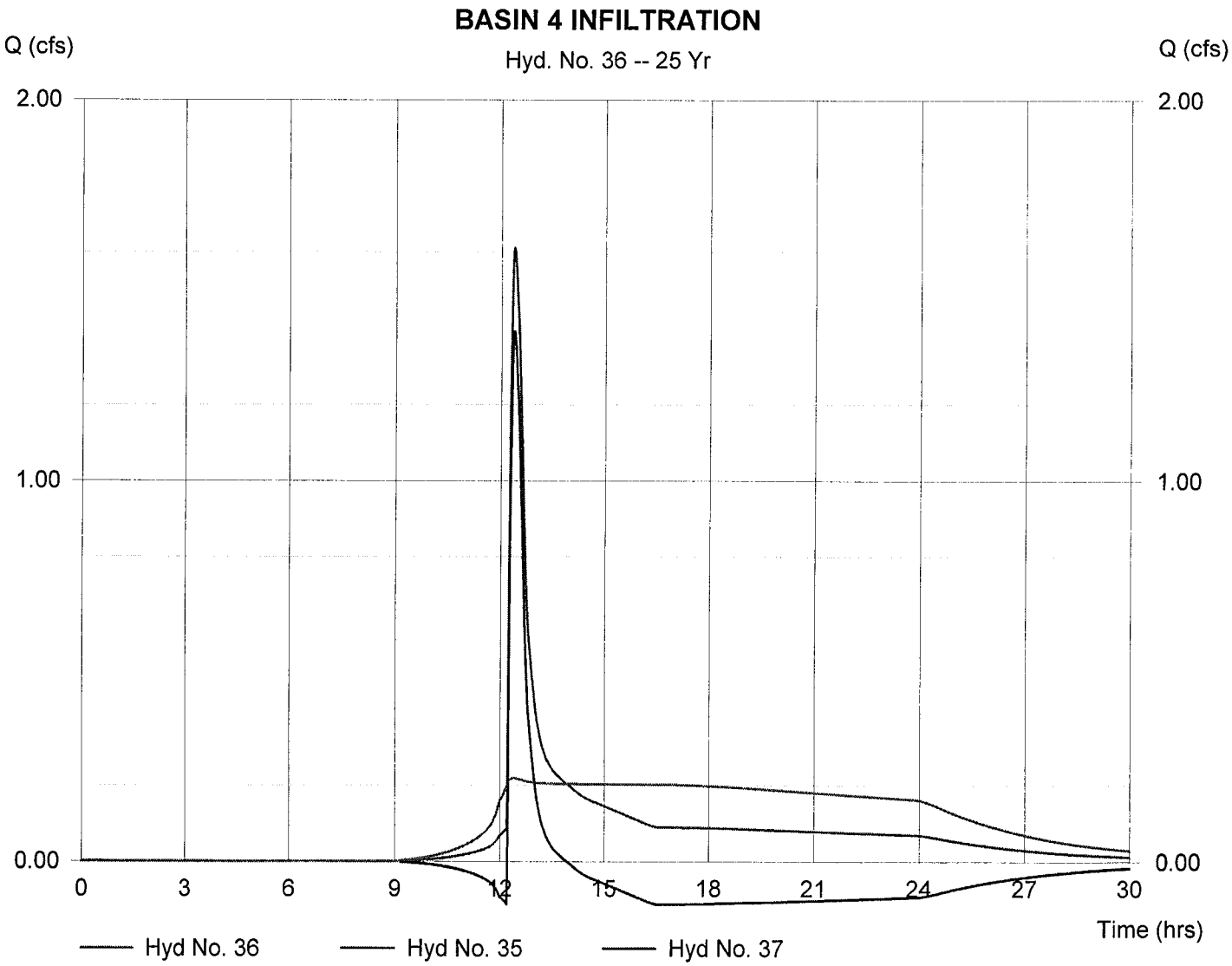
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 36

BASIN 4 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.22 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 37
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = 10,739 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

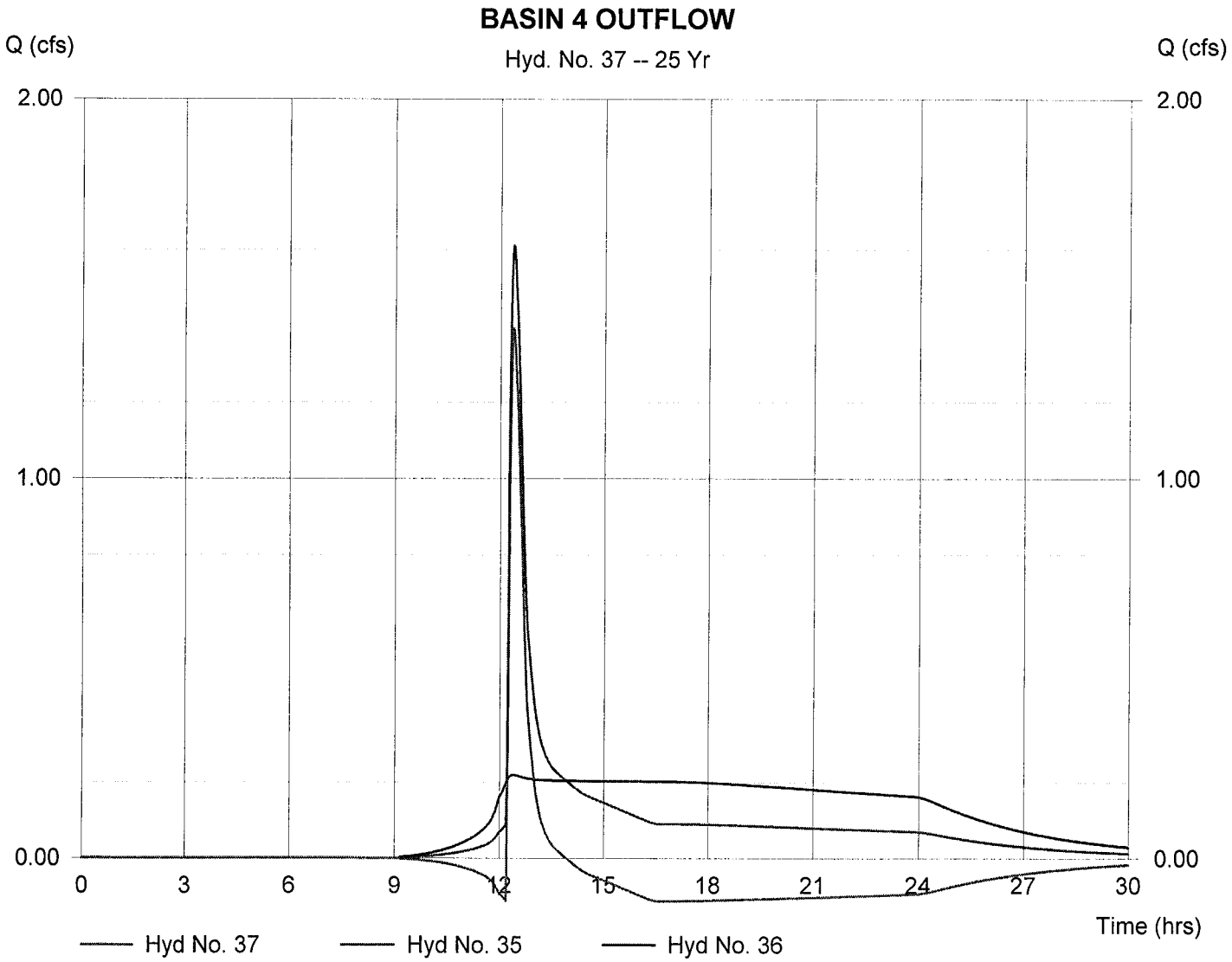
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Hyd. No. 37

BASIN 4 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 1.39 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 36
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = -2,462 cuft



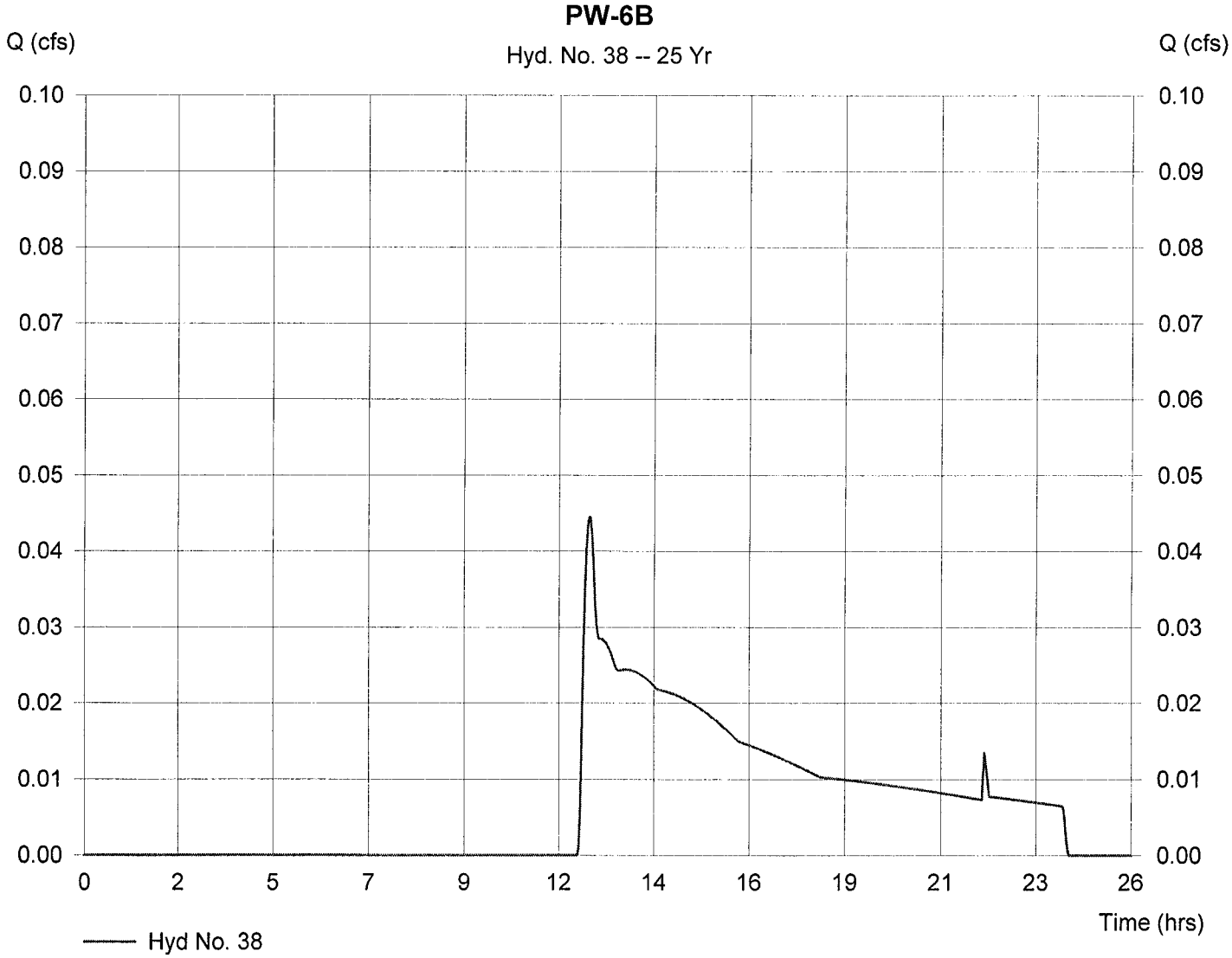
Hydrograph Plot

Hyd. No. 38

PW-6B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.04 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.600 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 595 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

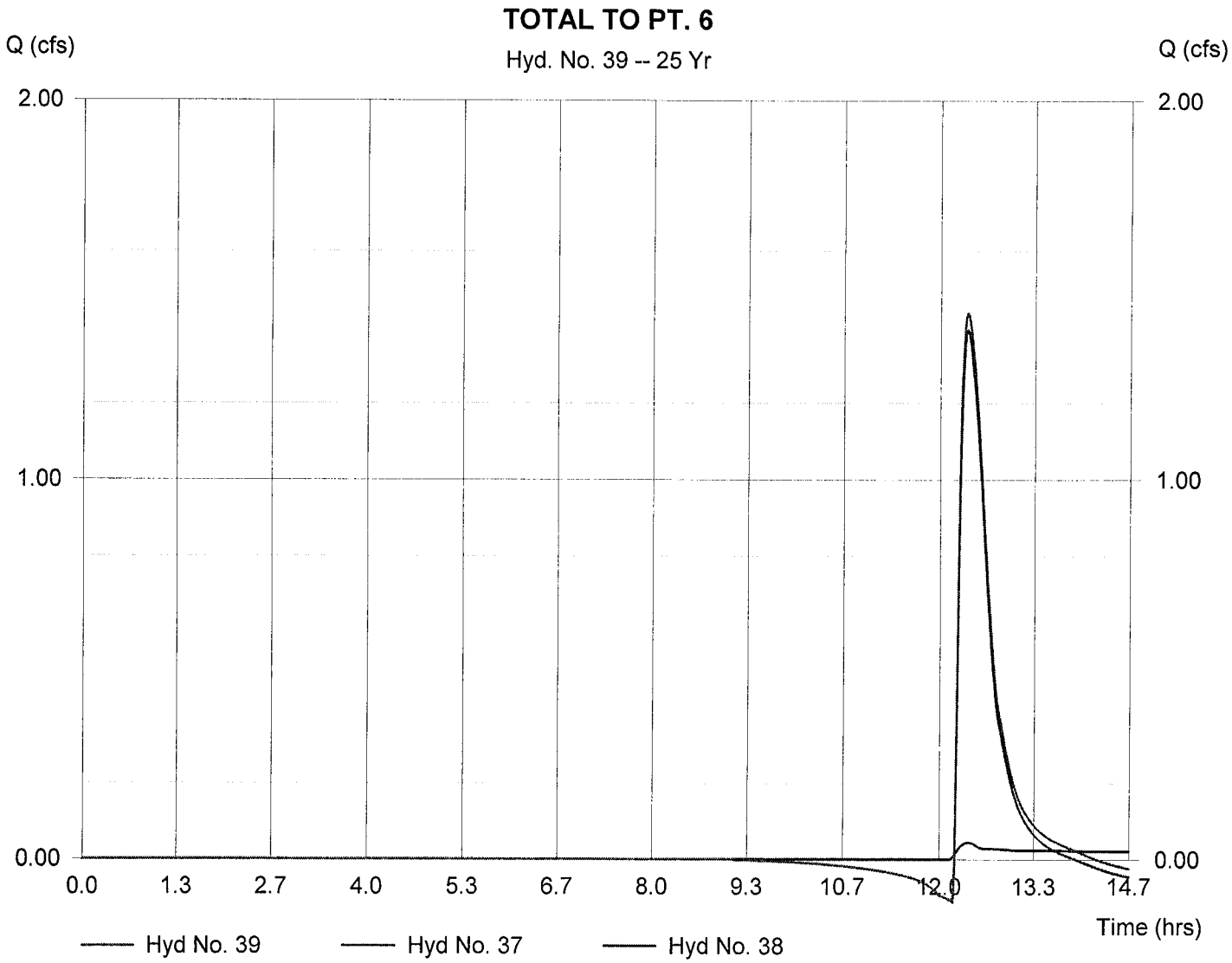
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 39

TOTAL TO PT. 6

Hydrograph type	= Combine	Peak discharge	= 1.44 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyds.	= 37, 38		

Hydrograph Volume = -1,868 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

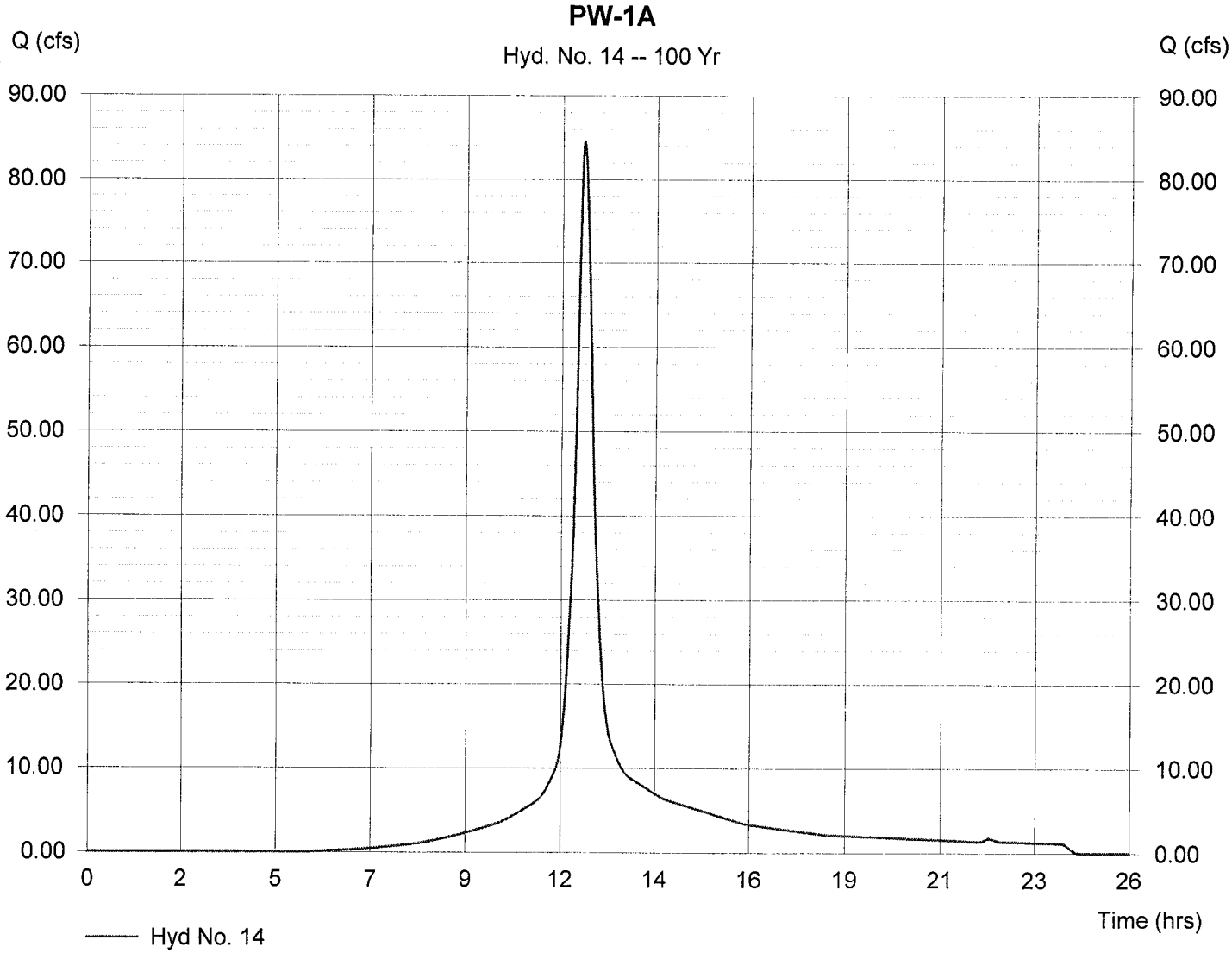
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 14

PW-1A

Hydrograph type	= SCS Runoff	Peak discharge	= 84.51 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 20.200 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.50 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 364,479 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

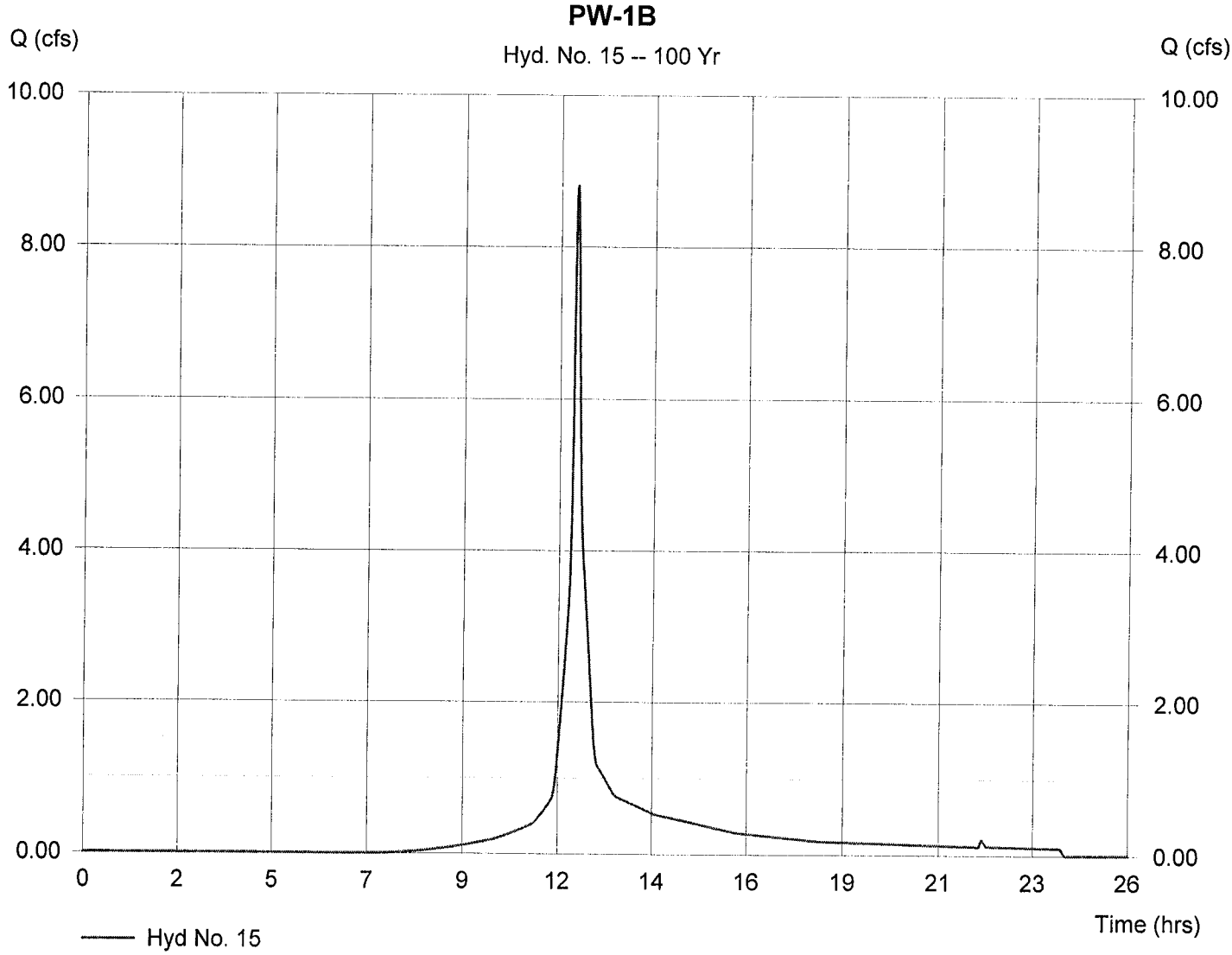
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 15

PW-1B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.80 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 1.750 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 27,183 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

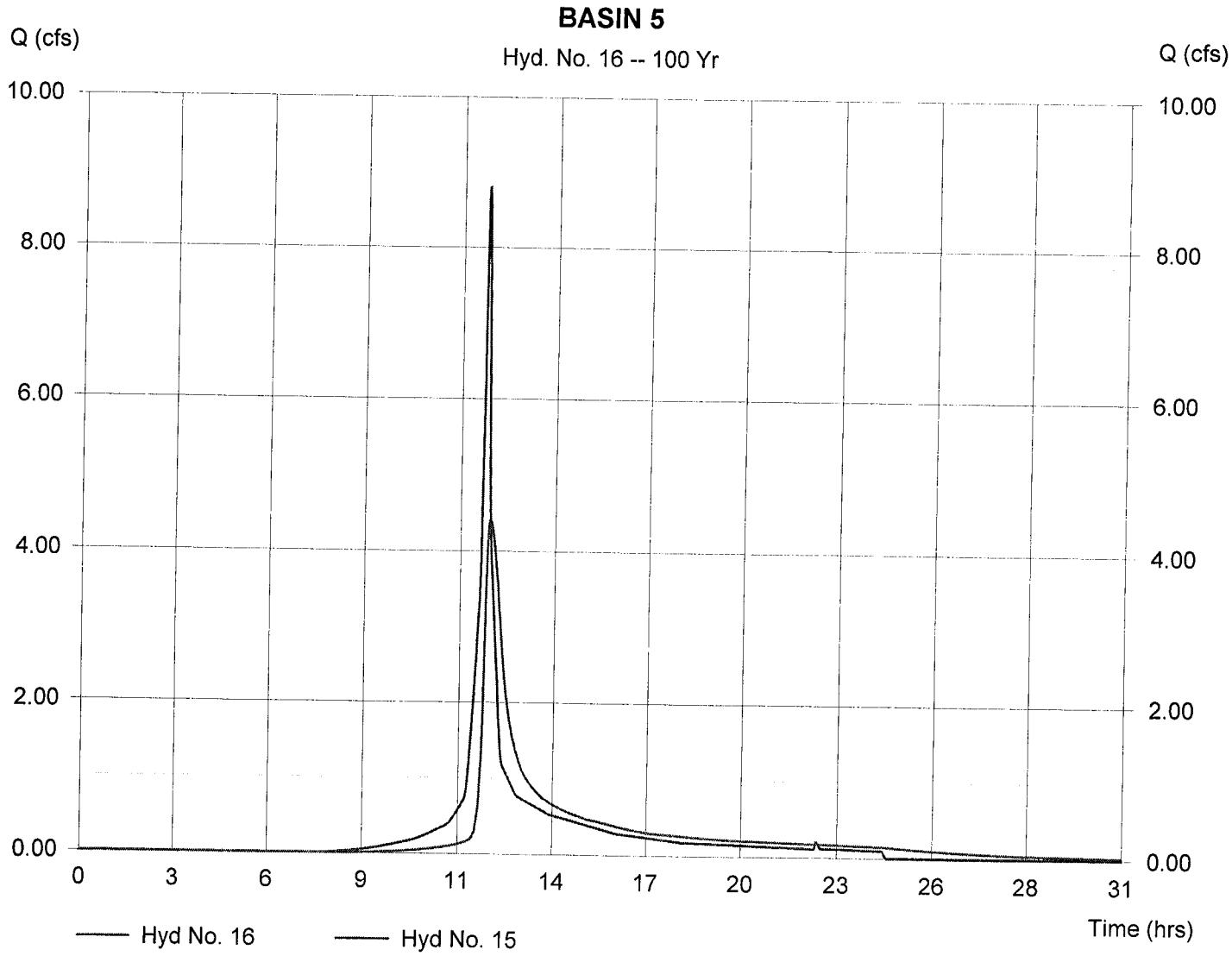
Hyd. No. 16

BASIN 5

Hydrograph type	= Reservoir	Peak discharge	= 4.41 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 15	Max. Elevation	= 127.96 ft
Reservoir name	= BASIN 5	Max. Storage	= 8,308 cuft

Storage Indication method used.

Hydrograph Volume = 27,170 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

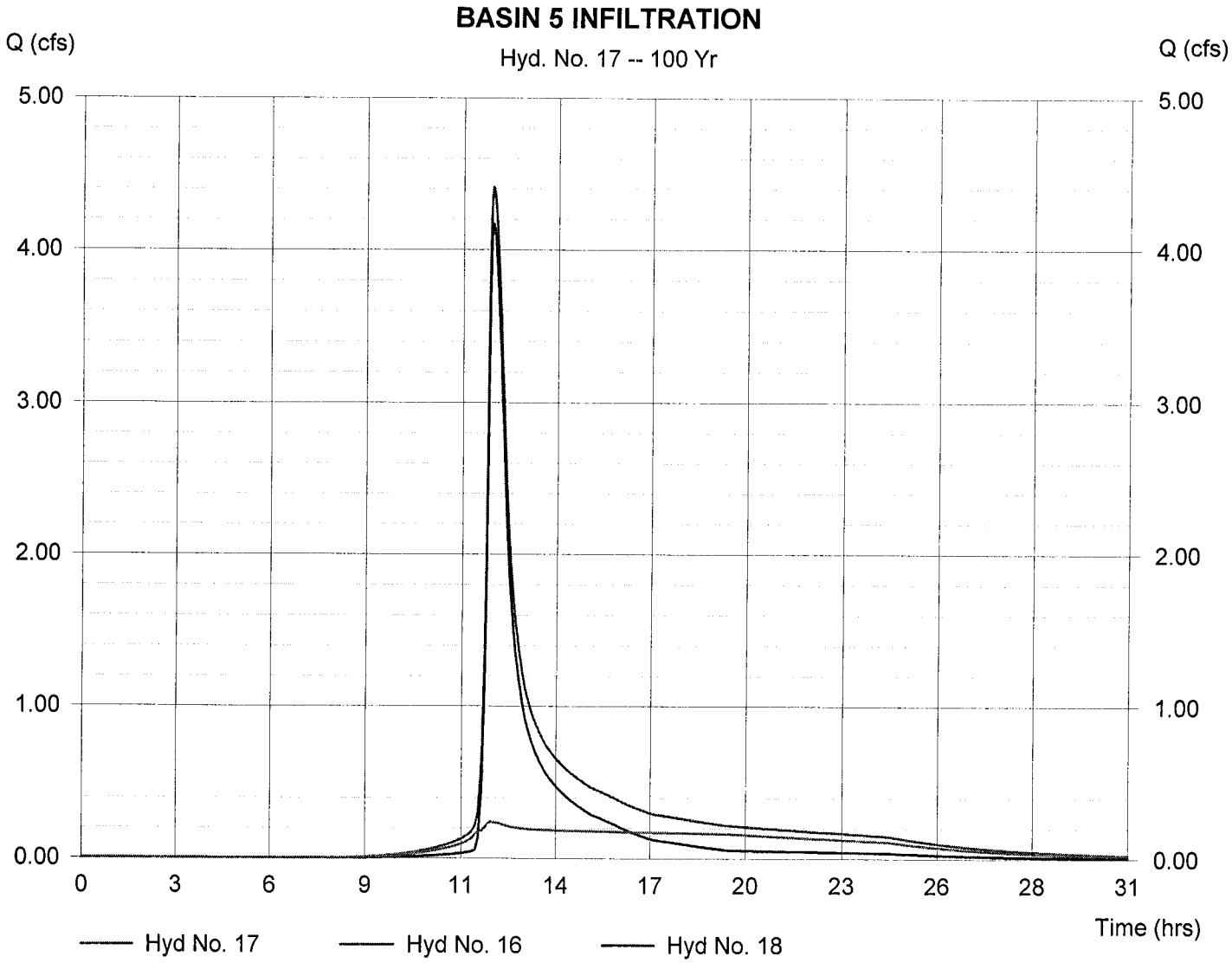
Hyd. No. 17

BASIN 5 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 100 yrs
Inflow hydrograph = 16
Diversion method = Pond - BASIN 5

Peak discharge = 0.24 cfs
Time interval = 1 min
2nd diverted hyd. = 18
Pond structure = Exfiltration

Hydrograph Volume = 9,236 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

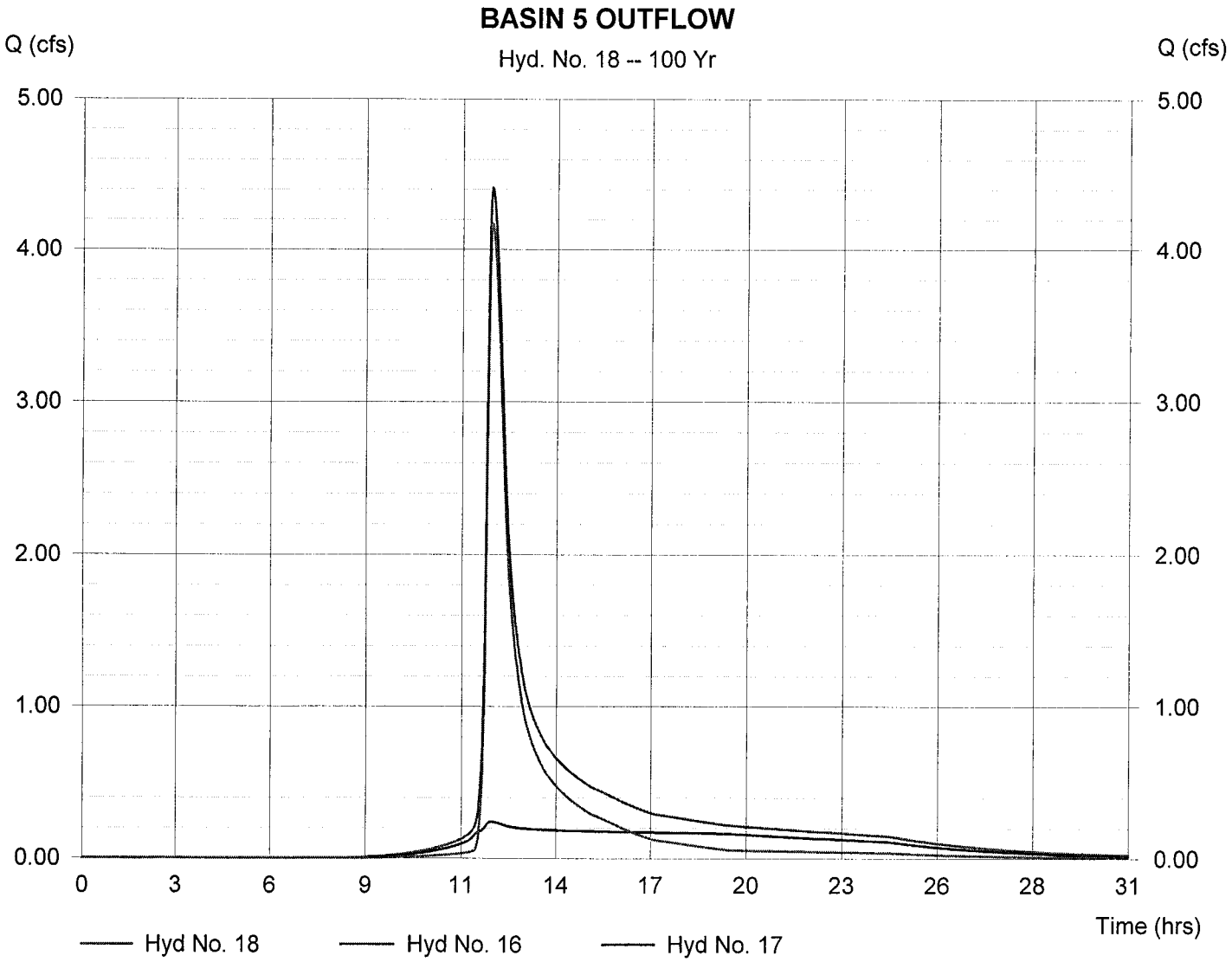
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 18

BASIN 5 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 4.17 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 16	2nd diverted hyd.	= 17
Diversion method	= Pond - BASIN 5	Pond structure	= Exfiltration

Hydrograph Volume = 17,934 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

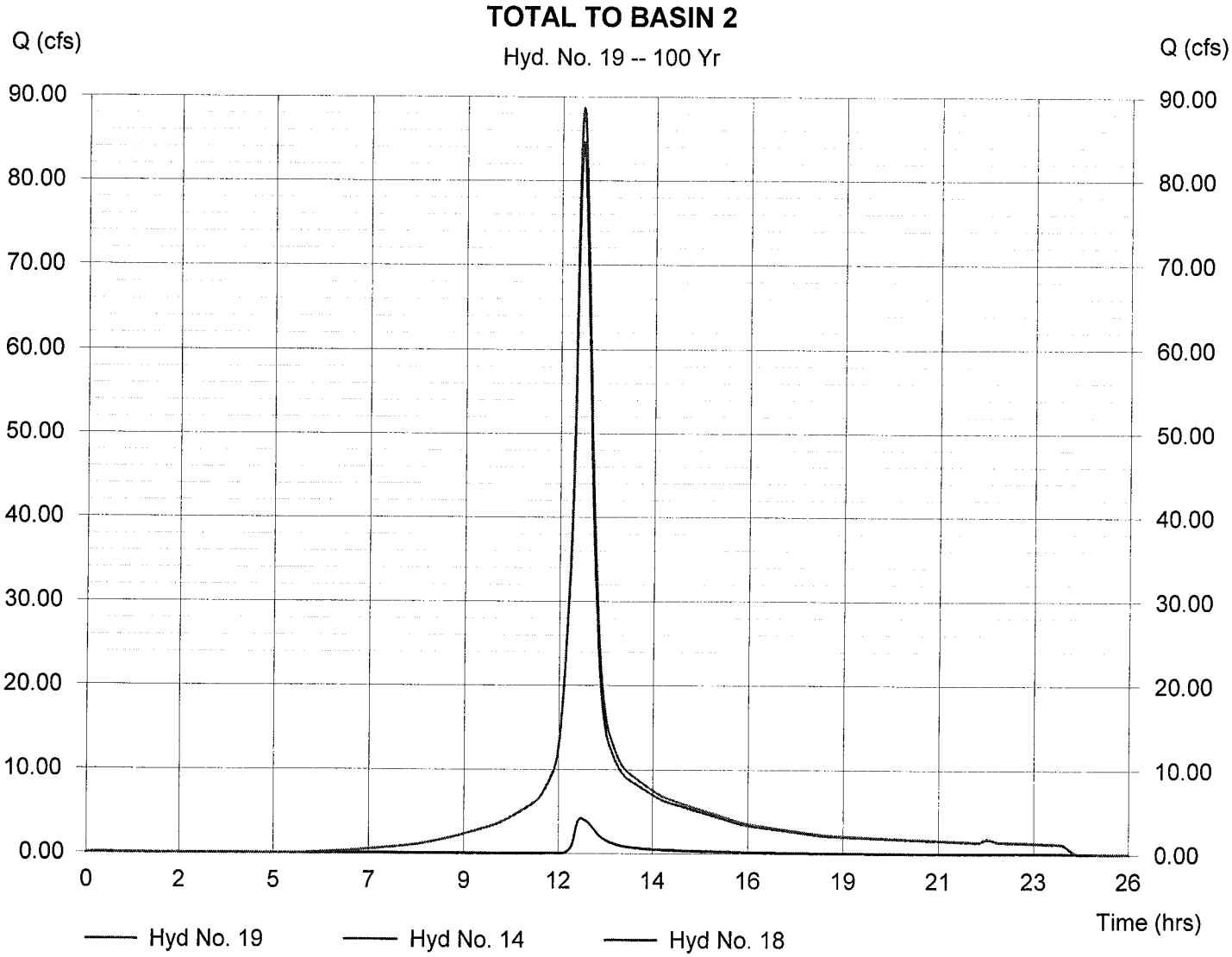
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 19

TOTAL TO BASIN 2

Hydrograph type	= Combine	Peak discharge	= 88.67 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 14, 18		

Hydrograph Volume = 382,413 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

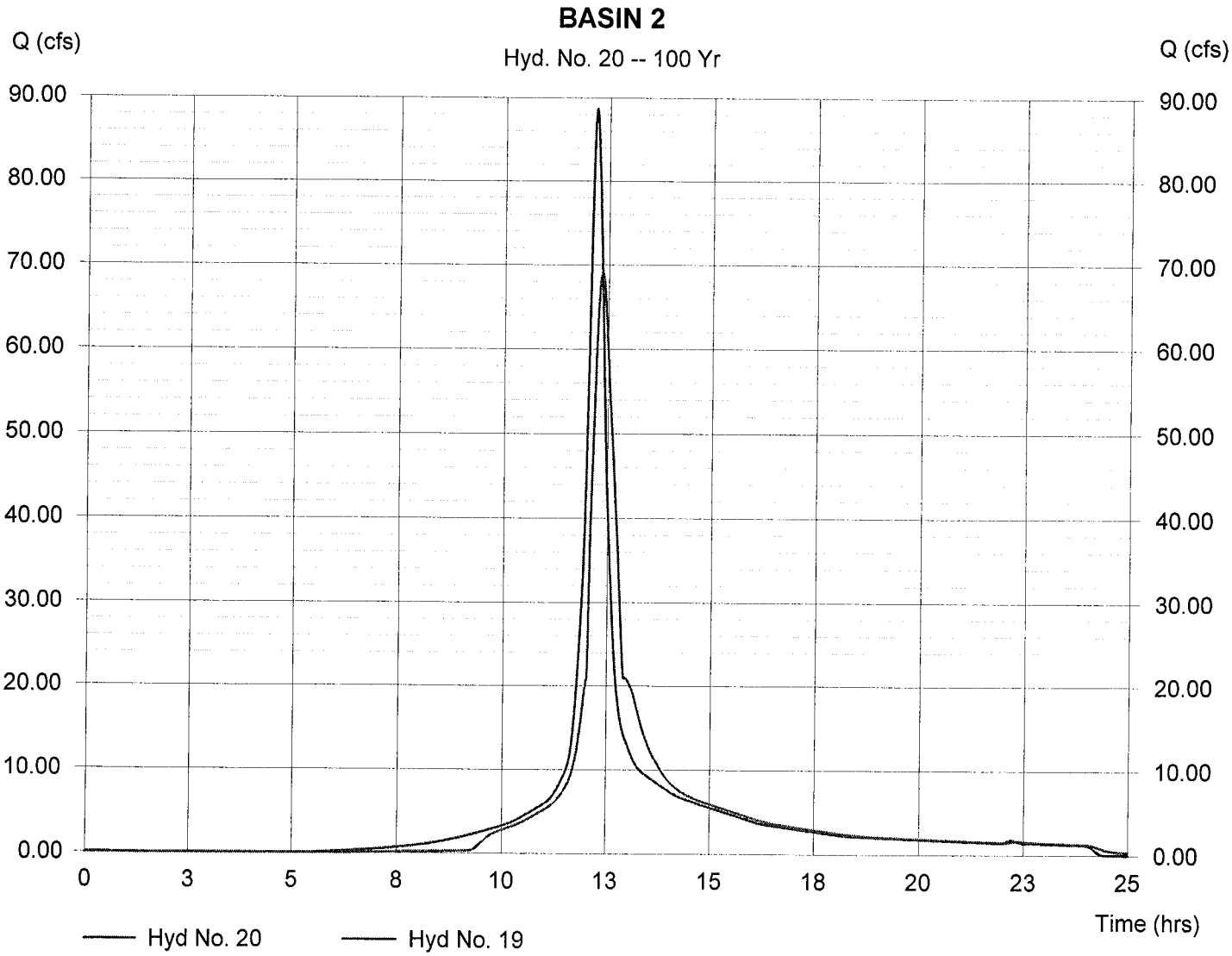
Hyd. No. 20

BASIN 2

Hydrograph type	= Reservoir	Peak discharge	= 69.02 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 19	Max. Elevation	= 123.36 ft
Reservoir name	= BASIN 2	Max. Storage	= 64,608 cuft

Storage Indication method used.

Hydrograph Volume = 382,352 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

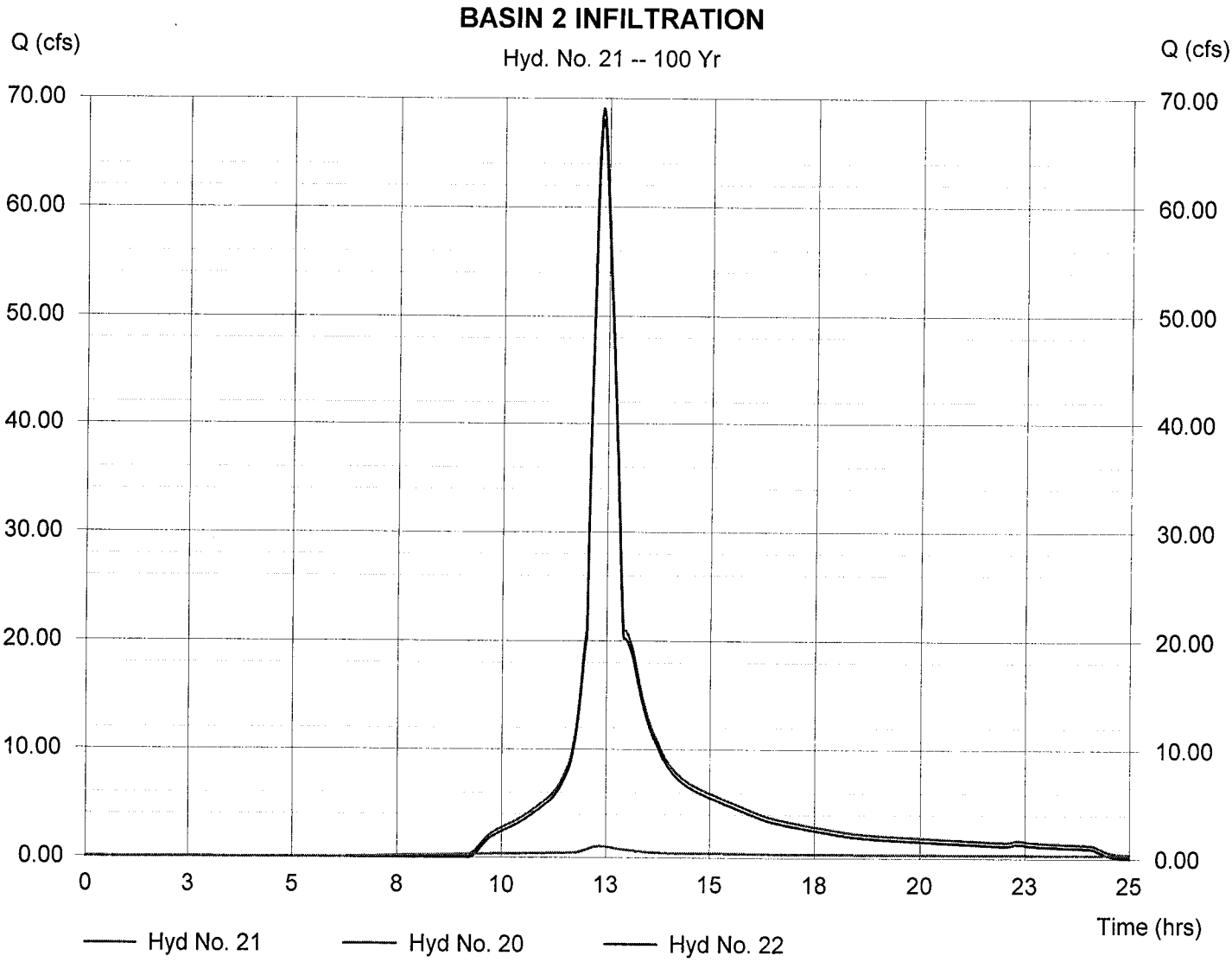
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 21

BASIN 2 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 1.03 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 20	2nd diverted hyd.	= 22
Diversion method	= Pond - BASIN 2	Pond structure	= Exfiltration

Hydrograph Volume = 33,201 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

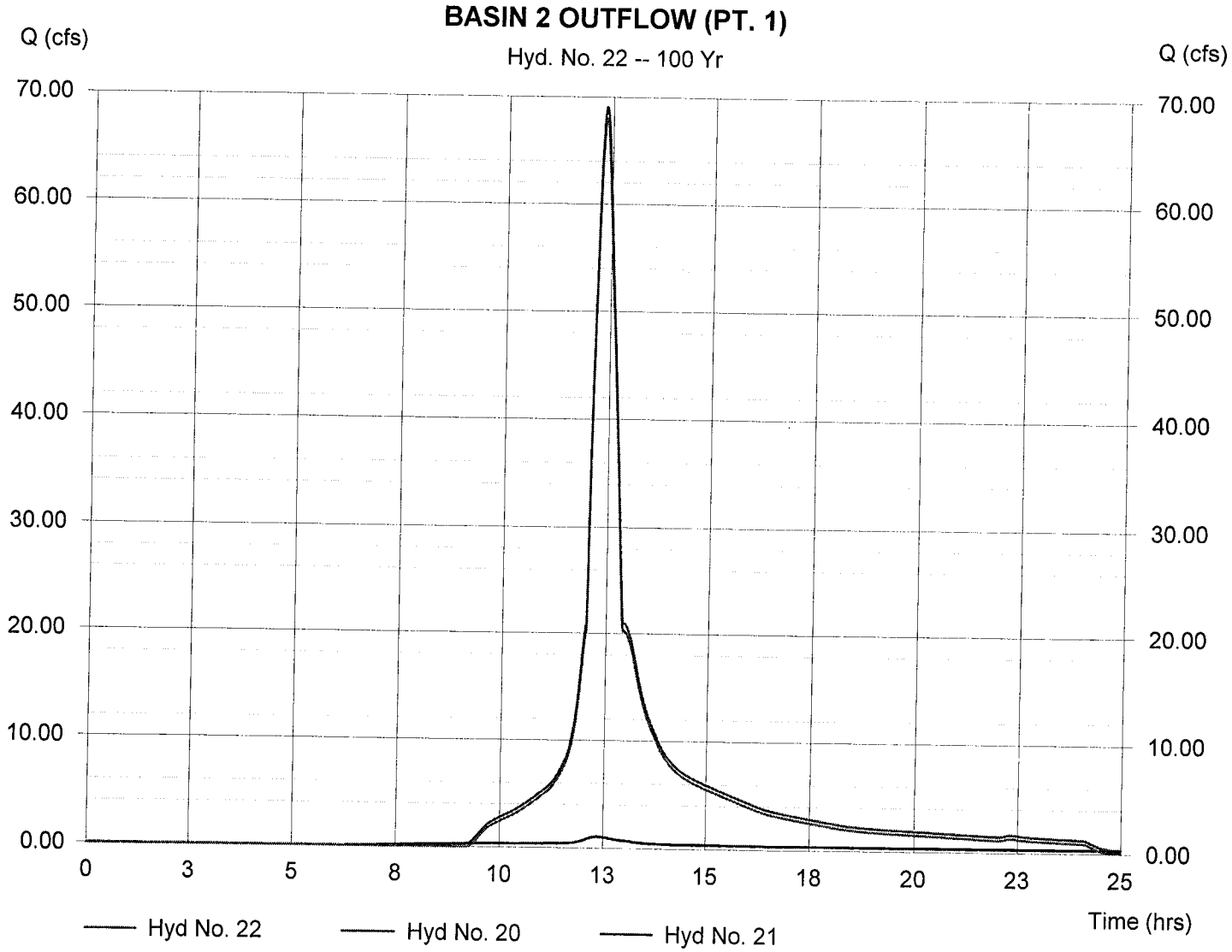
Hyd. No. 22

BASIN 2 OUTFLOW (PT. 1)

Hydrograph type = Diversion2
Storm frequency = 100 yrs
Inflow hydrograph = 20
Diversion method = Pond - BASIN 2

Peak discharge = 67.99 cfs
Time interval = 1 min
2nd diverted hyd. = 21
Pond structure = Exfiltration

Hydrograph Volume = 349,152 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

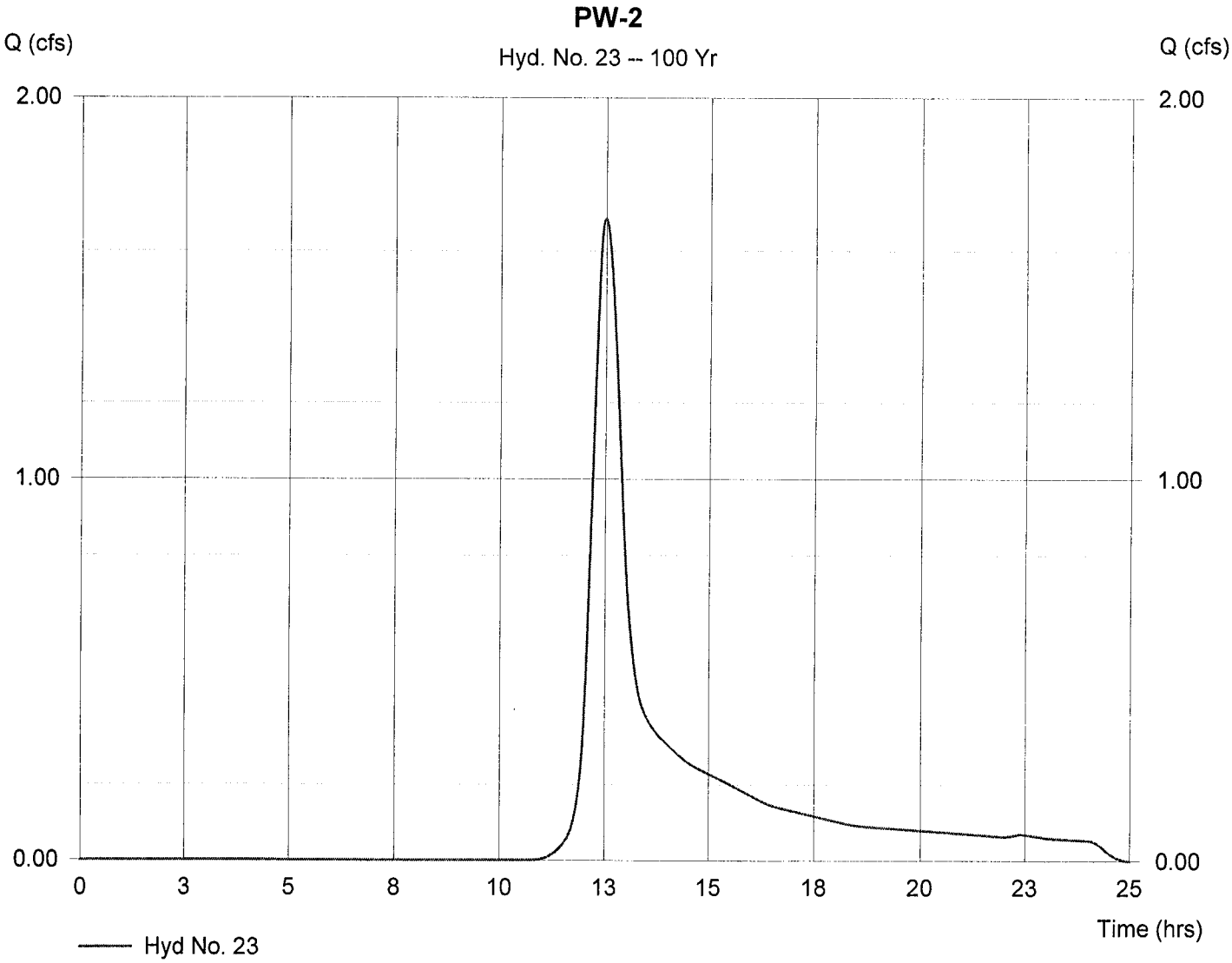
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 23

PW-2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.68 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 1.310 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.50 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 10,491 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

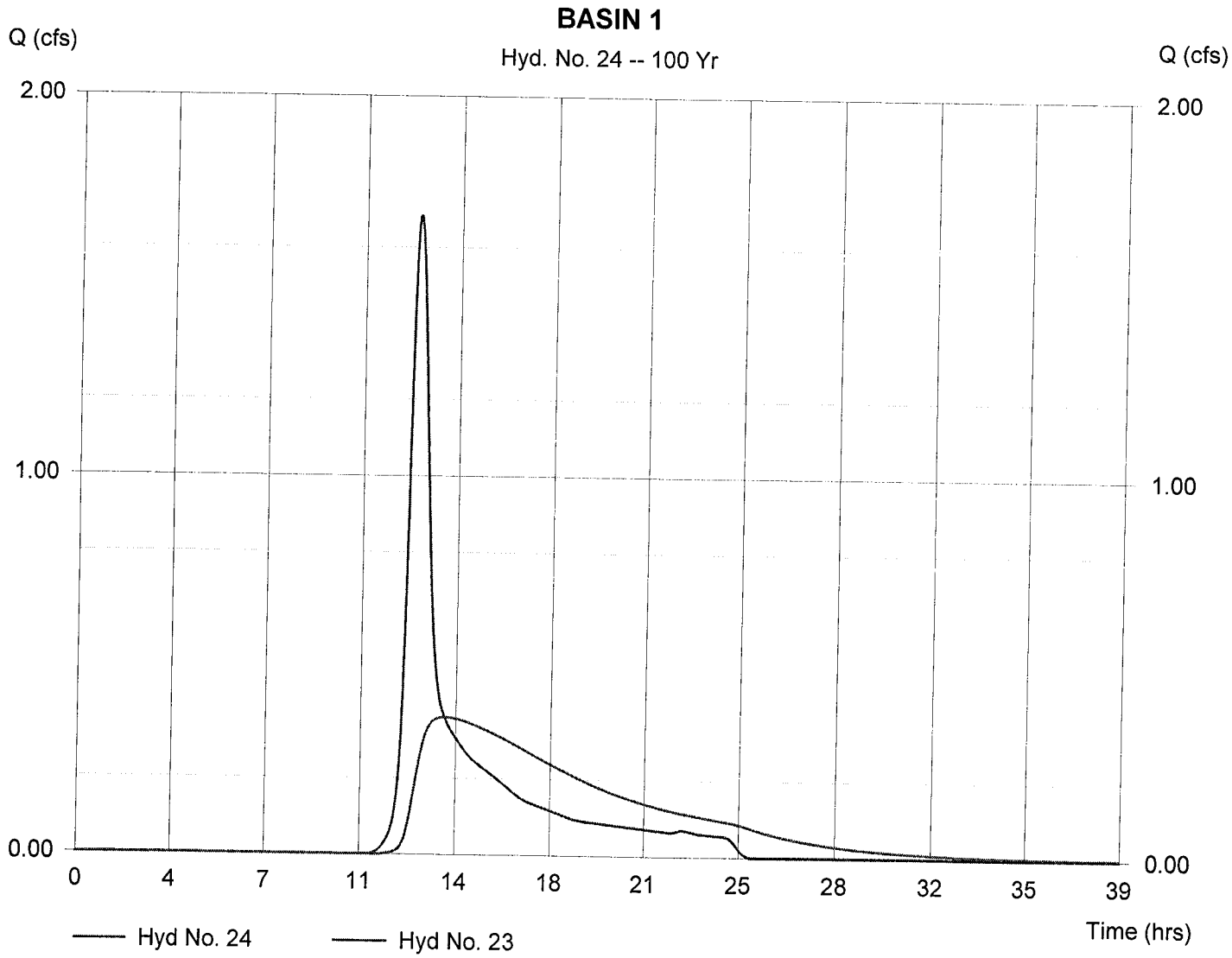
Hyd. No. 24

BASIN 1

Hydrograph type	= Reservoir	Peak discharge	= 0.36 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 119.08 ft
Reservoir name	= UPGRADED BASIN	Max. Storage	= 4,292 cuft

Storage Indication method used.

Hydrograph Volume = 10,479 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

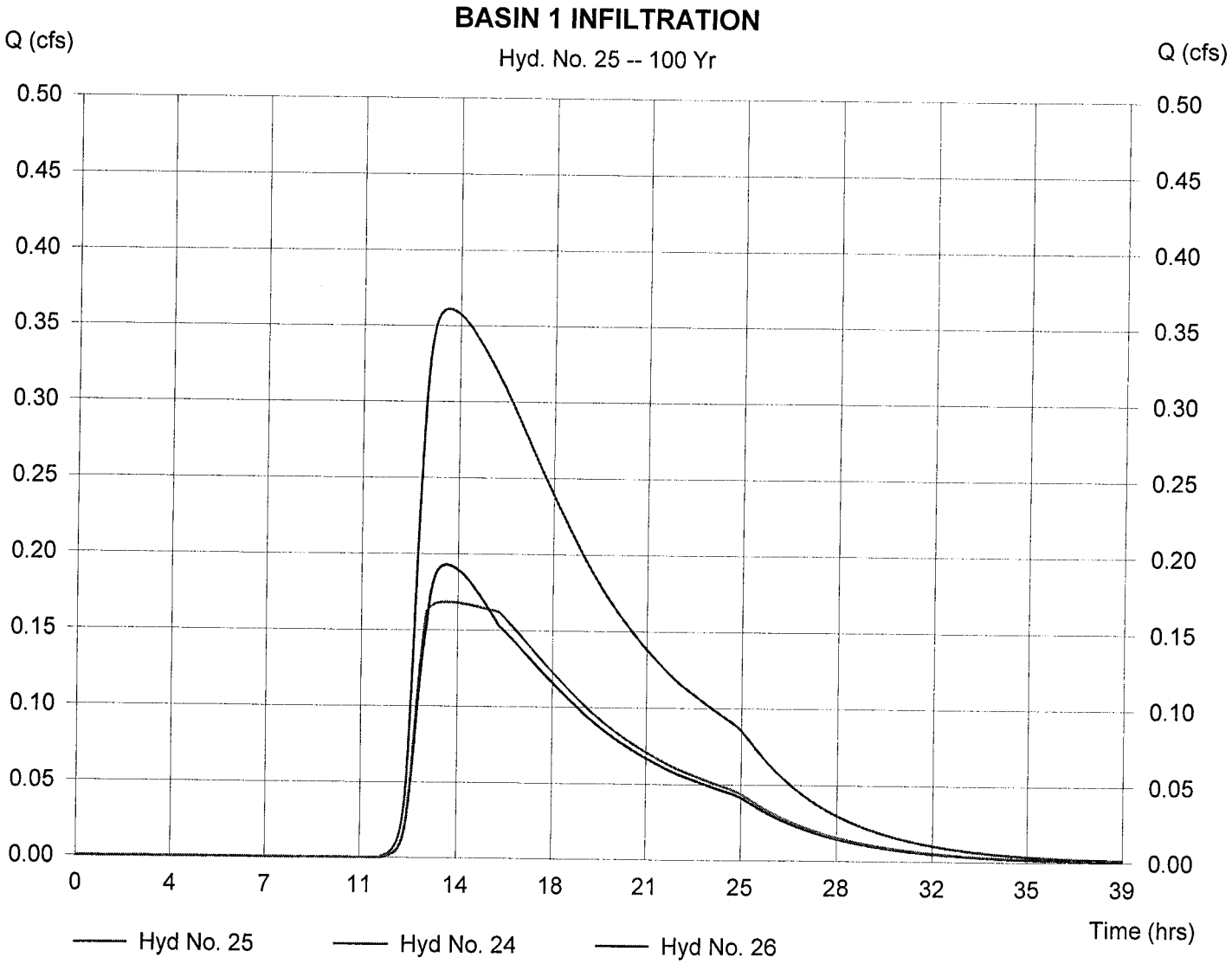
Hyd. No. 25

BASIN 1 INFILTRATION

Hydrograph type = Diversion1
Storm frequency = 100 yrs
Inflow hydrograph = 24
Diversion method = Pond - UPGRADED BASIN

Peak discharge = 0.17 cfs
Time interval = 1 min
2nd diverted hyd. = 26
Pond structure = Exfiltration

Hydrograph Volume = 5,282 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

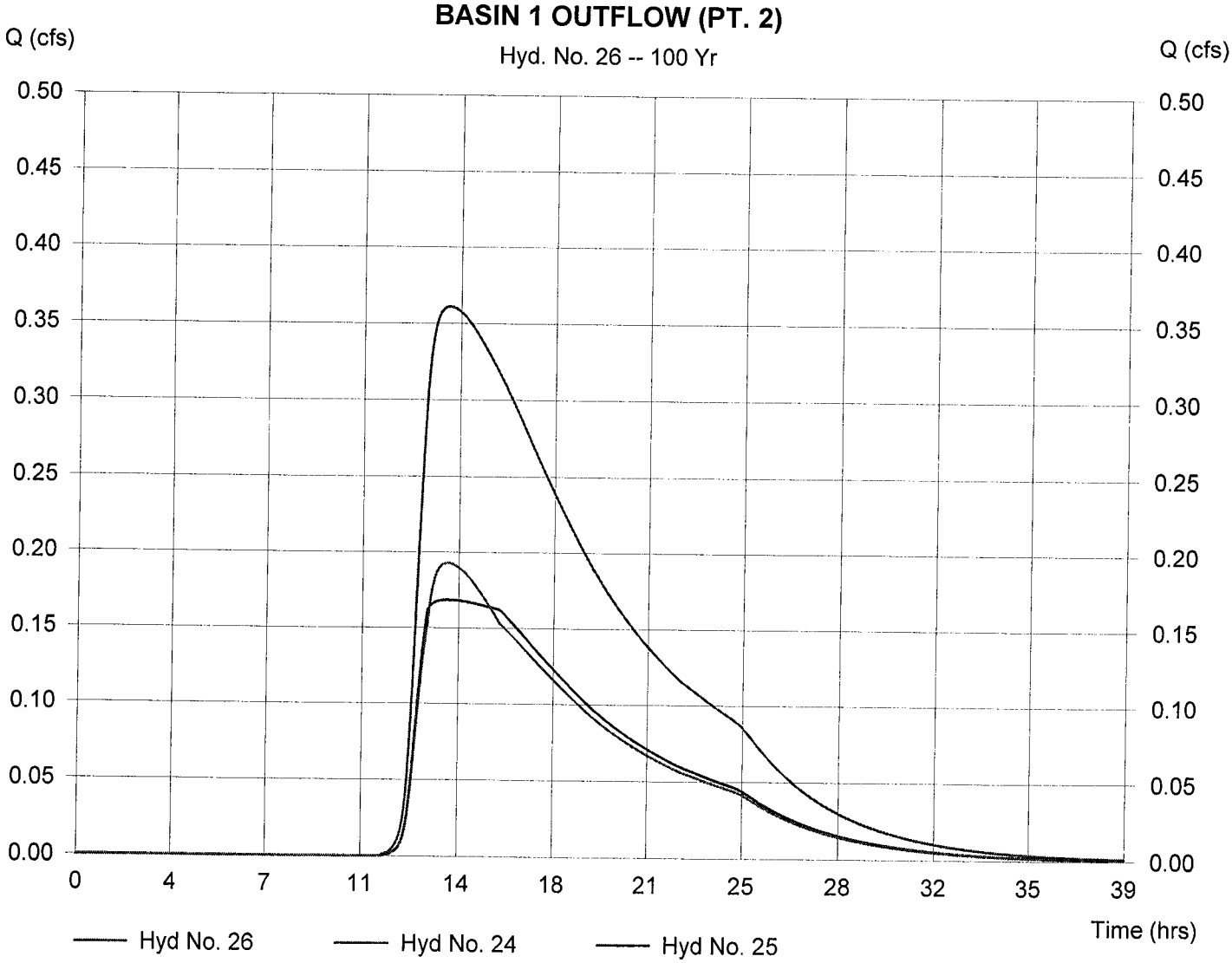
Hyd. No. 26

BASIN 1 OUTFLOW (PT. 2)

Hydrograph type = Diversion2
Storm frequency = 100 yrs
Inflow hydrograph = 24
Diversion method = Pond - UPGRADED BASIN

Peak discharge = 0.19 cfs
Time interval = 1 min
2nd diverted hyd. = 25
Pond structure = Exfiltration

Hydrograph Volume = 5,196 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

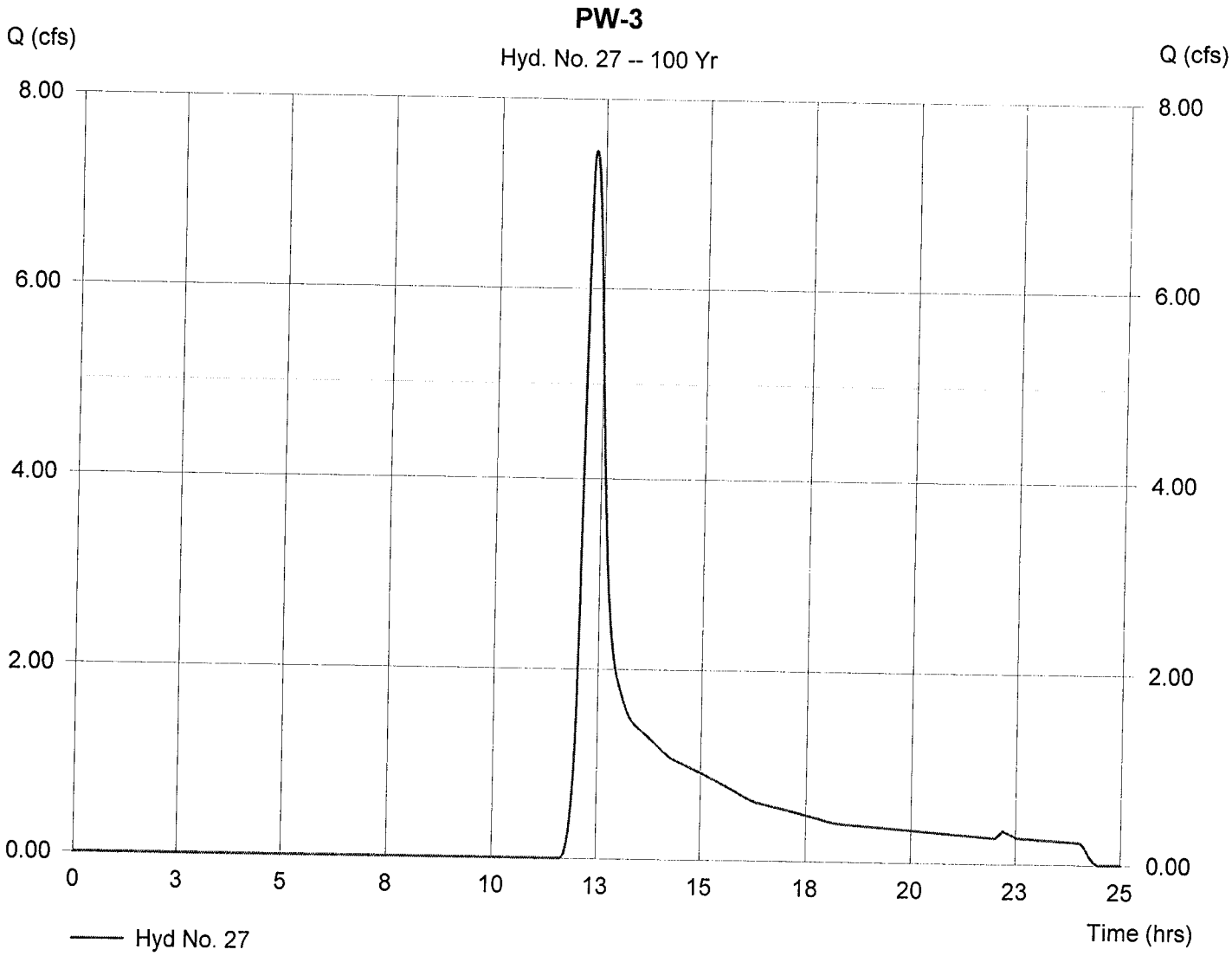
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 27

PW-3

Hydrograph type	= SCS Runoff	Peak discharge	= 7.45 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 7.250 ac	Curve number	= 48
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.80 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 39,243 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

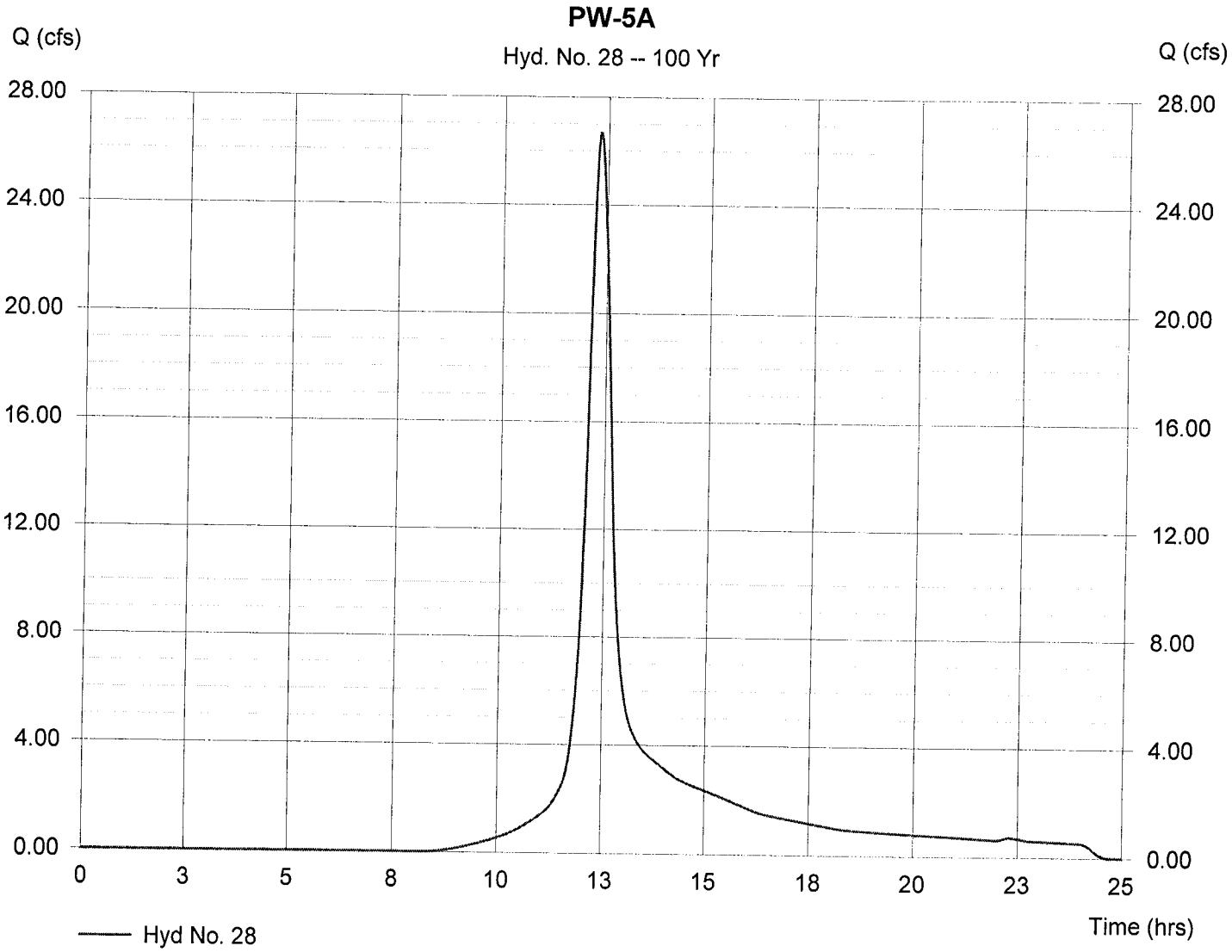
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 28

PW-5A

Hydrograph type	= SCS Runoff	Peak discharge	= 26.66 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 10.100 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.30 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 135,508 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

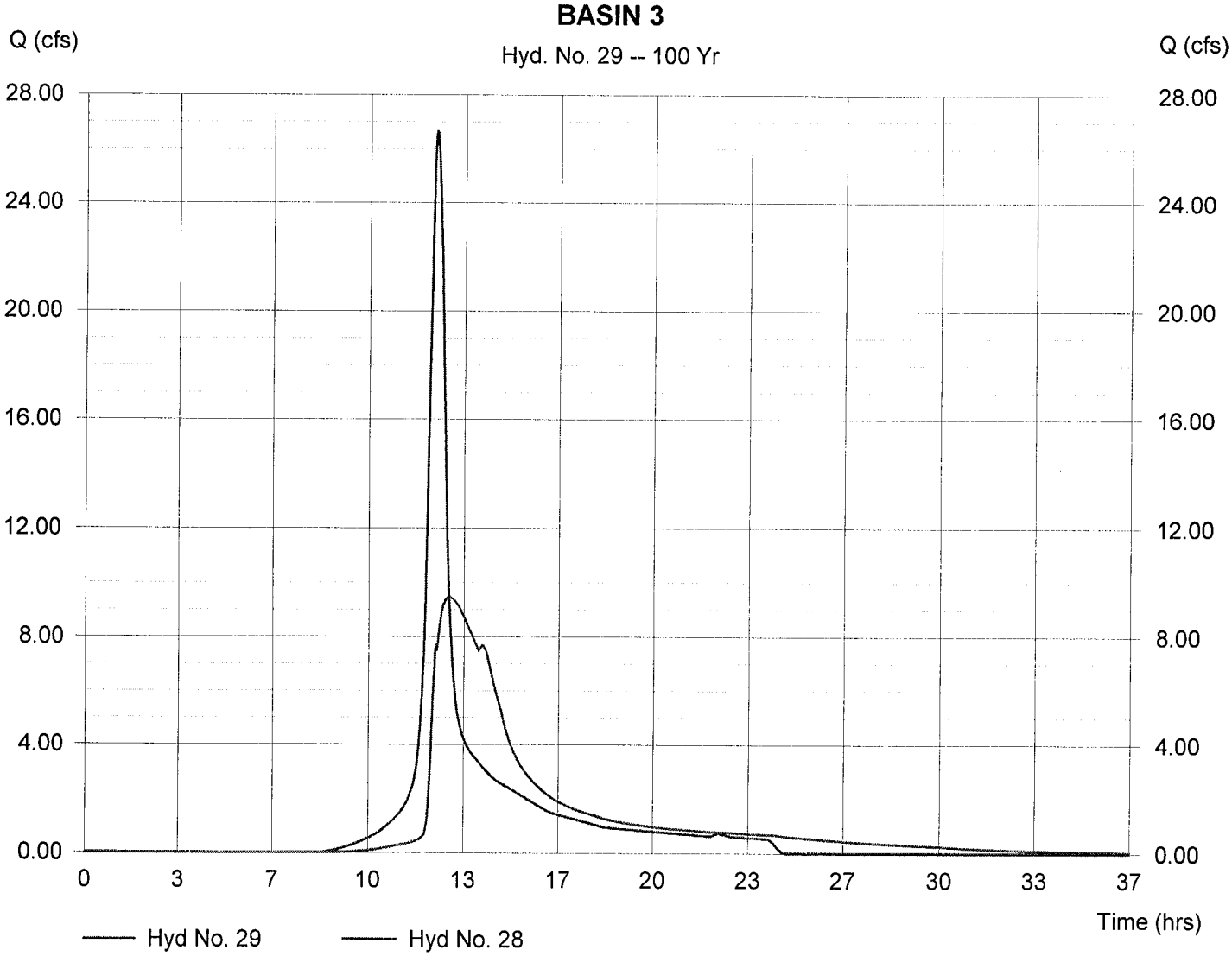
Hyd. No. 29

BASIN 3

Hydrograph type	= Reservoir	Peak discharge	= 9.44 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 28	Max. Elevation	= 130.13 ft
Reservoir name	= BASIN 3	Max. Storage	= 50,907 cuft

Storage Indication method used.

Hydrograph Volume = 135,483 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

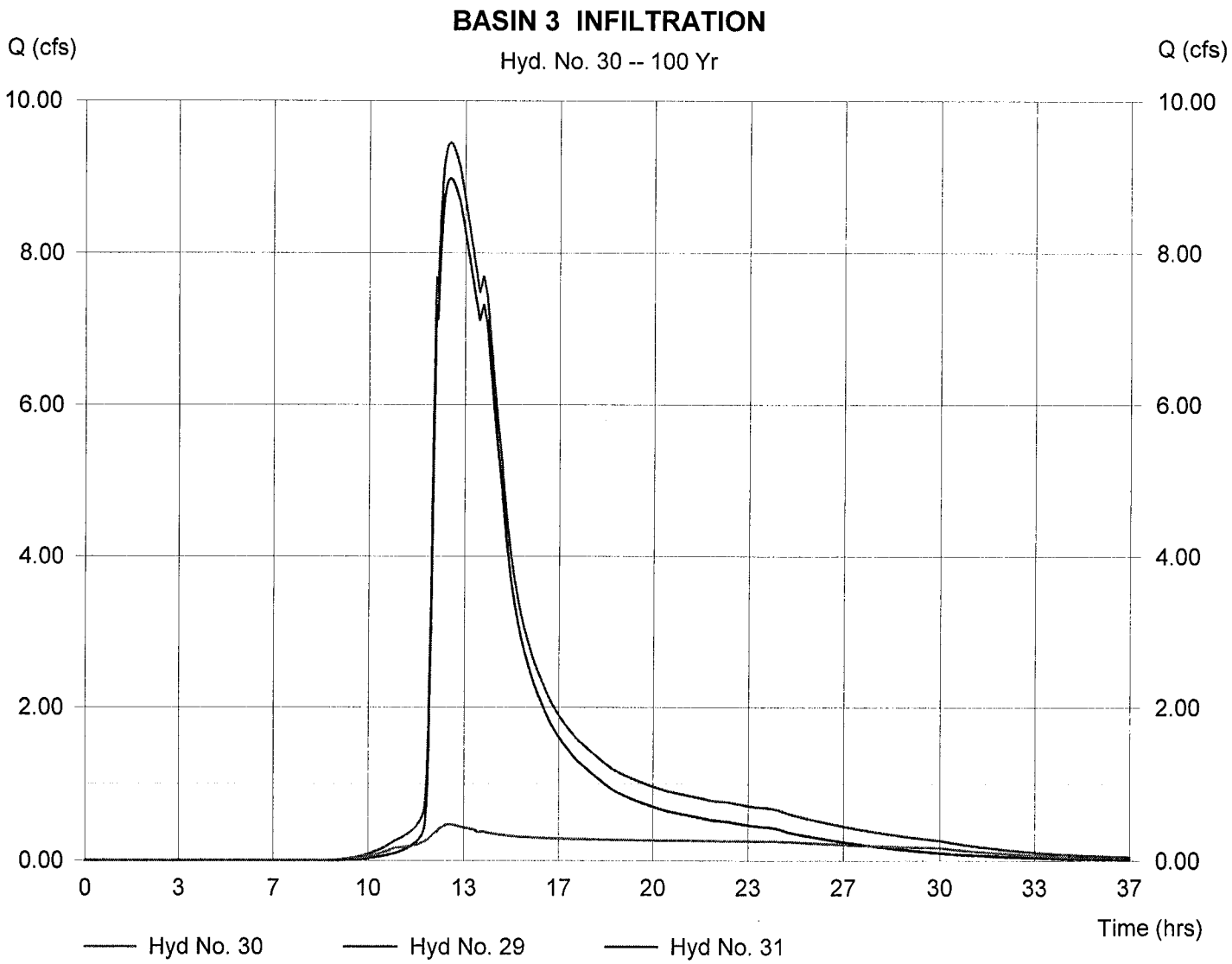
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 30

BASIN 3 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.47 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 31
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 20,683 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

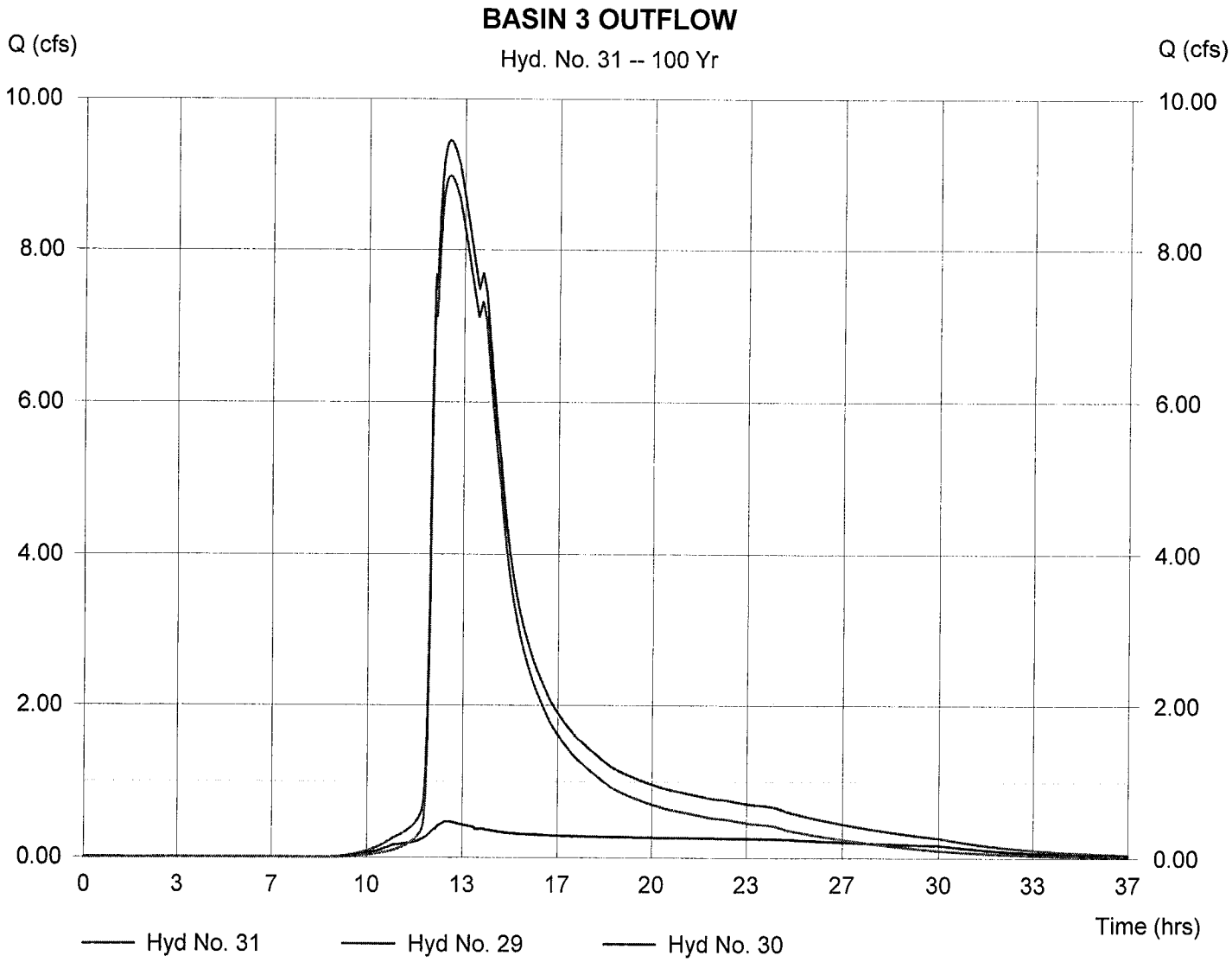
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 31

BASIN 3 OUTFLOW

Hydrograph type	= Diversion2	Peak discharge	= 8.97 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 29	2nd diverted hyd.	= 30
Diversion method	= Pond - BASIN 3	Pond structure	= Exfiltration

Hydrograph Volume = 114,799 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

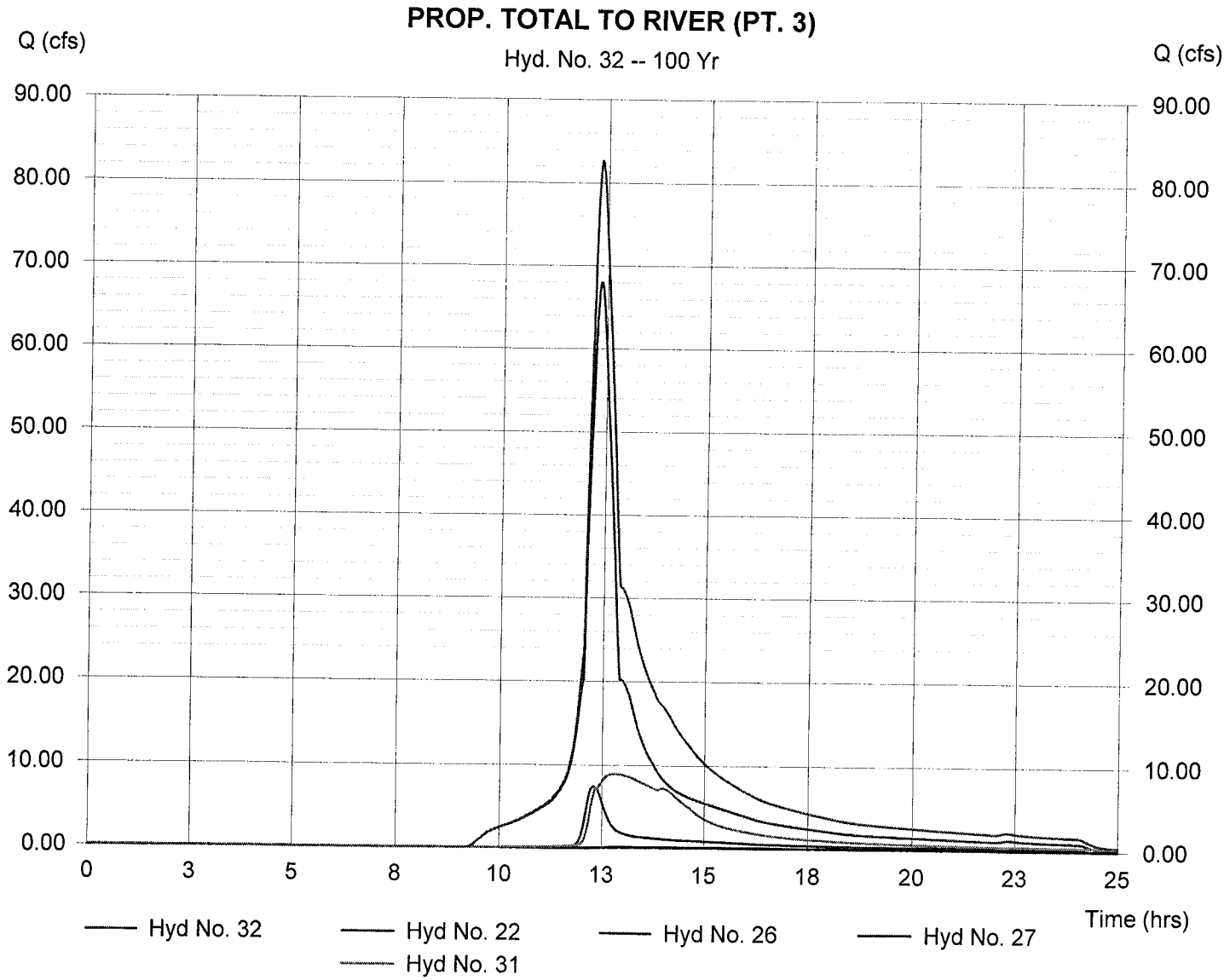
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 32

PROP. TOTAL TO RIVER (PT. 3)

Hydrograph type	= Combine	Peak discharge	= 82.62 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 22, 26, 27, 31		

Hydrograph Volume = 508,390 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

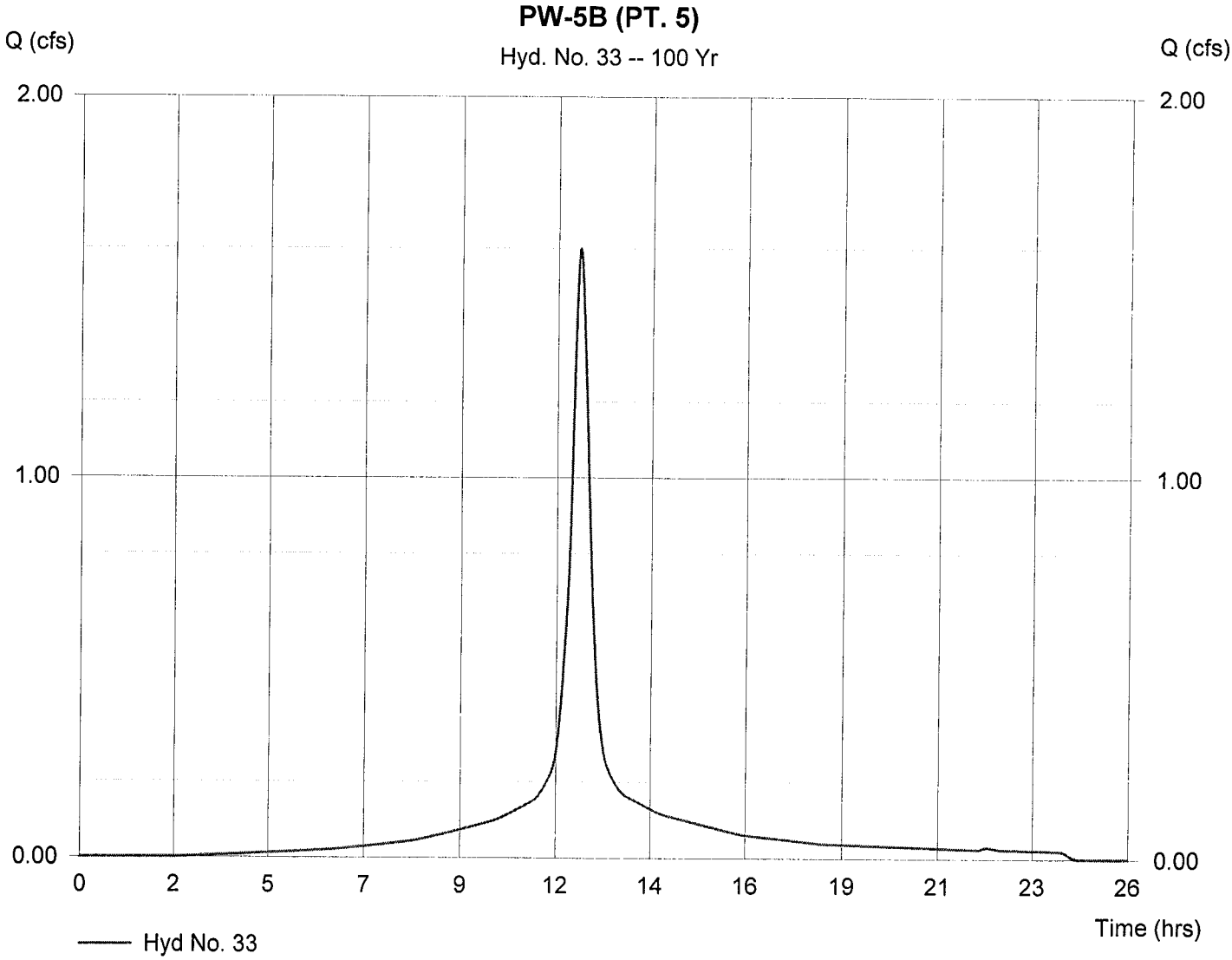
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 33

PW-5B (PT. 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.60 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.340 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.10 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,617 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

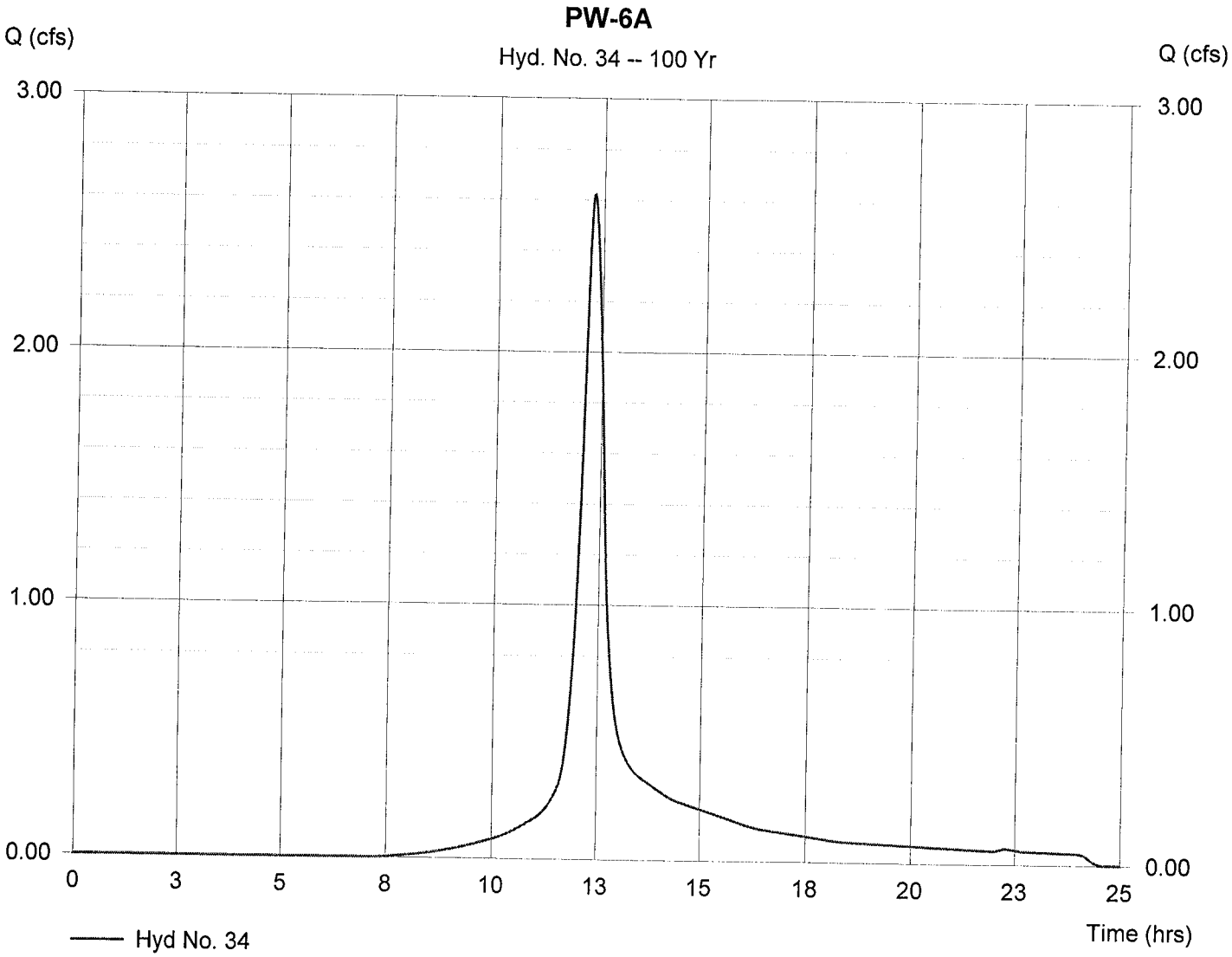
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 34

PW-6A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.62 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.820 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.70 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 12,672 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

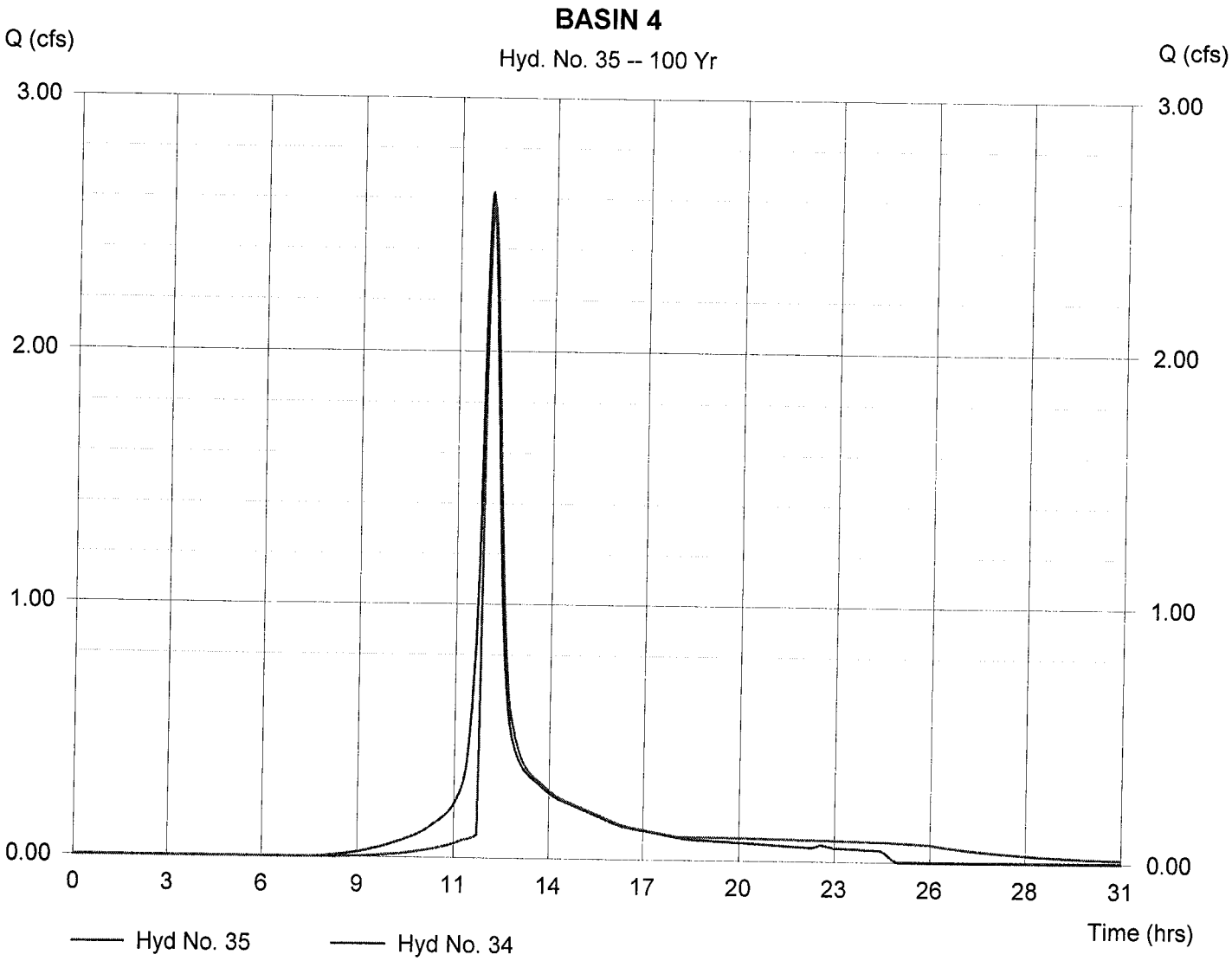
Hyd. No. 35

BASIN 4

Hydrograph type	= Reservoir	Peak discharge	= 2.58 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 34	Max. Elevation	= 129.79 ft
Reservoir name	= BASIN 4	Max. Storage	= 2,139 cuft

Storage Indication method used.

Hydrograph Volume = 12,660 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

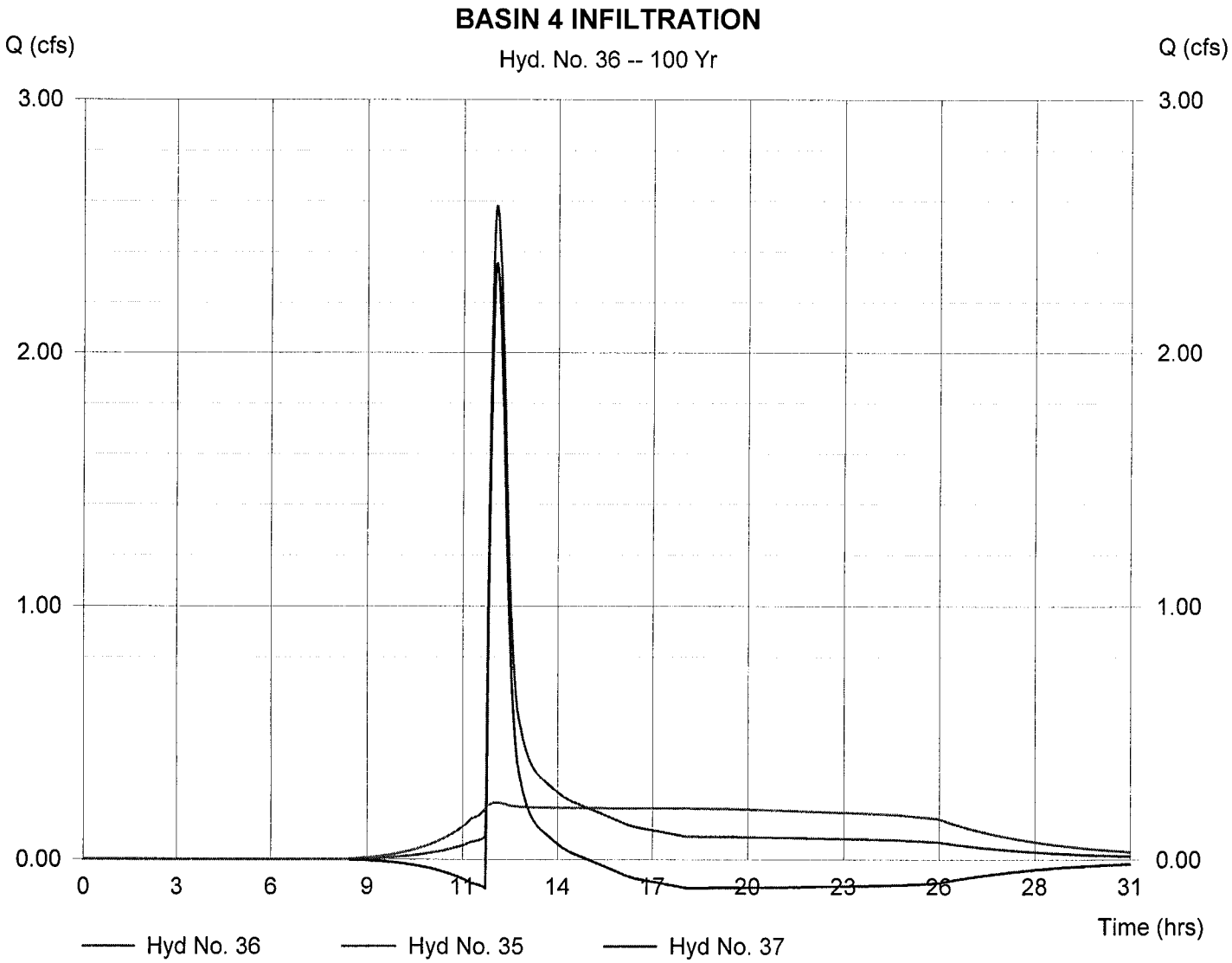
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 36

BASIN 4 INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.23 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hydrograph	= 35	2nd diverted hyd.	= 37
Diversion method	= Pond - BASIN 4	Pond structure	= Exfiltration

Hydrograph Volume = 12,376 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 3 2007, 6:33 PM

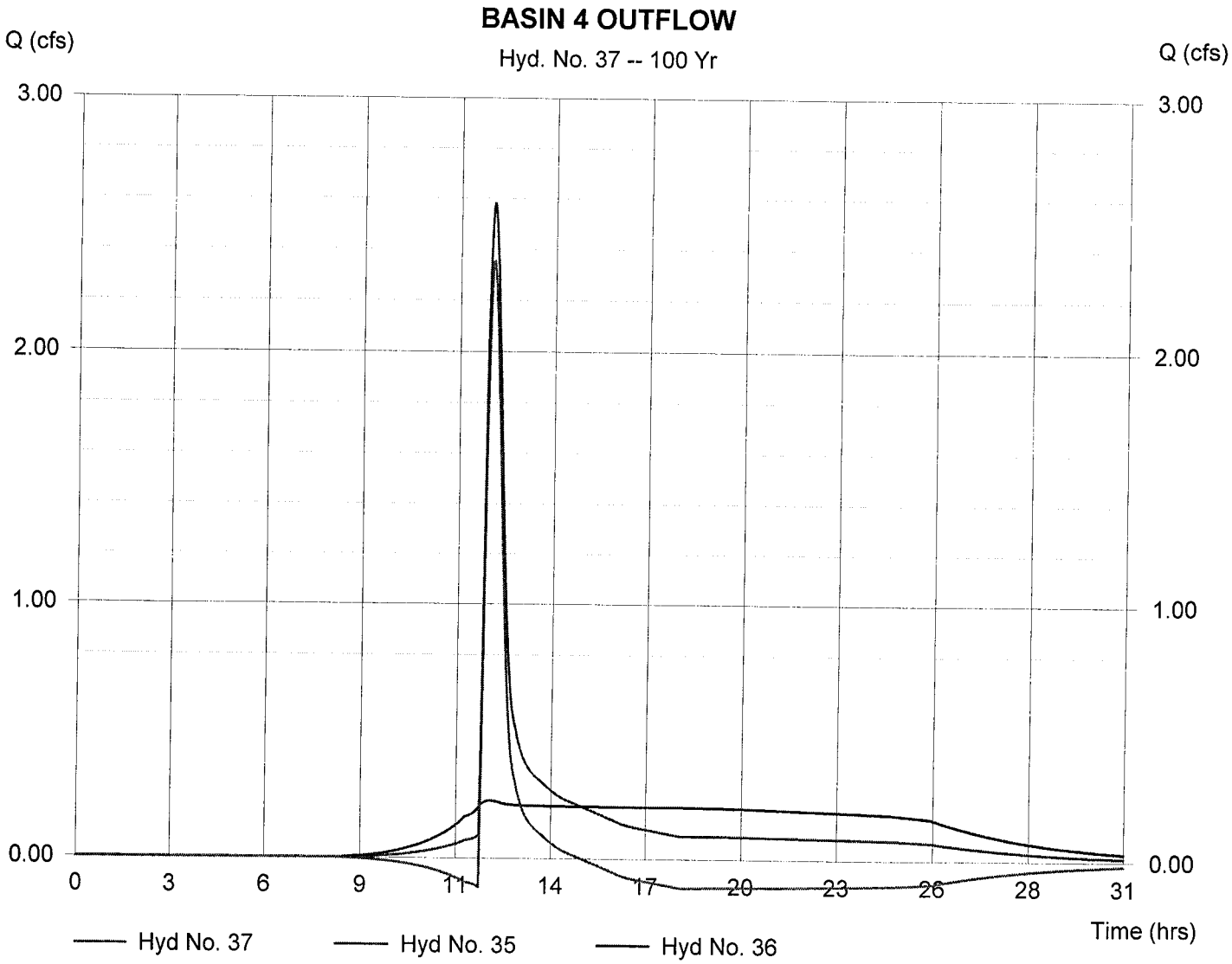
Hyd. No. 37

BASIN 4 OUTFLOW

Hydrograph type = Diversion2
Storm frequency = 100 yrs
Inflow hydrograph = 35
Diversion method = Pond - BASIN 4

Peak discharge = 2.35 cfs
Time interval = 1 min
2nd diverted hyd. = 36
Pond structure = Exfiltration

Hydrograph Volume = 285 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

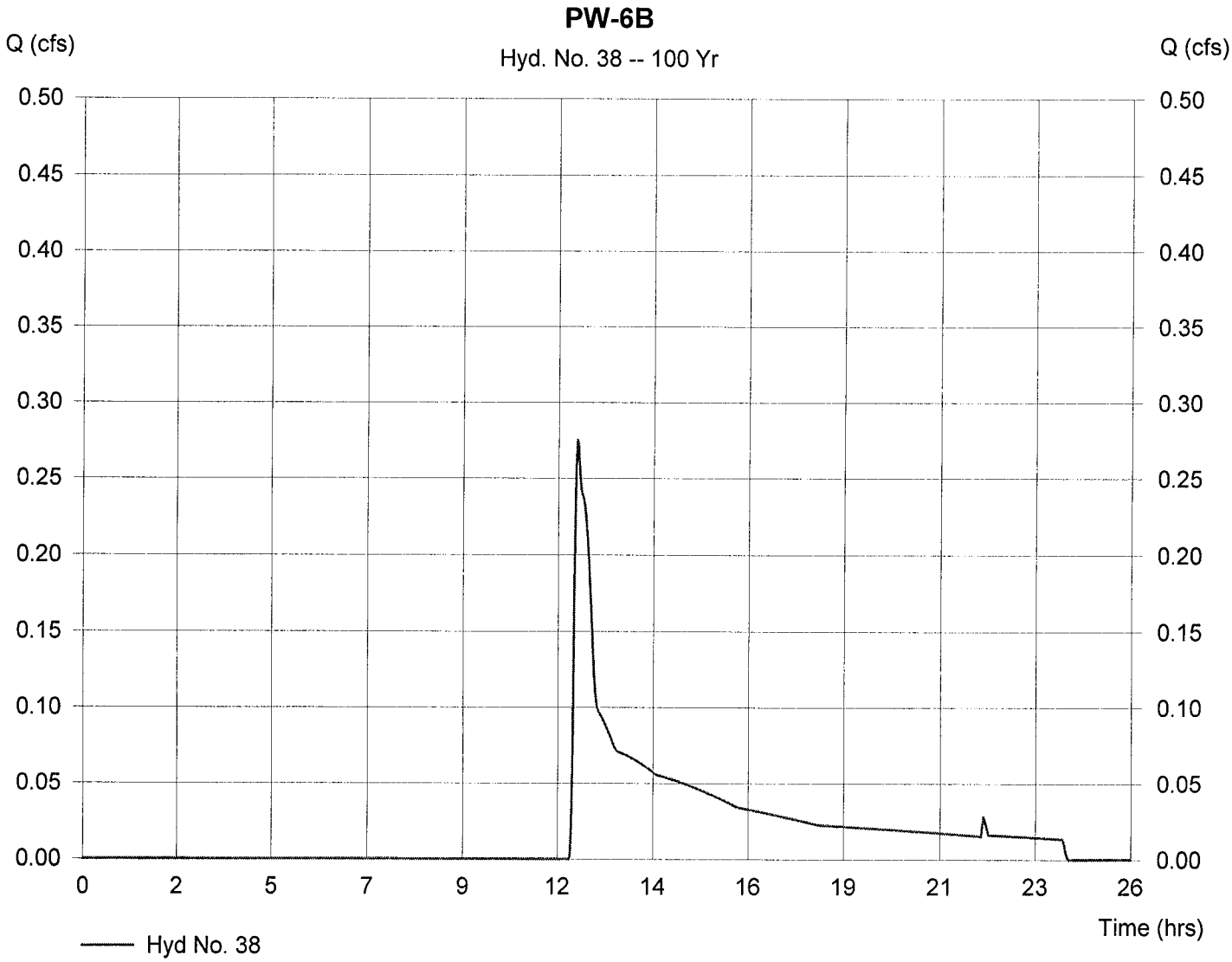
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 38

PW-6B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.28 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.600 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,726 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

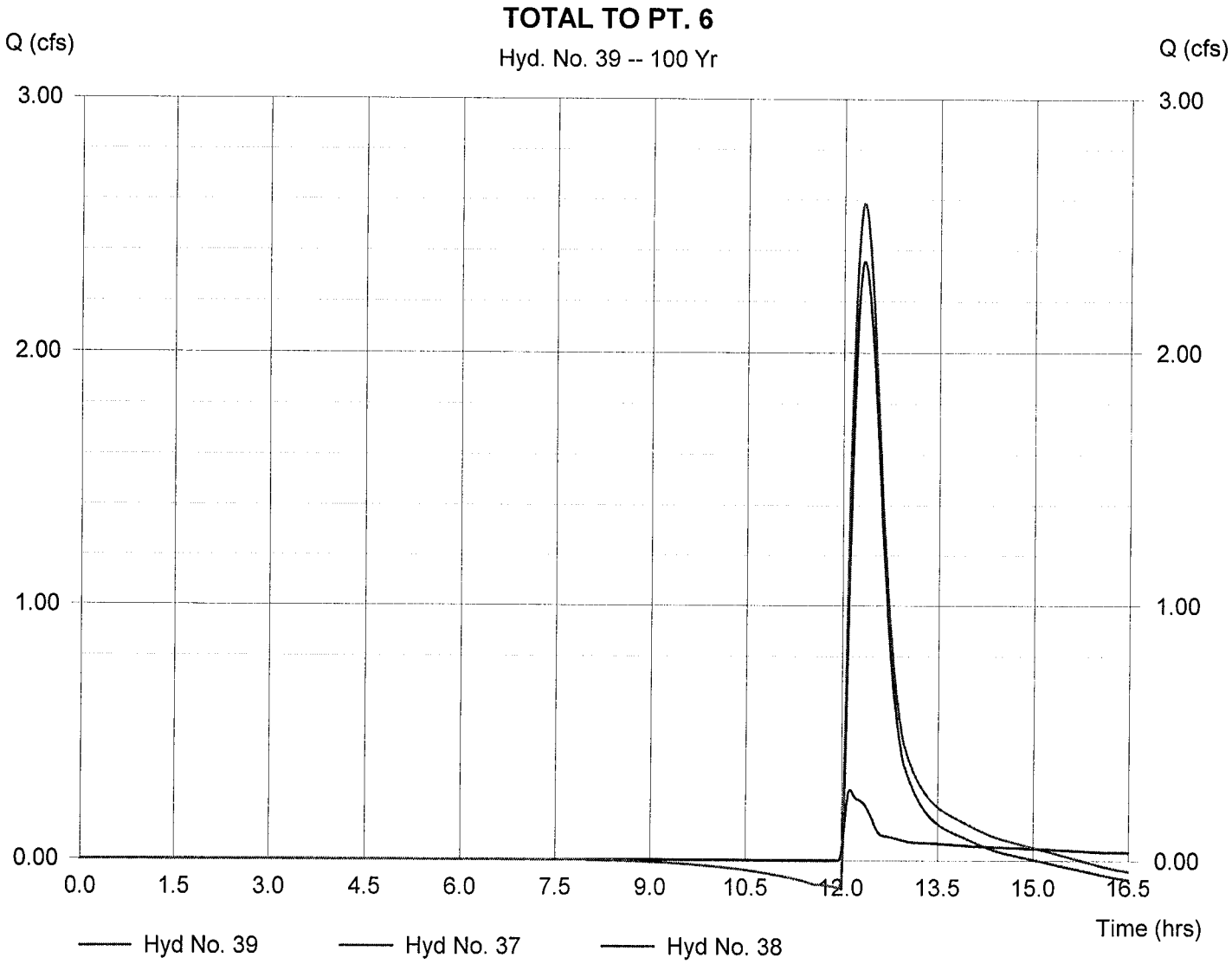
Wednesday, Oct 3 2007, 6:33 PM

Hyd. No. 39

TOTAL TO PT. 6

Hydrograph type	= Combine	Peak discharge	= 2.58 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 37, 38		

Hydrograph Volume = 2,010 cuft



APPENDIX C: STORM SEWER SIZING CALCULATIONS

RJO

Line No.	Line ID	DnStm Ln No	Line Length (ft)	Drng Area (ac)	Total Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	Inlet Time (min)	Tc (min)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Size (in)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)
1	DMH-12	Outfall	195.90	0.00	16.13	0.00	0.00	11.75	0.0	22.1	42.57	51.62	7.19	36	0.51	120.50	119.50	127.15	122.61	121.50	122.20
2	DMH-25	1	157.48	0.00	0.93	0.00	0.00	0.80	0.0	7.4	4.53	7.85	2.57	18	0.48	121.25	120.50	128.30	123.86	127.15	123.61
3	DMH-23	2	298.52	0.00	0.68	0.00	0.00	0.58	0.0	5.7	3.57	4.88	2.91	15	0.49	122.70	121.25	125.30	124.74	128.30	123.96
4	CB-28	3	92.14	0.34	0.34	0.86	0.29	0.29	5.0	5.0	1.84	2.84	2.34	12	0.54	123.20	122.70	125.70	125.06	125.30	124.85
5	CB-27	1	12.69	0.30	0.30	0.58	0.17	0.17	5.0	5.0	1.09	5.42	3.92	12	1.97	123.75	123.50	127.00	124.30	127.15	123.80
6	CB-30	2	7.21	0.25	0.25	0.86	0.22	0.22	5.0	5.0	1.35	7.18	4.41	12	3.47	124.25	124.00	128.25	125.12	128.30	124.30
7	CB-29	3	8.28	0.34	0.34	0.86	0.29	0.29	5.0	5.0	1.84	4.24	2.34	12	1.21	122.80	122.70	125.60	124.87	125.30	124.85
8	DMH-28	1	124.58	0.00	2.06	0.00	0.00	1.25	0.0	15.1	5.42	5.18	6.91	12	1.81	122.75	120.50	127.25	126.07	127.15	123.61
9	DMH-27	8	254.99	0.27	0.54	0.90	0.24	0.49	5.0	6.6	2.84	4.71	3.62	12	1.49	126.55	122.75	130.50	128.08	127.25	126.70
10	DMH-26	9	190.96	0.27	0.27	0.90	0.24	0.24	5.0	5.0	1.53	2.72	1.96	12	0.50	127.50	126.55	130.50	128.45	130.50	128.18
11	DMH-11	1	218.00	0.00	12.84	0.00	0.00	9.53	0.0	21.6	34.95	31.56	7.12	30	0.50	121.60	120.50	131.05	124.96	127.15	123.61
12	CB-31	8	16.96	1.52	1.52	0.50	0.76	0.76	15.0	15.0	3.31	4.68	4.22	12	1.47	123.00	122.75	127.00	126.83	127.25	126.70
13	DMH-22	11	129.52	0.00	2.83	0.00	0.00	1.83	0.0	21.0	6.81	8.06	3.86	18	0.50	122.25	121.60	129.20	126.21	131.05	125.75
14	DMH-21	13	140.16	0.00	2.23	0.00	0.00	1.45	0.0	20.3	5.50	8.04	3.11	18	0.50	122.95	122.25	127.10	126.74	129.20	126.41
15	CB-23	14	44.00	0.43	0.43	0.55	0.24	0.24	5.0	5.0	1.49	3.68	1.89	12	0.91	123.35	122.95	127.05	126.95	127.10	126.89
16	DMH-20	11	97.68	0.10	6.20	0.90	0.09	4.96	5.0	18.2	19.80	39.20	6.30	24	2.56	124.10	121.60	130.00	126.38	131.05	125.75
17	CB-25	13	35.58	0.40	0.40	0.56	0.22	0.22	5.0	5.0	1.41	4.09	1.79	12	1.12	124.90	124.50	128.90	126.45	129.20	126.41
18	CB-24	14	10.47	0.31	0.31	0.56	0.17	0.17	5.0	5.0	1.09	3.77	1.39	12	0.96	123.05	122.95	127.05	126.89	127.10	126.89
19	DMH-19	16	84.71	0.00	1.04	0.00	0.00	0.94	0.0	11.1	4.62	4.09	5.89	12	1.12	125.05	124.10	131.20	128.22	130.00	127.00
20	DMH-18	19	158.00	0.35	1.04	0.90	0.32	0.94	5.0	10.4	4.73	4.98	3.86	15	0.51	125.85	125.05	132.60	129.02	131.20	128.30
21	DMH-17	20	73.64	0.05	0.69	0.90	0.05	0.62	5.0	10.1	3.17	2.66	4.04	12	0.48	126.20	125.85	132.10	129.72	132.60	129.22

Project File: Wayland Drainage.stm | Number of lines: 112 | Date: 09-26-2007

NOTES: ** At critical depth

RJO

Line No.	Line ID	DnStm Ln No	Line Length (ft)	Drng Area (ac)	Total Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	Inlet Time (min)	Tc (min)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Size (in)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)
22	DMH-16	21	230.00	0.16	0.64	0.90	0.14	0.58	5.0	9.2	3.05	2.79	3.88	12	0.52	127.40	126.20	133.20	131.37	132.10	129.93
23	DMH-15	22	125.00	0.11	0.48	0.90	0.10	0.43	5.0	8.5	2.34	2.78	2.98	12	0.52	128.05	127.40	133.90	132.06	133.20	131.60
24	DMH-14	23	180.00	0.22	0.37	0.90	0.20	0.33	5.0	7.3	1.89	2.73	2.41	12	0.50	128.95	128.05	134.60	132.63	133.90	132.20
25	DMH-13	24	150.00	0.15	0.15	0.90	0.14	0.14	5.0	5.0	0.85	3.98	1.08	12	1.07	130.55	128.95	134.55	132.72	134.60	132.65
26	DMH-10	11	129.46	0.00	3.81	0.00	0.00	2.74	0.0	11.2	13.47	39.71	5.26	24	2.63	125.00	121.60	131.05	126.30	131.05	125.75
27	CB-26	13	25.64	0.20	0.20	0.78	0.16	0.16	5.0	5.0	0.98	6.81	1.25	12	3.12	124.80	124.00	128.80	126.42	129.20	126.41
28	DMH-54	16	158.35	0.00	4.70	0.00	0.00	3.69	0.0	17.6	14.95	17.42	4.76	24	0.51	124.90	124.10	130.00	127.59	130.00	127.00
29	DMH-9	26	134.97	0.00	3.30	0.00	0.00	2.44	0.0	10.6	12.26	17.65	4.57	24	0.52	125.70	125.00	131.80	127.11	131.05	126.90
30	DMH-53	28	361.87	0.00	3.20	0.00	0.00	2.59	0.0	15.8	11.03	17.28	3.57	24	0.50	126.70	124.90	132.00	128.56	130.00	127.89
31	DMH-8	29	88.54	0.00	2.96	0.00	0.00	2.26	0.0	10.2	11.49	17.47	4.37	24	0.51	126.15	125.70	131.80	127.56	131.80	127.47
32	CB-19	30	265.18	2.64	2.64	0.81	2.14	2.14	15.0	15.0	9.33	7.97	5.28	18	0.49	128.00	126.70	131.00	130.55	132.00	128.77
33	DMH-7	31	109.35	0.00	2.50	0.00	0.00	2.00	0.0	8.6	10.79	17.38	4.41	24	0.50	126.70	126.15	133.50	127.98	131.80	127.87
34	DMH-7A	33	87.50	0.00	0.33	0.00	0.00	0.29	0.0	6.4	1.72	3.45	4.11	12	0.80	128.70	128.00	132.20	129.26	133.50	128.50
35	CB-18	34	89.67	0.15	0.15	0.90	0.14	0.14	5.0	5.0	0.85	2.88	2.10	12	0.56	129.20	128.70	132.20	129.60	132.20	129.49
36	CB-22	16	10.19	0.36	0.36	0.68	0.24	0.24	5.0	5.0	1.54	7.64	3.79	12	3.93	126.90	126.50	129.90	127.43	130.00	127.00
37	CB-14	26	6.64	0.51	0.51	0.58	0.30	0.30	10.0	10.0	1.52	10.59	5.70	12	7.53	127.50	127.00	131.00	128.84	131.05	127.26
38	CB-21	28	11.26	1.50	1.50	0.73	1.10	1.10	15.0	15.0	4.78	8.13	6.08	12	4.44	125.50	125.00	129.50	128.06	130.00	127.89
39	CB-13	29	20.31	0.34	0.34	0.55	0.19	0.19	10.0	10.0	0.96	7.66	2.17	12	3.94	127.30	126.50	131.30	127.72	131.80	127.47
40	CB-20	30	10.61	0.56	0.56	0.81	0.45	0.45	15.0	15.0	1.98	8.38	2.84	12	4.71	128.00	127.50	131.00	128.74	132.00	128.77
41	CB-12	31	21.44	0.46	0.46	0.56	0.26	0.26	10.0	10.0	1.32	4.56	2.51	12	1.40	127.30	127.00	131.30	127.82	131.80	127.87
42	DMH-6	33	130.56	0.00	1.96	0.00	0.00	1.53	0.0	8.2	8.40	10.91	5.82	18	0.92	128.40	127.20	134.50	129.51	133.50	128.38

Project File: Wayland Drainage.stm | Number of lines: 112 | Date: 09-26-2007

NOTES: ** At critical depth

RJO

Line No.	Line ID	DnStm Ln No	Line Length (ft)	Drng Area (ac)	Total Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	Inlet Time (min)	Tc (min)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Size (in)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)
43	CB-15	34	8.28	0.18	0.18	0.87	0.16	0.16	5.0	5.0	0.98	4.24	1.61	12	1.21	128.80	128.70	132.20	129.48	132.20	129.49
44	DMH-5	42	169.46	0.00	1.76	0.00	0.00	1.36	0.0	7.5	7.66	8.29	4.34	18	0.53	129.30	128.40	134.60	130.79	134.50	130.07
45	DMH-4	44	84.14	0.00	1.43	0.00	0.00	1.07	0.0	7.1	6.15	7.84	3.48	18	0.48	129.70	129.30	134.80	131.32	134.60	131.08
46	DMH-3	45	81.71	0.00	1.27	0.00	0.00	0.95	0.0	6.8	5.50	4.89	4.48	15	0.49	130.10	129.70	135.20	132.02	134.80	131.51
47	DMH-2	46	60.67	0.00	0.69	0.00	0.00	0.49	0.0	6.3	2.91	2.71	3.70	12	0.49	130.40	130.10	134.80	132.67	135.20	132.33
48	DMH-1	47	60.00	0.00	0.38	0.00	0.00	0.27	0.0	5.8	1.60	3.52	2.04	12	0.83	130.90	130.40	135.05	132.99	134.80	132.89
49	CB-2	48	50.70	0.16	0.16	0.79	0.13	0.13	5.0	5.0	0.79	3.43	1.01	12	0.79	131.30	130.90	134.30	133.06	135.05	133.04
50	CB-10	33	51.14	0.11	0.11	0.85	0.09	0.09	5.0	5.0	0.59	2.95	2.78	12	0.59	129.00	128.70	133.00	129.33	133.50	129.00
51	CB-8	42	20.79	0.10	0.10	0.85	0.09	0.09	5.0	5.0	0.53	3.78	2.86	12	0.96	130.00	129.80	134.00	130.31	134.50	130.07
52	CB-6	44	21.04	0.13	0.13	0.90	0.12	0.12	5.0	5.0	0.73	7.04	0.94	12	3.33	130.00	129.30	134.30	131.09	134.60	131.08
53	CB-5	45	22.34	0.16	0.16	0.79	0.13	0.13	5.0	5.0	0.79	4.47	1.01	12	1.34	130.00	129.70	134.00	131.52	134.80	131.51
54	DMH-52	46	96.28	0.00	0.58	0.00	0.00	0.46	0.0	6.3	2.70	3.05	3.44	12	0.62	130.70	130.10	135.90	132.80	135.20	132.33
55	CB-3	47	27.34	0.10	0.10	0.85	0.09	0.09	5.0	5.0	0.53	4.04	0.68	12	1.10	130.70	130.40	134.50	132.89	134.80	132.89
56	CB-1	48	47.96	0.22	0.22	0.63	0.14	0.14	5.0	5.0	0.87	3.52	1.11	12	0.83	131.30	130.90	134.30	133.06	135.05	133.04
57	CB-17	54	145.68	0.32	0.32	0.71	0.23	0.23	5.0	5.0	1.43	2.67	1.82	12	0.48	131.40	130.70	134.70	133.18	135.90	132.98
58	CB-11	33	51.14	0.10	0.10	0.85	0.09	0.09	5.0	5.0	0.53	2.95	2.69	12	0.59	129.00	128.70	133.00	129.31	133.50	128.99
59	CB-9	42	20.56	0.10	0.10	0.86	0.09	0.09	5.0	5.0	0.54	3.81	2.88	12	0.97	130.00	129.80	134.00	130.31	134.50	130.07
60	CB-7	44	20.82	0.20	0.20	0.84	0.17	0.17	5.0	5.0	1.06	7.07	1.34	12	3.36	130.00	129.30	134.30	131.09	134.60	131.08
61	CB-4	47	7.62	0.21	0.21	0.67	0.14	0.14	5.0	5.0	0.88	6.25	1.13	12	2.62	130.60	130.40	134.50	132.89	134.80	132.89
62	CB-16	54	9.77	0.26	0.26	0.88	0.23	0.23	5.0	5.0	1.44	6.76	1.83	12	3.07	131.00	130.70	134.50	133.00	135.90	132.98
63	FES-16	14	82.24	1.49	1.49	0.70	1.04	1.04	20.0	20.0	3.98	7.43	5.06	12	3.71	126.00	122.95	0.00	127.76	127.10	126.89

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Number of lines: 112

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NOTES: ** At critical depth

Line No.	Line ID	DnStm Ln No	Line Length (ft)	Drng Area (ac)	Total Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	Inlet Time (min)	Tc (min)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Size (in)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)
64	DMH-34	Outfall	123.91	0.00	2.91	0.00	0.00	1.89	0.0	8.5	10.22	9.70	6.31	18	0.73	122.40	121.50	126.90	123.79	0.00	122.72
65	DMH-33	64	80.79	0.00	1.45	0.00	0.00	0.98	0.0	8.2	5.38	5.50	4.38	15	0.62	122.90	122.40	127.50	124.82	126.90	124.35
66	DMH-32	65	128.49	0.00	1.07	0.00	0.00	0.73	0.0	7.6	4.13	7.17	3.36	15	1.05	124.25	122.90	129.05	125.57	127.50	125.12
67	DMH-31	66	116.93	0.00	0.89	0.00	0.00	0.62	0.0	6.9	3.59	4.80	2.92	15	0.47	124.80	124.25	129.05	126.05	129.05	125.75
68	DMH-30	67	100.60	0.00	0.66	0.00	0.00	0.43	0.0	6.4	2.51	2.85	3.20	12	0.55	125.35	124.80	130.05	126.61	129.05	126.18
69	DMH-29	68	103.79	0.00	0.50	0.00	0.00	0.32	0.0	5.7	1.93	2.81	2.45	12	0.53	125.90	125.35	130.05	127.02	130.05	126.76
70	CB-32	69	76.36	0.37	0.37	0.62	0.23	0.23	5.0	5.0	1.44	3.42	2.13	12	0.79	126.50	125.90	130.50	127.21	130.05	127.12
71	CB-42	64	27.22	0.35	0.35	0.61	0.21	0.21	5.0	5.0	1.34	5.73	1.71	12	2.20	123.00	122.40	126.50	124.38	126.90	124.35
72	CB-37	65	13.92	0.38	0.38	0.65	0.25	0.25	5.0	5.0	1.55	3.27	1.98	12	0.72	123.00	122.90	126.50	125.15	127.50	125.12
73	CB-36	66	7.11	0.18	0.18	0.63	0.11	0.11	5.0	5.0	0.71	10.23	3.78	12	7.03	126.00	125.50	129.00	126.36	129.05	125.75
74	CB-35	67	6.07	0.23	0.23	0.85	0.20	0.20	5.0	5.0	1.23	7.00	1.56	12	3.29	125.00	124.80	129.00	126.19	129.05	126.18
75	CB-34	68	5.85	0.16	0.16	0.68	0.11	0.11	5.0	5.0	0.68	7.13	0.97	12	3.42	126.00	125.80	130.00	126.76	130.05	126.76
76	CB-33	69	6.77	0.13	0.13	0.67	0.09	0.09	5.0	5.0	0.55	4.69	0.70	12	1.48	126.00	125.90	130.00	127.12	130.05	127.12
77	DMH-38	64	61.04	0.00	1.11	0.00	0.00	0.69	0.0	8.3	3.79	5.95	4.82	12	2.38	123.85	122.40	127.50	124.94	126.90	124.35
78	DMH-37	77	124.04	0.00	1.11	0.00	0.00	0.69	0.0	7.6	3.89	5.06	3.36	15	0.52	124.50	123.85	129.05	125.54	127.50	125.21
79	DMH-36	78	138.40	0.00	0.82	0.00	0.00	0.50	0.0	7.0	2.90	2.74	3.69	12	0.51	125.20	124.50	129.55	126.52	129.05	125.74
80	DMH-35	79	127.25	0.00	0.60	0.00	0.00	0.36	0.0	6.3	2.15	2.76	2.73	12	0.51	125.85	125.20	130.05	127.13	129.55	126.73
81	CB-38	80	130.00	0.39	0.39	0.55	0.21	0.21	5.0	5.0	1.35	2.73	1.77	12	0.50	126.50	125.85	130.50	127.39	130.05	127.24
82	CB-41	78	6.46	0.29	0.29	0.65	0.19	0.19	5.0	5.0	1.18	10.73	1.73	12	7.74	125.00	124.50	129.00	125.72	129.05	125.74
83	CB-40	79	6.46	0.22	0.22	0.65	0.14	0.14	5.0	5.0	0.90	8.31	1.14	12	4.64	125.50	125.20	129.50	126.74	129.55	126.73
84	CB-39	80	5.35	0.21	0.21	0.70	0.15	0.15	5.0	5.0	0.92	6.46	1.18	12	2.80	126.00	125.85	130.00	127.25	130.05	127.24

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NOTES: ** At critical depth

Line No.	Line ID	DnStm Ln No	Line Length (ft)	Drng Area (ac)	Total Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	Inlet Time (min)	Tc (min)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Size (in)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)
85	DMH-50	Outfall	67.16	0.00	0.75	0.00	0.00	0.43	0.0	5.6	2.62	3.80	4.56	12	0.97	121.65	121.00	125.75	122.34	123.50	121.69
86	CB-53	85	11.13	0.43	0.43	0.55	0.24	0.24	5.0	5.0	1.49	6.33	2.26	12	2.70	121.95	121.65	125.95	122.63	125.75	122.66
87	CB-52	85	57.41	0.32	0.32	0.60	0.19	0.19	5.0	5.0	1.21	2.79	1.72	12	0.52	121.95	121.65	125.95	122.70	125.75	122.66
88	DMH-45	Outfall	137.32	0.00	2.93	0.00	0.00	2.16	0.0	8.1	11.88	17.49	5.90	24	0.51	127.60	126.90	131.25	128.83	128.90	128.12
89	DMH-44	88	155.48	0.00	2.81	0.00	0.00	2.08	0.0	7.4	11.78	17.58	5.33	24	0.51	128.40	127.60	133.50	129.62	131.25	129.07
90	DMH-43	89	96.53	0.00	2.36	0.00	0.00	1.79	0.0	7.1	10.24	10.36	5.80	18	0.83	129.20	128.40	133.40	130.94	133.50	130.16
91	DMH-43A	90	142.39	0.00	1.25	0.00	0.00	0.92	0.0	6.6	5.36	4.54	4.37	15	0.42	129.80	129.20	133.80	132.30	133.40	131.46
92	CB-43	91	216.60	0.38	0.38	0.74	0.28	0.28	5.0	5.0	1.77	2.87	2.25	12	0.55	131.00	129.80	134.50	133.00	133.80	132.55
93	CB-54	88	108.68	0.12	0.12	0.65	0.08	0.08	5.0	5.0	0.49	2.98	0.66	12	0.60	128.25	127.60	132.25	129.08	131.25	129.07
94	CB-46	89	69.59	0.45	0.45	0.65	0.29	0.29	5.0	5.0	1.84	2.74	2.34	12	0.50	128.75	128.40	132.25	130.31	133.50	130.16
95	CB-45	90	32.79	0.48	0.48	0.64	0.31	0.31	5.0	5.0	1.93	5.00	2.46	12	1.68	129.75	129.20	132.75	131.54	133.40	131.46
96	CB-44	91	21.71	0.87	0.87	0.73	0.64	0.64	5.0	5.0	3.99	4.75	3.25	15	0.46	129.90	129.80	133.40	132.62	133.80	132.55
97	DMH-42	90	97.05	0.19	0.63	0.90	0.17	0.57	5.0	6.5	3.34	2.77	4.25	12	0.52	129.70	129.20	133.80	132.19	133.40	131.46
98	DMH-41	97	278.00	0.44	0.44	0.90	0.40	0.40	5.0	5.0	2.49	3.10	3.17	12	0.65	131.50	129.70	135.50	133.63	133.80	132.47
99	DMH-47	Outfall	29.17	0.00	3.00	0.00	0.00	1.80	0.0	20.2	6.84	11.54	5.48	18	1.03	128.50	128.20	133.55	129.50	130.20	129.20
100	DMH-46	99	112.15	0.00	0.59	0.00	0.00	0.45	0.0	5.4	2.80	2.82	3.56	12	0.54	129.10	128.50	132.05	130.49	133.55	129.90
101	CB-50	100	6.89	0.27	0.27	0.90	0.24	0.24	5.0	5.0	1.53	4.65	1.94	12	1.45	129.20	129.10	132.00	130.66	132.05	130.65
102	FES-13	99	46.21	2.41	2.41	0.56	1.35	1.35	20.0	20.0	5.14	7.28	4.37	15	1.08	129.00	128.50	131.00	130.09	133.55	129.90
103	CB-49	100	42.33	0.32	0.32	0.66	0.21	0.21	5.0	5.0	1.33	2.65	1.69	12	0.47	129.30	129.10	132.00	130.70	132.05	130.65
104	CB-47	Outfall	18.00	0.53	0.53	0.13	0.07	0.07	10.0	10.0	0.35	7.04	2.27	12	3.33	127.60	127.00	130.60	127.85	129.00	127.25
105	FES-12	Outfall	54.68	1.58	1.58	0.64	1.01	1.01	15.0	15.0	4.41	4.67	6.01	12	1.46	129.00	128.20	131.00	129.88	130.50	129.08

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106	CB-48	Outfall	6.00	0.62	0.62	0.58	0.36	0.36	5.0	5.0	2.26	4.98	4.27	12	1.67	128.30	128.20	131.30	128.94	130.50	128.84
107	DMH-49	Outfall	17.39	0.00	0.49	0.00	0.00	0.42	0.0	5.4	2.59	5.07	4.53	12	1.73	127.70	127.40	132.25	128.38	129.00	128.08
108	CB-51	107	61.50	0.34	0.34	0.86	0.29	0.29	5.0	5.0	1.84	2.69	2.51	12	0.49	128.00	127.70	131.20	128.81	132.25	128.70
109	TR-DR	107	15.00	0.15	0.15	0.85	0.13	0.13	5.0	5.0	0.80	5.46	1.20	12	2.00	128.00	127.70	131.90	128.70	132.25	128.70
110	CB-55	Outfall	7.22	0.47	0.47	0.73	0.34	0.34	5.0	5.0	2.16	4.54	4.19	12	1.39	123.10	123.00	125.60	123.72	125.00	123.62
111	DMH-55	Outfall	191.03	0.46	0.46	0.90	0.41	0.41	5.0	5.0	2.60	6.75	4.54	12	3.06	124.50	118.65	129.00	125.18	128.55	119.33
112	DMH-56	Outfall	161.76	0.34	0.34	0.90	0.31	0.31	5.0	5.0	1.92	2.63	3.67	12	0.46	127.50	126.75	130.50	128.19	129.00	127.34

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NOTES: ** At critical depth

Draft WWTP Assessment Study, for the Wayland Wastewater Management District Commission

Wayland, Massachusetts

September 21, 2007

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1.0 INTRODUCTION

The Town of Wayland, Massachusetts owns a wastewater treatment plant (WWTP) located on the site of the former Raytheon manufacturing facility. The WWTP is approximately 40 years old and concerns have been raised about its adequacy and ability to treat effluent to its permit requirements. The plant's NPDES effluent discharge permit is currently under review by the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Environmental Protection Agency (USEPA).

M&E was retained by Twenty Wayland LLC (TW) in accordance with a Memorandum of Agreement between TW and the Town of Wayland (Town) dated March 28, 2006 referred to as the "Development Agreement." Under Article D of the Development Agreement, TW is responsible for preparing an assessment of the existing wastewater treatment facility and providing recommendations for facility modifications or facility replacement to meet the anticipated NPDES effluent discharge permit currently under review by the Massachusetts Department of Environmental Protection (MassDEP) and the US Environmental Protection Agency (USEPA).

The primary objective of this study is to answer two key questions:

- Should the 40-year-old existing wastewater treatment plant be modified to meet the new capacity and discharge permit requirements or should a new facility be constructed?
- Should the existing discharge to the wetlands adjacent to the Sudbury River be continued or should the discharge be relocated to the river proper or should a groundwater disposal permit be obtained?

M&E performed this assessment study through a series of the following tasks:

- **Site visits.** M&E staff visited the existing Wayland WWTP to collect background data on the treatment system, interview the treatment plant operator, and observe the WWTP in operation.
- **Wastewater Flow Estimation.** Data was collected from the monthly operating reports to develop a history of flow at the existing WWTP. Design flows were based on the permit limitations as well as Twenty Wayland's (TW) and the Town's stated demand.
- **Existing WWTP Assessment.** Information collected from the site visit as well as information from the monthly operating reports were used to evaluate the existing WWTP. Based on this evaluation, M&E feels that the existing plant has little or no salvage value and recommends that a new plant be constructed in its place.
- **Wastewater Disposal Evaluations.** M&E evaluated three alternatives for wastewater disposal, and their permitting implications: 1) Continue discharge to the wetland under existing draft NPDES permit, 2) Discharge to the Sudbury River under existing draft NPDES permit via a new outfall, and 3) Discharge to groundwater via new groundwater discharge permit.
- **Conceptual Design of Facility Recommendations.** M&E developed a conceptual design of a new facility that is cost-effective, will meet permit requirements, and can accommodate future

increases in flow. A discussion of odor control needs, control systems, and sludge disposal options is included in this section.

2.0 EXISTING AND DESIGN FLOWS

Effluent quality standards in the Federal National Pollutant Discharge Elimination Program (NPDES) generally require compliance with monthly average and maximum day or week permit limitations. Correspondingly, treatment plants are designed to achieve permit compliance not only under average conditions, but for the full range of permit conditions. For example, a WWTP would not be designed for just the average month, but for compliance during all months of the year. Thus, a statistical analysis of WWTP influent data is used to determine the incidence of higher flows and shorter durations.

Design conditions used in this report are defined as follows:

- **Annual Average.** The average daily value of a wastewater characteristic for the entire year.
- **Maximum Month.** Of all the months in a year, the maximum month value of a wastewater characteristic is obtained from the month with the highest monthly average. This value is also known as the design value because it corresponds to the monthly limit in the NPDES permit.
- **Maximum Day.** The highest 24-hour average value of a wastewater characteristic.

2.1 Existing Flows

The existing wastewater treatment plant was designed for an average daily flow of 65,000 gpd and a daytime sustained flow of 115,000 gpd when it was upgraded in 1973. However, based on the governing NPDES permit which was issued in 1998, the discharge was limited to an average monthly flow of 52,000 gpd and a maximum daily flow of 65,000 gpd. As indicated in Figure 2-1 below, the average flow for the past three years has been about 11,500 gpd, with a maximum daily flow of 23,000 gpd.

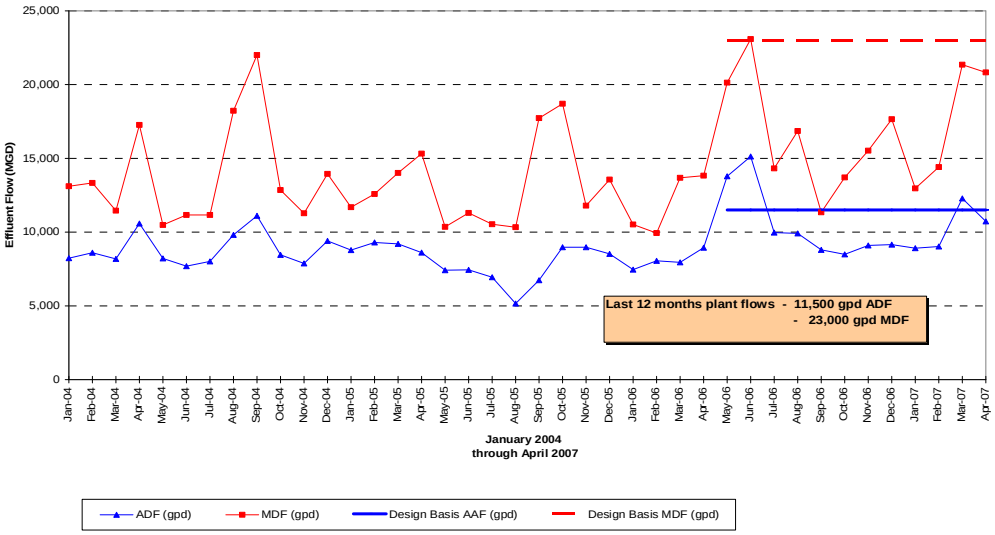


Figure 2-1. Existing WWTP Effluent Flow – January 2004 through April 2007

A list of existing users, together with their water usage for 2005, is listed in Table 2-1.

Table 2-1. Existing Sewer System Users

Name	Address	Water Use 2005 (gpd)
Wayland Business Center (Twenty Wayland)	400 Boston Post Road	551
Russell's Garden Center	397 Boston Post Road	125
Ralph Osmond	364 Boston Post Road	99
Dr. Stacks	311 Boston Post Road	325
Nails/Olga's	310 Boston Post Road	128
204 BPR LLC	304 Boston Post Road	41
Russell House	372 Boston Post Road	81
Wayland Cleaners	298 Boston Post Road	43
KaBloom	298 Boston Post Road	41
Shopping Center	297 Boston Post Road	4,465
State Road Autobody	292R Boston Post Road	93
Somerby's Hair Salon	292 Boston Post Road	446
U.S. Post Office	277 Boston Post Road	261
Dr. Ulbrich	264 Boston Post Road	6
Corner Stone Café	234 Boston Post Road	209
Dr. Carapezza	233 Boston Post Road	446
Wayland Capital Management	231 Boston Post Road	93
Phoenix Veterinary Svc	9 Pelham Island Road	116
Moodz Day Spa & Salon	19 Pelham Island Road	551
Richard Secor	30 Cochituate Road	159
Lew Russell	105 Pelham Island Road	47
Tim Skehan	101 Pelham Island Road	164
Prescott Baston	11 Cochituate Road	106
Thomas Duffy	25 Cochituate Road	75
Pei-Lin	31 Cochituate Road	162
Public Safety Building	38 Cochituate Road	794
267 BPR LLC	267 Boston Post Road	52
Verizon*	244 Boston Post Road	N/A
2005 Flows to WWTP*		**9,679**

***Verizon was not connected in 2005. Assuming Verizon is using their full allocation, the estimated existing water usage is 9,962 gpd.

2.2 Estimated Future Flows

The Wayland Wastewater Management District Commission has allocated capacity to customers who have not connected yet. Additionally, many of the connected customers are not yet using their full allocated capacity. This potential for future flow, including contributions from Twenty Wayland, is indicated in Table 2-2.

Table 2-2. Total Allocated Capacity

Name	Address	Title 5 Capacity (gpd)	Connected
Library	5 Concord Road	500	No
Wayland Commons	Old Sudbury Road	7,200	No
David Starmer	338 Boston Post Road	325	No
David Starmer	336 Boston Post Road	1,200	No
Sovereign Bank	326 Boston Post Road	332	No
Francis Poisson	300 Boston Post Road	342	No
Bank of America	289 Boston Post Road	266	No
Shepard House	274 Boston Post Road	330	No
Shepard Mobil	268 Boston Post Road	400	No
Kaplan, Lenow	13 Pelham Island Road	200	No
Olde Collins Market	21 Cochituate Road	257	No
Wayland Town Building	41 Cochituate Road	3,000	No
Jonathan Buchman	32 Pelham Island Road	880	No
Verizon	244 Boston Post Road	283	No
Russell's Garden Center	397 Boston Post Road	2,923	Yes
Ralph Osmond	364 Boston Post Road	200	Yes
Dr. Stacks	311 Boston Post Road	600	Yes
Nails/Olga's	310 Boston Post Road	215	Yes
204 BPR LLC	304 Boston Post Road	200	Yes
Russell House	372 Boston Post Road	330	Yes
Wayland Cleaners	298 Boston Post Road	150	Yes
KaBloom	298 Boston Post Road	150	Yes
Shopping Center*****	297 Boston Post Road	4,000	Yes
State Road Auto Body	292R Boston Post Road	200	Yes
Somerby's Hair Salon	292 Boston Post Road	800	Yes
U.S. Post Office	277 Boston Post Road	424	Yes
Dr. Ulbrich	264 Boston Post Road	200	Yes
Corner Stone Café	234 Boston Post Road	1,000	Yes
Dr. Carapezza	233 Boston Post Road	600	Yes
Wayland Capital Management	231 Boston Post Road	200	Yes
Phoenix Veterinary Svc	9 Pelham Island Road	300	Yes
Moodz Day Spa & Salon	19 Pelham Island Road	1,000	Yes
Richard Secor	30 Cochituate Road	330	Yes
Lew Russell	105 Pelham Island Road	440	Yes
Tim Skehan	101 Pelham Island Road	440	Yes
Prescott Baston	11 Cochituate Road	440	Yes
Thomas Duffy	25 Cochituate Road	200	Yes
Pei-Lin	31 Cochituate Road	260	Yes
Public Safety Building	38 Cochituate Road	1,100	Yes
267 BPR LLC	267 Boston Post Road	310	Yes
Wayland Business Center (TW)	400 Boston Post Road	45,000	Yes
Total Allocated Capacity		**77,527**	
Total Allocated Capacity (not including TW's Allocation)		**32,527**	

*****Note that based on 2005 water usage records, the shopping center at 297 Boston Post Road is exceeding its allocation by 465 gpd.

The estimated flows for TW, based on the planned mixture of commercial and residential properties, are summarized in Table 2-3. These flows were calculated in accordance with Title 5 and result in a total Title 5 flow of 45,000 gpd to be discharged to the WWTP and an additional 9,900 gpd to be discharged to a new on-site disposal system.

Table 2-3. Wastewater Flows from Twenty Wayland

Wastewater Generation								**Commercial Bldg Area (SF)**
WWTP Connection								
Apt. Pool, Fitness Center	1	LS	@	2000	GPD	=	2,000	-
Restaurants	500	Seats	@	35	GPD/SEAT	=	17,500	15,000
Municipal Bldg Allocation	1	LS	@	3000	GPD	=	3,000	
Cafes, Breakfast Shops	170	Seats	@	35	GPD/SEAT	=	5,950	4,250
Multiple Family Dwelling	150	Bedrooms	@	110	GPD/BEDROOM	=	16,500	
					Subtotal:		**44,950 GPD**	**19,250**
					Call:		**45,000 GPD**	
Connect to Septic System								
Office	10,000	SF	@	75	GPD/1K SF	=	750	10,000
Supermarket	45,000	SF	@	97	GPD/1K SF	=	4,365	45,000
Retail	90,750	SF	@	50	GPD/1K SF	=	4,538	90,750
					Subtotal:		**9,653 GPD**	**145,750**
					Total:		**54,603 GPD**	**165,000**
					Call:		**54,900 GPD**	**165,000**

2.3 Flow Allocation

The March 28, 2006 Development Agreement and the 1999 Memorandum of Agreement regarding the WWTP allocate the maximum daily flow (Title 5 flow) of 65,000 gpd capacity allowed by the 1998 permit as follows: 45,000 gpd to TW and 20,000 gpd to the Town, a 69%/31% split. TW would pay a betterment in accordance with Massachusetts law; thus, applying the 69%/31% flow split, TW would finance 69% of the modified plant construction cost[1] and would be compensated with 69% of the plant's allocated flow capacity.

2.4 Design Flow

In 2006, a draft NPDES permit was issued to the Town for the existing WWTP. The proposed permit does not include a restriction on maximum daily flow and the monthly average was replaced by a 12-month rolling average. These differences are summarized in Table 2-4.

[1] The March 28, 2006 Development Agreement also contains TW's additional agreement to provide a gift of 7% of the total construction cost of the new plant or upgrade up to $175,000.

Table 2-4. Permitted Flow Capacity (existing vs. proposed permit)

	1998 NPDES Permit (governing)	Draft 2006 NPDES Permit
Average Daily Flow (gpd)	52,000 (monthly average)	52,000 (rolling annual average)
Maximum Daily Flow (gpd)	65,000	No limit

This raises the question of what maximum daily flow would be appropriate given a 12-month rolling average flow limitation. Typically, maximum daily flow is at least twice as large as an average annual flow. For example, the TR-16, "Guides for the Design of Wastewater Treatment Works" suggests a peaking factor of three for estimating maximum day flows based on annual average flows in the range of 50,000 gpd. MassDEP, in published guidance for on-site system design, suggests that when water usage data is available, maximum day (or Title 5) flow can be estimated as two times the average water record flow[2]. Finally, the existing plant data, as evident from Figure 2-1, also demonstrates this trend, and accordingly, M&E recommends that a conservative peaking factor of two times average annual flow be used to estimate Title 5 or maximum day flow.

Applying this factor to the 52,000 gpd rolling annual average, the appropriate maximum daily design flow once the proposed permit becomes effective is 104,000 gpd. Applying the same 69%/31% flow split to the increased maximum daily flow increases TW's maximum daily flow capacity from 45,000 gpd to 72,000 gpd and the Town's maximum daily flow capacity from 20,000 gpd to 32,000 gpd. Refer to Table 2-5 for a summary of this revised allocation.

Table 2-5. WWTP Capacity Allocation based on Permitted Capacity

	Max. Daily Flow (1998 Permit)	Percent Allocation	Average Daily Flow (Draft 2006 Permit)	Max. Daily Flow (Draft 2006 permit)
Town	20,000 gpd	31%	16,000 gpd	32,000 gpd
Twenty Wayland	45,000 gpd	69%	36,000 gpd	72,000 gpd
Total	65,000 gpd	100%	52,000 gpd	104,000 gpd

TW's proposed development needs a maximum daily flow capacity of 55,000 gpd. Based on currently committed allocations and usage, the Town needs a maximum daily flow capacity of 33,000 gpd, which is more than their entire allocation based on the analysis presented in Table 2-5. Since TW would have spare capacity at the plant based on the above allocation, they may be able to eliminate their proposed on-site disposal system.

[2] See 310 CMR 15.203(6) and *Guidelines for the Design, Construction, Operation, and Maintenance of Small Wastewater Treatment Facilities with Land Disposal,* April 2004, Section IV.2. page 32.

Since 104,000 gpd of permitted Title 5 capacity is consistent with the 52,000 gpd rolling average flow in the draft NPDES permit, M&E recommends that this design flow basis be used for evaluating the existing and replacement WWTP capacity. Because a conservative peaking factor was used and Title 5 requirements are conservative (typically 20-30% higher than actual maximum daily flows), it is likely that additional capacity may be obtained in the future by documenting any lower than expected flows and re-permitting the connected flow capacity with MassDEP. However, for the current project, M&E recommends the Town and TW employ the simplest permitting approach which would be to maintain the current discharge capacity and defer a capacity expansion to the future.

3.0 EXISTING WWTP DESCRIPTION

The Wayland WWTP is owned by the Town of Wayland and is operated by Aquarion Operating Services, Inc. The WWTP serves a combination of approximately 36 residential homes and commercial developments in the proximity of the project site. A WWTP has been present on the site since 1961. The existing plant was upgraded in the early 1970s (phosphorus removal and multi-media filtration was added to supplement an extended aeration activated sludge process). In the early 1990s UV disinfection was added in lieu of chlorine, but the other unit processes remain the same.

Unit treatment processes include a comminutor, extended aeration activated sludge, influent equalization, multi-media filtration, and ultraviolet (UV) disinfection. Sodium Aluminate is used to control phosphorus. Treated flow is discharged by gravity to a wetland adjacent to the Sudbury River. Sludge from the facility is partially thickened and liquid sludge is trucked off-site for disposal.

In June 2005, a wastewater treatment facility evaluation was conducted for the Town by Aquarion Engineering Services Company. The evaluation concluded that the life cycle of most of the original equipment components has now been exceeded. Over the years several equipment components have been replaced "in-kind". While the plant functions adequately at current flow rates, the capabilities of the existing equipment may not meet the future needs of the Town with respect to hydraulic load and ability to meet more stringent permit requirements[3].

The summary of the existing plant provided below is based on the Aquarion evaluation, Aquarion monthly operating reports subsequent to the evaluation, original design criteria from the 1973 Metcalf & Eddy Operating and Maintenance manual, and M&E's site visit on July 23, 2007.

3.1 Influent Sewers

Current flow is delivered to the plant through a 4-inch force main from downtown businesses and residences. There is also a larger 6-inch force main from the Wayland Business Center but this property is currently unoccupied and due to be demolished as part of the Town Center Project. The influent sewer is flushed twice per year to resuspend sewage that has settled in depressions present in the pipeline. Due to the fact that the small collection system does not allow for a continuous stream of influent, the wastewater often becomes septic which can generate odors.

[3] The June 17, 2005 Aquarion WWTP Evaluation includes the statement: "The operations staff is fairly confident that the discharge standards can be met at a flow of 20,000 to 25,000 gpd". During M&E's July 23, 2007 site visit this concern was repeated, with the understanding that the current plant capacity is limited to the 20,000 to 25,000 gpd range.

3.2 Headworks

The headworks consists of a single “Muffin Monster” comminutor and manual bar rack bypass. The original 7-inch Muffin Monster had a 300,000 gpd unit capacity. It ran 24 hours per day even if there was no influent flow to the WWTP. A new Muffin Monster was installed in September 2005. There are no mechanical screens or grit removal facilities in the headworks. Prior to September 2006, when the first influent sampler was installed, there was no historical data on the influent quality. The plant was designed for the following influent waste characteristics: 204 mg/l 5-day BOD and 185 mg/l TSS.

3.3 Aeration Basin

The single aeration basin is 34 feet long by 19 feet wide by 11 feet deep. It was designed for a detention time of 19.7 hours at average flow and 11.1 hours at sustained peak flow. The aeration headers were replaced within the last 7 years, but the retrievable diffuser piping needs replacement. The basin is almost 50 years old, so its condition is questionable. The single basin design provides no redundancy, making it very difficult to take it off-line for inspection or integrity testing. Since the aeration basin is an essential part of the treatment process, the entire plant flow would either have to be hauled off-site or a replacement treatment process would have to be supplied on a temporary basis. Note that any efforts to bypass flow for aeration tank inspection or construction of any improvements will get significantly more complicated once the influent flows increase due to the Wayland Common development which is scheduled for completion in the fall of 2007. These complications will require a significant investment which may approach the replacement cost of new tankage. Other problems with the existing aeration tankage includes its relatively shallow depth (modern tanks are deeper for improved energy efficiency), and the below grade design of the access walkways to the aeration diffusers and headworks equipment suggest that the confined space entry requirements of OSHA should be applied.

The 6-inch gravity line from the aeration basin to the clarifier has often surcharged in the past because of a partially plugged line, resulting in high level alarms in the aeration basin. Many of the monthly operating reports cite its need to be repaired so as not to limit hydraulic capacity. This problem may be improved by



Figure 3-1. Aeration Basin and Sludge Holding Tank

better screening at the headworks; however, with the relatively large pipe (6") and current low flows, low velocities are occurring in the pipeline and this is conducive to solids deposition. Accumulated solids in the pipeline are a likely cause of frequent plugging. Note that this problem may not be improved in the future if the plant were to stay in service as the original plant was designed for significantly higher peak flows[4].

Two new constant-speed Kaeser blowers rated to provide 150 standard cubic feet per minute (scfm) of air at 2 hp were installed in 2004. Their capacity (one operating/one standby) is similar to the design criteria of the original blowers (125-200 cfm). This equipment should be considered for reuse in any new facility.



Figure 3-2. Blowers

3.4 Secondary Clarifier

The secondary clarifier is a 24-foot diameter concrete tank with about a 10-foot side water depth (12 feet according to original design criteria). It was designed for a detention period of 15 hours at average flow and an overflow rate of 144 gal/sq ft/day at average flow. The mechanical equipment is most likely original to the plant and needs replacement. According to the June 2005 Aquarion report, the ploughs may need to be repaired (since there were been problems with inconsistent sludge), the beach for collecting scum needs replacement, and the weirs are not level and need readjustment and/or replacement. There have been concerns about fatigued bearings in the clarifier drive unit. The single unit design provides for no redundancy. If it were to fail, the plant would not meet permit requirements. The condition of the 34-year-old structure is uncertain, and similar to the aeration basin, the secondary clarifier is difficult to take out of service to perform a detailed inspection and condition assessment.

[4] Approximately 300,000 gpd for the combined influent and return sludge





Figure 3-3. Secondary Clarifier

3.5 RAS Pumps/Sludge Storage Tank

Sludge from the secondary clarifier is, by adjusting the position of a manual valve, either pumped to the aeration basin by the return activated sludge (RAS) pumps or wasted to the sludge storage tank. There are no flow controls on the RAS pumps, which are normally set for 25-30 gpm. One of the pumps needs to be rebuilt. The chart recorder for the pumps was replaced in 2005. The lower air manifold supports in the sludge storage tank need replacing.

3.6 Chemical Feed

Sodium aluminate is added to the aeration basin for phosphorus removal. There are no means to regulate the chemical dosage to the aeration basin and the sodium aluminate is “dripped” to the aeration basin 24 hours per day. The chemical storage tanks are not heat traced and therefore cannot be used in the winter. There are no secondary containment facilities for the sodium aluminate drums that are trucked to the site.

3.7 Equalization

The old surge tank and chamber provide approximately 13,000 gallons of equalization capacity between the secondary clarifier and multi-media filters, which provides approximately 6 hours of detention at the design flow of 52,000 gpd. According to the Aquarion report, the mercury level probes are prone to freezing and will require installation of a heat lamp and housing in the future. Additionally, the cinder blocks in the surge tank have been compromised structurally as a result of freeze-thaw cycles.

3.8 Multi-Media Filtration

The effluent from the secondary clarifier is pumped to a multi-media filtration unit consisting of 4.5 feet of mixed media (ceramic, stone, sand, and carbon). A backwash scouring system was added on after the construction of the filters. The piping, which showed signs of heavy scaling, was re-plumbed in June 2005. According to the Aquarion report it is likely that this unit operation will require replacement.

3.9 Ultraviolet (UV) Disinfection

There are two UV systems, each with 12 tubes per system. Since installed, the system has consistently met the 200 colonies/100 ml standard, but flows have been significantly less than the NPDES limits. The design standards of this system are not clear from the report. New UV bulbs and tubes, which had not been changed out in 5 years, were installed in the upper unit in March 2007 and there were plans to change out the bulbs and tubes in the lower unit. A significant issue with the UV system is that the original equipment manufacturer, Ideal Horizons, is no longer in business and the availability of spare parts and replacement bulbs may get increasingly difficult if not impossible to obtain.

A new magnetic flow meter for final effluent monitoring was installed in April 2006. Previous to that the differential pressure meter and manifold would give false readings due to trapped air and solids in the 6-inch discharge pipe.

3.10 Buildings

The 34-year-old buildings have had several issues over the years including poor ventilation systems, lack of heat, a leaking conduit, and leaking flat roofs.



Figure 3-4. Wayland WWTP Buildings

3.11 Summary

Based on the information presented above, the existing WWTP appears to be at the end of its useful life. There is little salvage value. There is no redundancy of the key unit processes. More stringent permit requirements will also require a technology upgrade. With the flow increase from Wayland Common due this fall, the plant will be close to the limit of its capacity as defined by the observations of the plant operator. Based on these considerations, M&E recommends that a new plant be constructed adjacent to the existing plant be and to get it online as quickly as possible.

4.0 NPDES PERMIT REQUIREMENTS

The Sudbury River is designated as "Scenic" under the Wild and Scenic Rivers Act. A portion of the Sudbury River (upstream in Hopkinton) is designated as an Outstanding Resource Water; the reach of the river in the immediate project vicinity is a Class B, High Quality Water. The Sudbury River is listed as "impaired" in the *Massachusetts Year 2004 Integrated List of Waters,* formerly referred to as the 303(d) list; water quality impairments are attributed to metals. Given this classification of the river, the following sections summarize the draft requirements of the latest NPDES permit revision and available data on the current levels of metals in the Wayland water supply which would ultimately be included in the effluent discharge from the Wayland WWTP.

4.1 Draft NPDES Permit

The 2006 draft NPDES permit included two sets of limits: one set for the current discharge to the wetlands and a second set of limits for a relocated discharge to the river. Both sets of limits are identical for BOD, TSS, fecal coliforms, and total phosphorus. The only difference is that the wetlands discharge includes microgram per liter limits on aluminum, copper, and lead, and a chronic effluent toxicity NOEC (no observed effect concentration) using 100% effluent (i.e. no dilution).

The draft permit limits are summarized in Table 4-1. Permit limits applicable to the existing wetlands discharge location are shaded.

Table 4-1 Draft NPDES Permit Summary

	Effluent Limits		
Parameter	**Average Monthly**	**Average Weekly**	**Maximum Daily**
Flow	0.052 MGD		Report
BOD_5	30 mg/L	45 mg/L	Report
TSS	30 mg/L	45 mg/L	Report
Fecal Coliform	200 cfu/100 ml		400 cfu/100 ml
Total P (April – October)	0.2 mg/L		
Total P (Nov – March)	0.5 mg/L		
Aluminum	87 ug/L		750 ug/L
Copper	9.2 ug/L		13.7 ug/L
Lead	3.1 ug/L		79.6 ug/L
Whole Effluent Toxicity	Acute LC_{50} ≥ 100%, Chronic C-NOEC ≥100%		

There are two significant compliance issues created by the new wetlands permit:

(1) Metal limits in the low ppb range are generally beyond the control of conventional and even beyond the control of advanced wastewater treatment due to the very dilute concentrations. These dilute metal concentrations are likely to pass unaffected through the treatment process, making compliance with NPDES permit limits mainly a function of the influent concentration.

(2) A chronic toxicity requirement in 100% wastewater effluent is also a potential problem. This test measures differences in the reproductive rate of test organisms in effluent and in an idealized (control) water sample. No observable impact is allowable. Considering that trace metal levels and other factors can influence chronic toxicity measurements, long term compliance may be not be achievable.

4.2 Metals in Wayland Town Water

In the absence of industrial activity, the primary influence on the concentration of metals in domestic wastewater is typically metals levels in the water supply. Low concentrations of metals can occur in a municipal water supply due to leaching from household and water distribution piping. These low concentrations may be acceptable in terms of safe drinking water requirements yet may not be acceptable per water quality criteria. The net result is a difficult situation for achieving NPDES permit compliance as the choice of treatment technology is not likely to make a significant difference in whether or not there is a pending compliance issue due to the small impact of treatment at such low concentrations. Thus, depending on the historical metals levels as measured in the wastewater or in the Town's water supply, the only option for compliance may be to re-route the flow directly to the river or consider a discharge to groundwater. As indicated in Table 4-2, a review of a sampling of the Wayland Water Department's Annual Consumer Reports on the Quality of Tap Water indicates that lead may or may not be a compliance issue but copper would most likely be a compliance issue for discharge to the wetlands. In December 2005, Aquarion ran a test on the WWTP effluent for copper and the result was 130 ug/l.

Table 4-2. Lead/Copper Data for Wayland Town Water

Annual Water Quality Report Date	Copper (ppb / ug/L)			Lead (ppb / ug/L)	
	Source Water	Distribution System	NPDES Permit	Distribution System	NPDES Permit
1999	< 200	280 – 6,600	Average Monthly, 9.2; Maximum Daily, 13.7	-	Average Monthly, 3.1; Maximum Daily, 79.6
2000	ND - 360	21 out of 70 sites > action limit (1300)		2 out of 70 sites > action limit (15)	
2001	-	8 out of 66 sites > action limit (1300)		All 66 sites tested < action limit (15)	
2003	-	2 out of 39 sites > action limit (1300)		All 39 sites tested < action limit (15)	
2005	-	3 out of 34 sites > action limit (1300)		2 out of 34 sites > action limit (15)	
2006	560 - 980	-		-	

An alternative to a wetlands or river discharge is a groundwater discharge. Based on our past experience with groundwater discharge permits, we would anticipate that the discharge standards for BOD, TSS, and fecal coliform discharge would be similar to those proposed in the draft permit. There would likely be no requirements for phosphorus (which could result in savings on chemical and sludge disposal costs) or any limits on trace metals, but a total nitrogen requirement of less than 10 mg/l would apply due to the fact that the beds would be located in Zone II of the Baldwin Pond Wellfield.

The options for discharge of wastewater effluent to the river via a new outfall and to groundwater are explored further in the Section 5.

5.0 EFFLUENT DISPOSAL

The location of the existing WWTP and outfall is shown in Figure 5-1. As indicated in Section 4, the NPDES permit metal and chronic toxicity limits for discharge to the wetlands are stringent. Alternatives to the existing wetlands outfall may be necessary. This section explores two other options for wastewater effluent disposal: 1) constructing a new outfall to reroute the flow directly to the Sudbury River, and 2) groundwater discharge; and their permitting implications.

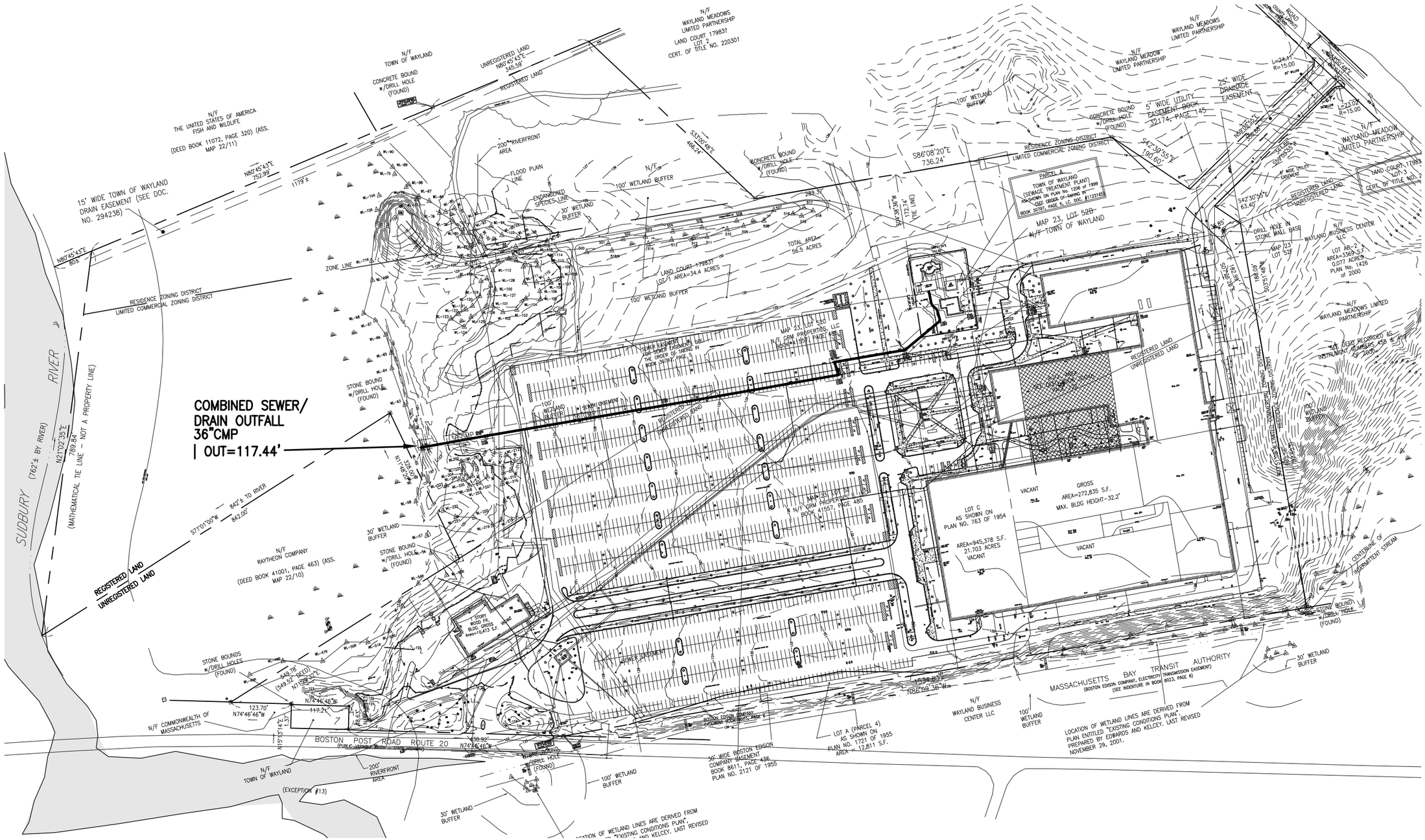
5.1 Extension of Outfall to Sudbury River

Due to the distance from the river and breadth of wetlands that must be crossed, altering the outfall location is likely to be a major permitting and engineering challenge. The Town would need to obtain an easement or take land from TW to cross their property. The best route to the river is possibly along the Route 20 right-of-way, but this too will present permitting and scheduling issues. A conceptual route for an outfall to the river is indicated in Figure 5-2. The conceptual force main is approximately 2220 feet long. While the survey data available to M&E at this time is not accurate enough to determine the extent of the wetlands near the intersection of Route 20 and the Sudbury River, it is probable that a force main route can be selected that minimizes wetland impacts, such that the altered area does not exceed 50 linear feet of Inland Bank or 5,000 square feet of bordering vegetated wetlands (BVW).

5.2 Subsurface Disposal

Subsurface disposal systems are most often associated with septic systems that serve individual homes or businesses. These systems are commonly used to dispose of wastewater that has undergone rudimentary treatment in a septic tank. Residential or commercial complexes have, in recent years, constructed subsurface systems to dispose of effluents from septic tanks or from secondary treatment facilities. The degree of pretreatment, rate of application, and size of infiltration area are engineered during design to achieve project objectives in a cost-effective manner. Typical project goals include minimizing system size, optimizing final water quality, and maintaining the aesthetic values of the site to the extent possible. Effluent from a wastewater treatment plant has experienced a higher level of pretreatment and therefore can be applied to the land at a higher rate than wastewater that has not been treated (such as to a septic system).

The site characteristics that must be evaluated to determine suitability for subsurface disposal are stratigraphy, infiltration rate, and extent of groundwater mounding under projected operating conditions.



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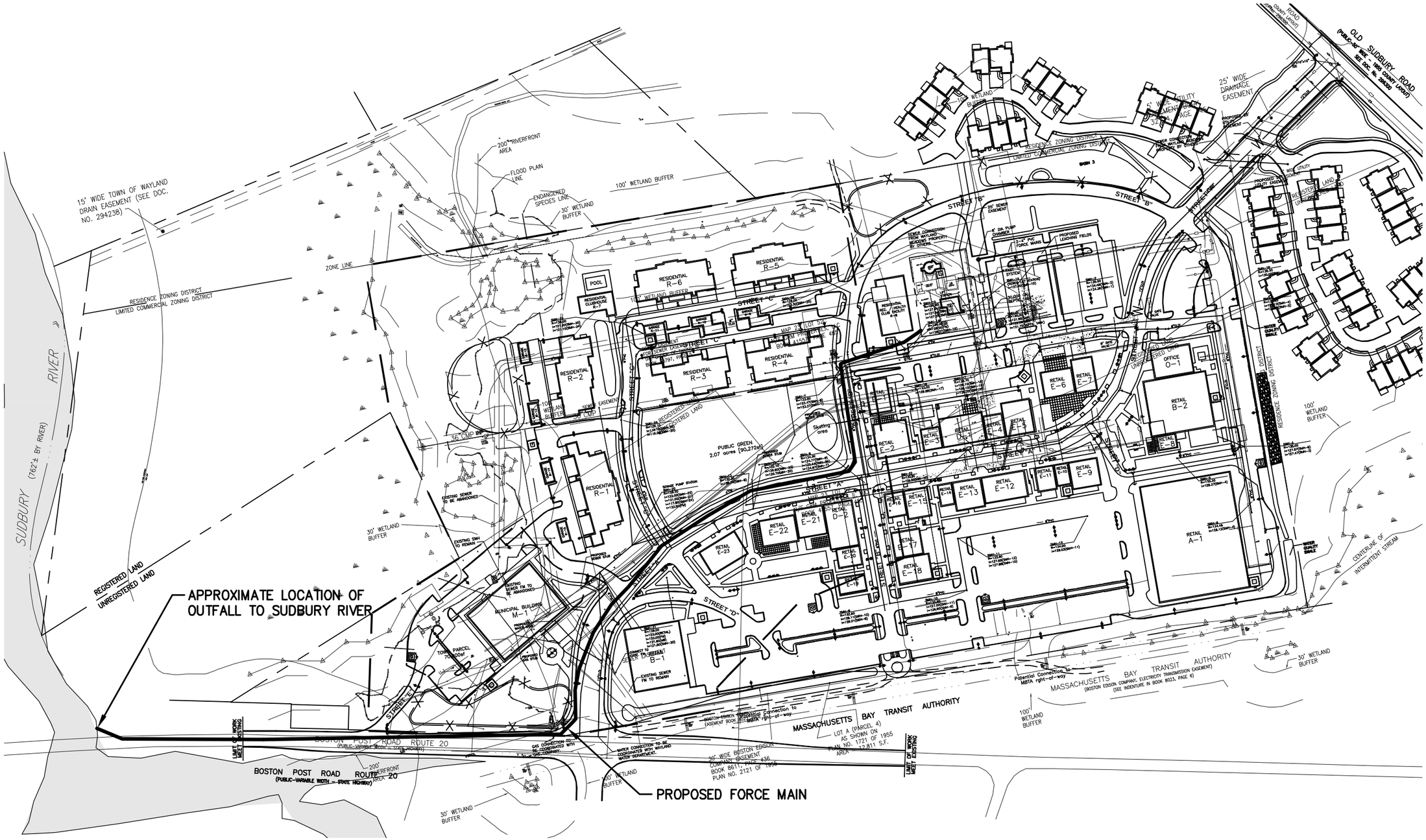
METCALF & EDDY | AECOM

TWENTY WAYLAND

WAYLAND TOWN CENTER PROJECT

EXISTING DISCHARGE TO WETLANDS

SCALE: AS NOTED | DATE: AUG 2007 | FIG 5-1



ANSI B – 3-8-05

METCALF & EDDY | AECOM

TWENTY WAYLAND

WAYLAND TOWN CENTER PROJECT

OUTFALL TO SUDBURY RIVER

SCALE: AS NOTED | DATE: AUG 2007 | FIG 5-2

Stratigraphy. Sandy or gravelly soils that contain less than about 10 percent fine particles (silt or clay) typically have moderate to high permeabilities. As the content of the fine particles rises above 10 percent, permeability generally declines. When the amount of fine particles reaches 25 percent or more, the soils will generally be poorly permeable since the pores between the larger particles are mostly filled by finer particles.

Infiltration Rate. The required infiltration area depends on the infiltration rate. Infiltration tests will need to be conducted to confirm measured rates at any proposed site for groundwater discharge. For other projects in Massachusetts, M&E has obtained MassDEP approval using a hydraulic loading rate of 5 gpd/sf for groundwater disposal of highly treated effluent. Based on this loading rate, a subsurface system of less than 21,000 square feet would be needed.

Mounding. Groundwater mounding will occur beneath the subsurface disposal system. The extent of the mounding will depend on the infiltration rate, the permeability and thickness of the soils beneath the site, the depth to groundwater, and the proximity of discharge areas for groundwater. The depth to groundwater at the site of a subsurface disposal system should be a minimum of 10 feet.

Conclusion. Assuming favorable soil conditions and adequate depth to groundwater, a subsurface system may be achievable for the 57-acre site. To confirm feasibility, it is recommended that field explorations (borings and wells), water level monitoring, infiltration tests, and permeability tests be performed and that a groundwater flow model be developed to predict the effluent flow path and to confirm that it does not interfere with the existing solvent plume. If the Town is interested in exploring this option further, they should speak to TW. Negotiations would be required between the Town and TW regarding the property and environmental constraints.

5.3 Evaluation of Required Permits for Three Disposal Options

M&E has prepared an evaluation of the permits required and approximate review time required for each disposal option:

- Discharge to the Sudbury River under existing draft NPDES permit via a new outfall
- Discharge to groundwater via new groundwater discharge permit
- Continue discharge to wetland under existing draft NPDES permit

The evaluation assumes that the new WWTP would be constructed entirely within an upland area, outside wetland resource areas, floodplains, or rare species habitat. Should the location of the WWTP be moved and encroach on such resources/habitat, additional permitting effort may be required. The evaluation for the new outfall pipe assumes that an alignment can be identified which would minimize wetland impacts, such that the altered area does not exceed 50 linear feet of Inland Bank or 5,000 square

feet of Bordering Vegetated Wetlands (BVW). If these thresholds are exceeded, then additional permits may be required, possibly including a 401 Water Quality Certification from MassDEP and/or a Variance from the MA Wetlands Protection Act. As these approvals can be difficult, and require considerable time to obtain, the best approach is to identify an alignment which minimizes wetland impacts to the maximum extent practicable.

The three scenarios are presented in the attached Table 5-1.

TABLE 5-1. ANTICIPATED PERMITS LISTED BY DISPOSAL OPTION
WAYLAND TOWN CENTER - WWTP

Disposal Option	Permits Required	Degree of Difficulty	Approximate Time Required for Agency Review (does not include time to prepare application)	Commentary
Construct new WWTP and discharge to the Sudbury River via a new outfall, as authorized under existing NPDES permit	NPDES Permit MA0039853 USEPA and MassDEP	Moderate	2-3 months (coordination with EPA and MassDEP) Note: This time frame assumes that EPA and MassDEP are agreeable to discharge from a new WWTP under the existing permit.	The existing draft NPDES permit allows for discharge to the river. The accompanying Fact Sheet recognizes that "during the term of the reissued permit, the Town may upgrade their WWTP and/or choose to relocate the discharge (from the wetland) to the Sudbury River. In the event that the Town decides to relocate their outfall to the river during the term of the permit, a second set of limits has been included in the permit." The permittee is required to notify both EPA and MassDEP 60 days prior to commencing discharge to the Sudbury River. However, if the town decides to discharge to the Sudbury River, the draft NPDES permit does not authorize any changes in the discharge by adding more pollutants (i.e. additional parameters) or increasing the discharge to the Sudbury River.
	Chapter 91 Waterways License MassDEP	Moderate	9-10 months	The structural alteration and/or fill that would result from the construction and placement of a new outfall on the Sudbury River will require a Chapter 91 License, falling under Waterways jurisdiction as a non-tidal navigable river/stream on which public funds have been expended for stream clearance, channel improvement, or any form of flood control or prevention work. The Chapter 91 License application must provide DEP with the proposed project location, type of project, project plans, information about other applicable state permits, a certification that the project does not violate municipal zoning, and notification to the municipal planning board.
	Order of Conditions (NOI) Wayland Con Com and MassDEP	Moderate	2-4 months	A new outfall to the Sudbury River will require construction/fill within 'Inland Bank' and 'Land Under Water Bodies and Waterways'. Additionally, temporary (and/or permanent) impacts would likely occur within Bordering Vegetated Wetlands and potentially other resource areas regulated by the MA Wetlands Protection Act and/or the Town of Wayland Wetland By-law. It is assumed that an outfall alignment can be identified which will result in impacts of less than 50 linear feet of Inland Bank and less than 5,000 sf of BVW; if this is not possible, additional permitting will be more onerous. At least one public hearing will be conducted by the Wayland Conservation Commission.
	Section 404/10 Programmatic General Permit (PGP) US Army Corps of Engineers	Moderate	3-4 months	Constructing a new outfall to the Sudbury River will require work within a "water of the US", and thus is subject to review under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act. It is anticipated that the project will be reviewed as a Category II PGP. The USACE will coordinate with other federal agencies, including EPA, USFWS, and the National Park Service (because of the Sudbury River's designation as a '"Scenic" under the Wild and Scenic Rivers Act) during review of the application. It is anticipated that USACE will place restrictions on the type/methods of construction, and may also restrict the construction to time periods of low flow (such as July 1 to October 1).
	Massachusetts Endangered Species Act (MESA) Review NHESP	Minor	2-3 months	The Sudbury River corridor in vicinity of project is designated as Priority Habitat for State-Protected Rare Species and Estimated Habitat for Rare Wildlife for four wading/swimming birds protected under the MA Endangered Species Act and the MA Wetlands Protection Act. An application must be submitted to demonstrate no impacts to endangered species habitat that would result in a "taking", or loss, of any individuals in these endangered populations.
	Application for Permit to Access State Highway MassHighway Department	Moderate	1-4 months	The effluent outfall to the river would likely be constructed within the shoulder (right-of-way) and then cross under Route 20, a state highway. An application to MassHighway must be submitted to demonstrate that the construction activity would not jeopardize traffic safety or adversely affect the structural integrity of the roadway. The MassHighway review process is iterative, and may extend several months until concurrence on design means/methods is achieved.

Disposal Option	Permits Required	Degree of Difficulty	Approximate Time Required for Agency Review (does not include time to prepare application)	Commentary
Construct new WWTP and discharge to groundwater via a new GW discharge permit	BRP WP 06 (Major Groundwater Discharge Permit) MassDEP	Extensive	9-14 months	The applicant presently does not have authorization to discharge effluent to groundwater. Any discharge of sanitary sewage to groundwater in excess of 150,000 gpd, or any discharge to groundwater from a facility that provides treatment of sewage more advanced than secondary treatment (which includes but is not limited to nitrification/denitrification, and/or phosphorus removal) requires a Major Groundwater Discharge Permit. Thus, an application must be submitted to MassDEP for authorization. The application would include plans and specifications for the effluent disposal area, a hydrogeologic study of the disposal site and its surroundings, and a groundwater monitoring plan. DEP cannot complete technical review of permit until MEPA process has been concluded. Following an initial 30 day administrative review, MassDEP has a Technical Review period of 200 days. If the applicant submits additional materials in response to MassDEP's review, MassDEP can add a second Technical Review Period of 200 more days. The review also provides for a 30 day public notice period. If no comments are received, the permit is effective at the end of the public comment period. This permit has filing fees of $13,875 and annual compliance fees of $12,500.
Construct new WWTP and continue discharge to wetland authorized under existing NPDES permit	NPDES Permit MA0039853 USEPA and MassDEP	Moderate	2-3 months (coordination with EPA and MassDEP) Note: This scenario assumes that EPA and MassDEP are agreeable to discharge from a new WWTP under the existing permit.	The existing draft NPDES permit allows for discharge to the wetland. The accompanying Fact Sheet recognizes that "during the term of the reissued permit, the Town may upgrade their WWTP and/or choose to relocate the discharge to the Sudbury River. If, and until the outfall is relocated to the river, the (more stringent) limits appearing in Part I.A.1 will be effective." Thus, upgrading the existing WWTP and utilizing the existing discharge is authorized by the existing permit. However, preliminary engineering review suggests that it may not be possible for a new/upgraded WWTP to meet the extremely stringent effluent limits for aluminum, copper, and lead associated with a wetland discharge (because no dilution factor can be applied). Thus, the long-term solution appears to be either a river discharge or a groundwater discharge. If the applicant constructs a new WWTP and elects to use the existing wetland discharge on an interim basis until a groundwater discharge is permitted and constructed, it is recommended that a coordination meeting be held with EPA and MassDEP. The permit's compliance schedule appears to allow up to 4 years from the effective date for the discharge to comply with permit limits for phosphorous, copper, lead, and aluminum.

6.0 NEW WWTP

Based on an evaluation of the existing plant as discussed in Section 3, it is recommended that a new plant that incorporates an advanced wastewater treatment process that can meet the projected effluent requirements be constructed. We have based this alternative on Membrane Bioreactor (MBR) technology. Although MBR equipment is more expensive than many advanced wastewater treatment technologies, MBR installations have a smaller footprint and do not require as extensive concrete work as the other technologies, which can result in a lower overall capital cost. Note that in subsequent engineering phases, additional engineering studies can be performed to compare alternative technologies and treatment plant designs and finalize selection of the treatment technology. The following paragraphs further outline M&E's initial process recommendations.

The new WWTP would consist of a wastewater treatment system based on Membrane Bioreactor (MBR) technology with an initial design treatment capacity of 52,000 gpd average and 104,000 gpd maximum day and effluent criteria to meet the NPDES permit as outlined in Section 4. The new facility would be located next to the existing WWTP. Unit treatment processes at the proposed WWTP would include fine screening, pre-MBR equalization, MBR biological treatment with nutrient removal, and UV disinfection. Treatment of the liquid and solids streams are shown in the conceptual process flow (Figure 6-1). Solids treatment processes would include sludge pumping and sludge holding. Ancillary facilities include odor control and chemical feed systems. Further details on each unit process are provided in the following paragraphs:

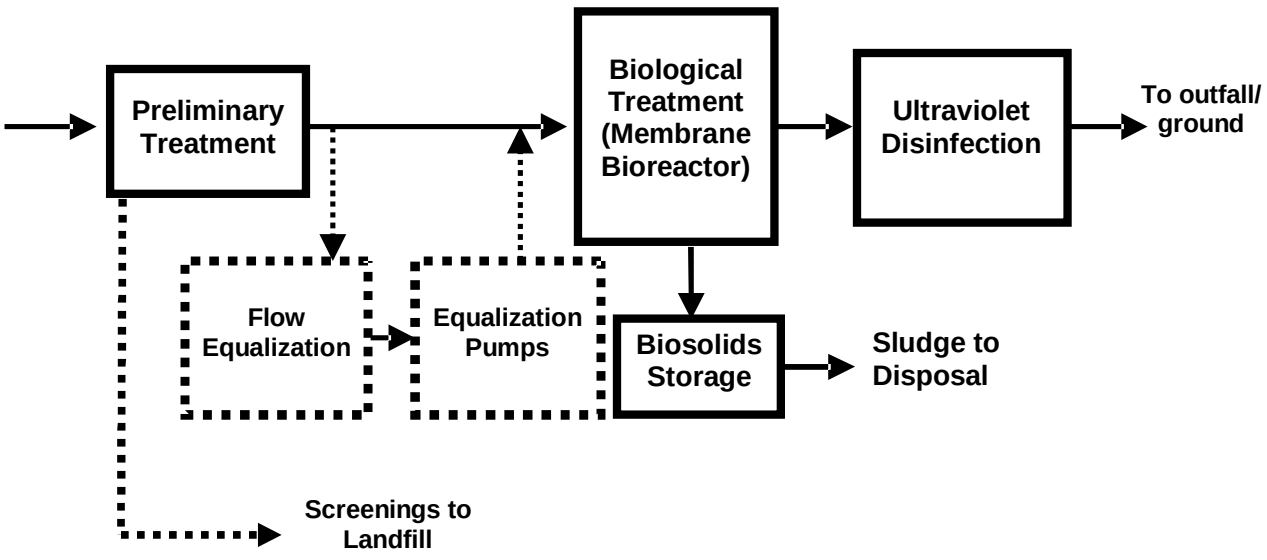


Figure 6-1 Proposed Treatment Block Diagram

6.1 Liquid Treatment Processes Description

Liquid phase treatment processes would be provided as follows:

Screening. Screening would be the first step in the treatment process. A fine screen, with approximately 1 to 3 mm openings depending on the membrane manufacturer, would be provided. Either a rotary drum or traveling band type screen is recommended, with screenings further processed by a compactor/ washer.

Grit Removal. This is a typical unit process at wastewater treatment plants as the presence of grit (sand) can cause excessive wear on downstream mechanical equipment. However, for small plants with short collection systems that do not include stormwater, sources of grit are very limited, and a separate grit removal process is sometimes omitted. The existing plant, for example, does not include a grit removal step. M&E recommends that this issue be further examined during subsequent design phases and an allowance for grit removal appropriate to the project needs be included[5].

Pre-MBR Equalization. An equalization tank would be provided to receive the highly variable system discharges from the collection system and provide a continuous flow to the MBRs throughout the day. Aeration would be provided in the equalization tank to provide mixing and discourage solids settling.

MBR Biological Treatment. Membrane Bioreactors combine a single sludge biological treatment system with integrated membranes immersed directly in the process tanks. Wastewater enters a biological reactor operating at a high mixed liquor suspended solids (MLSS) concentration (8,000-12,000 mg/L). The wastewater is purified by the bacteria in the MLSS and the purified water flows by gravity or is drawn by vacuum through a membrane. The membranes replace the conventional clarification and tertiary filtration system by using membrane separation of the biomass and the treated effluent. With a nominal membrane pore size ranging from 0.04 to 0.4 microns, and an effective pore size of 0.035 to 0.1 microns, the membranes operate at the nexus of ultrafiltration and microfiltration, thus providing an effective barrier to bacteria, cysts and some viruses (Figure 6-2).

[5] Options could include a trough in the screening channel for grit accumulation and manual removal; sumps in the process tankage designed to facilitate annual cleaning; or a dedicated unit process such as a vortex system or aerated grit chamber.

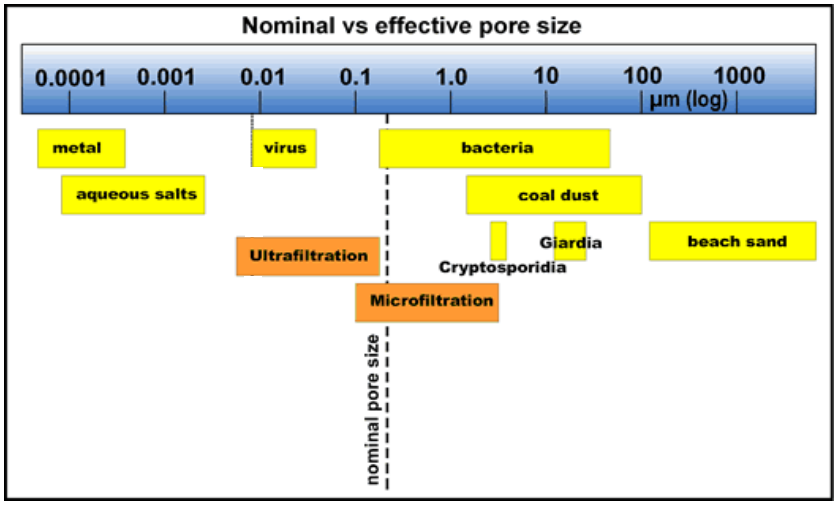


Figure 6-2. Size distribution of particles and pore size range for membranes used in MBR systems

The relatively high mixed liquor concentrations in the membrane bioreactors result in reduced footprints while providing a high effluent quality. Lower sludge production is also typical of membrane bioreactor systems, as long solids retention times are achieved, particularly for smaller systems. The combination of operating conditions provides a high degree of biological system redundancy without demanding much operator attention. This creates a reliable treatment system, whose effluent would be compatible with drip irrigation systems, and phasing of influent flow and wastewater loadings.

Membranes require continuous air scour to avoid accumulation of solids on the membrane that would temporarily plug the membrane and reduce the flow of treated water. Periodic chemical cleaning is also required, as biological and chemical fouling of the membranes occurs over time. Eventually, the membranes lose their permeability and must be replaced. The attributes of the membrane bioreactor system, such as the operating mixed liquor solids levels, the air scour rate (and thus energy requirements), chemical cleaning frequency, and susceptibility to fouling and wear are dependent on the properties of the membrane, which differ between membrane manufacturers.

Another manufacturer-specific attribute of MBRs are the screening requirements for the influent wastewater, and the membrane's tolerance to long term accumulation of substances such as hair, non-biodegradable plastics, etc, which can form mats and block or damage the membranes. The spacing of the screens and the need to screen the mixed liquor (internal screening recirculation) in some applications, affects both capital expenditure and operating costs, necessitating that it be considered in detail in the analysis.

The range of flowrates that can be permeated through the membranes (membrane flux) is limited by factors such as pore size, maximum operating pressure and temperature. This results in the need to provide equalization of the influent flow. The amount of equalization required for each membrane type depends on that membranes' range of allowable flux rates and thus hydraulic peaking factors. The equalization volume would thus vary between designs as would the level of membrane redundancy, in

order to be able to take membranes off-line for cleaning. In summary, the major differences between the MBR processes include: operating MLSS concentrations, scour air requirements, flow equalization requirements, membrane configuration and pore size, membrane chemical cleaning frequency and chemicals, and membrane life expectancy.

The MBR process uses an anoxic zone, an aeration zone, and a membrane cassette zone where the membranes are immersed as shown in Figure 6-3.

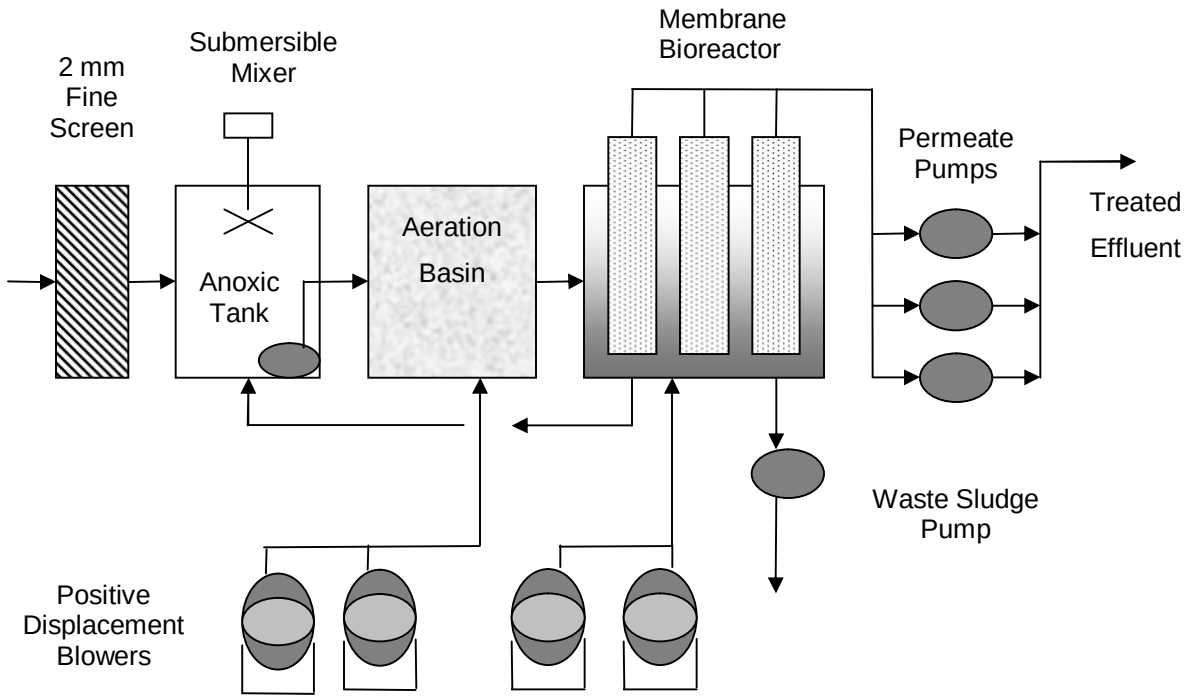


Figure 6-3. Typical MBR Process Flow Diagram

Screened influent wastewater is directed to the anoxic tank. Submersible mixers keep contents of the anoxic basin in suspension. In order to keep the buildup of solids within reasonable levels in the MBR tanks, flow is generally pumped to or from the MBR tanks at 300% to 400% of the influent flowrate. Figure 6-3 shows a typical configuration where flow is pumped from the anoxic basin to the aeration and MBR tanks and excess flow is returned by gravity back to the anoxic tank.

The aeration basin is aerated using fixed fine bubble diffusers, then the mixed liquor flows by gravity into the membrane cassette tank. Positive displacement blowers deliver air to diffusers in the aeration basin as well as the membrane cassette tanks. Internal recycle flows by gravity from the bioreactor to the anoxic basin.

Permeate pumps pull a vacuum on the membranes which causes the mixed liquor to be pulled toward the membranes. Suspended solids are rejected by the membrane because of their size and treated effluent is

pumped out (permeated) through the membrane. A programmable logic controller (PLC) is linked to all of the pumps and blowers. This allows an operator to program various set points for the system to match flow conditions.

In addition to the air scour, sludge or biofilm build up on the membranes is minimized by programming a "relax mode" into the PLC. Relax mode occurs when the permeate vacuum is turned off and the scour aeration continues to brush the membranes. This relaxation of the membranes typically occurs 1 out of every 10 to 15 minutes, and can be followed by a backpulse cycle.

In order to overcome fouling of the membranes, chemical cleanings are required approximately every six months. They require taking a membrane cassette tank offline and would thus occur during non peak flows. Different chemical cleaning options are available depending on the nature of the foulant. The most common approach would be to pump a dilute hypochlorite solution (~1%) into the permeate piping and in a reverse flow direction, back into the membrane cassette tank being cleaned, allowing it to soak for several hours. The permeate pumps are then used to pull the chemical cleaning solution through the system. The effluent would temporarily be directed to a reject tank that would be bled back to the plant for future processing.

The MBR process lends itself to the stepped increases in flow, without concerns about degradation of performance. A nutrient removal process designed around any of the membranes would be able to provide equivalent treatment performance, as summarized in Table 6-1.

Table 6-1. Expected Performance for a Membrane Bioreactor Plant

Parameter	Average Influent Concentrations	Effluent Performance
BOD	250 mg/L	< 5 mg/L
TSS	250 mg/L	< 1 mg/L
TKN	44 mg/L	< 3 mgN/L
TP	10 mg/L	< 7 mgP/L*
NO_3	- mg/L	< 7 mgN/L
Minimum Design Temp.	12°C	-

*TP levels of down to 0.2 mg/L can be achieved through chemical addition to the MBR although this may not be a design goal for the Wayland WWTP

UV Disinfection. A low-pressure, high-intensity UV system would also be located in the new MBR support building and would receive membrane permeate. The UV system would be sized for a transmittance of 70% and effluent fecal coliforms of 200 counts/100 ml. Redundancy would be provided by a second (standby) unit installed in series with the first. Effluent from the UV system would be discharged to the ground or to the Sudbury River outfall.

6.2 Solids Treatment Processes Description

Solids phase treatment processes would be provided as follows:

WSL Pumping. Waste activated sludge (WSL) would be discharged from the membrane bioreactor to the WSL storage tank.

WSL Storage. The WSL storage tank would be concrete. Approximately seven days of storage would be provided under normal operating conditions and storage over the weekend would be provided for peak-week sludge production. To keep the WSL sludge fresh and to minimize septic odors, the WSL tank would be aerated using fine-bubble diffuser assemblies installed on the bottom of the tank and dedicated WSL tank blowers. It is estimated that the sludge can be thickened to 1.5% by turning off the air, letting the sludge settle by gravity, and decanting the liquid, similar to current practice at the plant.

WSL Thickening and Thickened Sludge Storage. An evaluation of the cost effectiveness of sludge thickening is provided in this section. The current practice for disposal of WWTP sludge is to haul liquid sludge to the Wayland-Sudbury Septage Treatment Facility, which is just down the street at 490 Boston Post Road, Wayland, MA. According to Aquarion, the annual disposal cost of the sludge is approximately $90 per 1000 gallons of sludge. At a 52,000 gpd average daily flow, it is estimated that the plant would generate approximately 85 pounds per day or 251,000 gallons per year of 1.5% waste activated sludge, which results in a cost of $22,600 dollars per year at the $90/1000 gallon rate.

The alternative to hauling liquid sludge to disposal is to thicken the sludge on site to a solids concentration of between 4% and 6% with a screw thickener or rotary drum thickener, thereby reducing the quantities of sludge required for disposal. This would involve a building to house the sludge thickening equipment, a thickened sludge storage tank, and a polymer system. Additionally, odor control would be expanded to the thickened sludge building and thickened sludge storage tank. In this scenario, WSL sludge would be pumped from the WSL storage tank using a dedicated sludge thickener feed pump. WSL sludge (0.75 percent to 1 percent) would be pumped to a sludge thickener. To condition the sludge prior to thickening, polymer would be added. Waste liquid from the thickener would be routed to the plant drain. The thickened sludge would flow by gravity into a thickened sludge storage tank, which would be constructed of concrete and sloped to a sump to facilitate withdrawal of thickened sludge. The thickened sludge pump would discharge thickened sludge to a sludge hauling truck for ultimate off-site disposal. The loading area would be equipped with a sump and drain valve, which would be piped to a recycle pump station.

It is estimated that the installed facilities as described above would have a capital cost of approximately $290,000. Assuming that the sludge could be thickened to 6%, sludge quantities could be reduced to approximately 64,000 gallons per year, reducing the disposal cost to approximately $5,800 per year. However, a sludge thickening process would require polymer addition. Assuming 18 pounds of polymer

per ton of dry solids, it is estimated that polymer costs would be approximately $1,300 annually. Additionally, there would be an incremental increase in power costs to operate the thickener and sludge thickener feed pump, although the sludge quantities are so small that we would only anticipate the equipment to be operating approximately 2 hours per week. For the purposes of this analysis, $100 was assumed for incremental power costs. The total annual disposal/operating costs for sludge thickening are estimated at $7,200. There would be savings in disposal/operating costs of $15,400 per year.

Based on the capital cost estimate for the sludge thickening facilities and the anticipated savings in disposal costs presented above, a simple payback can be calculated. The payback works out to 19 years. Based on this analysis, we would not recommend incorporating sludge thickening facilities at the Wayland WWTP at this time. A design could incorporate space for future sludge thickening facilities, should sludge disposal rates become less favorable.

6.3 Odor Control

The existing plant does not have odor control facilities. Due to the location of the proposed WWTP in the immediate vicinity of a residential and commercial development, it is recommended that odor control be provided. Odors at the existing plant are generated from the septic conditions in the influent sewers and the sludge holding facilities.

For the purposes of this discussion, the estimated air flow to be treated is based on the conceptual MBR facility discussed above. Odor control ventilation would be provided for the headworks, membrane bioreactor, equalization tank, WSL storage tank. It is not recommended that sludge thickening facilities be provided at this time, but if they were provided the odor control ductwork would extend to the sludge thickening area and the thickened sludge storage tank. An odor control fan would draw odorous air from these areas. The odor control system would be located outdoors. A preliminary estimate of air flow volume is summarized below:

Source	Air Volume (cfm)
Influent Headworks	151
Anoxic Tank	258
Equalization Tank	1,965
WSL Storage Tank	344
Total (no thickening facilities)	2,718
Sludge Thickening Area	1,387
Thickened Sludge Storage Tank	160
Total (including thickening facilities)	4,265

There are several choices in odor control equipment. We solicited vendor quotes on carbon adsorption units and wet scrubbers for both 2,700 cfm (estimated air flow without sludge thickening facilities and 4,300 cfm (estimated air flow with sludge thickening facilities). Biofilters are not as well suited to a small

plant because they require a continuous stream of odors to sustain the biomass and maintain the required level of treatment. The quotes are summarized in Table 6-2.

Table 6-2. Odor Control Equipment Quotes

Odor Control Equipment	2700 cfm	4300 cfm
Purafil Deep Bed Scrubber (Carbon)	$ 44,872	$ 54,450
Duall Single Bed Carbon Adsorber	$ 69,680	$ 77,600
Duall Wet Scrubber	$148,000	$161,500

For this application, an activated carbon adsorber is recommended due to its lower capital cost and the fact that wet scrubbers generally require more attention from the operator than carbon adsorbers. Operating and life cycle costs associated with carbon are also likely to be lower than a wet scrubber but this will be confirmed during detailed design once air flows and expected odor concentrations are more defined.



Figure 6-4. Activated Carbon Unit (left) and Wet Scrubber (right)

6.4 Supervisory Control and Data Acquisition (SCADA) System

It is recommended that the treatment plant be equipped with a complete instrumentation and control system based on programmable logic controllers, and a SCADA system to monitor process functions, control panel status, and all appropriate alarms.

The existing WWTP control system includes limited automation and operator interface functions. Any new WWTP that is constructed would be provided with a state of the art control system to allow for automatic operation, monitoring, and reporting of WWTP system status. The instrumentation and control system for a new WWTP should standardize on programmable logic controllers (PLCs) for all new equipment and equipment systems. PLCs would be used for the main control panel as well as in some vendor-supplied equipment.

Operator Interface. An operator workstation would be located in the main control room of a new WWTP. The workstation would be able to monitor input/output (I/O) points from any of the new equipment. From this work station an operator would be able to control and monitor all plant functions. In addition, a remote work station could be provided at a location to be determined by the Town of Wayland to allow for Town officials to monitor WWTP status and alarms from a remote location.

System Software. The software used for the graphic displays also needs to be standardized and one example is Intelution iFix Plus SCADA Pack full development package and it would reside on the SCADA server in the main control room. It is recommended that a second operator workstation be provided that would run iFIX Plus SCADA Pack runtime version or equivalent, to provide redundancy should the primary SCADA server go down.

To facilitate the reporting of WWTP compliance and data to DEP and Town of Wayland officials, reporting software such as XLReporter and Microsoft Office XP Professional could also be utilized to generate historical data reports. Software such as PCAnywhere could be used to communicate between remote laptops and the SCADA server computer. Remote alarming software could also be provided that would dial out all required alarms to a phone to alert staff of any problems that may occur while the Wayland WWTP is not staffed.

Plantwide Communication Hardware. Remote terminal units would be installed in selected locations to communicate from the new equipment to the plant control room. Equipment-manufacturer-supplied PLCs for the various pieces of equipment would be integrated with the main PLC located in the plant control room. The vendor panels would be specified to have spare I/O so that additional signals can be added to the panel for local I/O. Equipment-vendor PLCs would be configured to provide data files, which would include basic controls information such as status, alarms, analog data points, and set points.

All new computers and PLCs would be networked using Ethernet. Within the buildings, components would be connected with CAT 5e cables, and, external to the building, all network connections would be made by wireless Ethernet using Cisco Aironet hardware or equivalent. All wireless hardware and the wireless network would use encryption to secure the network from outsiders.

7.0 OPINION OF COST

M&E has collected construction cost data on a sampling of similar projects in the area (refer to Table 7-1). For plants this small, there is no consistent extrapolation based on a $/gallon estimate. As indicated, the total capital cost for the smaller plants is approximately $3 million. All of these projects are either under construction, about to start construction, or recently completed construction. None of the figures are engineering estimates; all represent the successful general contractor's price to construct the facility.

Table 7-1. Construction Cost for Similar Projects (w/o engineering & permitting)

Location	Max. Daily Flow (gal)	Total Capital Cost	$/gallon
Harvard, MA (SBR Facility)	33,130	$2,691,899	$81.25
Acton, MA (Spring Hill) RBC Facility	40,000	$2,998,095	$74.95
North Reading, MA RBC Facility	63,000	$2,638,135	$41.88
Acton, MA (Avalon Bay) MBR facility	95,000	$2,920,494	$30.74
Fishkill, NY MBR Facility	160,000	$3,500,000	$22.00

Based on this sampling of projects, the capital cost for a new wastewater treatment plant in Wayland is estimated to be approximately $3.3 million. The engineering fee is estimated as follows:

Allowance for Permitting:	$ 30,000
WWTP Design fee (9% of construction):	$300,000
Construction Services, Office:	$150,000
Construction Services, Resident Representative (9 months):	$205,000
Total:	$685,000

This results in an overall project capital cost budget of approximately $4.0 million.

8.0 IMPLEMENTATION STRATEGY

The Wayland Town Center Project is scheduled to be open in December 2008. As discussed in previous sections, M&E recommends that the new WWTP be online prior to the opening. This will be a problem for a typical public bid project as there are only 15 months remaining. Typical steps in a design-bid-build project implementation include: engineer selection (1-2 months); engineering design (4-5 months); Owner review (1 month); MassDEP review and approval (1-2 months); contractor bidding and award (2 months); construction (8-10 months) and commissioning (1 month). Although some of these activities can overlap and others can potentially be omitted, a reasonable estimate of the timeline is about 17 to 21 months. Thus, depending on how the project is implemented, the goal of having a new plant in place prior to the startup of the Town Center project may not be achievable.

The timeline above further assumes that permitting requirements reflect constructing the new WWTP and its discharge in two phases. First, a replacement to the existing plant would be designed, permitted, and constructed with the intent of continuing to use the existing NPDES permit and outfall. Second, in a parallel effort, the long term discharge solution would be pursued, either a new discharge line and outfall to the river proper or a new groundwater disposal permit. This separation of long lead and relatively short term permit approvals would allow the construction of the new plant to begin prior to completion of the permitting for the long term solution. Clearly this approach will require the cooperation and agreement of EPA, MassDEP, and MEPA and close coordination to make sure the effluent limits are confirmed (for a river discharge) or established (for a groundwater permit) in advance.

Assuming all parties are in agreement as to the desirability of replacing the existing WWTP as soon as possible (e.g. the EPA, MassDEP, as well as the TW and the Town), then M&E recommends TW consider a design-build approach to meet this ambitious schedule. This would require the Town and TW to revise the MOA to include a division of responsibility similar to the approach in the October 14, 2005 memorandum of agreement. This approach would have TW, rather than the Town, leading the implementation of the WWTP, and would permit a design-build implementation approach to be employed. Typical steps in a design-build project implementation include: preliminary design (1 month); design-build pricing and contract negotiation (1-2 months); final engineering design (3-4 months); MassDEP & Owner review and approval (1-2 months); construction (6 months) and commissioning (1 month). This schedule results in a revised timeline of 13 to 16 months, indicating the 15 month goal is reachable. The principal time savings accrue from a shorter construction schedule which results from earlier purchase of major equipment, processing and approval of equipment shop drawings during the design phase, and equipment fabrication release immediately after MassDEP permit approval.

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