238A.A-1

2005-0225
2006-0178
2006-0131

41 Hutchins Drive

Bld. Addition and Amendment

Cadcam

Eric Cianchette

Woodard + Curran

The applicant has outlined concerns with the previous suggested condition along these lines (included as xii in the Report)(Attachment IV E page 5) and this memo includes a revised suggested condition.

Soils and Drainage

Previous concerns with the possible need for extra curbing, erosion control measures and underdrains have been addressed, as confirmed by the DRC Jim Seymour in his review of 3.8.2006 (Attachment IV D). The applicant submitted an Erosion and Sedimentation Control Plan and Plan (Attachments IV A e and IV I d respectively) and these have been included in a suggested condition in view of the sensitivity of the site.

Fire

The Captain Greg Cass of the Fire Department originally requested an additional hydrant be provided along the internal access road. After further discussions with the applicant regarding the distance from the existing hydrant, this requirement has been removed (Attachment IV H).

City Infrastructure

The applicant has extended the existing sidewalk along Hutchins Drive in accordance with Ordinance 25 (requirement for sidewalks and curbs along the frontage). The applicant has formally requested a waiver for curbing along Hutchins drive in the latter of 2.23. 2006 from Ken Volock which argues that waiver conditions 4 (*"strict adherence to the curb requirement would result in the loss of significant site features related to the landscaping or topography that are deemed to be of a greater public value"*) and 5 (*"runoff from the development site or within the street does not require curbing for stormwater management"*) have been met. The City Engineer, Eric Labelle, supports this waiver as he does not recommend the installation of granite curbing in this location (see Report). Details of the sidewalk need to be submitted and to be in accordance with City Standards.

The City of Portland has a 10inch sewer main running through the site within a 30 foot easement. The applicant proposes to relocate the sewer and easement to the north so that so that it does not run beneath the proposed building. The diverted sewer is proposed to be 15 feet from the new building addition, centered within a 30 foot easement. The City Engineer has confirmed that there may be other uses, such as a water main, within the sewer easement as long as they remain a minimum of 10 feet from the sewer main (Attachment IV C).

Easements

Progress has been made regarding the easements required for this site as follows:

a. The applicant is preparing language for the sewer and drainage easements (confirmed in letter of 3.9.2006 (Attachment IV E) and the City Engineer requests a second drainage

subsurface detention structure and vegetated swale, and the Erosion and Sedimentation Control Plan (including Plan C200) submitted February 23, 2006.

v. The applicant shall present the sidewalk, drainage and sewer easements for final review and approval by Corporation Counsel, including evidence of an appropriate easement in relation to the water main blow-off valve discharge pipe.

vi. The applicant shall submit details of the sidewalk extension and sewer diversion, which must be in accordance with the City Standards and directly reviewed and approved by Public Works.

vii. The applicant to adhere to the submitted Geotechnical Report during construction and involve a Geotechnical Engineer at regular intervals during the construction of foundations and retaining walls; also to amend the plans to reference the construction measures required for such foundation and retaining wall construction. The final retaining wall design shall be designed by a professional engineer and reviewed and approved by the code enforcement officer.

viii. The applicant shall discuss and agree an alternative treatment of the central area of the turning circle at the main entrance with the City Arborist.

ix. That in view of the sensitive nature of this site and its proximity to wetland areas, as a condition of this approval there shall be no further expansion or development of parking areas or commercial space outside of the existing building footprint or impervious surface areas approved herein.

2. That the Planning Board waives the Technical Standard (Section III 2 A.(b), which requires a 24 foot wide driveway for two-way ingress and egress, to allow the driveway alongside the proposed new building (excluding where it meets Hutchins Drive) to be 20 feet wide in order to minimize impact on the nearby wetland area.

3. That the Planning Board waives the Technical Standard set out in Ordinance Sections 14-498 and 14-499 which requires granite curbs, as curbing along the frontage of this site would result in the loss of landscaped swales, and runoff does not require curbing for stormwater management.

(Attachments on next page)

Attachment IV - A

WOODARD & CURRAN
Engineering • Science • Operations

CORPORATE OFFICES: Maine, Massachusetts,
New Hampshire, New York, Connecticut, Florida
Operational offices throughout the U.S.

February 23, 2006

Jean Fraser
City of Portland
389 Congress Street
Portland, ME 04101

Re: Woodard & Curran Building Addition
Major Site Plan Review - Additional Information

Dear Jean:

On behalf of the joint applicants, CADCAM Associates and Peggy and Eric Cianchette, we are submitting 10 copies of additional information in support of the Major Site Plan Application for the Woodard & Curran Building Addition, originally submitted September 21, 2005, to be used in Planning Board review.

These documents were prepared in accordance with Chapter 14, Land Use, of the Code of Ordinances of the City of Portland, Maine, and meet the applicable sections of the City of Portland, Maine, Technical and Design Standards and Guidelines adopted September 1987, last amended March 2000.

The information that follows includes updated plans and addresses comments that have arisen from our continued discussion of this project with City staff and with the Maine Department of Environmental Protection (MeDEP), in a memo received from Jim Seymour, Sebago Technics, on January 31, 2006, and comments submitted by the City's Traffic Engineer, Tom Errico, Wilbur Smith Associates, on January 31, 2006. Specific to issues we have discussed:

- We are requesting a waiver from the requirement set forth in Sec 25-96 requiring curbing on Hutchins Drive along the length of our property. Currently, Hutchins Drive is constructed without catch basins or a piped drainage system. Instead, drainage is provided through ditching on either side of the road. If curbing were to be installed along the property's road frontage, there would be significant negative impacts to drainage along this portion of Hutchins Drive; therefore, the project meets City Ordinance of Section 14-506 (b), condition 4 for curbing because "[s]trict adherence to the curb requirement would result in the loss of significant site features related to [...] topography that are deemed to be of a greater public value." Further, the project meets City Ordinance of Section 14-506 (b), condition 5 for curbing because "[r]unoff from the development site or within the street does not require curbing for stormwater management." The project meets two conditions and therefore is eligible for a waiver of the curbing requirement.

- Captain Greg Cass of the Portland Fire Department added the provision of a fire hydrant along the access drive to his comments dated September 28, 2005. He states that the hydrant is needed to ensure there is a hydrant every 500 feet. There is an existing hydrant located next to the main entrance to the building. Every face of the building can be reached in less than 500 feet from the hydrant. An additional hydrant is not necessary to meet the 500 foot requirement and is not proposed as part of the project. We have unsuccessfully attempted to contact Captain Cass to resolve the matter and understand that the Planning Department has also attempted to reach Captain Cass.

- An evaluation has been done to examine alternatives to the proposed project, the impacts of the proposed project on natural resources on the parcel, and ways in which those impacts may be minimized. The evaluation has been attached to this submittal in the form of a memorandum from Woodard & Curran to the Maine Department of Environmental Protection, dated February 22, 2006.

The following responses address comments provided in the memo received from Jim Seymour, Sebago Technics, on January 31, 2006. Our responses have been organized in order of the comments provided.

Stormwater Management

Comment:

Our review of the quality calculations revealed that the treatment factors utilized for wooded buffer treatment appear not to be correctly sized and incorporate the use of wetlands, which are not allowed. This affects the overall treatment value, which may reduce the effective sediment removal and not meet the sliding scale factor as declared by the engineer. The engineer must re-evaluate the treatment factors for our or staff review.

Response:

Based on conversations with the City's DRC and with the stormwater review engineer for the Maine Department of Environmental Protection (MeDEP), treatment factors have been reassessed for the Filtration Basins. The stormwater quality calculations have been rerun using a TSS removal factor of 90% for the basins. A dry swale has been added off the end of the rear parking lot to treat runoff from the access road and the rear parking lot. Through the Filtration Basins and the dry swale, the Sliding Scale TSS removal standard (45% for this project) can be achieved without the use of buffers.

Comment:

As attempted all buffers shall be shown on the site plan with labels indicating the width, slope, and percentage of removal efficiency for each buffer shown.

Response:

As stated above, the use of buffers has been eliminated from the project.

Comment:

All structures such as manholes, catch basins, and drainage structures with surface openings must label rim elevations.

Response:

Sheet C202 Proposed Utility Plan has been revised to indicate rim elevations for all structures.

Comment:

The curbing along the access driveway/road along the addition should be extended to discourage scouring at the pavement edge. Therefore, we recommend curbing be extended to the edge of sidewalks at the entrance. The curbing from the building's end sidewalk shall be extended from the circle as well.

Response:

Curbing along the access drive has been extended toward the entrance where the road curves and runoff velocities are expected to be higher. No curbing is proposed where the drive takes a straight course, in order to encourage some amount of filtering as runoff passes through the landscaped area. These changes can be seen on Sheet C201 Proposed Site Plan.

Comment:

The internal parking lot islands must be curbed in the satellite lot, for protection of landscape features.

Response:

Internal parking lot islands in the northerly parking lot have been designed without curbing in order to break up drainage pathways and facilitate some amount of filtering as runoff passes through landscaped areas.

Comment:

Will the underground detention/storage require an underdrain due to the depth in poor clay silt soils where water tables could be high?

Response:

A boring in the area of the proposed subsurface detention structure indicated saturated soils at an elevation of approximately 38 feet. The base of the detention structure will be at 40, providing two feet of separation from the water table. Additionally, the subsurface detention structure will be constructed over a geogrid placed directly on existing soils. The primary outlet is located at the base of the structure; therefore no build-up is expected and no underdrain is proposed.

At the request of the MeDEP, additional test pits were dug by S.W. Cole Engineering in the locations of the proposed filter basins and the dry swale to ensure that a one foot separation could be achieved between the filter layer and seasonal high ground water. The borings indicated that the separation could be achieved, but the test pits were required for confirmation. The summary of the findings is included with this submission in the form of an email to Woodard & Curran, dated Wednesday, February 8, 2006.

Road Access/Circulation

Comment:

Please refer to comments from the City Traffic Engineer for concerns of traffic movements, trip generation, and internal movements.

Response:

Comments from the City Traffic Engineer are addressed below.

Comment:

[excerpt] The width of 20 feet is marginal, and it is clear 24 feet width is desirable. Based on the layout and spacing between the proposed structure we feel 22 feet may be completed with a compromise of 1 foot towards the building and 1 foot towards the wetlands, with the access road from the proposed building's Hutchins Drive end to the curb cut designed to be 24 feet not 22 feet. Final discussion, arguments, and impacts will have to be weighed by the Board. Our feeling is that at a minimum, both the City and applicant, to accomplish and improvement for safety and vehicular passage can make a compromise for a 22-foot road.

Response:

Based on our understanding of discussions involving City Planning staff, Public Works and the City Traffic Engineer, we continue to request a waiver from the 24-foot wide access drive standard. The 20-foot wide access drive provides for vehicular and pedestrian safety, provides fire access, and minimizes wetland impact.

Comment:

Details are needed for the sidewalk section along the street frontage and shall be in accordance with City of Portland design standards.

Response:

A detail showing typical sidewalk construction in accordance with City design standards has been added to Sheet C301.

Utilities

Comment:

Letters to serve and available capacities have been requested showing that adequate service exists for the development. To date those have not been administered by Public Works.

Response:

Our office has had several conversations with Frank Brancely, City of Portland Public Works, regarding sewer collection capacity for the project. Mr. Brancely has assured us that a response is forthcoming. The response will be forwarded upon receipt.

Comment:

The City wastewater division and City Engineer shall assist review of the construction details and location of the re-located interceptor sewer. We did not receive plans or construction details for the sewer relocation plan or profile design. All designs must be in accordance with City details, and the City must accept relocated easements. This should be directly reviewed by Public Works, but we can assist is so directed.

Response:

Rim and invert elevations have been added for the proposed sewer relocation on Sheet C202 Proposed Utility Plan. Due to the small amount of sewer design involved, profiles have not been included. It is our understanding the sewer layout and proposed easement have been reviewed and found acceptable by City of Portland Public Works; we will continue to work with Public Works as we finalize construction documents.

Comment:

There is a 12 inch steel culvert shown outleting into the stream from either Hutchins Drive or the Water District easement. Please place an easement around this drainage pipe such that either the City or Water District has rights to maintain on private property.

Response:

The 12-inch steel pipe in question is connected to a blow-off for the Portland Water District (PWD) 42-inch water main and is located on land that is unaffected by the proposed development. The PWD is currently investigating whether an easement is required for this pipe. The Applicants will grant an easement if required by the PWD for the 12-inch steel pipe; however, the pipe does not have any bearing on the project as proposed.

Grading & Erosion Controls

Comment:

The applicant should consider stabilized entrances when building the parking lots and access drives. Notes shall be added addressing mud tracking, pavement cleaning, dust control, and or street sweeping during construction.

Response:

In order to address erosion and sedimentation control, Sheet C200 Erosion and Sedimentation Control Plan, has been added to the drawing set. Stabilized construction exits have been added and erosion control notes during construction have been included. Additionally, a Notice of Intent (NOI) to comply with the Maine Construction General Permit has been filed with the MeDEP Site Law Minor Amendment. The NOI is accompanied by a written Erosion and Sedimentation Control Plan. Although the MeDEP will send a copy to the City, copies of the NOI and the Erosion and Sedimentation Control Plan have been included with this submission.

Comment:

All existing and proposed catch basins in or near the construction area shall be protected with Silt sacs until the base course of paving is completed for the project.

Response:

We are proposing to protect existing and proposed catch basins using straw bale sediment barriers rather than Silt sacs. Information related to the protection of existing and proposed catch basins has been added

to Sheet C200 Erosion and Sedimentation Control Plan and a catch basin protection detail has been added to Sheet C303 Civil Details – 4.

General

Comment:

The project has an attached Geotechnical report, which shall be adhered to during construction. The plans shall add a note referencing the construction measures required for such foundation and retaining wall construction. The final retaining wall design shall be designed by a profession engineer, and reviewed and approved by the code enforcement officer. It also may be beneficial to require weekly reports from a geotechnical engineer or geologist summarizing findings and construction monitoring during excavation and preparation of the retaining walls and building foundations.

Response:

The Geotechnical Report shall be adhered to in preparing final design of the proposed project. Additionally, a copy of the report will be included in the construction specifications. S.W Cole will be enlisted to review final design documents to ensure the recommendations presented in the Geotechnical Report have been met as applicable. Construction monitoring and testing will be incorporated into the final construction documents.

Comment:

The applicant is likely required to file a revised Maine Construction General Permit for this project. This must be obtained prior to the start of construction. Additionally the applicant shall indicate on the drawings a construction elevation benchmark with the datum specified. Ideally this should be in accordance with City datum for sewer project work. Please contact Bill Clark at public Works to confirm Survey information requirements.

Response:

An NOI to comply with the Maine Construction General Permit has been filed with the MeDEP Site Law Minor Amendment. Following procedure, the MeDEP will send a copy to the City.

The plans indicate a benchmark in Utility Pole #3.5 between the main entrance to the site and the entrance to the north parking lot. The original survey references the existing site as the vertical datum. We are currently working with Bill Clark to locate a nearby City benchmark to determine the relationship between our vertical datum and the City standard, NVGD 29.

Comment:

The applicant has appears to have available space for development, but given resource protection limits, treatment measures requiring avoidance of snow storage, and given the extent of parking, snow removal is of some concern. Please provide on a plan to address snow storage locations on site or note on the site plan how it will be removed.

Response:

Snow storage areas have been added to Sheet C201 Proposed Site Plan.

The following responses address comments provided to the Planning Department by the City Traffic Engineer on January 31, 2006. Our responses have been organized in order of the comments provided.

Comment:

The internal roadway providing access to the 43-space parking lot to the rear of the building will not meet general City roadway width standards. The roadway is proposed to be 20 feet. I support a waiver for the roadway width in light of the increased environmental impact a wider facility would have. It will be extremely important that good winter maintenance practices are followed to ensure that the effective width is not reduced due to snow accumulation.

Response:

Snow removal from the access drive has been discussed above. The 20 foot driveway width will be maintained; no snow storage is proposed for along the roadside.

Comment:

The driveway "throat" at the Hutchins Drive entrance is currently proposed to be approximately 22 feet. The driveway should be modified such that it is 24 feet wide.

Response:

The width of the driveway entrance at Hutchins Drive has been increased to 24 feet.

Comment:

The applicant should provide details on the traffic control/pavement markings at the internal intersection at the main entrance.

Response:

Pavement markings at the intersection near the main entrance have been added to Sheet C201 Proposed Site Plan.

Comment:

I have reviewed the proposed parking supply and it is my professional opinion that the parking provisions are reasonable. Under the current proposal, a total of 167 parking spaces will be provided. At the time of project completion, 143 employees can be expected to occupy the facility. Under a full occupancy scenario 207 employees can be expected. A review of parking generation information provided by the Institute of Transportation Engineers indicates approximately 164 parking spaces are required for an office building with 207 employees. Accordingly, I find the supply to be adequate and not excessive.

Response:

In an effort to minimize wetland and stream impacts, we have reduced the number of proposed total parking spaces to 164.

Comment:

Gorrill-Palmer Consulting Engineers, Inc. provided information on the permitting aspect of developments along Hutchins Drive. Based upon the information provided, I concur that a MaineDOT Traffic Movement Permit is not required for the project. However, based upon traffic increases since 1997, I would ask that the applicant conduct an analysis of the Congress Street/Hutchins Drive intersection during the weekday AM and PM peak hours to ensure safe and reasonable operations will be provided following completion of the project.

Response:

Gorrill-Palmer Consulting Engineers, Inc. has conducted the requested analysis of the intersection of Congress Street and Hutchins Drive. Findings are attached to this submission and have been forwarded directly to the City's Traffic Review Engineer.

Thank you for the assistance you have provided thus far. We look forward to continuing our work with your office and the Planning Board on this project. If you have any questions or comments, please do not hesitate to contact me at (207) 797-7515, or via email, kvolock@woodardcurran.com.

Sincerely,
WOODARD & CURRAN INC.

Kenneth Volock
Engineer

KRV/djt
203834.01

STATE OF MAINE
KENNETH R. VOLOCK
NO. 11062
REGISTERED PROFESSIONAL ENGINEER

Enclosures: Drawings, including:

- Cover
- G001 General Notes, Legend, Abbreviations and Sheet Index
- C100 Existing Site Plan
- C200 Erosion and Sedimentation Control Plan
- C201 Proposed Site Plan
- C202 Proposed Utility Plan
- C300 Civil Details - 1
- C301 Civil Details - 2
- C302 Civil Details - 3
- C303 Civil Details - 4

Alternatives Analysis and Impact Minimization memorandum from Woodard & Curran to the Maine Department of Environmental Protection, dated February 22, 2006

Stormwater Management with attachments, revised February 22, 2006

Findings of February 8, 2006 test pits in the form of an email to Woodard & Curran, dated Wednesday, February 8, 2006

Notice of Intent to comply with the Maine Construction General Permit

Erosion and Sedimentation Control Plan: Woodard & Curran Office Expansion

Letter from Gorrill-Palmer Consulting Engineers, Inc. to Mr. Tom Errico, P.E., dated February 22, 2006

IV - A - a

WOODARD & CURRAN
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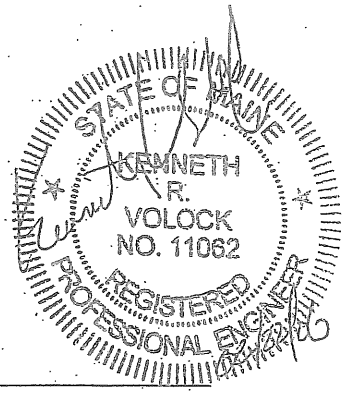
CORPORATE OFFICES: Maine, Massachusetts, New Hampshire, Connecticut, Florida
Operational offices throughout the U.S.

MEMORANDUM



TO: Maine Department of Environmental Protection

FROM: Kenneth Volock, P.E.

DATE: February 22, 2006

RE: Woodard & Curran Office Expansion – Alternative Analysis and Impact Minimization

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This memorandum is written in support of our Permit by Rule (PBR) Notification for the above referenced project. The project involves the construction of an addition to the office building currently located on the parcel, an expansion of existing parking lots, and associated utility improvements.

The parcel is currently occupied by the offices of Woodard & Curran, with 111 employees located in two connected buildings. Woodard & Curran also has 32 employees located in leased space on the adjacent parcel on Hutchins Drive. The purpose of the project is to allow Woodard & Curran to bring its employees into interconnected buildings and to allow for growth within that expansion. Sheet C100 Existing Site Plan, Sheet C201 Proposed Site Plan and Sheet L-1.0 Landscape Plan have also been included within this submission.

The parcel contains a central wetland area with a small unnamed brook passing through it. Another smaller brook runs along the easterly edge of the parcel. Layout of the proposed development has been designed to avoid natural resource impacts to the maximum extent practicable and protect remaining buffers and the resource. As is shown on Sheet C100 Existing Site Plan, there is little area available on the parcel outside the 75-foot setback from either resource that has not already been developed. In order to provide the building expansion and necessary related infrastructure, development within the 75-foot setback is required.

ALTERNATIVES ANALYSIS

In an effort to reduce impacts to the resource, we looked at four alternatives for the project. These are:

1. No project
2. Avoidance
3. Alternate Location of Building Addition
4. Alternate Location of Parking

No Project

One alternative to this proposed project is no-change, i.e., maintain the existing buildings and no expansion. Unfortunately, this alternative would not allow the company to centralize its staff or allow for any growth and would likely force the company to relocate its offices.

Avoidance

As stated above, there is little area available on the parcel outside the 75-foot setback from either resource. Complete avoidance of development within the 75-foot natural resource setbacks would not allow the level of development required by the Applicant to remain in their current location. We have made several attempts to avoid impacts to the resource by locating parking facilities outside resource setbacks, as can be seen on the site plan and in the Alternative Location of Parking narrative below.

Alternate Location of Building Addition

Woodard & Curran considered siting the building on the south side of the existing buildings. Unfortunately, siting the building there would create two subterranean levels, or a wing that is one or even two stories higher than the rest of the building. Such a building would be out of character with the campus feel and may also present setback problems. This layout would have displaced all of the parking in the south lot and required the same amount of expanded rear parking as is currently proposed.

Woodard & Curran also considered siting the building on the east side of the parcel, in the location currently occupied by the rear parking lot expansion. This orientation would have required that the first story be partially enclosed parking, reducing the allowance for growth in the expanded facility. The partially enclosed parking also would have represented a significant increase in cost of the project. Emergency access to the rear of the buildings would have required a more significant natural resource impact than in the current proposed layout.

With the presented layout, the Applicant will be creating a campus-type setting for the three wings of the building, each accessible by a common central plaza. The common plaza reduces the amount of paved surface on the project site by providing a shared amenity for the three buildings. Upon completion, the building addition will have a similar look and feel to that of the existing North Wing, to which it will be adjacent. Floor elevations have been coordinated to match the adjacent buildings, allowing free-flow of office personnel.

Alternate Location of Parking

Other areas were considered for development for additional parking during planning for the proposed project. One area was between the existing southerly parking lot and the south wing. This area is currently grassed and falls away from the parking area toward the building. It is crossed by a bridge to the second floor of the south wing. A sketch of how parking could be added in this area had been previously submitted to the City of Portland and to the Department as Figure 1 in Section 5 Off-Site Facilities. In order to develop this area for parking, a significant amount of fill material would be required. Further, there is not enough room between the parking area and the south wing to fit both a driveway and parking spaces. The current configuration would need to be altered to that shown in the sketch. Approximately 4,500 square feet of paved area would need to be added and the parking would result in a net increase of 5 spaces, from 26 to 31; this area does not present a more practicable option for expanded parking.

Another area considered is the wooded area in front of the south wing, between the building and Hutchins Drive. An initial sketch of how parking could be added in this area had been previously submitted to the City of Portland and to the Department as Figure 2 in Section 5 Off-Site Facilities. Some fill material would need to be brought in for this area as well. This area would require a similar amount of additional pavement as the scenario depicted in Figure 1, but could provide approximately 16 additional parking spaces. We initially determined this scenario was undesirable as depicted; clearing of the existing wooded area and opening the south wing up to Hutchins Drive would be in sharp contrast to what has been attempted over the rest of the site in providing necessary parking behind buildings or otherwise buffered with landscaping to the extent practicable.

As a result of discussions with the Department, relocation of parking to the area in front of the South Wing has been reconsidered. A portion of the area proposed for site parking has been shifted from within the 75-foot brook setback to an alternate location on the southerly portion of the parcel, near the entrance to the south parking lot. In the revised layout, currently depicted on Sheet C201 Proposed Site Plan, 11 parking spaces have been eliminated from the rear parking lot and 8 have been added along the entrance

to the south lot. By relocating the spaces to the south lot, the total number of parking spaces for the site has been reduced from 167 to 164. We consider 164 the minimum acceptable number of parking spaces to meet the project need, and is consistent with the City's reviewing traffic engineer's opinion based on Institute of Transportation Engineering parking generation information.

The access drive is the only access to the rear parking and also provides emergency access to the rear of the building. Access from the north would require crossing the unnamed brook (in the center of the parcel). Access from the south, around the existing buildings, would require construction within 25 feet of the small brook along the easterly edge of the site. As such, no alternative is available for the location of the access drive.

NATURAL RESOURCE IMPACT

On the main area of the parcel, where the building and adjacent parking is located, a portion of the proposed access driveway, totaling approximately 1,000 square feet, is located within the 25-foot setback from the wetland. However, this area is outside the 25-foot setback from the brook. Based upon discussions with the City and a desire to reduce impact from the access drive, we have requested a waiver from the City from its 24-foot wide driveway standard to the 20-foot wide driveway proposed.

As a result of discussions with the Department, we have shifted a portion of the rear parking lot expansion to within the 25-foot wetland setback near the easterly edge of the parcel. The purpose of this revision was to get a far as possible from the unnamed brook (in the center of the parcel). Although the parking area is within the 25-foot wetland setback along the easterly edge of the parcel, it does not sit within the 25-foot setback from the smaller brook (at the easterly edge of the parcel).

On the northern portion of the parcel, where the parking lot expansion is proposed, a small area of wetland fill, totaling approximately 50 square feet, is proposed. As this area is greater than 100 feet from the brook, it is our understanding that no additional permitting is required for this small fill area.

MINIMIZATION OF IMPACT

Impacts to the natural resources will be minimized during construction through the use of temporary measures such as sedimentation berms and siltation fencing, a stabilized construction exit, and catch basin inlet protection. A Notice of Intent to comply with the Maine Construction General Permit has been filed for the project. An Erosion and Sedimentation Control Plan has been prepared to describe the proposed measures. Both have been included with this submission.

Permanent measures to protect the remaining buffers and the resource will include pavement, seeding of disturbed areas that will not be paved or built upon, trees, shrubs and other plantings, and soil reinforcement where applicable. Treatment of stormwater runoff will be accomplished prior to its discharge into the natural resources through filtration and detention. Runoff from the roof of the building expansion will pass through a subsurface detention structure. Runoff from the proposed expansion to the north parking lot will pass through a filter basin. Runoff from the access drive and the expansion to the rear parking lot will be filtered through a dry swale.

CONCLUSION

The Applicant is working with the MeDEP in developing the proposed project in as environmentally sensitive a manner as practicable. To this end, construction impacts to natural resources will be minimized through the use of sedimentation berms and siltation fencing, a stabilized construction exit, and catch basin inlet protection during construction. Permanent erosion control measures include pavement, grass, trees, shrubs and other plantings, and soil reinforcement blankets where applicable.

The Applicant has incorporated alternative location to certain site elements presented herein to the extent possible. The project as proposed represents the most practical, cost effective and reasonable alternative that satisfies the purposes and needs of the proposed project. There is no practicable alternative based on cost, existing technology and overall purpose of the project.

If you have any questions or require further information, please contact me at (207) 774-2112, or via email at kvolock@woodardcurran.com.

KRV/
203834.01

6. STORMWATER MANAGEMENT

6.1 OVERVIEW

The proposed project consists of the expansion of the existing offices of Woodard & Curran at 41 Hutchins Drive in Portland. The project involves the construction of an addition to the office building currently located on the site, an expansion of an existing parking lot, and the relocation of a City of Portland sewer main and its associated easement.

The site consists of two parcels of land, lots #15 & #16 of the Stroudwater Estate Subdivision, owned by CAD-CAM Associates and located at 41 Hutchins Drive. These lots occupy a total area of approximately 6.65 acres. As stated earlier, the site is occupied by an office building with a footprint of 13,232 square feet (approximately 0.3 acres). Other impervious areas on the site include parking lots, paved driveways and walkways which combine to make up 50,170 square feet (approximately 1.15 acres) of paved area.

6.2 SITE CHANGES

The proposed building addition will be a three-story structure with a building footprint of approximately 7,560 square feet, with a direct link to the existing North Wing. Other changes to the site include: an addition to the parking lot on the northerly portion of the site; an increase in parking at the rear of the building; the new access drive to rear parking areas; and the redesigned plaza and walkway in the center of the campus. The total increase in paved area is 24,881 square feet. In total, the proposed project will increase site imperviousness by 32,441 square feet (approximately 0.74 acres) to 95,843 square feet (approximately 2.2 acres).

Table 6.1 below indicates the changes in impervious area within the upland portions of the site as a result of the proposed project:

Table 6.1: Site Impervious Area Summary

	Total Site Area (acres)	Impervious Area (acres)	Percent Impervious (%)
Pre-Development	6.65	1.46	21.9
Post-Development	6.65	2.20	33.1
CHANGE	0.00	0.74	11.2

6.3 STORMWATER MANAGEMENT DESIGN

Stormwater runoff from the site ultimately flows to an unnamed brook in a 30-foot wide drainage easement running through the middle of the site. The unnamed brook flows through the easement and makes its way to the Stroudwater River, a little more than a quarter of a mile away.

The Woodard & Curran site falls under the existing Site Location of Development permit for Stroudwater Estates Phase II, L-010223-99-A-A. As a condition of that permit, peak discharge from the site must be controlled. Therefore, the project has been designed to prevent an increase in peak runoff from the site.

6.3.1 Existing Stormwater Management

The existing building roof drains, a portion of the adjacent parking area to the north, and the adjacent open space to the east collect in a small pond designed to reduce peak discharge rates. Runoff is discharged from the pond through a 6-inch diameter PVC pipe into a wooded area and flows to the brook. The remainder of the adjacent parking area to the north is graded such that stormwater runs off overland into wooded areas and toward the brook. Runoff from the area between the existing building and Hutchins Drive, including the main entrance drive to the building, is collected in a catch basin and piped toward the brook.

The parking lot on the northerly portion of the site drains into another small pond, also designed to reduce peak discharge rates. The pond contains an outlet structure controlling the inlet of a 12-inch corrugated polyethylene culvert. The culvert discharges to a riprap apron and then flows to the brook. The area above the parking lot to the north and west is graded such that runoff is diverted to a ditch along Hutchins Drive and then into the brook through a 48-inch concrete culvert under Hutchins Drive. Runoff from the undeveloped portion of the site, east of the northern-most parking lot, flows over land directly to the brook.

6.3.2 Proposed Stormwater Management

Runoff from the area between the building and Hutchins Drive, including the main entrance drive to the building, will continue to be collected in a catch basin and piped toward the brook. The existing portion of the satellite parking lot and the area above it to the north and west will drain as in the existing condition. Runoff from the access lane and the existing parking area adjacent to the North Wing will be collected in a catch basin, which will empty into a ditch running to a dry swale, then through existing wooded buffers and toward the brook. The proposed expansion to parking at the rear of the buildings will not be collected, but rather drain overland into the same dry swale.

The roof drains from the entire building will be collected and piped to a subsurface detention structure, similar to the Rainstore product by Invisible Structures, Inc. The detention structure will be located under the parking lot adjacent to the existing North Wing, and will be approximately 60'x50' in area and 2 feet deep. Product cut sheets for the Rainstore product have been included in this section.

According to Invisible Structures product literature, the Rainstore product has 94% void space, providing 2,820 square feet of effective area in the subsurface detention structure. The primary discharge is through a 4-inch culvert at the bottom of the structure (invert elevation 40.0'), detaining flow during the larger storms. A secondary discharge is provided in the form of a 12-inch culvert set one foot above the base of the structure (invert elevation 41.0'). The structure is modeled as Pond 23 in the Post-Development Stormwater Model (see section 6.3.3.2 and the attached HydroCad data). The detention structure will discharge toward the brook.

On the northerly portion of the site, the proposed addition to the northerly parking lot will be collected and treated in two underdrained filter basins. Each basin will drain either through the underdrain or over a spillway and into the brook. The area above the proposed expansion to the north will be diverted to the brook to the east without being collected in either basin.

6.3.3 Stormwater Quantity Calculations

The intent of this section is to address the effects of site runoff from a proposed development project on the local watershed. The stormwater modeling presented herein compares the existing site conditions with the proposed site conditions (existing and proposed).

Stormwater modeling was done using the HydroCAD Stormwater Modeling System by Applied Microcomputer Systems. HydroCAD uses TR20 runoff calculation methodology. The computation sheets resulting from the models are attached at the end of this section.

The runoff curve numbers (RCN) for the subcatchments have been computed using the TR55 methodology. The subcatchments were divided based on land use and acreage measurements were used to compute a weighted (composite) RCN.

The time of concentration (Tc) paths for the subcatchments were selected to represent the most hydrologically remote point of the watershed. The Tc paths are shown respectively on the Pre-Development and Post-Development Stormwater Plans. Note that the Tc computations contain time calculations using TR55 sheet flow, shallow concentrated flow equations, and circular channel (pipe).

Soils information used in the computations was obtained from the Soil Survey of Cumberland County, Maine, USDA Soil Conservation Service (SCS Survey). The project site is located in an area of Elmwood and Scantic soils. The Elmwood soils are mapped for the generally higher, drier topography of the site, while the Scantic soils are in the lower, wet regions. An interpretation of the delineation between soils was made using the site's wetland mapping. Selection of the hydrologic soil group for computation of runoff curve numbers assumes that the floodplain wetlands mapped for the project are Scantic soil and the remaining non-floodplain areas are Elmwood soil. The Scantic series soil is Hydrologic Soils Group "D" and the Elmwood series soil is Hydrologic Soils Group "C".

For this project, the 2-, 10-, and 25-year return frequency storms of 24-hour duration were analyzed. A Type III rainfall distribution was applied to these storms. The 2-, 10-, and 25-year 24-hour precipitation measurements (3.0 inch, 4.7 inch, and 5.5 inch, respectively) were taken from Appendix D of the BMPs, rather than the values published in the Portland Technical and Design Standards and Guidelines. Through other work in the City of Portland, we have learned that the values published in the BMPs are preferred.

6.3.3.1 Existing Condition

To model the project, the existing site was separated into multiple drainage area subcatchments. Subcatchments 11X, 12X, 13X, 14X, 21X, 22X, 23X and 24X represent the Existing conditions. These subcatchments are depicted in Figure 6.1 attached to this section. Subcatchments 11X through 14X have been numbered generally west to east along the northerly area of the project site, in the vicinity of the satellite parking lot. Subcatchments 21X through 24X depict the southerly area of the project site, in the vicinity of the building.

Reaches 1R, 2R and 3R are located in the middle of the project site and represent the unnamed brook running through the 30-foot wide drainage easement. Reach SP represents the study point in the brook near the eastern edge of the project site for the purpose of quantity modeling.

Ponds P11 and P23 represent existing ponds where runoff is collected from Subcatchments 11X and 23X respectively. Reaches R11, R12, R22 and R23 represent paths by which Subcatchments 11X, 12X, 22X and 23X respectively, are routed through other subcatchments to the unnamed brook.

The Existing Stormwater Plan drawing, Figure 6.1, attached to this section, depicts the subcatchments, reaches, ponds, and time of concentration paths utilized in the model.

6.3.3.2 Post-Development Condition

The proposed site was separated into multiple drainage area subcatchments. Subcatchments 11S through 16S, and 21S through 26S represent the Proposed conditions. These subcatchments are depicted in Figure 6.2 attached to this section. Subcatchments 11S and 12S are similar to subcatchments 11X and 12X respectively. Subcatchments 13S and 14S represent the areas of subcatchments 13X and 14X that are not routed through quality BMPs in the proposed condition. Subcatchments 15S and 16S represent the expansion of the northerly parking lot.

Subcatchment 21S is similar to a portion of subcatchment 21X. Subcatchment 22S is similar to subcatchment 22X, with the addition of a portion of 21X. Subcatchment 23S represents the existing and proposed buildings. Subcatchment 24S and 25S represent the access lane and the existing and proposed rear parking. Subcatchment 26S represents a small area, formerly part of 23X, that runs directly into the woods.

Reaches 1R, 2R and 3R are located in the middle of the project site and represent the unnamed brook running through the 30-foot wide drainage easement. Reach SP represents the study point in the brook near the eastern edge of the project site for the purpose of quantity modeling.

Pond P11 is the same as in the Existing condition. Ponds P15 and P16 represent underdrained filter ponds where runoff is collected from Subcatchments 15S and 16S respectively, and treated. Pond P23 represents the subsurface detention structure where runoff from the roof drains is collected. Pond P24 represents an underdrained dry swale where runoff is collected from Subcatchment 24S and 25S and treated. Reaches R11, R12, R15, R16, R22 and R26 represent paths by which Subcatchments 11S, 12S, 15S, 16S, 22S and 26S respectively, are routed through other subcatchments to the unnamed brook. Reach R25 represents the vegetative swale by which Subcatchment 25S is routed to Pond P24. The discharge from P23 is routed through Reach R23.

The Proposed Stormwater Plan, Figure 6.2, is attached at the end of this section, depicting the subcatchments, reaches, ponds, and time of concentration paths utilized in the model.

6.3.3.3 Summary

Peak runoff values calculated for the Existing and Proposed conditions are listed in Table 6.2 below.

Table 6.2: Runoff Summary

STUDY POINT	PEAK RUNOFF 2 Year (CFS)	PEAK RUNOFF 10 Year (CFS)	PEAK RUNOFF 25 Year (CFS)
Existing Condition	4.92	11.31	14.61
Proposed Condition	4.07	10.62	13.94
CHANGE IN RUNOFF	**-0.85**	**-0.69**	**-0.67**

As shown in Table 6.2 and the appended calculations, runoff from the site is decreased slightly during each storm event. The decrease during the 2-year storm is about 17%, whereas the decrease for the 10- and 25-year storms is only around 6% and 5%, respectively. The decrease during the 2-year storm is greater than the decreases for the 10- and 25-year storms since the

runoff from the parking lots detained in the filtration basins and dry swale represents a much more significant portion.

The watershed routing diagram and model output from HydroCAD is attached at the end of this section for both the Existing and Proposed conditions.

6.3.4 Stormwater Quality

Stormwater quality has been addressed on the site through a combination of native and constructed quality treatment measures. Filtration basins will be used to filter runoff from smaller storms and the initial runoff from larger storms in the proposed expansion to the north lot. A dry swale will filter runoff from the access drive and parking lot at the rear of the building addition. The existing portion of the north lot will continue to receive some level of treatment from the existing detention basin.

6.3.4.1 Applicable Standards

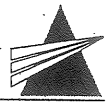
The City of Portland Code of Ordinances was reviewed to determine the applicability of local stormwater quality standards. City Code of Ordinances Section 14-526, Subsection (a), Paragraph 20 states, in part, "Stormwater runoff from paved areas shall be treated to the extent practicable to minimize contaminants." Additionally, the City of Portland Technical and Design Standards and Guidelines, Section V, Subsection 3, Paragraph A states that "[a]ll development proposals shall conform to the standards set forth in Chapter 500 of the Maine Department of Environmental Protection Stormwater Management [...] Rules". In the same section and subsection, Paragraph H states "[a]ny parking facility for the equivalent of 25 cars or 10 trucks or greater shall be required to provide for on-site treatment to remove contaminants such as oils, greases, sediments and grits fro the stormwater runoff."

The Maine Department of Environmental Protection (MeDEP) has recently adopted an updated Chapter 500: Stormwater Management. The updated chapter went into affect November 16, 2005. While not required, but because we believe these rules are consistent with our project approach, the project has been designed with these new rules in mind where possible.

Through discussions with the Maine Department of Environmental Protection (MeDEP), we have determined that stormwater requirements for the site are covered by the Site Law permit originally granted to Stroudwater Estates Phase II in 1984. As such, the new Chapter 500 does not apply to the proposed project. An email from Linda Kokemuller with the MeDEP, dated December 16, 2005, has been attached to Section 8 - State and Federal Permitting, providing confirmation. The project need only prevent a post-development peak runoff rate in excess of the pre-development rate.

Through discussions with the City's review engineer, it was determined that some level of stormwater quality treatment would be required, even if the project was not required to meet the new Chapter 500. In discussions with MeDEP, it was determined that their review for runoff quality will include the proposed areas of the site. The City's review engineer agreed that he would be satisfied with water quality if the MeDEP was. Based on these discussions, the treatment measures for the proposed areas of the site were designed to meet the Sliding Scale TSS removal standard, present in the previous Chapter 500 regulations.

Because the project will remain under the coverage of the original Stroudwater Estates Phase II Site Law permit, the site need not meet the BMP Standards set forth in the new MeDEP Chapter 500. However, the expansion to the northern-most parking lot has been designed to meet the BMP Standards in an attempt to create a lower impact design.



In summary, the project is designed to meet the Sliding Scale TSS Removal Standard for the proposed aspects of the site. Stormwater Quality calculations below (see section 6.3.4.3) indicate that the treatment measures for the site will achieve a 54.6% TSS removal rate, which exceeds the 45% required based on percentage of site impervious area. The expansion to the north parking lot is designed to meet the BMP Standard, as described in the recently adopted version of MeDEP's Chapter 500: Stormwater Management. We believe that this meets the requirement to treat "to the extent practicable" as described in the City Code of Ordinances.

6.3.4.2 BMP Assessment and Selection

In Chapter 500: Stormwater Management, the MeDEP suggests four potential treatment methods to comply with the BMP standards:

- Wetponds with detention above the permanent pool,
- Filtration,
- Infiltration, and
- Buffers.

The area required to construct a wetpond to meet the BMP is too great considering the disturbance of forest and wetlands as well as the changes to site topography that would be required. The varied site topography and presence of wetlands prohibits the ability to classify certain areas as buffers. The soils on the site make infiltration difficult, but soils could be brought in to create filtration basins and dry swales, two filtration methods that do not require as much area as wetponds. The types of BMPs that seem most feasible for the site are constructed filtration basins and dry swales.

Due to the location of each proposed element of the project, and in an effort to minimize site disturbance, two underdrained filtration basins are proposed to treat runoff from the proposed expansion to the satellite parking lot. Each basin is sized to detain a volume of runoff equal to one inch times the impervious area that drains to it, plus 0.4 inches times the vegetated area that drains to it. The basins are designed so that storage volume will be less than 18 inches deep. The floor of the basin will be constructed with a soil filter layer capable of passing the stored volume within two days. The soil filter layer will be underlain by a well-drained gravel layer with a perforated underdrain. Filter Basin details have been provided on Sheet C301 Civil Details-2, attached to Section 1.

The dry swale will be located off the northeast end of the rear parking lot, and constructed in accordance with the previous Stormwater BMP sizing requirements. In order to achieve a TSS removal of 69%, the swale will be sized to detain 0.4 inches of runoff over the area that drains to it. As with the filtration basins, the swale is designed so that storage volume will be less than 18 inches deep. The floor of the swale will be constructed with a soil filter layer capable of passing the stored volume within two days. The soil filter layer will be underlain by a well-drained gravel layer with a perforated underdrain. Dry Swale details have been provided on Sheet C302 Civil Details-3, attached to Section 1.

Level spreaders are used wherever stormwater runoff must be converted back into sheet flow before passing into existing wooded buffers. Four level spreaders are proposed: one will be constructed at the outlet of the Filtration Basin 1 underdrain and will also catch flow from the Basin 1 spillway; one will be constructed at the base of the retaining wall near the western end of the access lane and will handle flow from Subcatchment 22S; one will be constructed below the retaining wall near the eastern end of the access lane and will handle discharge from Pond P23;

and the fourth will be located off the northern end of the rear parking area and will handle discharge from Pond P24.

Calculations for the filter basins, the dry swale and the level spreaders can be found attached to the end of this section.

6.3.4.3 Stormwater Quality Calculations

The removal of TSS from the stormwater flows is achieved through the use of filtration basins, a dry swale and an existing detention basin. Through discussions with the City DRC and with the MeDEP, a TSS removal efficiency of 90% was used for the filtration basins. The dry swale has been sized to provide a TSS removal efficiency of 69%. The existing detention basin which collects runoff from the existing portion of the north lot provides 10% TSS removal. All catch basins on site will have water quality inlets which provide an additional 10% TSS, but only if followed by some other treatment measure.

For the purposes of TSS removal calculations, the proposed areas of the site were evaluated. The calculations are based upon worksheets 1, 2 and 3c from Appendix F of the Stormwater BMPs. Net TSS removal was calculated for each subcatchment (or proposed portion of each subcatchment) individually and then the weighted totals were summed.

The constructed water quality measures for the site will yield a net TSS removal of 54.6% for the proposed areas of the site. For a 33.1% impervious site, the Sliding Scale TSS removal standard requires a net TSS removal of roughly 45%; therefore the measures for the site will meet the standard. The individual subcatchment and total site net TSS removal calculations for this project are found attached to this section.

6.4 MAINTENANCE OF STORMWATER SYSTEMS

Upon completion of the project, responsibility for overseeing the property will fall on the Facilities Manager, including the inspection and maintenance of the site's stormwater drainage system, treatment measures, roadways, parking areas, permanent erosion control measures, and landscaped areas located outside of City right-of-ways.

The Facilities Manager will be an agent of the Owner. Until a Facilities Manager has been assigned to the site, the responsible parties will be Peggy and Eric Cianchette, who can be reached c/o ELC, Inc., 42 Market Street, Portland, Maine 04101.

6.4.1 Catch Basins

Catch basins will be inspected semi-annually in spring and fall. These visual inspections ensure the catch basin grate is free of debris and that sediment in the sump has not accumulated above the pipe inverts. If cleaning is required, the Facilities Manager can contract the services of Catch Basin Cleaners [P.O. Box 1579; Meredith, N.H., 03253; (603) 279-3118] or a similar firm.

6.4.2 Parking and Paved Areas

Parking and paved areas will be inspected annually each spring. Visual inspections will enable site roads and parking areas to be kept clean and clear through contracting periodic sweeping and winter plowing as required. The inspections will also ensure pavement markings are repainted as needed to maintain property traffic circulation and parking space delineation. Paved areas will be plowed and sanded as often as necessary to maintain public safety.

The Facilities Manager will inspect all parking and paved areas in the project site and will have the pavement swept and cleaned within the project site on an annual, as-needed basis. This work

will be contracted with Zebra Striping, Inc. [101 Pleasant Hill Rd.; Scarborough, ME, 04074; (207) 883-7081] or a similar firm.

6.4.3 Filter Basins and Dry Swales

The underdrained filter basins and dry swales will be inspected semi-annually in spring and fall. Additionally, each basin and swale will be inspected following major storms. These inspections will ensure that there is no erosion in the basin or swale, the basin or swale remains capable of filtering runoff within two days, and sediment does not build up.

MeDEP recommends mowing at least twice each year to allow visual inspection and to prevent the growth of woody plants. At the Woodard & Curran site, each basin and swale will be mowed in conjunction with regular mowing, typically on a weekly basis. Sediment will be removed annually. Any eroding areas will be repaired immediately. Should a basin or swale fail to filter the runoff form a storm within two days, the soil filter layer may need to be retilled. The Facilities Manager would likely hire a local contractor to perform this work.

No basin or swale will be used for snow storage or for any activities that involve heavy foot traffic. Vehicles will not be allowed.

6.5 CONCLUSION

The project has been designed to prevent an increase in peak runoff from the site to comply with the existing Site Location permit. Additionally, in order to provide measurable stormwater quality treatment and to comply with the City Ordinance, the project was designed to meet the Sliding Scale TSS removal standard, present in the previous Chapter 500 regulations. The peak runoff rate will decrease during the 2-year storm by about 17%, and by 6% and 5% for the 10- and 25-year storms, respectively. The water quality measures for the site will yield a net TSS removal of 54.6% for the proposed areas on site, exceeding the 45% required by the Sliding Scale TSS removal standard. As designed, the project will meet both goals.

Some aspects of the recently adopted MeDEP Chapter 500: Stormwater Management have been incorporated into the design of the project. Stormwater filtration basins are proposed for the expanded areas of the satellite parking lot. These basins will collect and filter runoff from smaller storms, and the first flush, which carries the majority of the sediment load, from larger storms.

Upon completion of the project, maintenance responsibility for the site stormwater conveyance and treatment measures will be the responsibility of the Facilities Manager.

6.6 ATTACHMENTS

Rainstore, by Invisible Structures, Inc., Product Detail Sheets

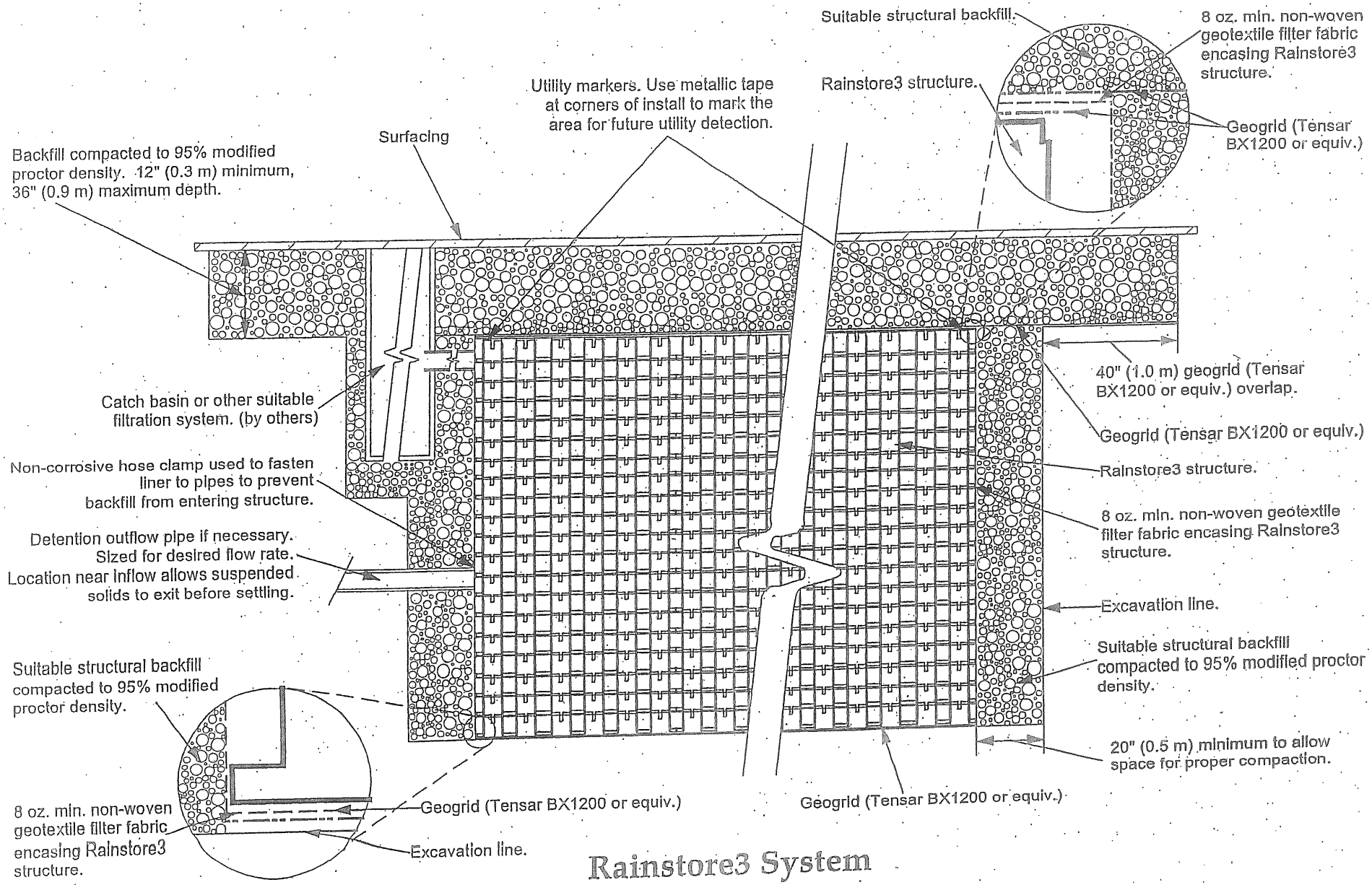
Figure 6.1 – Existing Stormwater Management Plan.

Figure 6.2 – Proposed Stormwater Management Plan.

HydroCAD Calculations (Existing).

HydroCAD Calculations (Proposed).

Water Quality Calculations.



Rainstore3 System

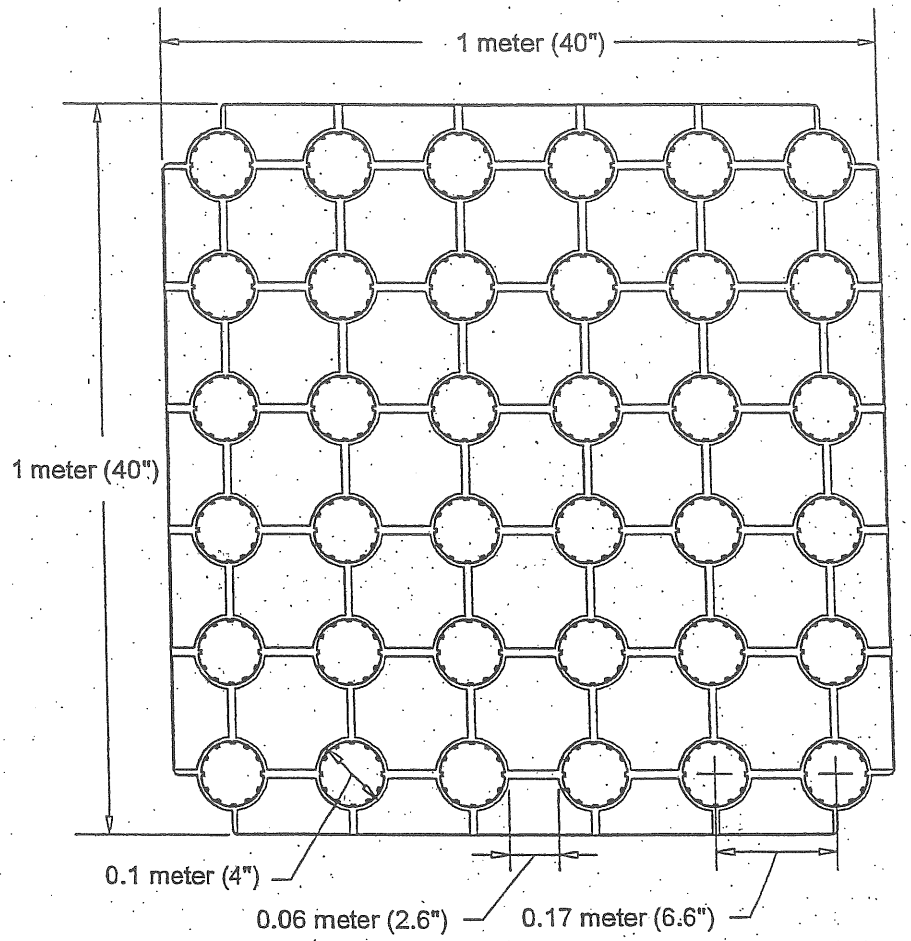
Typical RS3 installation below paving

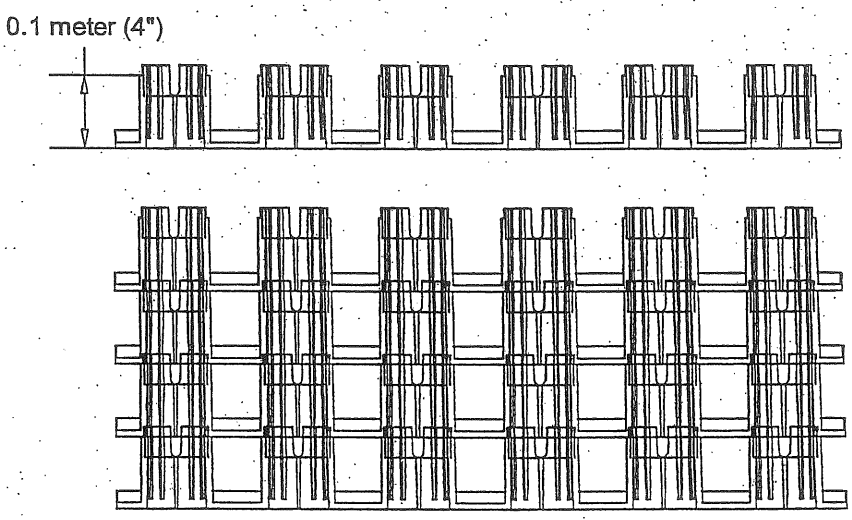
NOT TO SCALE

Invisible Structures, Inc.
RS3system.dwg

1600 Jackson Street, Suite 310
Golden, Colorado 80401
800-233-1510 FAX: 800-233-1522
www.Invisiblestructures.com 02/04

Rainstore3 Unit Dimensions





Rainstore3 Unit Detail

NOT TO SCALE

Single Rainstore3 injection molded unit geometry and dimensions

Invisible
Structures, Inc.
RS3detail.dwg

1600 Jackson St. Suite 310
Golden, Colorado 80401
800-233-1510 FAX: 800-233-1522
www.invisiblestructures.com 08/04

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CLIENT CADCAM Associates
PROJECT Woodard & Curran Building Addition
DESIGNED BY KRV DATE 2/17/2006
CHECKED BY DATE
PROJECT NO. 203834.01 SHEET NO 1 OF 4

TSS REMOVAL EFFICIENCY (%)

The following estimate is based on the following references.
Stormwater Management for Maine: BMPs (Table 5.1, Table 6.1, Section 6.2.3)
Stormwater Management for Maine: BMPs (1996 Addendum)

INCLUDED IN QUALITY CALCULATIONS - *

SUBCATCHMENT	Description	BMP	%	TOTAL %	Imp Acres	%Imp	TSS Removal
15S	Proprosed North Lot	Water Quality Inlet / Filtration Basin	91	91.0	0.34	25.8	23.5
16S	Proprosed North Lot	Filtration Basin	90	90.0	0.1	7.6	6.8
21S	Proposed Access Road			0.0	0.01	0.8	0.0
22S (partial)	Central Plaza and Parking			0.0	0.26	19.7	0.0
23S (partial)	Proposed Building	Detention Basin	10	10.0	0.17	12.9	1.3
24S	Rear Parking (separate from Bldg)	Dry Swale	69	69.0	0.22	16.7	11.5
25S	Access Rd and Adj. Rear Parking	Dry Swale	69	69.0	0.22	16.7	11.5
					1.32	100.2	54.6

NOT INCLUDED IN QUALITY CALCULATIONS - **

SUBCATCHMENT	Description	BMP	%	TOTAL %	Imp Acres	%Imp	TSS Removal
11S	Existing North Lot	Detention Basin	10	10.0	0.27	0.31	3.1
12S	Entrance to North Lot	Vegetative Swale	25	25.0	0.17	0.20	5.0
22S (partial)	Existing South Lot			0.0	0.11	0.13	0.0
23S (partial)	Existing Building	Detention Basin	10	10.0	0.31	0.36	3.6
					0.86	1.00	11.7

* - Per discussions with MeDEP, TSS removal for the site were based on proposed impervious areas.
** - Existing impervious areas shown for comparison.

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STORMWATER QUALITY TREATMENT MEASURE SIZING

The following estimate is based on the following references.

Stormwater Management for Maine: Volume III BMPs Technical Design Manual
Stormwater Management for Maine: BMPs (Table 5.1, Table 6.1, Section 6.2.3)
Stormwater Management for Maine: BMPs (1996 Addendum)

Treatment Measure	Subcatchments Treated	%TSS Removal	Impervious Area (acres)	Runoff (inches)	Pervious Area (acres)	Runoff (inches)	WQV Required	WQV Provided
Filter Basin #1	16S	90	0.1	1	0.12	0.4	537.2	**561.0**
Filter Basin #2	15S	90	0.34	1	0.14	0.4	1437.5	**1615.0**

Each basin will have a spillway constructed to allow flow from larger to storms to pass through. Each spillway will be at a height of 18 inches above the basin floor and 18 inches below the top and the basin embankments. The width of each spillway has been design so that the peak height of water in each basin during the 25-year storm will be at least one foot below the top of the embankment.

The required treatment storage must be at a depth of no more than 18 inches. As shown in the attached HydroCad calculations, Filter Basin #1 (modeled as Pond P16) and Filter Basin #2 (modeled as Pond P15), have cumulative storages, at depths of 18 inches, of 561 cubic feet and 1,614 cubic feet, respectively. Both Basins have been sized to provide sufficient treatment storage to comply with the requirements of the recently adopted Chapter 500 Stormwater rules. Based on discussions with MeDEP, the basins will provide 90% TSS removal.

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DESIGNED BY KRV DATE 2/17/2006
CHECKED BY DATE
PROJECT NO. 203834.01 SHEET NO. 3 OF 4

STORMWATER QUALITY TREATMENT MEASURE SIZING

The following estimate is based on the following references.

Stormwater Management for Maine: Volume III BMPs Technical Design Manual
Stormwater Management for Maine: BMPs (Table 5.1, Table 6.1, Section 6.2.3)
Stormwater Management for Maine: BMPs (1996 Addendum)

Treatment Measure	Subcatchments Treated	%TSS Removal	Total Area (acres)	Runoff (inches)	WQV Required	WQV Provided
Dry Swale	24S, 25S	69	0.61	0.4	885.7	895.0

The swale will have a spillway constructed to allow flow from larger to storms to pass through. The spillway will be at a height of 18 inches above the basin floor and will allow runoff from the 10-year storm to pass with 6 inches of freeboard. Further, the swale will be constructed to remain stable and pass runoff from the 25-year storm.

The required treatment storage must be at a depth of no more than 18 inches. As shown in the attached HydroCad calculations, the dry swale (modeled as Pond P24) has a cumulative storage, at a depth of 18 inches, of 895 cubic feet. The swale passes runoff from the 10-year storm with 6.1 inches of freeboard and the 25-year storm with 5.8 inches of freeboard. The dry swale has been properly sized to provide 69% TSS removal.

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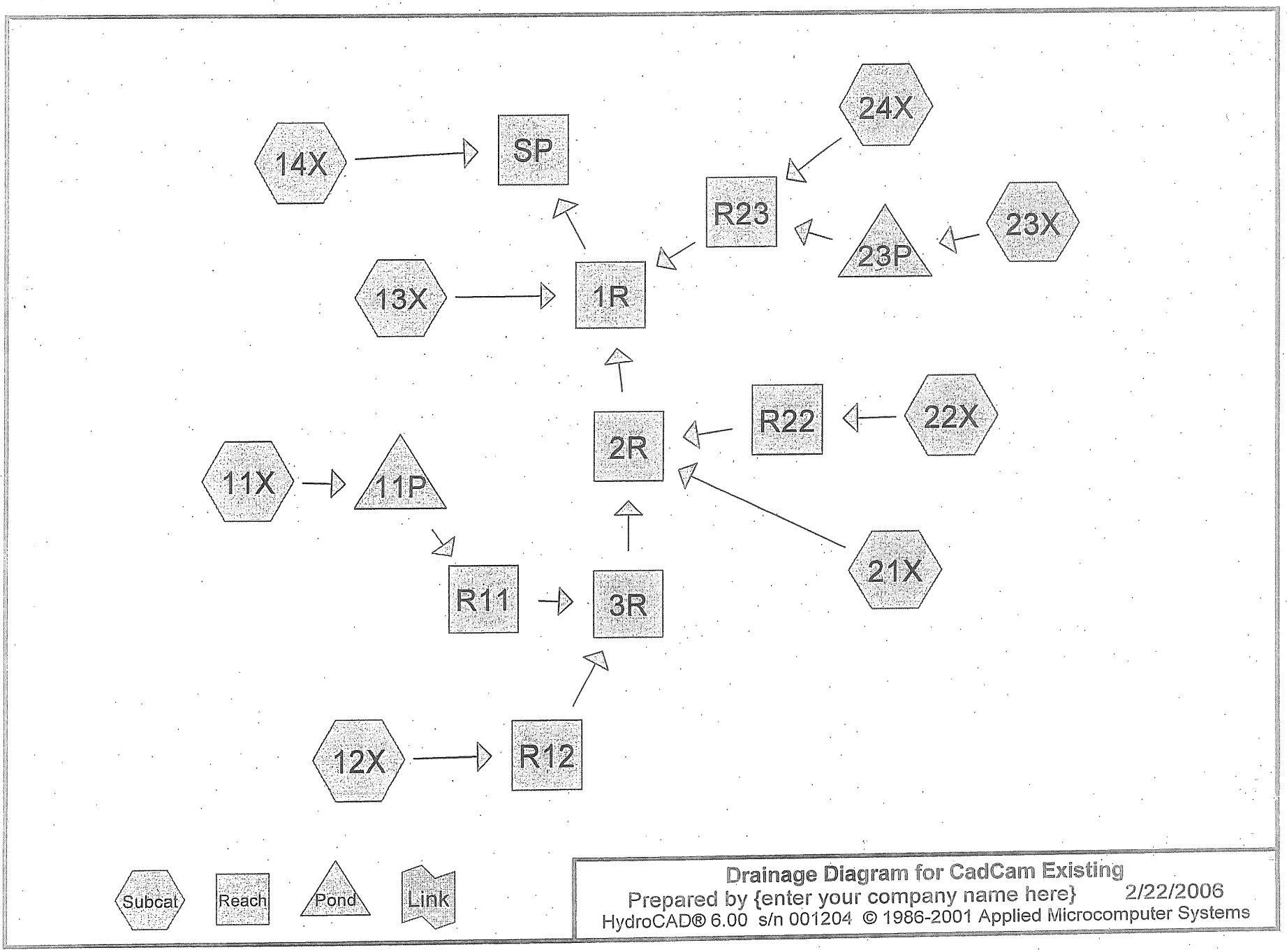
STORMWATER QUALITY TREATMENT MEASURE SIZING

The following estimate is based on the following references.

Stormwater Management for Maine: Volume III BMPs Technical Design Manual
Stormwater Management for Maine: BMPs (Table 5.1, Table 6.1, Section 6.2.3)
Stormwater Management for Maine: BMPs (1996 Addendum)

Treatment Measure	Location	10-year runoff (cfs)	Design Length (Linear Feet)
Level Spreader	Outlet of Filtration Basin #1	0.74	2.96
Level Spreader	West side of Access Lane	2.49	9.96
Level Spreader	East side of Access Lane	0.42	1.68
Level Spreader	Outlet of Dry Swale	2	8

The design criteria for the level spreaders, presented in the Maine Erosion and Sedimentation Control BMPs, were consulted to determine the required level spreader length. Level Spreaders were sized based on 0.25 cfs per linear foot for the 10-year storm. However, the specifications for level spreaders state that the minimum length shall be 12 feet. Therefore, all level spreaders will be 12 feet in length.


24X
14X
SP
R23
23X
23P
13X
1R
R22
22X
2R
11X
11P
21X
R11
3R
12X
R12
Subcat
Reach
Pond
Link
Drainage Diagram for CadCam Existing
Prepared by {enter your company name here} 2/22/2006
HydroCAD® 6.00 s/n 001204 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-30.00 hrs, dt=0.10 hrs, 251 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=3.00"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11X: Satellite Parking
Tc=2.1 min CN=95 Area=0.320 ac Runoff= 0.89 cfs 0.065 af

Subcatchment 12X: North/West of Satellite
Tc=4.8 min CN=81 Area=0.590 ac Runoff= 0.85 cfs 0.065 af

Subcatchment 13X: Existing NORTH-CENTRAL
Tc=15.4 min CN=75 Area=0.910 ac Runoff= 0.70 cfs 0.073 af

Subcatchment 14X: Existing Northeast
Tc=20.4 min CN=74 Area=1.040 ac Runoff= 0.67 cfs 0.079 af

Subcatchment 21X: Existing Central
Tc=7.3 min CN=79 Area=0.850 ac Runoff= 1.00 cfs 0.084 af

Subcatchment 22X: Existing Parking and Entrance Circle
Tc=12.0 min CN=84 Area=0.720 ac Runoff= 1.02 cfs 0.091 af

Subcatchment 23X: Existing Buildings and surrounding
Tc=8.3 min CN=91 Area=0.810 ac Runoff= 1.65 cfs 0.140 af

Subcatchment 24X: Behind Existing Pond
Tc=11.6 min CN=73 Area=0.230 ac Runoff= 0.17 cfs 0.016 af

Reach 1R: Existing Swale Inflow= 4.49 cfs 0.533 af
Length= 200.0' Max Vel= 0.9 fps Capacity= 43.53 cfs Outflow= 4.25 cfs 0.533 af

Reach 2R: Existing Swale Inflow= 2.50 cfs 0.304 af
Length= 80.0' Max Vel= 1.3 fps Capacity= 144.69 cfs Outflow= 2.38 cfs 0.304 af

Reach 3R: Existing Swale Inflow= 0.95 cfs 0.129 af
Length= 120.0' Max Vel= 0.9 fps Capacity= 63.42 cfs Outflow= 0.87 cfs 0.129 af

Reach R11: From P11 to Swale Inflow= 0.17 cfs 0.064 af
Length= 70.0' Max Vel= 0.2 fps Capacity= 33.01 cfs Outflow= 0.17 cfs 0.064 af

Reach R12: 48" RCP Inflow= 0.85 cfs 0.065 af
Length= 90.0' Max Vel= 7.0 fps Capacity= 463.95 cfs Outflow= 0.82 cfs 0.065 af

Reach R22: From 22 to Swale Inflow= 1.02 cfs 0.091 af
Length= 90.0' Max Vel= 0.4 fps Capacity= 27.37 cfs Outflow= 0.91 cfs 0.091 af

Reach R23: From Pond23 to Swale Inflow= 1.60 cfs 0.156 af
Length= 40.0' Max Vel= 0.5 fps Capacity= 21.38 cfs Outflow= 1.44 cfs 0.156 af

Reach SP: Study Point Inflow= 4.92 cfs 0.612 af
Length= 100.0' Max Vel= 0.4 fps Capacity= 239.77 cfs Outflow= 4.72 cfs 0.612 af

Pond 11P: Existing Satellie Lot Detention Pond Peak Storage= 917 cf Inflow= 0.89 cfs 0.065 af
Primary= 0.17 cfs 0.064 af Secondary= 0.00 cfs 0.000 af Outflow= 0.17 cfs 0.064 af

Pond 23P: Pond 23 Peak Storage= 894 cf Inflow= 1.65 cfs 0.140 af
Primary= 0.86 cfs 0.133 af Secondary= 0.58 cfs 0.006 af Outflow= 1.45 cfs 0.140 af

Runoff Area = 5.470 ac Volume = 0.613 af Average Depth = 1.34"

Subcatchment 11X: Satellite Parking

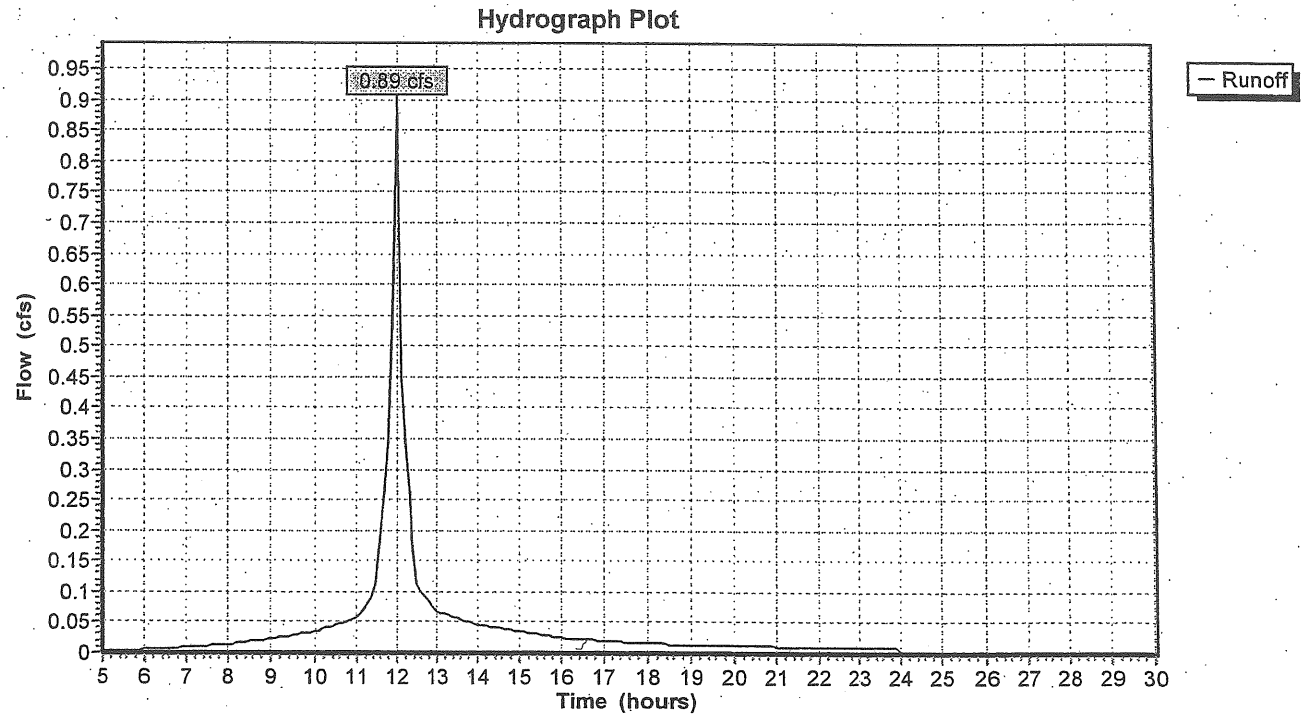
Runoff = 0.89 cfs @ 11.99 hrs, Volume= 0.065 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.270	98	IMPERVIOUS (PARKING LOT)
0.040	74	OPEN SPACE (GOOD)-HSG "C"
0.010	89	RIP RAP-HSG "C"
0.320	95	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0303	1.6		**Sheet Flow, Segment ID:AB** Smooth surfaces n= 0.011 P2= 3.00"
0.1	15	0.3300	4.0		**Shallow Concentrated Flow, Segment ID:BC** Kv= 7.0 fps
0.9	55	0.0200	1.0		**Shallow Concentrated Flow, Segment ID:CD** Short Grass Pasture Kv= 7.0 fps
2.1	170	Total			

Subcatchment 11X: Satellite Parking



Subcatchment 12X: North/West of Satellite

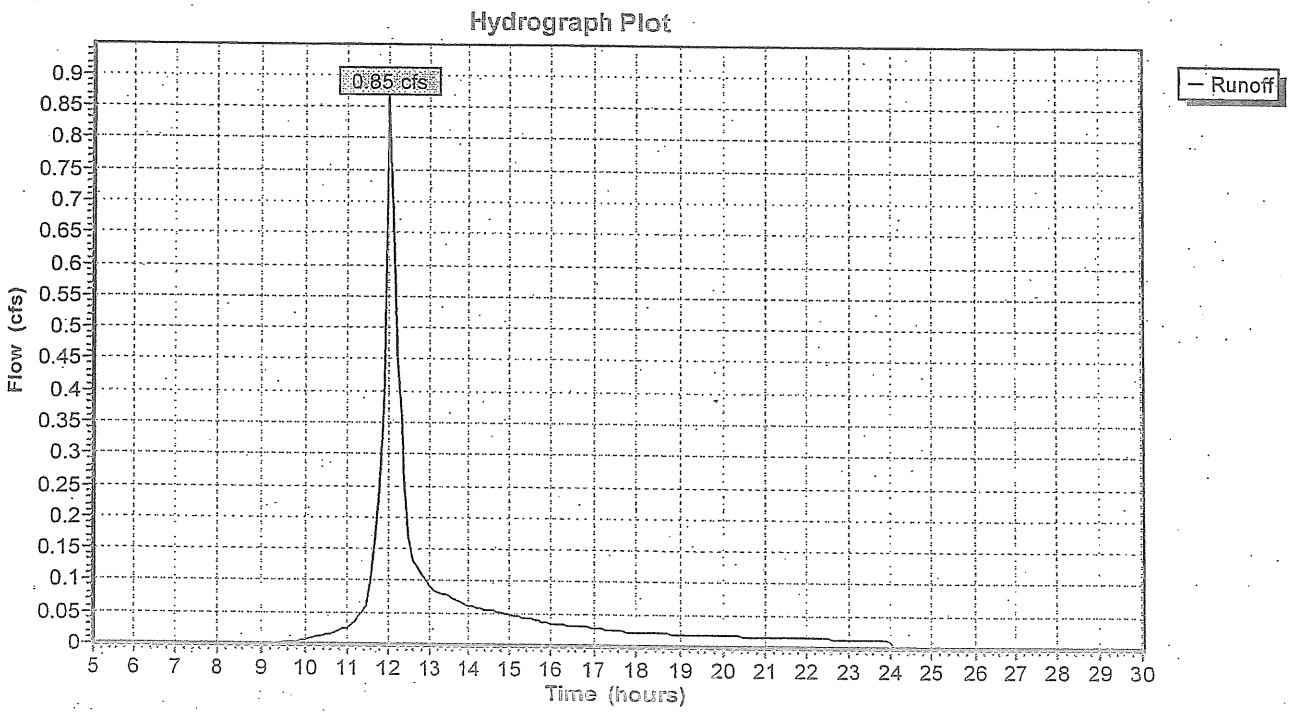
Runoff = 0.85 cfs @ 12.02 hrs, Volume= 0.065 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.020	73	WOODS (FAIR)-HSG "C"
0.400	74	OPEN SPACE (GOOD)-HSG "C"
0.170	98	IMPERVIOUS
0.590	81	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	16	0.1900	0.2		Sheet Flow, Segment ID:AB Grass: Dense n= 0.240 P2= 3.00"
0.8	13	0.5000	0.3		Sheet Flow, Segment ID:BC Grass: Dense n= 0.240 P2= 3.00"
1.3	185	0.0270	2.5		Shallow Concentrated Flow, Segment ID:CD Grassed Waterway Kv= 15.0 fps
0.2	60	0.0100	5.7	7.00	Circular Channel (pipe), SEGMENT ID:DE Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
1.1	165	0.0300	2.6		Shallow Concentrated Flow, SEGMENT ID:EF Grassed Waterway Kv= 15.0 fps
4.8	439	Total			

Subcatchment 12X: North/West of Satellite



Subcatchment 13X: Existing NORTH-CENTRAL

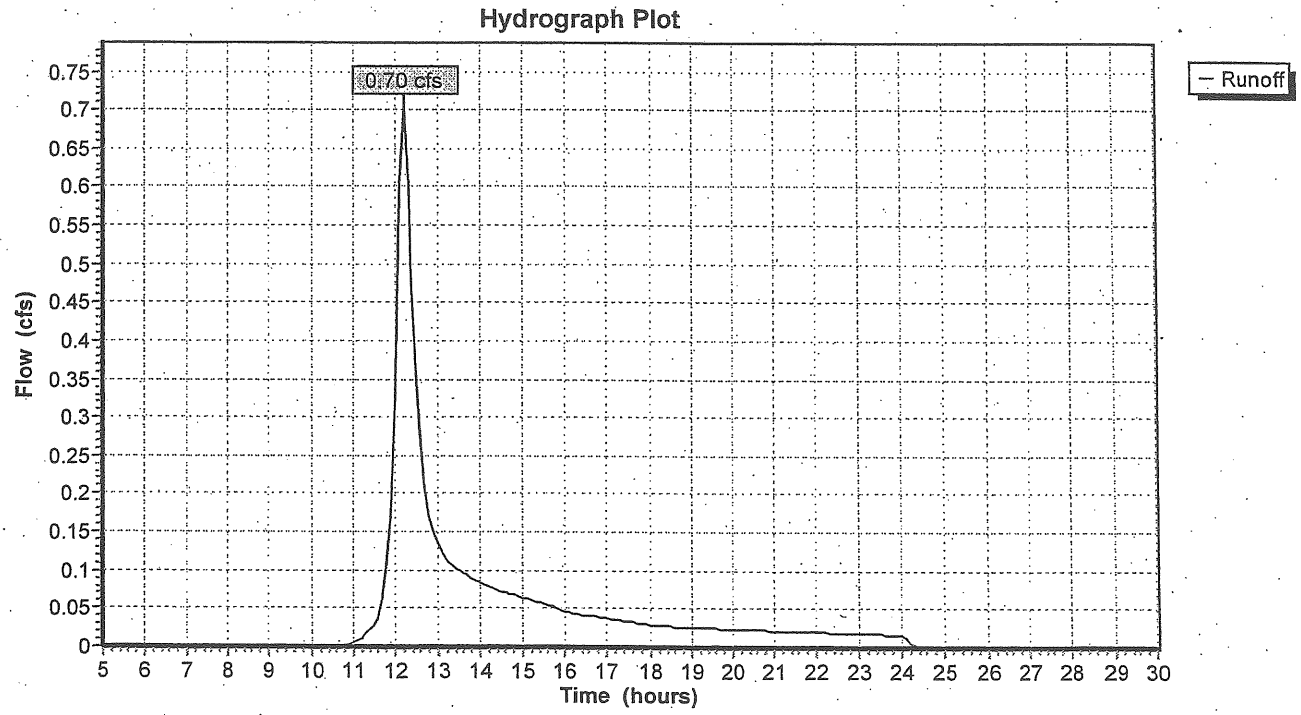
Runoff = 0.70 cfs @ 12.20 hrs, Volume= 0.073 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.000	98	IMPERVIOUS (PAVEMENT)
0.540	73	WOODS (FAIR)-HSG "C"
0.130	74	OPEN SPACE (GOOD)-HSG "C"
0.240	79	WOODS (FAIR)-HSG "D"
0.910	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	35	0.0700	0.1		**Sheet Flow, Segment ID:AB** Woods: Light underbrush n= 0.400 P2= 3.00"
6.7	65	0.1700	0.2		**Sheet Flow, Segment ID:BC** Woods: Light underbrush n= 0.400 P2= 3.00"
1.2	130	0.1300	1.8		**Shallow Concentrated Flow, SegmentC-D** Woodland Kv= 5.0 fps
1.7	100	0.0400	1.0		**Shallow Concentrated Flow, Segment ID:DE** Woodland Kv= 5.0 fps
15.4	330	Total			

Subcatchment 13X: Existing NORTH-CENTRAL



Subcatchment 14X: Existing Northeast

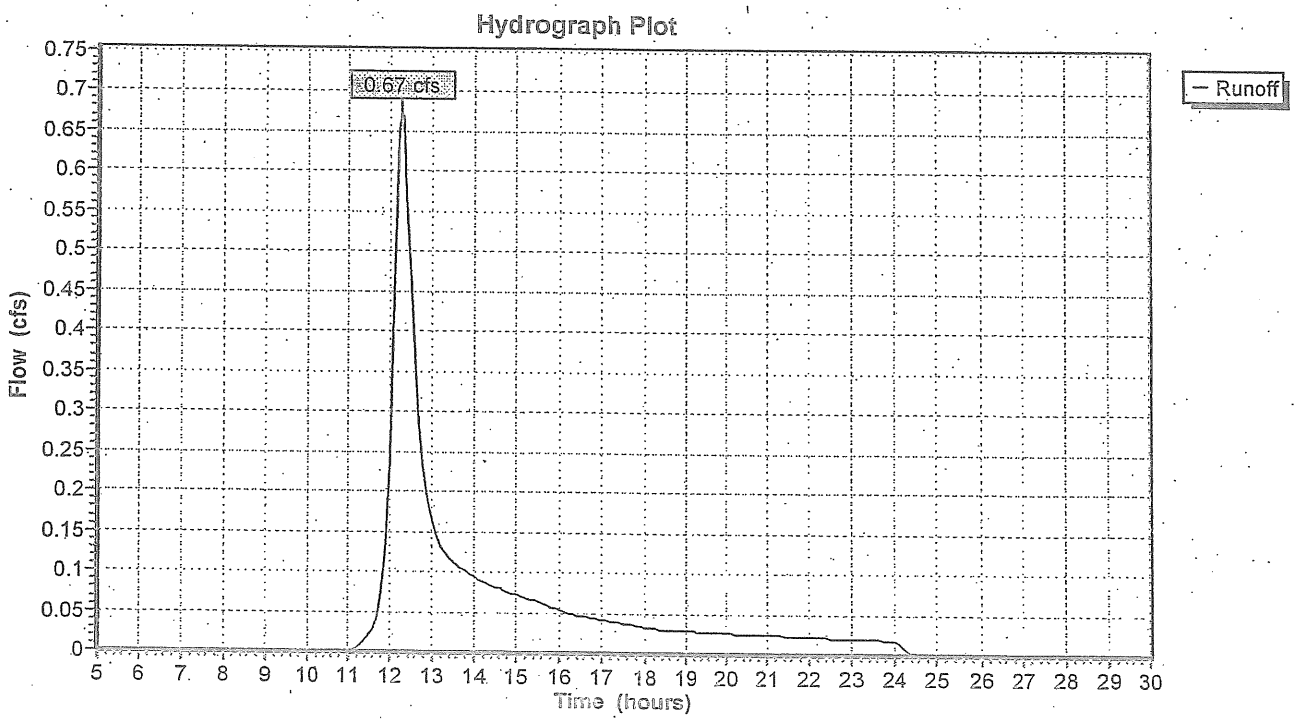
Runoff = 0.67 cfs @ 12.27 hrs, Volume= 0.079 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.810	73	Woods, Fair, HSG C
0.230	79	Woods, Fair, HSG D
1.040	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	60	0.0250	0.1		**Sheet Flow, Segment AB** Woods: Light underbrush n= 0.400 P2= 3.00"
4.0	40	0.2250	0.2		**Sheet Flow, SegmentBC** Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	90	0.1444	1.9		**Shallow Concentrated Flow, SegmentCD** Woodland Kv= 5.0 fps
0.1	25	0.4400	3.3		**Shallow Concentrated Flow, SegmentDE** Woodland Kv= 5.0 fps
2.0	70	0.0140	0.6		**Shallow Concentrated Flow, SegmentEF** Woodland Kv= 5.0 fps
20.4	285	Total			

Subcatchment 14X: Existing Northeast



Subcatchment 21X: Existing Central

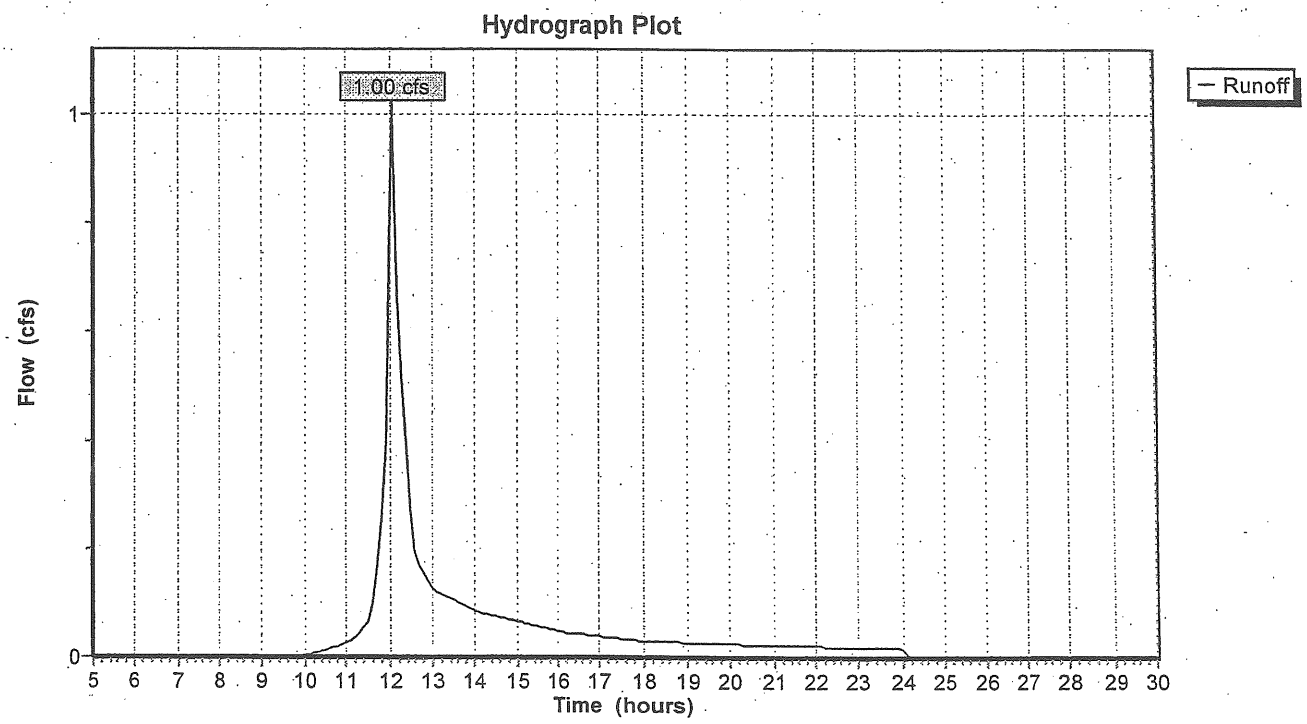
Runoff = 1.00 cfs @ 12.08 hrs, Volume= 0.084 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.260	73	WOODS (FAIR)-HSG "C"
0.250	74	OPEN SPACE (GOODG "C"
0.200	79	WOODS (FAIR)-HSD "D"
0.140	98	IMPERVIOUS (BLDG, PAVEMENT)
0.850	79	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	75	0.0600	0.2		**Sheet Flow, Segment ID:AB** Grass: Short n= 0.150 P2= 3.00"
0.7	15	0.4000	0.4		**Sheet Flow, SegmentBC** Grass: Short n= 0.150 P2= 3.00"
0.2	30	0.2700	2.6		**Shallow Concentrated Flow, Segment ID:CD** Woodland Kv= 5.0 fps
1.2	80	0.0500	1.1		**Shallow Concentrated Flow, Segment ID:DE** Woodland Kv= 5.0 fps
7.3	200	Total			

Subcatchment 21X: Existing Central



Subcatchment 22X: Existing Parking and Entrance Circle

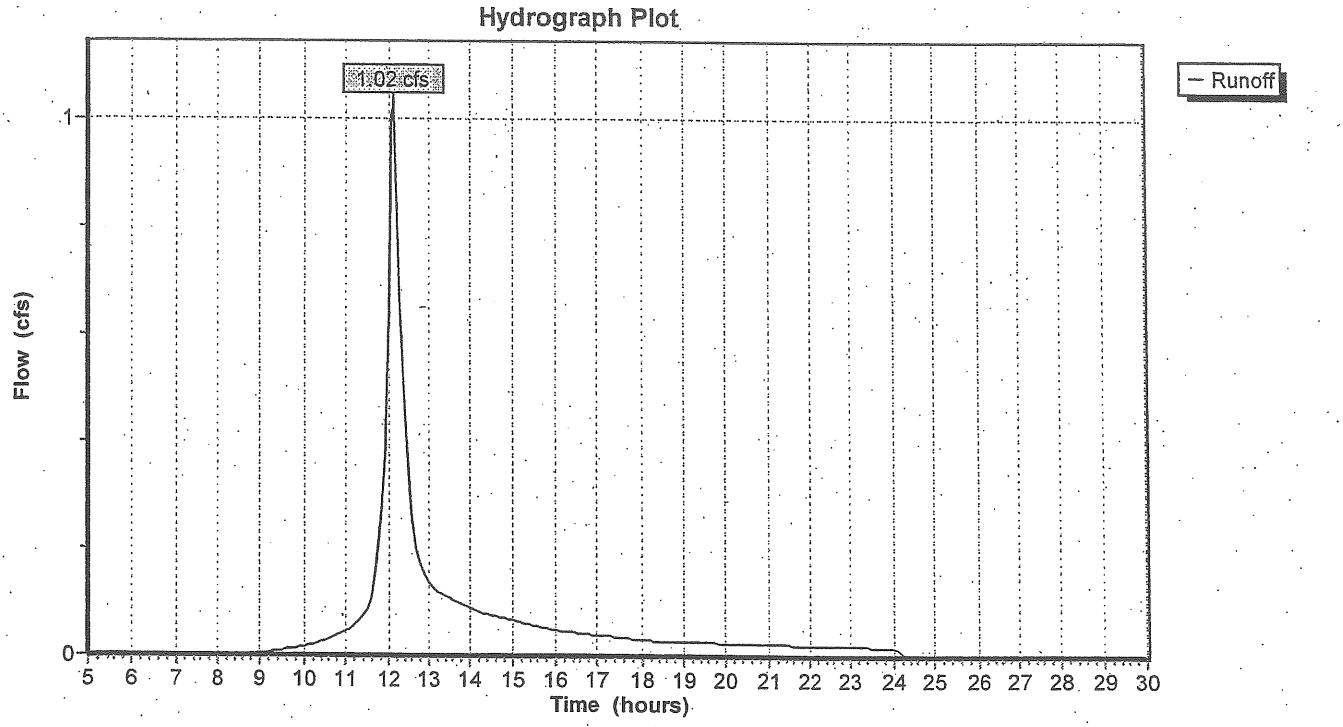
Runoff = 1.02 cfs @ 12.13 hrs, Volume= 0.091 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.130	73	WOODS (FAIR)-HSG "C"
0.280	74	OPEN SPACE (GOODG "C"
0.310	98	IMPERVIOUS (BLDG, PAVEMENT)
0.720	84	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	15	0.0167	0.1		**Sheet Flow, Segment ID:AB** Grass: Short n= 0.150 P2= 3.00"
0.4	20	0.0125	0.8		**Sheet Flow, SegmentBC** Smooth surfaces n= 0.011 P2= 3.00"
7.9	65	0.1100	0.1		**Sheet Flow, SegmentCD** Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	70	0.0860	1.5		**Shallow Concentrated Flow, Segment ID:DE** Woodland Kv= 5.0 fps
0.4	90	0.0333	3.7		**Shallow Concentrated Flow, Segment ID:EF** Paved Kv= 20.3 fps
0.1	65	0.0500	12.0	9.42	**Circular Channel (pipe), SegmentFG** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
12.0	325	Total			

Subcatchment 22X: Existing Parking and Entrance Circle



Subcatchment 23X: Existing Buildings and surrounding

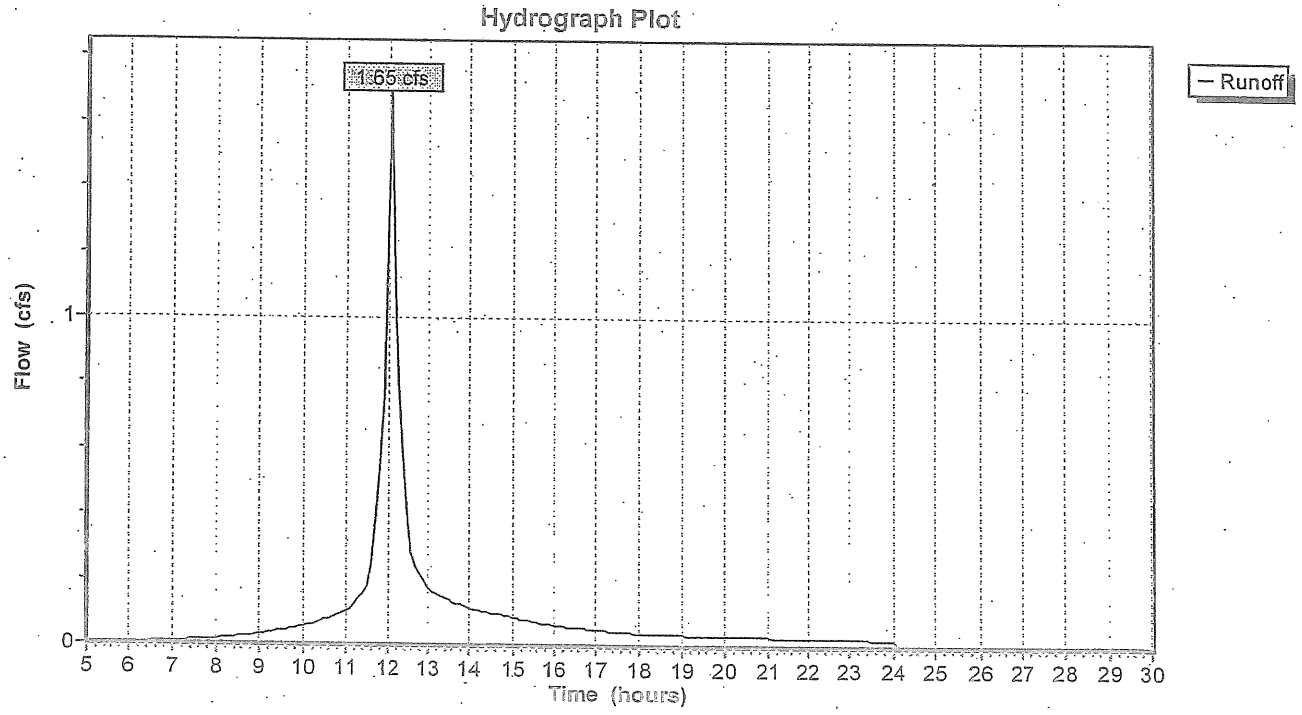
Runoff = 1.65 cfs @ 12.08 hrs, Volume= 0.140 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.310	79	OPEN SPACE (FAIR)-HSG "C"
0.200	98	Paved parking & roofs
0.300	98	Paved parking & roofs
0.810	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	10	0.2000	0.3		Sheet Flow, Segment ID:AB Grass: Short n= 0.150 P2= 3.00"
6.4	90	0.0500	0.2		Sheet Flow, Segment ID:BC Grass: Short n= 0.150 P2= 3.00"
0.4	60	0.1100	2.3		Shallow Concentrated Flow, Segment ID:CD Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3000	3.8		Shallow Concentrated Flow, Segment ID:DE Short Grass Pasture Kv= 7.0 fps
0.9	95	0.0630	1.8		Shallow Concentrated Flow, SegmentEF Short Grass Pasture Kv= 7.0 fps
8.3	265	Total			

Subcatchment 23X: Existing Buildings and surrounding



Subcatchment 24X: Behind Existing Pond

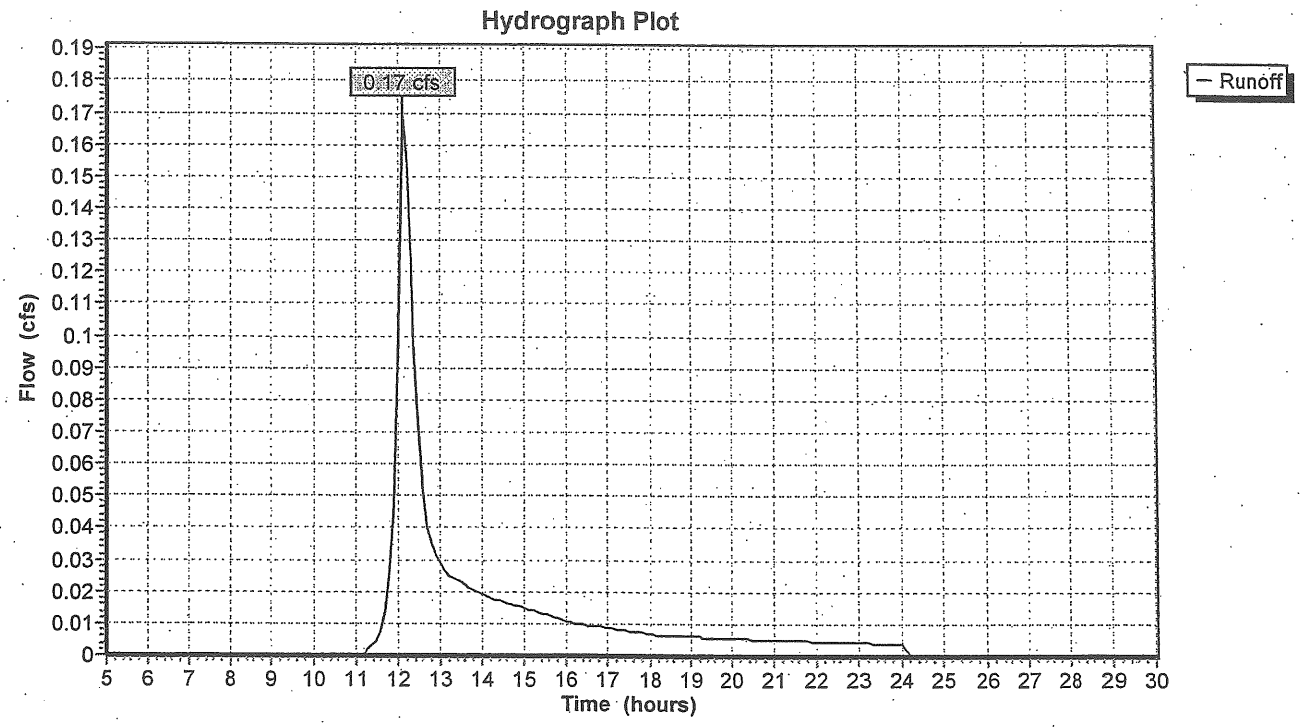
Runoff = 0.17 cfs @ 12.14 hrs, Volume= 0.016 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=3.00"

Area (ac)	CN	Description
0.230	73	Woods, Fair, HSG C

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	45	0.1111	0.1		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00"
4.2	55	0.0545	0.2		**Sheet Flow, BC** Grass: Short n= 0.150 P2= 3.00"
1.5	125	0.0800	1.4		**Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps
11.6	225	Total			

Subcatchment 24X: Behind Existing Pond



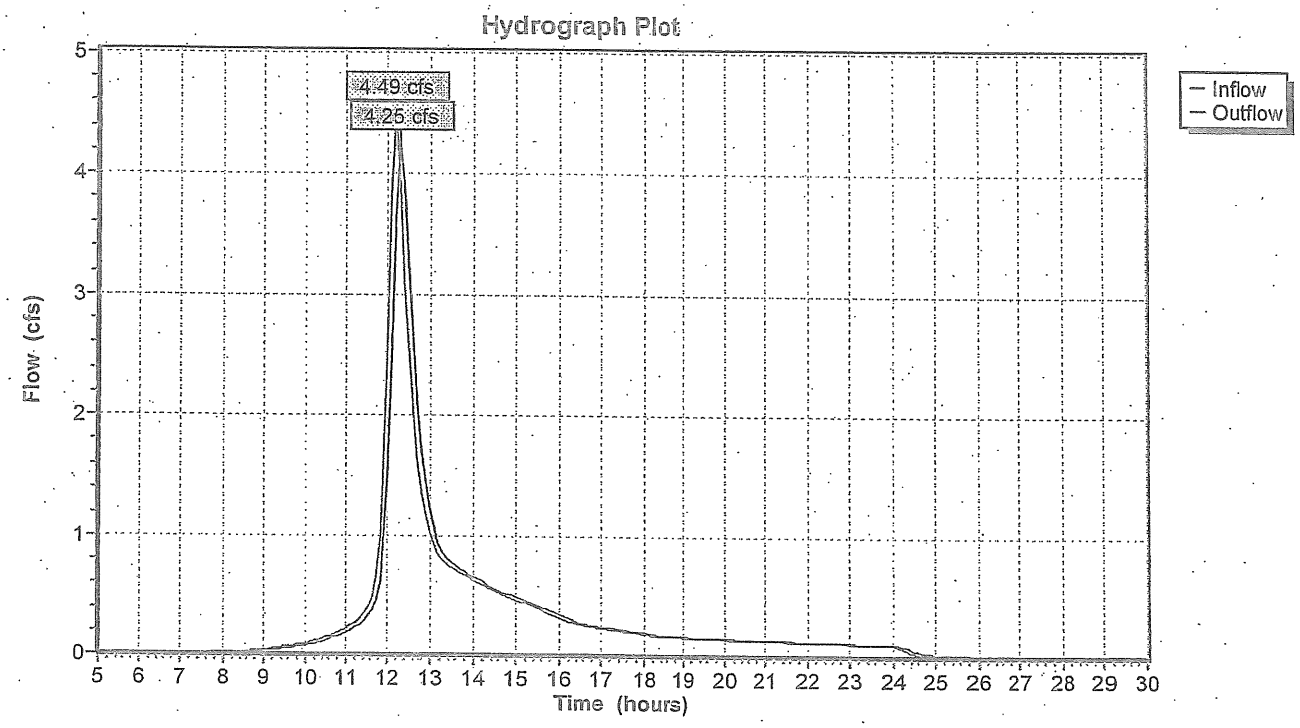
Reach 1R: Existing Swale

Inflow = 4.49 cfs @ 12.20 hrs, Volume= 0.533 af
Outflow = 4.25 cfs @ 12.31 hrs, Volume= 0.533 af, Atten= 5%, Lag= 6.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.9 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.3 fps, Avg. Travel Time= 13.1 min

Peak Depth= 0.57'
Capacity at bank full= 43.53 cfs
Inlet Invert= 30.00', Outlet Invert= 29.50'
7.00' x 2.00' deep channel, n= 0.050 Length= 200.0' Slope= 0.0025 '/'
Side Slope Z-value= 3.0 2.0 '/'

Reach 1R: Existing Swale



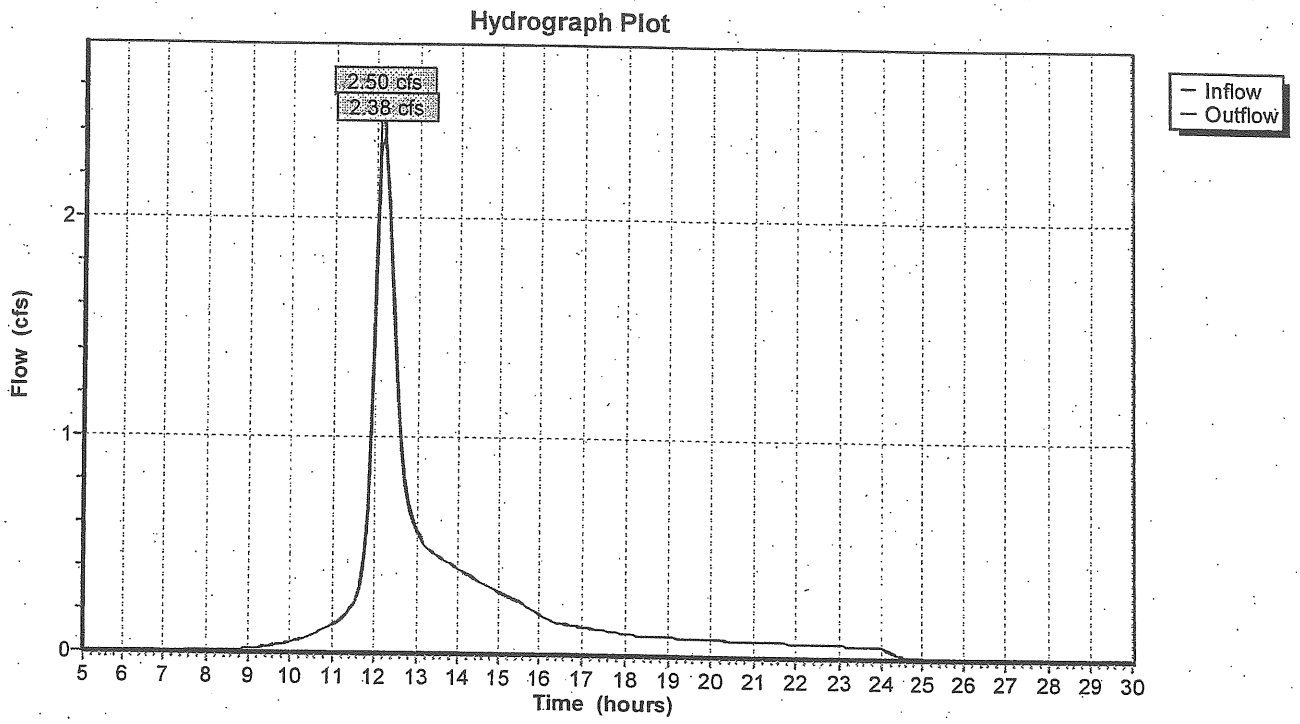
Reach 2R: Existing Swale

Inflow = 2.50 cfs @ 12.13 hrs, Volume= 0.304 af
Outflow = 2.38 cfs @ 12.16 hrs, Volume= 0.304 af, Atten= 5%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 1.3 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 3.1 min

Peak Depth= 0.34'
Capacity at bank full= 144.69 cfs
Inlet Invert= 30.80', Outlet Invert= 30.00'
5.00' x 3.00' deep channel, n= 0.050 Length= 80.0' Slope= 0.0100 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Existing Swale



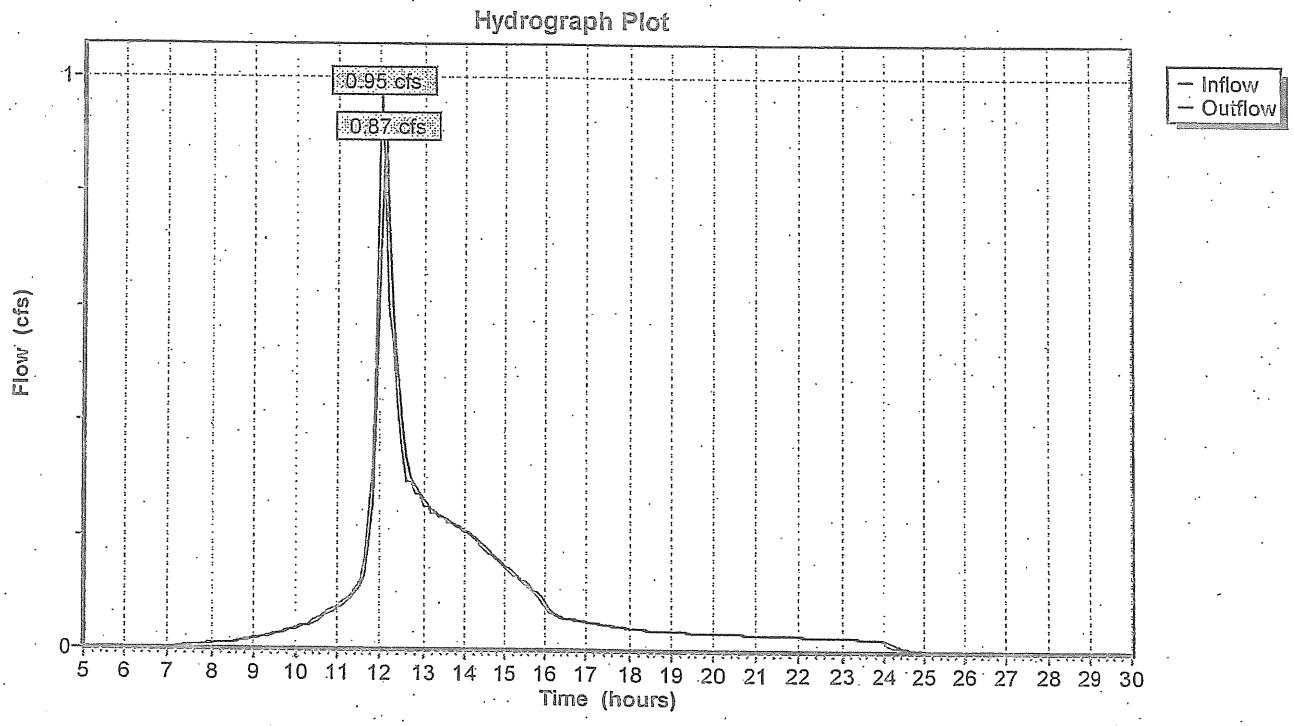
Reach 3R: Existing Swale

Inflow = 0.95 cfs @ 12.04 hrs, Volume= 0.129 af
Outflow = 0.87 cfs @ 12.12 hrs, Volume= 0.129 af, Atten= 8%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.9 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.3 fps, Avg. Travel Time= 6.4 min

Peak Depth= 0.19'
Capacity at bank full= 63.42 cfs
Inlet Invert= 32.00', Outlet Invert= 30.80'
5.00' x 2.00' deep channel, n= 0.050 Length= 120.0' Slope= 0.0100 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Existing Swale



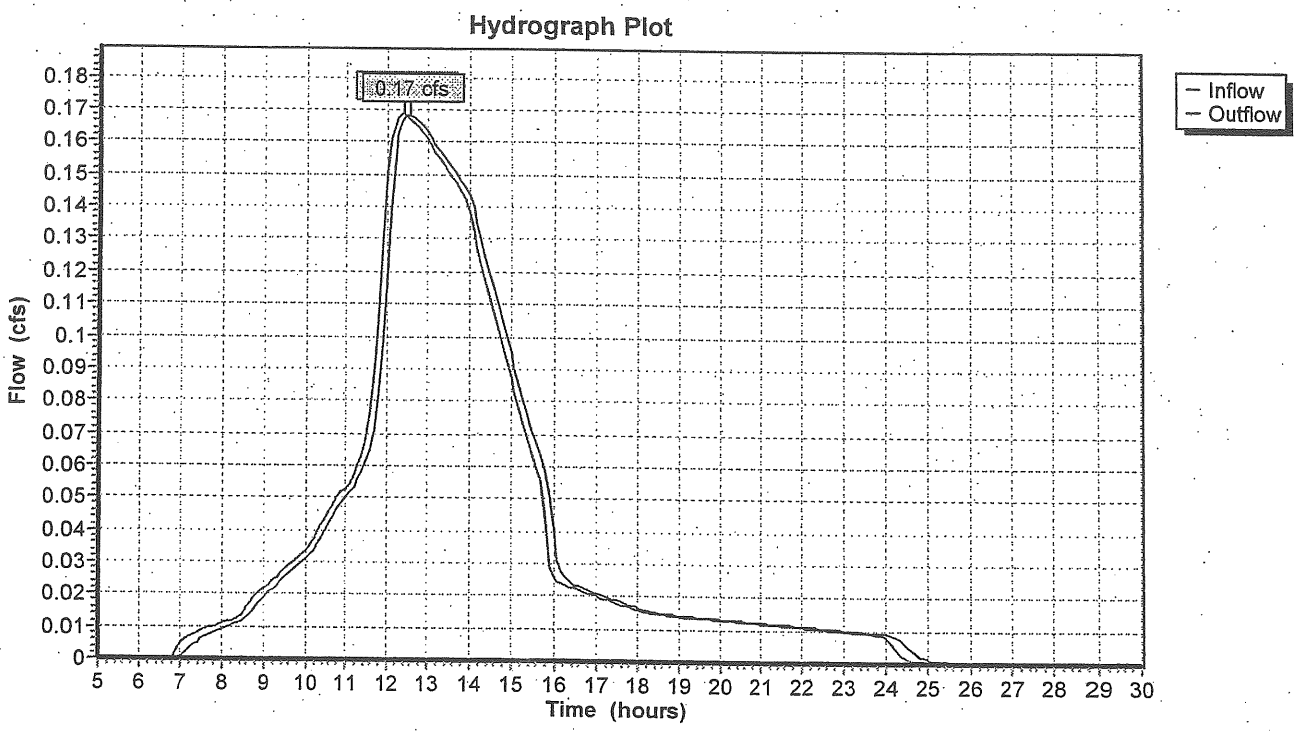
Reach R11: From P11 to Swale

Inflow = 0.17 cfs @ 12.42 hrs, Volume= 0.064 af
Outflow = 0.17 cfs @ 12.57 hrs, Volume= 0.064 af, Atten= 0%, Lag= 9.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.2 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.1 fps, Avg. Travel Time= 10.8 min

Peak Depth= 0.05'
Capacity at bank full= 33.01 cfs
Inlet Invert= 45.90', Outlet Invert= 32.00'
15.00' x 1.00' deep channel, n= 0.400 Length= 70.0' Slope= 0.1986 '/'
Side Slope Z-value= 10.0 '/'

Reach R11: From P11 to Swale



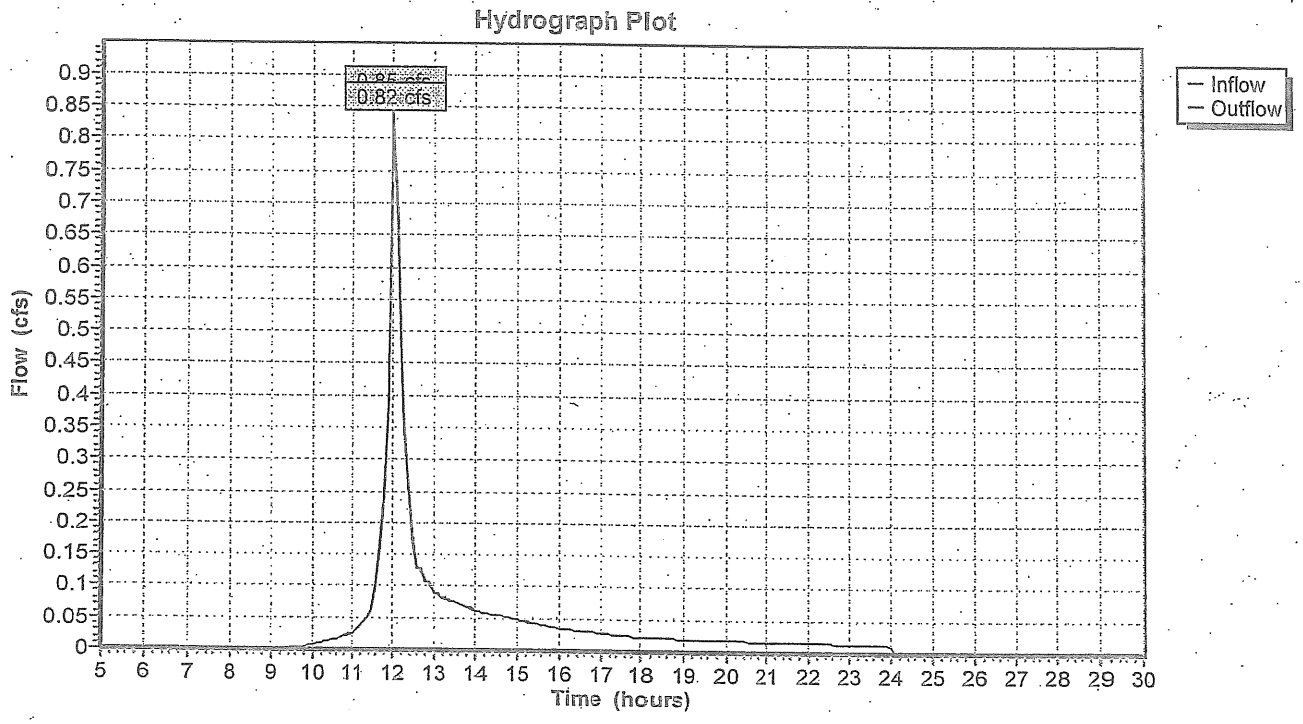
Reach R12: 48" RCP

Inflow = 0.85 cfs @ 12.02 hrs, Volume= 0.065 af
Outflow = 0.82 cfs @ 12.03 hrs, Volume= 0.065 af, Atten= 3%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 7.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.5 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.13'
Capacity at bank full= 463.95 cfs
Inlet Invert= 40.00', Outlet Invert= 32.00'
48.0" Diameter Pipe n= 0.012 Length= 90.0' Slope= 0.0889 '/'

Reach R12: 48" RCP



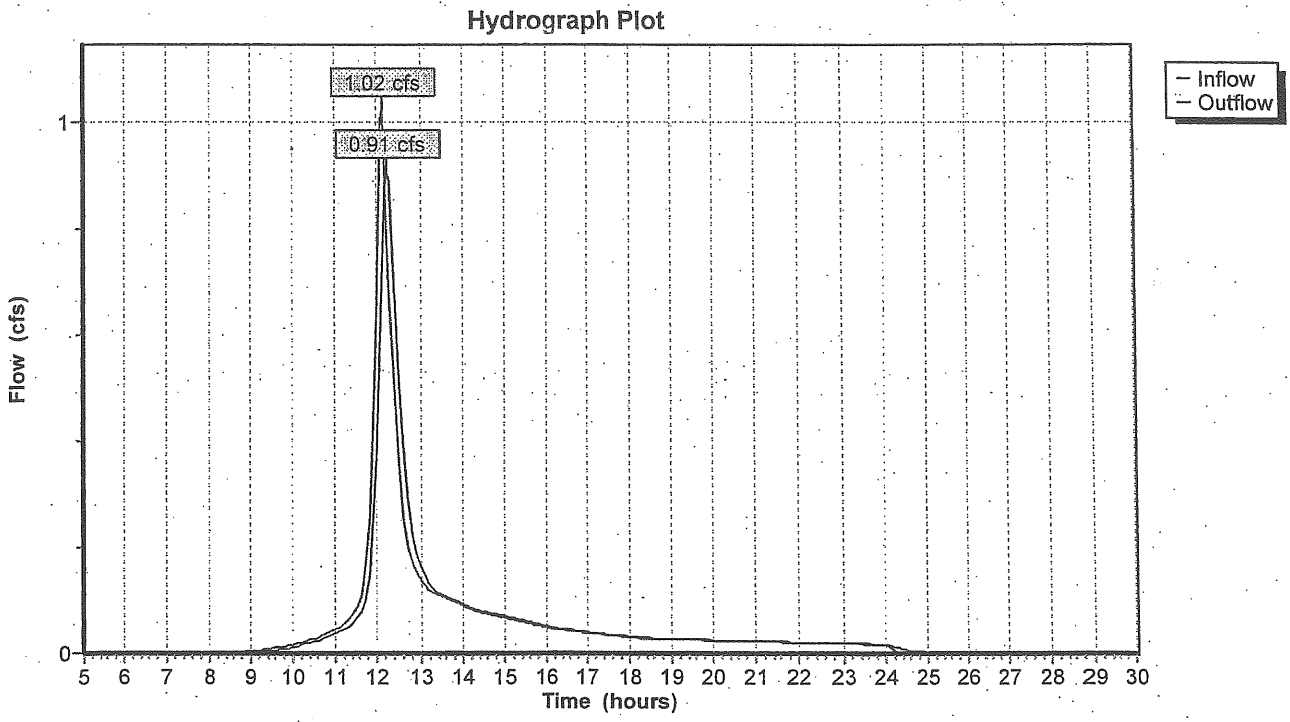
Reach R22: From 22 to Swale

Inflow = 1.02 cfs @ 12.13 hrs, Volume= 0.091 af
Outflow = 0.91 cfs @ 12.25 hrs, Volume= 0.091 af, Atten= 11%, Lag= 7.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.4 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.1 fps, Avg. Travel Time= 13.2 min

Peak Depth= 0.15'
Capacity at bank full= 27.37 cfs
Inlet Invert= 44.00', Outlet Invert= 30.50'
15.00' x 1.00' deep channel, n= 0.400 Length= 90.0' Slope= 0.1500 '/'
Side Slope Z-value= 15.0 2.0 '/'

Reach R22: From 22 to Swale



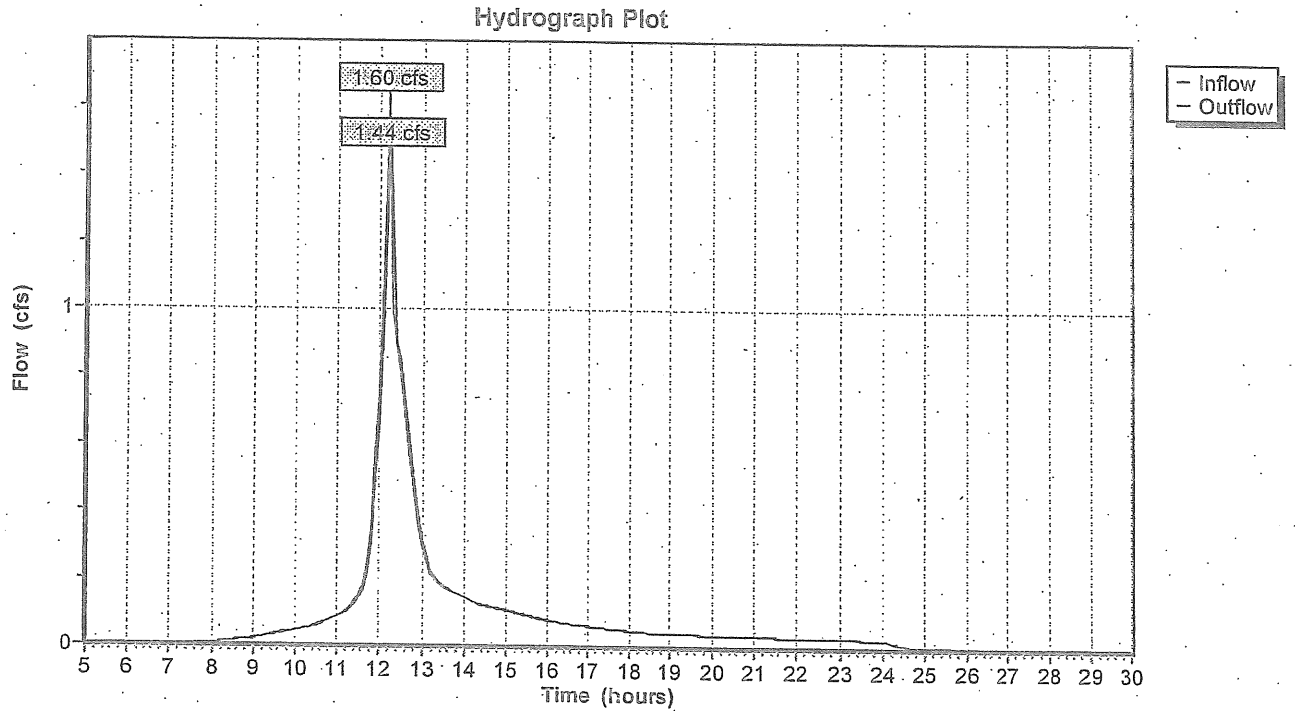
Reach R23: From Pond23 to Swale

Inflow	=	1.60 cfs @	12.19 hrs, Volume=	0.156 af
Outflow	=	1.44 cfs @	12.22 hrs, Volume=	0.156 af, Atten= 10%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.5 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.2 fps, Avg. Travel Time= 4.0 min

Peak Depth= 0.30'
Capacity at bank full= 21.38 cfs
Inlet Invert= 37.00', Outlet Invert= 30.00'
5.00' x 1.00' deep channel, n= 0.400 Length= 40.0' Slope= 0.1750 '/'
Side Slope Z-value= 15.0 '/'

Reach R23: From Pond23 to Swale



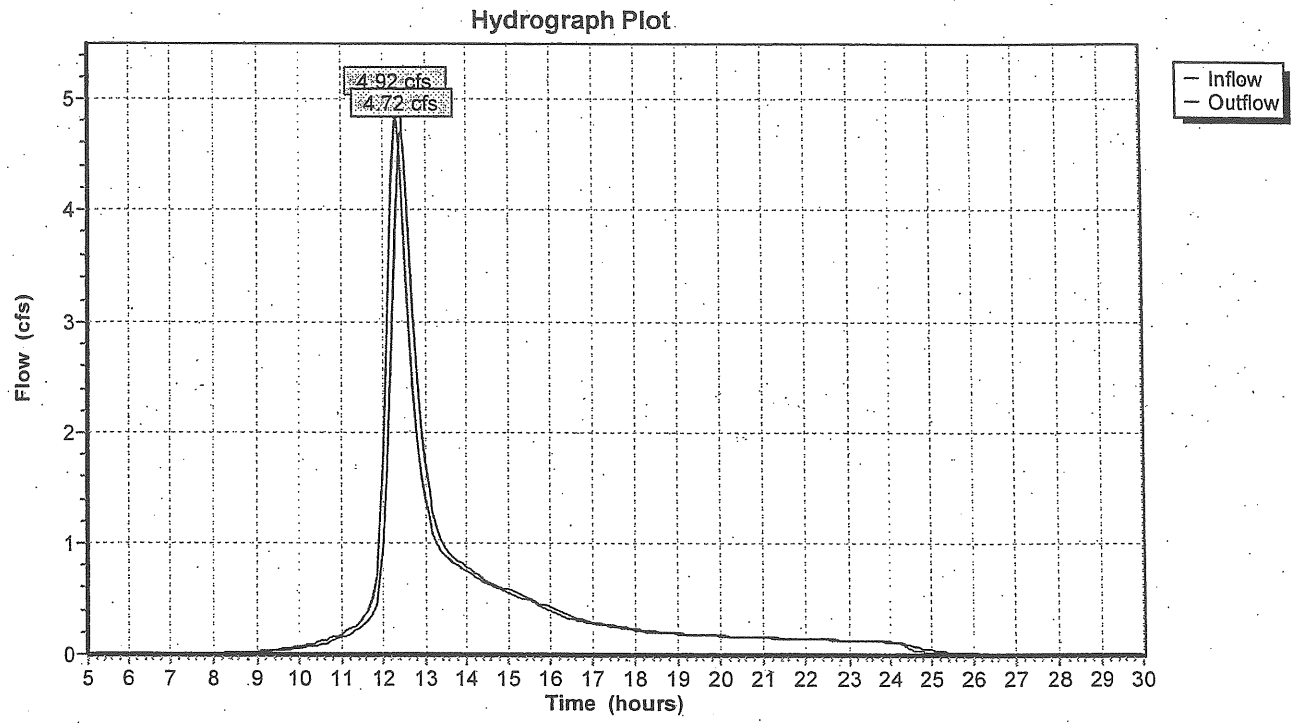
Reach SP: Study Point

Inflow = 4.92 cfs @ 12.31 hrs, Volume= 0.612 af
Outflow = 4.72 cfs @ 12.43 hrs, Volume= 0.612 af, Atten= 4%, Lag= 7.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.4 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.1 fps, Avg. Travel Time= 12.9 min

Peak Depth= 0.31'
Capacity at bank full= 239.77 cfs
Inlet Invert= 29.50', Outlet Invert= 29.40'
35.00' x 3.00' deep channel, n= 0.050 Length= 100.0' Slope= 0.0010 '/'
Side Slope Z-value= 5.0 4.0 '/'

Reach SP: Study Point



Pond 11P: Existing Satellie Lot Detention Pond

Inflow	=	0.89 cfs @	11.99 hrs,	Volume=	0.065 af
Outflow	=	0.17 cfs @	12.42 hrs,	Volume=	0.064 af, Atten= 81%, Lag= 25.5 min
Primary	=	0.17 cfs @	12.42 hrs,	Volume=	0.064 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs

Peak Elev= 48.47' Storage= 917 cf
Plug-Flow detention time= 55.7 min calculated for 0.064 af (98% of inflow)
Storage and wetted areas determined by Prismatic sections

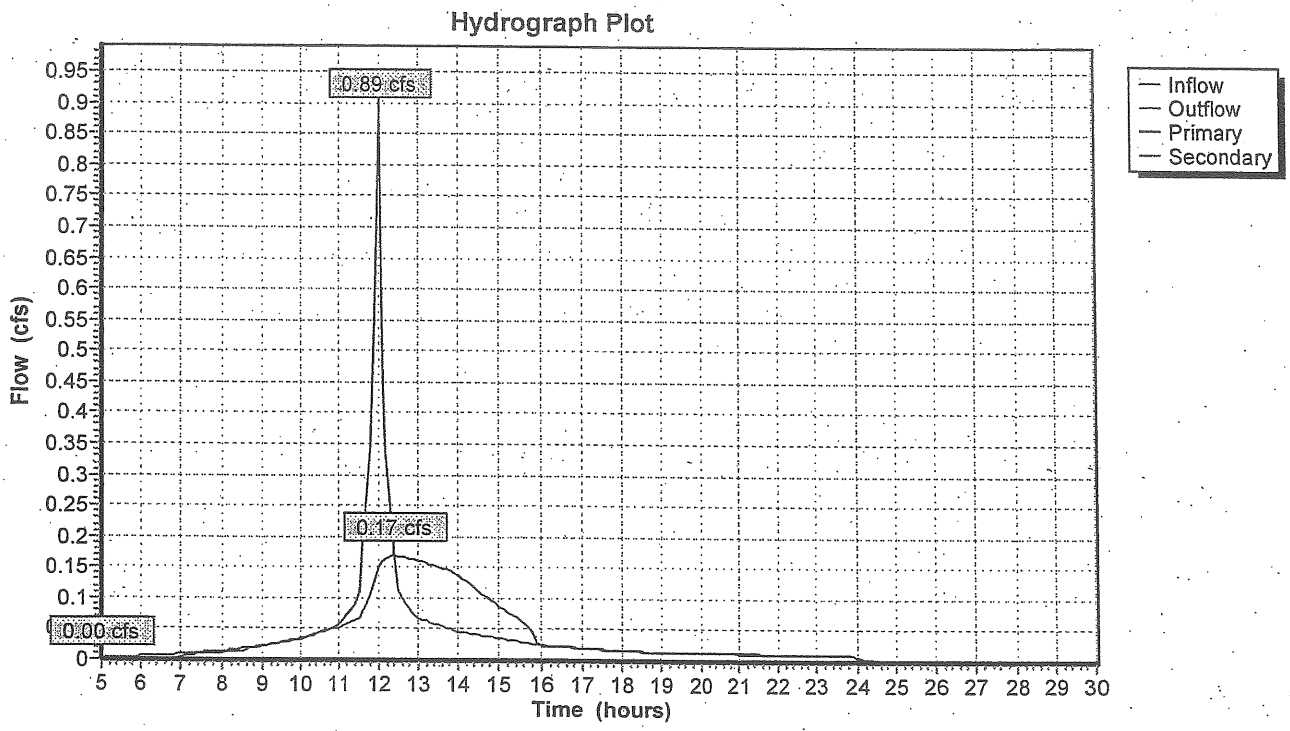
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
46.00	10	0	0
47.00	117	64	64
48.00	674	396	459
49.00	1,276	975	1,434

Primary OutFlow (Free Discharge)
- 1=Orifice/Grate
- 2=Orifice/Grate

Secondary OutFlow (Free Discharge)
- 3=Sharp-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	46.50'	1.0" Vert. Orifice/Grate C= 0.600
2	Primary	46.80'	2.0" Vert. Orifice/Grate C= 0.600
3	Secondary	48.50'	3.1' long x 0.5' high Sharp-Crested Rectangular Weir 0 End Contraction(s)

Pond 11P: Existing Satellie Lot Detention Pond



Pond 23P: Pond 23

Inflow	=	1.65 cfs @	12.08 hrs, Volume=	0.140 af
Outflow	=	1.45 cfs @	12.20 hrs, Volume=	0.140 af, Atten= 13%, Lag= 6.8 min
Primary	=	0.86 cfs @	12.19 hrs, Volume=	0.133 af
Secondary	=	0.58 cfs @	12.20 hrs, Volume=	0.006 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs

Peak Elev= 41.08' Storage= 894 cf
Plug-Flow detention time= 22.7 min calculated for 0.139 af (99% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	608	0	0
41.00	996	802	802
41.50	1,265	565	1,367

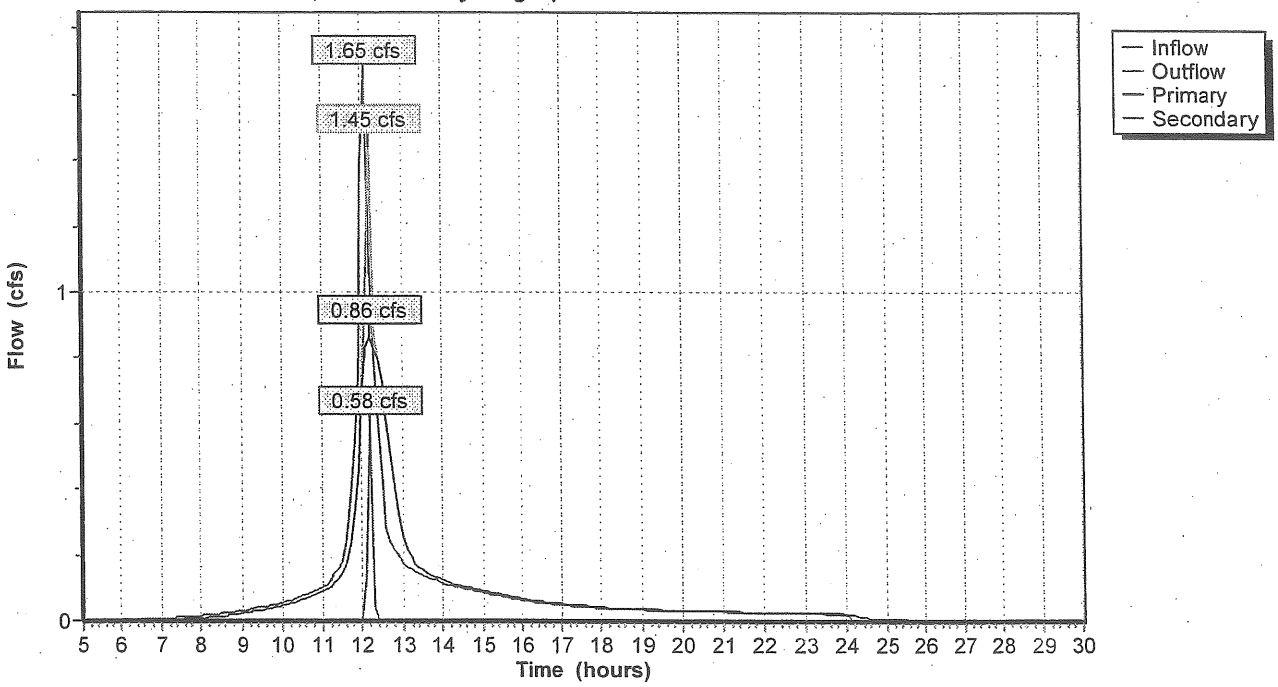
Primary OutFlow (Free Discharge)
└─1=Culvert

Secondary OutFlow (Free Discharge)
└─2=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	40.00'	**6.0" x 17.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 37.00' S= 0.1765 '/' n= 0.011 Cc= 0.900
2	Secondary	41.00'	**10.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.3

Pond 23P: Pond 23

Hydrograph Plot



Time span=5.00-30.00 hrs, dt=0.10 hrs, 251 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11X: Satellite Parking
Tc=2.1 min CN=95 Area=0.320 ac Runoff= 1.44 cfs 0.109 af

Subcatchment 12X: North/West of Satellite
Tc=4.8 min CN=81 Area=0.590 ac Runoff= 1.78 cfs 0.134 af

Subcatchment 13X: Existing NORTH-CENTRAL
Tc=15.4 min CN=75 Area=0.910 ac Runoff= 1.69 cfs 0.167 af

Subcatchment 14X: Existing Northeast
Tc=20.4 min CN=74 Area=1.040 ac Runoff= 1.70 cfs 0.184 af

Subcatchment 21X: Existing Central
Tc=7.3 min CN=79 Area=0.850 ac Runoff= 2.17 cfs 0.180 af

Subcatchment 22X: Existing Parking and Entrance Circle
Tc=12.0 min CN=84 Area=0.720 ac Runoff= 2.01 cfs 0.180 af

Subcatchment 23X: Existing Buildings and surrounding
Tc=8.3 min CN=91 Area=0.810 ac Runoff= 2.87 cfs 0.249 af

Subcatchment 24X: Behind Existing Pond
Tc=11.6 min CN=73 Area=0.230 ac Runoff= 0.44 cfs 0.039 af

Reach 1R: Existing Swale
Inflow= 10.28 cfs 1.058 af
Length= 200.0' Max Vel= 1.2 fps Capacity= 43.53 cfs Outflow= 9.61 cfs 1.058 af

Reach 2R: Existing Swale
Inflow= 5.59 cfs 0.602 af
Length= 80.0' Max Vel= 1.7 fps Capacity= 144.69 cfs Outflow= 5.48 cfs 0.602 af

Reach 3R: Existing Swale
Inflow= 2.03 cfs 0.242 af
Length= 120.0' Max Vel= 1.2 fps Capacity= 63.42 cfs Outflow= 2.02 cfs 0.242 af

Reach R11: From P11 to Swale
Inflow= 1.13 cfs 0.108 af
Length= 70.0' Max Vel= 0.4 fps Capacity= 33.01 cfs Outflow= 0.86 cfs 0.108 af

Reach R12: 48" RCP
Inflow= 1.78 cfs 0.134 af
Length= 90.0' Max Vel= 8.8 fps Capacity= 463.95 cfs Outflow= 1.74 cfs 0.134 af

Reach R22: From 22 to Swale
Inflow= 2.01 cfs 0.180 af
Length= 90.0' Max Vel= 0.5 fps Capacity= 27.37 cfs Outflow= 1.82 cfs 0.180 af

Reach R23: From Pond23 to Swale
Inflow= 3.43 cfs 0.288 af
Length= 40.0' Max Vel= 0.7 fps Capacity= 21.38 cfs Outflow= 3.14 cfs 0.288 af

Reach SP: Study Point Inflow= 11.31 cfs 1.242 af
Length= 100.0' Max Vel= 0.6 fps Capacity= 239.77 cfs Outflow= 10.81 cfs 1.242 af

Pond 11P: Existing Satellie Lot Detention Pond Peak Storage= 1,141 cf Inflow= 1.44 cfs 0.109 af
Primary= 0.18 cfs 0.090 af Secondary= 0.95 cfs 0.019 af Outflow= 1.13 cfs 0.108 af

Pond 23P: Pond 23 Peak Storage= 1,015 cf Inflow= 2.87 cfs 0.249 af
Primary= 0.92 cfs 0.207 af Secondary= 2.08 cfs 0.042 af Outflow= 3.00 cfs 0.249 af

Runoff Area = 5.470 ac Volume = 1.243 af Average Depth = 2.73"

Subcatchment 11X: Satellite Parking

Runoff = 1.44 cfs @ 11.99 hrs, Volume= 0.109 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.10 hrs
Type III 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.270	98	IMPERVIOUS (PARKING LOT)
0.040	74	OPEN SPACE (GOOD)-HSG "C"
0.010	89	RIP RAP-HSG "C"
0.320	95	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0303	1.6		Sheet Flow, Segment ID:AB Smooth surfaces n= 0.011 P2= 3.00"
0.1	15	0.3300	4.0		Shallow Concentrated Flow, Segment ID:BC Kv= 7.0 fps
0.9	55	0.0200	1.0		Shallow Concentrated Flow, Segment ID:CD Short Grass Pasture Kv= 7.0 fps
2.1	170	Total			

Subcatchment 11X: Satellite Parking