RUSSELL CITY ENERGY CENTER

A joint development of Calpine and Bechtel

September 12, 2001
SO-2449-091101-DD

DOCKET
01-AFC-7
DATE SEP 12 2001
RECD. SEP 12 2001

Ms. Kae Lewis
Project Manager
California Energy Commission
1516 9th Street
Sacramento, CA 95814

SUBJECT: RESPONSE TO ADDITIONAL CALIFORNIA ENERGY COMMISSION STAFF DATA REQUESTS AND ADDITIONAL INFORMATION IN SUPPORT OF THE APPLICATION FOR CERTIFICATION RUSSELL CITY ENERGY CENTER (01-AFC-07)

Dear Ms. Lewis:

Attached for filing with the California Energy Commission Docket Unit are an original and 12 copies of responses to additional California Energy Commission data requests and some additional information items provided by the Calpine/Bechtel Joint Development in support of the Application for Certification for the Russell City Energy Center. This submittal responds to your Data Request letters dated August 30 and September 6, 2001.

Sincerely,

Douglas M. Davy, Ph.D.
AFC Project Manager

Attachment

cc: Alex Ameri, City of Hayward
Service list

Responses to

California Energy Commission Staff Additional Data Requests

Dated August 30 and September 6, 2001

And

Additional Information

In Support of the

Application for Certification

For the

Russell City Energy Center

Hayward, California

01-AFC-07

Submitted to the
California Energy Commission

Submitted by
Calpine/Bechtel Joint Development

September 2001

CONTENTS

INTRODUCTION

The following are the Calpine/Bechtel Joint Development's responses to California Energy Commission (CEC) additional data requests for the Russell City Energy Center (RCEC) (01-AFC-07). The City served these data requests as part of the discovery process for the RCEC project. The CEC provided the data requests on August 30 and September 6, 2001.

The CEC Staff filed 8 data requests relating to the discipline of Visual Resources on August 30. The Staff also provided 11 data requests on September 6, based on Calpine/Bechtel's Additional Information filing of August 28. These data requests relate to the areas of Transmission System Engineering, Cultural Resources, Biological Resources, Project Description, and Visual Resources.

The responses in this submittal are given in the order presented by the CEC Staff. The responses have also been re-numbered sequentially starting with the number 219. This was done to ensure that each Data Request response or piece of additional information provided by the Applicant is that has been docketed for the Russell City case has a unique number for future reference. (The most recent Applicant filing of additional information numbered through 218.) For convenience, the CEC Staff's number is provided in the Table of Contents and in parentheses after each data request number. New or revised graphics or tables are numbered in reference to this new data request number. (For example, Figure DR220-1 would be the first figure submitted in response to Data Request 220.)

In addition to responses to the CEC Staff's Data Requests of August 30 and September 6, this filing provides additional information that Calpine/Bechtel wishes to provide in support of the Application. Some of this information is in response to previous data requests and could not be completed at the same time as the responses to other data requests from the same filing. Some of this information updates information previously provided. Information is provided in the disciplines of Biological Resources, Project Description, and Water Resources.

Additional tables, figures, or documents submitted in response to a data request (supporting data, plans, folding graphics etc.) are found at the end of a discipline-specific section and are not sequentially page-numbered consistently with the remainder of the document, though they may have their own internal page numbering system. This keeps all material belonging to a given discipline together.

Data Request Responses

August 30, 2001
September 6, 2001

Russell City Energy Center
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Technical Area: Visual Resources

Feasibility of Relocating the Power Block

219 (1). *Please discuss the feasibility of relocating the power block to the western portion of the project site. If it is infeasible, please explain the specific reasons why this would be the case.*

Response: While it is theoretically possible to relocate the power block to the western portion of the site, it is not feasible from a practical perspective. In determining the site layout for the Russell City Energy Center and its ancillary facilities, several factors were carefully considered by the Applicant.

The RCEC project will interconnect with the Eastshore Substation located approximately 1 mile from the RCEC site. The new 230-kV transmission line proposed by the Applicant will be constructed along the existing Eastshore-Grant 115-kV transmission corridor, which runs in a northwest-southeast direction approximately 600 feet northeast of the project site. The new RCEC switchyard has been located at the north edge of the site with a new transmission tower located in the northeast corner of the project site to allow for straightforward access to the existing Eastshore-Grant transmission line right of way without crossing over any facilities. This necessary arrangement precludes placement of the Advanced Wastewater Treatment (AWT) facility to the east of the power plant. Moving the AWT would be necessary to accommodate any reconfiguration of the power block.

During pre-filing discussions with the City of Hayward, Applicant was made aware of the City's plan to widen and extend Whitesell Avenue through the unincorporated land north of the WPCF to connect with Cabot Boulevard to the north. The City requested that the RCEC site layout be configured to place the relatively low power plant buildings along the eastern boundary of the site and the cooling tower as far from Whitesell Avenue as possible. Reconfiguration of the plant site as requested by the CEC staff would directly conflict with the City's request.

Even if the above two factors did not preclude rearrangement of the power block, it is not feasible to reconfigure the project within the timeframe of this proceeding. To prepare the original site plan, the applicant devoted hundreds of hours to engineering and design. Once a preliminary design was developed, the Applicant undertook expensive and time-consuming modeling of the air quality and noise impacts, to determine if the project was feasible and consistent with LORS. Rerunning the air quality analysis alone would require several weeks of analysis, and might result in further iterations of the plant design. Additional, unforeseen impacts of the new configuration could pose additional obstacles to any reconfiguration of the plant's design.

220 (2). *If it is feasible to relocate the power block to the western portion of the site, please provide the revised site plan and 11 x 17" high-resolution color photocopies of the following visual simulations at life-size scale of the reoriented project as seen from the Hayward Shoreline Interpretive Center (KOP 2) and KOP 1:*

a. *The RCEC without any architectural treatment including scaled elevations of the RCEC without any architectural treatment;*
b. *The RCEC with the proposed "Wave" design; and*
c. *The RCEC with an alternative architectural treatment that is not as massive as the Wave design. [As a frame of reference, an alternative architectural design that staff believes may be appropriate is attached to these requests.]*

d. *Please provide electronic files of the requested site plan, elevations, and visual simulations.*

Response: Please see response to 219 (1) above.

221 (3). If it is not feasible to relocate the power block, please provide 11" x 17" high-resolution color photocopies (and the electronic files) of visual simulations of the project from KOPs 1 and 2 with an alternative treatment that is less massive than the Wave design.

Response: Please see our objection to this data request, filed September 7, 2001.

222 (4). Please provide scaled plans and elevations (and electronic copies) of the alternative architectural treatment.

Response: Please see our objection to this data request, filed September 7, 2001.

Simulation from the Freshwater Marsh

Staff has recently communicated with Mr. Larry Tong, Interagency Planning Manager of the East Bay Regional Park District to determine the specific nature of the EBRPD's concerns regarding the potential adverse impacts of the project. In a letter dated August 20, 2001 to Chairman William J. Keese, Mr. Tong expressed the EBRPD's concern that the project may result in "significant impacts on scenic vistas in [the] Hayward Shoreline park," which is operated by EBRPD. The EBRPD is concerned that the proposed project, when viewed from the freshwater marsh portion (located about 1,000 feet southwest of the site) of the Hayward Regional Shoreline Park, "would potentially obliterate the view of Mt. Diablo and replace it with a massive Wave and cooling towers." As described in a fax sent to staff, this area of the marsh is used for scientific investigation and study purposes by undergraduate and graduate students and international delegations from countries such as Italy and Japan, who "depend upon San Francisco Bay and Mt Diablo as landmarks for regional orientation." According to Mr. Koslosky with HARD, this area of the marsh is visited by these groups of people about 8-10 times per year. Mr. Tong suggests that two additional KOPs should be established in this area of the marsh from which to evaluate the potential impacts of the project. Staff believes that a KOP representing this area of the marsh is warranted since it is located substantially closer to the project site than KOP 2 (Hayward Shoreline Interpretive Center), and potential impacts would be substantially different. The applicant, staff, and EBRPD officials should visit the freshwater portion of the marsh to identify and agree on the exact location for the new KOP.

223 (5). Please provide 11 x 17" high-resolution color photocopies (and electronic files) of a new photograph from the area of the freshwater marsh described above to represent the existing visual character and quality of views from this area toward the project site.

Response: Please see our objection to this data request, filed September 7, 2001.

224 (6). Please provide 11 x 17" high-resolution color photocopies (and electronic files) of the following visual simulations at life-size scale in the current configuration and the reconfigured site described above.

a. *The RCEC without any architectural treatment*
b. *The RCEC with the proposed "Wave" design; and*

c. *The RCEC with an alternative architectural treatment that is not as massive as the Wave design.*

Response: Please see our objection to this data request, filed September 7, 2001.

Reconfigured Transmission Line

Staff understands from statements made by the applicant at the Informational Hearing and Site Visit that the proposed transmission line may change from the configuration described in the AFC. As proposed in the AFC, the existing steel lattice towers carrying the two 115-kV circuits of the Grant-Eastshore line will be removed, and replaced with tubular H-frame towers that will carry the project's 230-kV circuits as well as the existing 115-kV circuits. One of the proposed H-frame towers is depicted in the visual simulation from KOP 7 (State Route 92 at Clawiter Road). As staff understands the modification, the project's 230-kV circuits would be carried on a separate set of towers that would run adjacent to the existing Grant-Eastshore line.

225 (7). *Please provide a revised simulation (KOP 7) showing the project's 230-kV transmission line running adjacent to the existing Grant-Eastshore line.*

Response: Please see Figure DR225-1 (attached), a simulation of the newly configured transmission line from KOP 7 (State Route 92).

226 (8). *Please provide a discussion of the potential visual effects of the modifications to the configuration of the proposed 230-kV transmission line.*

Response: Figure DR225-1 (revised version of AFC Figure 8.13-9b) is a simulated view of the project's transmission line at the point where it crosses State Route 92 at the interchange with Clawiter Road. As this simulation indicates, a 120-foot high steel pole transmission tower carrying two 230 kV circuits will be sited adjacent to the existing 120-foot high lattice steel transmission tower that carries the two 115 kV circuits of the Grant-Eastshore line. The new transmission tower will be fully visible adjacent to the existing tower. However, because of the slim profile that its steel pole design provides, and because of its similarity in scale to the existing transmission tower, the new transmission tower will be no more visually salient than the existing tower, and its presence will not substantially change the view's composition. Because the conductors will be strung at the same heights as the conductors on the existing lines, they will be parallel to them, creating a high degree of visual consistency. The overall effect of the new transmission tower and conductors on this viewpoint will be small. There will be no change in the visual quality of the view seen from this KOP, which is now classified as moderately low.

Data Request 225 (7)

Figure DR225-1
SIMULATED VIEW FROM KOP 7

Oversize Document(s)

for more information contact

California Energy Commission
Docket Unit
1516 9th Street, MS4
Sacramento, CA 95814-5512
Telephone # (916) 654-5076

Transmission Line

The Project Description Addition (in the Additional Information submittal of August 28) provided information that a new transmission line will be built in the existing transmission line corridor. It is not clear from the AFC or supplemental information how wide a survey corridor was originally used to survey the transmission line for the presence of cultural and biological resources.

227 (1). How wide is the existing transmission line corridor? How wide was the survey corridor used to determine the presence of cultural resources along the transmission line? If an additional survey is needed to accommodate the area to be used by the new transmission line and new power poles, please conduct one and provide the results.

Response: The original survey considered potential impacts at the existing tower locations because the new towers were to replace the existing towers under the original plan. The reconfigured transmission line involves building new towers approximately 80 feet west of the existing towers. Including two new turning towers, one where the project connects to the existing corridor on the north side of Enterprise Avenue, and one where the transmission line enters the open area next to the PG&E Eastshore Substation, the project will require 7 new towers. The original tower areas were surveyed for the AFC. AFC Figure 6.1-2 is an aerial photograph that shows the locations of the existing towers. On September 7, 2001, Douglas Davy conducted a cultural resources survey of the new tower locations, as follows:

Tower 1: Turning tower located on the City property north of Enterprise Avenue, surveyed for the AFC.

Tower 2: Located in the asphalt parking lot at Tuscarora Industries, 3466 Enterprise Avenue, just south of Enterprise Avenue.

Tower 3: Existing tower is located in an island between two railroad tracks. The new tower will be inside the Rohm and Haas property fence in an area currently covered with asphalt.

Tower 4: The existing tower is located in an office complex parking lot. The new tower would be located within the same, asphalt-covered, lot.

Tower 5: The existing tower is located within the State Route 92 on-ramp loop. The new tower would also be located within this same loop. The ground surface in the loop is currently covered with sand, piles of fill dirt, and asphalt fill such that the ground surface is not visible for archaeological survey

Tower 6: The existing tower is located just north of Investment Road, in the asphalt-covered parking lot of an office complex. The new tower would be located in the parking lot of the adjacent office complex (Pacific Gulf Eden Plaza).

Tower 7: This would be a new tower located just northwest of the existing 230 kV transmission line. The tower is located in the asphalt parking lot of an office/warehouse building.

With the exceptions of Tower 1, the ground surface is not visible at the new tower locations for cultural resources survey. This fact was confirmed on the September 5 field visit. Cultural resources were not discovered at any these locations on during the survey.

228 (2). How many new power poles will be added to support the new transmission line? Please verify that the base diameter of the steel poles will be approximately four feet and provide the *conductor size. Please provide a map indicating the locations of the new poles and approximate distance to other lines in the corridor.*

Response: Seven new power poles will be added, including the turning poles at each end of the RCEC transmission corridor. The diameter of the poles is 4 feet (please see Figure AI195-1 in the Additional Information submittal of August 28, 2001). Conductor size will be either 954 kcmil SSAC or 1113 kcmil SSAC. Please see Figure DR228-1 (attached), a map showing the power pole locations.

229 (3). On which side of the existing transmission line with the new transmission line be built?

Response: The new line will be built on the west side of the existing transmission line.

230 (4). Will additional substation construction be necessary to accommodate the new transmission line? If new construction is needed and the area to be affected was not surveyed for cultural resources, please conduct a literature search and cultural resources survey and provide the results?

Response: As described in the AFC (see Page 6-6 and Figure 6.2-3), PG&E will expand the Eastshore Substation to better accommodate electrical flows from the RCEC. At the time the AFC was prepared it was expected that the expansion area would lie between the existing (new) Eastshore substation and the buildings and parking lots to the north. Based on the most recent analyses of power flows performed by Calpine/Bechtel and PG&E, it now appears that more extensive modifications of the existing Eastshore Substation will be required to accommodate the addition of the RCEC and to improve the reliability of the existing PG&E system in the region to maximize the benefits to the system of adding the RCEC. The new substation facilities will be constructed immediately west of the existing facility, and will involve development of approximately 2 acres of the PG&E property. Revised graphics are being prepared to depict the location and dimensions of the area to be developed. These new graphics will be submitted no later than September 28.

This area is disked annual by PG&E for weed abatement and fire prevention. This area was included in the cultural resources literature search and pedestrian field survey for the AFC. Cultural resources were not discovered in the expansion area.

Data Request 228 (2)

Figure DR228-1
NEW POWER POLE LOCATIONS

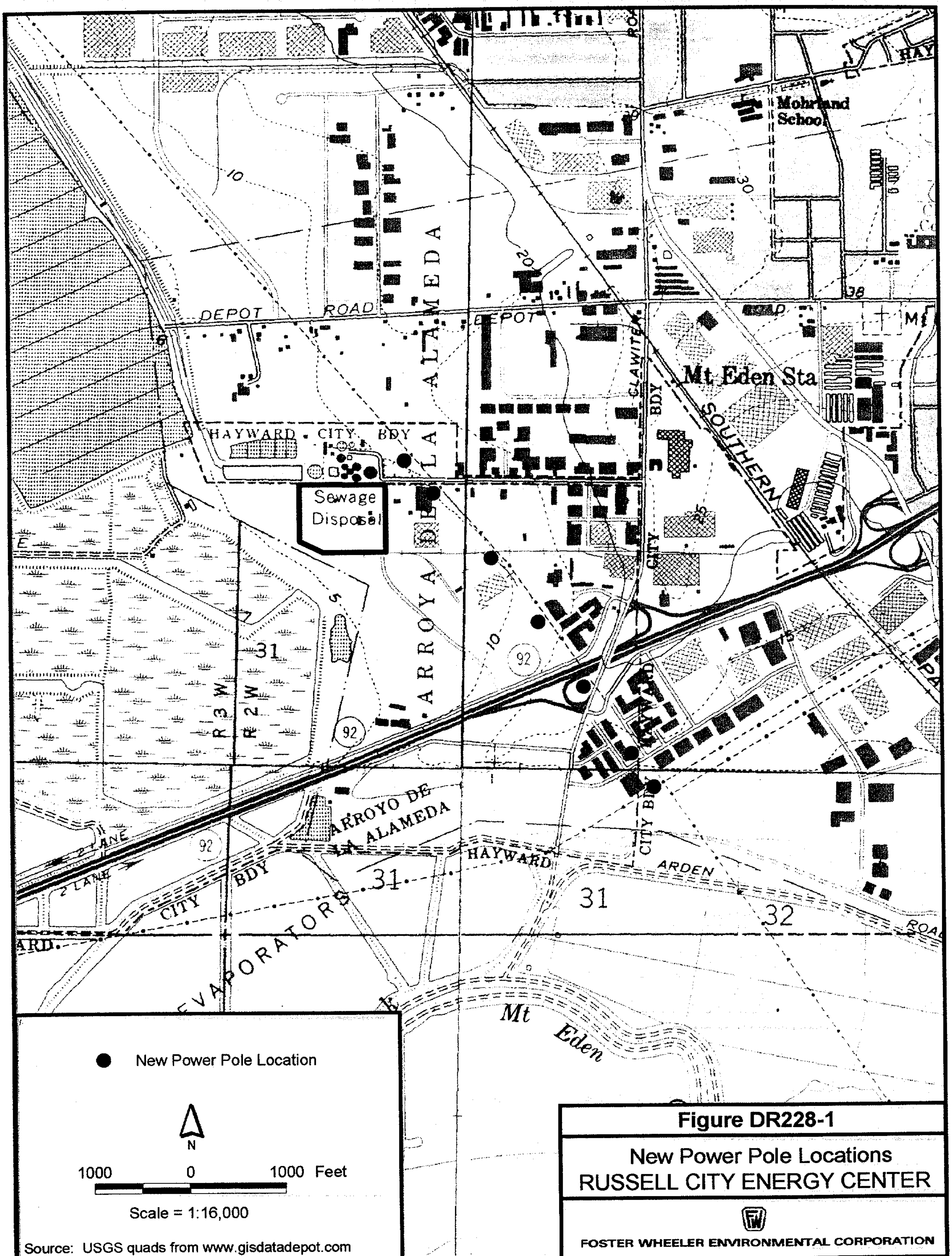

Figure DR228-1

New Power Pole Locations
RUSSELL CITY ENERGY CENTER

Off-Site Parking

The Project Description Section submitted as part of Additional Information Items included information that Calpine is negotiating for use of four off-site parking areas.

231 (5). Please identify the location of the parking areas and provide an assessment of Environmental Impacts.

Response: Calpine/Bechtel is continuing to negotiate with PG&E for the temporary use of approximately 10 acres of PG&E land immediately south of the Eastshore Substation as a parking lot for construction personnel. Calpine/Bechtel is also negotiating with the City of Hayward and three private property owners in the project area for the use of various parcels for construction laydown and additional parking. All of these parcels are located in Hayward's Industrial Zone and front either Enterprise or Clawiter. Specifics will be submitted as pending agreements are finalized. All of the parcels under consideration are paved or open lots that are managed for weed control.

Off-Site Parking

The Project Description Section submitted as part of Additional Information Items included information that Calpine is negotiating for use of four off-site parking areas.

232 (6). *If additional parking and/or laydown areas are added to the areas already proposed, please conduct a literature search and survey for the affected areas and provide the results.*

Response: The Applicant will conduct a literature review and pedestrian field survey of any areas newly proposed for off-site parking or construction laydown that were not previously included in the literature search and pedestrian survey for the project, and will provide the results to the CEC Staff as soon as they are available.

Technical Area: Visual Resources

AWT Relocation

The Project Description section of Additional Information Items includes a discussion of minor modifications to the Advanced Wastewater Treatment (AWT) Plant.

233 (7). *Describe the existing setting of the site and surroundings, including the visual quality of the view and viewer sensitivity and exposure of the project (i.e. AWT facilities). Discuss the visual change, such as dominance and view blockage. Provide an overall assessment of the change in visual quality and significance of the visual impact.*

Response: The solids handling facility portion of the AWT will be located approximately 500 feet north of the energy center site, on property that is a part of the City of Hayward Water Pollution Control Facility (WPCF). The portion of the WPCF on which the solids handling facility will be located is the open area to west of the clarifier tanks on which newly created sludge is spread out to dry and stacked into large piles 10-15 feet high. The solids handling facility will be sited in the northeast corner of this area. The layout of the solids handling facility, and its relationship to the drying yard and the adjacent sewage treatment plant equipment are indicated on Figure 1A with Additional Information item 241, below. The large sludge drying and storage area within which the solids handling facility will be located, is bordered on the north by several automobile salvage yards and a pallet storage yard that front onto Depot Road. To the west, it is bordered by a portion of the Hayward Regional Shoreline. The area of the shoreline closest to the sludge drying and storage area, however, is not open to the public, and the nearest public trails lie over 0.75 miles to the west of the proposed solids handling facility site. To the south, the sludge drying and storage area is bordered by a wastewater treatment pond, which separates it from Enterprise Avenue. Enterprise Avenue lies over 400 feet to the south of the area where the solids handling facility will be sited, and views toward the solids handling facility site are screened by tanks and other equipment in the WPCF and plantings and fencing along the edge of the street. From the trucking distribution and warehouse center at the western end of Enterprise Avenue, views toward the solids handling facility site are screened by the latticed fence along the southern edge of the WPCF property.

The elements of the solids handling facility will include a chemical water and dewatering area building that is approximately 25 feet in height, and various pumps, clarifiers, and storage containers that are lower in height than 25 feet. The lime silo is 47 feet high and 18 feet in diameter. The sludge loading bays are 42 feet high and 65 feet wide.

Exposure of these facilities to viewers would be low to very low, as far as foreground and middleground views are concerned. The facility would not be visible or would be barely visible (tops of the sludge loading bays and lime silo) to viewers on Depot Road (KOP 5), 1,000 feet to the north. The junked cars in the auto salvage yards and pallets in the pallet storage yard are piled high, and these in combination with the board fence surrounding these facilities would substantially block views toward the facility. Viewer sensitivity from Depot Road and from the auto salvage and pallet storage yards is low to very low, and to the extend that the solids handling facility would be visible from this area, it would have little impact on the existing character of this view, and its existing visual quality, which is now low.

The solids handling facility would not be exposed to public views from the east, because the City of Hayward WPCF is located there and its large tanks and the row of tall trees along its eastern edge screens views from this direction.

The facility would be visible from the cul-du-sac at the end of Enterprise Avenue in views over the WPCF fence. However the degree of visual impact will be relatively low. Viewer sensitivity at this location is low because the view toward the sludge drying yard is seen only by those using the trucking warehouse at the west end of the street. From this area, the sludge loading bays will be seen at distance of approximately 400 feet, which will attenuate the apparent size of these structures. The changes to this view will not substantially alter its existing industrial character and will not change its visual quality, which is now low.

From the west, the solids handling facility will be visible to some degree from the trails along the San Francisco Bay shoreline, approximately 0.75 miles or more from the facility. The tops of the lime silo and sludge loading bays would be visible from the Cogswell Marsh bridge (KOP 3) and to a limited degree from the Hayward Shoreline Interpretive Center (KOP 2). From these locations, however, the visual salience of these features would be greatly attenuated by their distance from the viewers and by their visual absorption into a complex backdrop that includes the large clarifier tanks in the WPCF and stands of large trees. In addition, the solids handling facility structures would not block views of any significant elements in the viewshed. Although the sensitivity of viewers at these locations is high and the views are of moderately high visual quality (see AFC page 8.13-6), the degree of change in existing view character and quality that the solids handling facility will create will not be substantial, because of the solids handling facilities' limited visual salience in these views. The degree of visual impact will therefore be less than significant.

AWT Relocation

234 (8). What amount of acreage will be affected by the movement of AWT equipment to existing City-owned lands?

Response: The solids handling facility will measure approximately 400 feet east-west, by 150 feet north-south, covering 1.38 acres, not including its access road from Enterprise Avenue.

235 (9). Was the area to be affected by the movement of AWT equipment included in the literature search and cultural resources (survey) provided for the AFC? If it was not included, please conduct a literature search and cultural resources survey and provide the results.

Response: On September 7, 2001, Douglas Davy conducted a cultural resources survey of the new solids handling facility location. This location lies within the area covered in the literature search for the AFC. Ground visibility in the facility area was good to excellent, since the area is frequently scraped with a front-end loader, as sludge piles are created and moved. Consequently, there is no vegetation in the sludge yard. There is a very sparse cover of weeds along the northern boundary. The ground surface was not visible under the sludge piles, which covered a portion of the area. The survey was conducted in 15-meter-wide, linear transects as permitted by the sludge piles. An area roughly 700 feet east-west by 300 feet north-south was surveyed. The access road area was also surveyed.

AWT Relocation

236 (10). The Applicant needs to submit biological survey results for the proposed relocation of the AWT.

Response: Foster Wheeler staff conducted a survey of the new solids handling facility location on September 5, 2001. The sludge drying yard is nearly devoid of vegetation, due to the repeated use of front-end loading equipment to create and move the sludge piles. Only along the northern fenceline of the sludge yard, is there any vegetation, and this consists entirely of a sparse coverage of ruderal species. Consequently the solids handling facility area does not contain habitat for threatened or endangered plant or animal species.

Biological Assessment

237 (11). Please indicate when the Biological Assessment will be submitted to the USFWS and when the Service expects to render a decision on whether or not a formal consultation will be necessary?

Response: The Biological Assessment will be prepared and filed at the CEC by September 21, 2001. Mr. Don Hankins of the USFWS has agreed to an expedited review of the Biological Assessment due to the ongoing energy crisis.

Additional Information

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September 2001

Effluent Effects on Bay Invertebrates

Item 238. On a telephone conference call on September 7, 2001, CEC Staff and Don Hankins of the U.S. Fish and Wildlife Service expressed some concerns about the potential effects of RCEC effluent on invertebrates living in San Francisco Bay.

Additional Information: The RCEC cooling system will use, at a maximum, 5.27 million gallons per day (mgd) of recycled water (average 3.33 mgd) from the City of Hayward Water Pollution Control Facility (WPCF). The water will be cycled through the cooling system approximately 50 times before cooling tower blowdown is returned to the City's WPCF for discharge through the East Bay Dischargers Authority (EBDA) pipeline to the EBDA outfall in San Francisco Bay. The outfall is located midway between the Oakland Airport and the City of Brisbane and extends extends 37,000 feet (7 miles) from the San Leandro Marina into the Bay (which if 5.5 miles from the RCEC), discharging at a depth of about 20 feet (varies with tides).

Under conditions of peak demand, the RCEC will return 0.07 mgd (0.05 average) of cooling process wastewater to the City's WPCF for discharge. A much larger percentage of the recycled water the RCEC discharges is non-cooling process water. This non-cooling process discharge is 1.47 mgd at peak (0.92 average) and consists of microfiltration backwash, reverse osmosis reject concentrate, and clarified Clean-in-Place (CIP) blowdown.

The bulk of the recycled water that the RCEC receives from the City is evaporated as part of the power plant cooling process. The evaporation of water that would otherwise be discharged to the Bay results in a net reduction of fresh water entering the Bay, which is a net benefit to aquatic life. The City of Hayward's total discharge volume will be reduced by 29 percent, from 13.3 to 9.5 mgd (average). The Advanced Wastewater Treatment (AWT) plant that will be constructed as part of the RCEC project will remove sufficient copper from the water it processes to reduce by 8 percent the total copper discharged to the San Francisco Bay through the EBDA outfall (all sources, see AFC page 8.15-17). This will also benefit the Bay.

EBDA includes the City of Hayward, the Union Sanitary District (Fremont, Union City, and Newark), the Oro Loma Sanitation District (unincorporated Alameda County near Hayward), the City of San Leandro, the Dublin San Ramon Service District, and the City of Livermore. The total combined average discharge from the EBDA system currently averages 82.1 mgd (maximum 102.1). The City of Hayward's contribution to this total averages 13.3 mgd (maximum 16.5 mgd). Assuming maximum RCEC use of cooling water and average Hayward and EBDA discharge, the RCEC cooling process discharge would amount to 0.53 percent of Hayward's discharge and 0.09 percent of the combined EBDA outfall.

The temperature of the RCEC cooling tower blowdown when it leaves the RCEC will be less than the 140 °F limit for industrial discharges to the Hayward WPCF (generally between 85 and 100 °F). The 0.07 mgd of RCEC blowdown will be quickly cooled by mixing with the City of Hayward's 9.43 mgd of effluent and the 68.8 mgd of effluent from the other EBDA members. The dilution factor for RCEC effluent is approximately 1,172. The RCEC blowdown will be added to the Hayward and EBDA discharges several miles upstream of the EBDA discharge to the bay, providing ample opportunity for

RCEC blowdown to mix thoroughly with the bulk of the discharge before the combined streams discharge into the Bay. For these reasons, the RCEC will not contribute to an elevation of temperature in the San Francisco Bay.

Reconfigured Transmission Line

Item 239. On a telephone conference call on September 7, 2001, CEC Staff and Don Hankins of the U.S. Fish and Wildlife Service expressed some concerns the potential for the construction of a new transmission line to increase bird mortality due to collisions with the shield wire and to increase predation on threatened and endangered species by providing perches for raptors.

Additional Information: The reconfigured transmission line will involve the construction of 7 new towers parallel to the existing towers. The new towers will be of monopole construction, so that they will not provide the same kinds of perching opportunities for raptors that lattice towers might provide. If it is necessary to install a shield wire at the top of the transmission tower, bird flight diverters will be used as necessary to reduce the risk of bird collisions (many transmission lines in the San Francisco Bay area do not use a shield wire, but PG&E may require one).

Technical Area: Project Description

The following additional information items are submitted in support of the Russell City Energy Center AFC Project Description:

Item #	Additional Information
240	Revised AFC Figure 2.3-1, Advanced Wastewater Treatment Facility Expanded Site Layout (updates attachment to Additional Information Item 196)
241	Revised AFC Figure 2.3-1a, Solids Handling Facilities Expanded Site layout (updates attachment to Additional Information Item 196)
242	Revised AFC Figure 2.2-1 (Site Arrangement), showing the reconfigured AWT

Additional Information Items 240-242

AI-240: REVISED AFC FIGURE 2.3-1
ADVANCED WASTEWATER TREATMENT FACILITY

AI-241: REVISED AFC FIGURE 2.3-1a
SOLIDS HANDLING FACILITY

AI-242: REVISED AFC FIGURE 2.2-1
SITE ARRANGEMENT

Technical Area: Water Resources

The following additional information items are submitted in support of the Russell City Energy Center AFC in the discipline of Water Resources:

Item #	Additional Information
243	Revised Drainage Plan (updates Supplement to the AFC)
244	Grading and Drainage Details (updates Supplement to the AFC)
245	Revised Storm Water Management Basin Sizing Calculations, Pre and Post Runoff (updates Supplement to the AFC)
246	Responses to Questions from the City of Hayward, ACFCD, and FEMA regarding storm water management

Additional Information Items 243-244

AI-243: REVISED GRADING PLAN

AI-244: GRADING AND DRAINAGE PLAN DETAILS

Oversize Document(s)

for more information contact

California Energy Commission
Docket Unit
1516 9th Street, MS4
Sacramento, CA 95814-5512
Telephone # (916) 654-5076

Additional Information Item 245

REVISED STORM WATER MANAGEMENT BASIN SIZING CALCULATIONS

RUSSELL CITY ENERGY CENTER

PRELIMINARY STORM WATER MANAGEMENT BASIN SIZING, PRE & POST-DEVELOPMENT RUNOFF ANALYSIS

Calculation No. H&H-1, Rev. 1

Job No. 24405

BECHTEL CORPORATION
GEOTECHNICAL & HYDRAULIC ENGINEERING SERVICES
FREDERICK, MARYLAND

September 2001

Use of these calculations by persons, without access to pertinent factors and without proper regard for their purpose, could lead to erroneous conclusions.

Should it become necessary to use any of these calculations in future work, it is suggested that the calculations be reviewed with authorized Bechtel personnel to ensure that the purposes, assumptions, judgements, and limitations are thoroughly understood. Bechtel cannot assume responsibility for the use of these calculations not under our direct control.

Calculation Cover Sheet

Project	Job No.	Calc. No.	Sheet
Russell City Energy Center	24405	H&H-1	1

Subject	Discipline
Preliminary Storm Water Management Basin Sizing, Pre- & Post - Runoff	G&HES

Calculation Status Designation	X	Preliminary		Confirmed		Superseded		Voided

Computer Program/Type	SCP				Mainframe	PC	Program No.	Version/Release No.
		Yes	X	No		X	TR-20	PC 09/83 (.2)

The pre- and post-development peak discharges for the site are developed and the storm water management basin is sized to maintain pre-development peak discharge rates.

Attachments:

1. AFC Precipitation Data (1 sheet)
2. Pre-Development TR-20 Output File (6 sheets)
3. Post-Development TR-20, Case 1 Output File (11 sheets)
4. Post-Development TR-20, Case 2 Output File (12 sheets)
5. Post-Development TR-20, Emergency Spillway Output File (4 sheets)

Revision 1:

SWM basin draining time is calculated and SWM basin stage storage information is updated. Sheets 10 and 15 through 18 and Attachments 2 through 5 are revised.

1	Issue to Project	19+ 5 Att	19	CJT	KN	KN	Sep 6 2001
0	Issue to Project	17 + 5 Att.	17	CJT	SWT	KN	15 Jun 2001
No.	Reason for Revision	Total No. of Sheets	Last Sheet No.	By	Checked	Approved/ Accepted	Date

Record of Revisions

BECHTEL	**CALCULATION SHEET**	PROJECT Russell City Energy Center
		JOB NUMBER 24405
SUBJECT Preliminary Storm Water Management Basin Sizing, Pre- and Post-Development Runoff		CALC NO H&H-1
BY Craig J. Talbot	DATE June 11 2001	SHEET NO 2
CHECKER SWT	DATE 6/14/01	SHEET REV 0

I. Objective

To size the storm water management basin for the Russell Energy Center Project located Hayward, CA. The basin will collect the runoff from the power plant portion of the Russell City Energy Facility site. A portion of the site will be dedicated to a Title 22 water treatment facility. Runoff from this portion of the site will not drain to the proposed basin. The basin will be sized to control peak discharges from storms up to and including the 25-year, 24-hour storm, per the project scope book. The basin will discharge to an existing Alameda County drainage canal south of the site. This canal was designed for the 15-year peak flow from the existing site. Therefore, the basin is sized to maintain the post-development peak discharges at the 15-year, 24-hour pre-development peak flow rate from the entire site. Alameda County drawings for the canal indicate that this discharge was estimated to be about 9.0 cfs. NRCS (formerly SCS) methodologies and the NRCS computer program TR-20 are used to determine the pre- and post-development peak discharges as well as perform the flood routing through the storm water management basin.

II. Rainfall Data

The 24-hour rainfall depths for site are determined from the Application for Certification (Attachment1) and are tabulated below for the design frequencies:

2-Year	1.98 inches
10-Year	3.34 inches
25-Year	4.01 inches
50-Year	4.50 inches
100-Year	4.98 inches

The 15-Year, 24-hour rainfall depth is determined by plotting the 24-hour values above on extreme probability paper. This plot is shown on sheet 3. From this plot, the 15-year, 24-hour value is estimated to be about 3.63 inches.

An SCS Type I rainfall distribution is used to simulate the 24-hour events.

III. Soils Information

Based on field observation of slow draining soils, for this analysis hydrologic soil group C, which is typical of floodplain areas, is assumed to represent the site soil conditions.

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BY Craig J. Talbot DATE June 11 2001 SHEET NO 3

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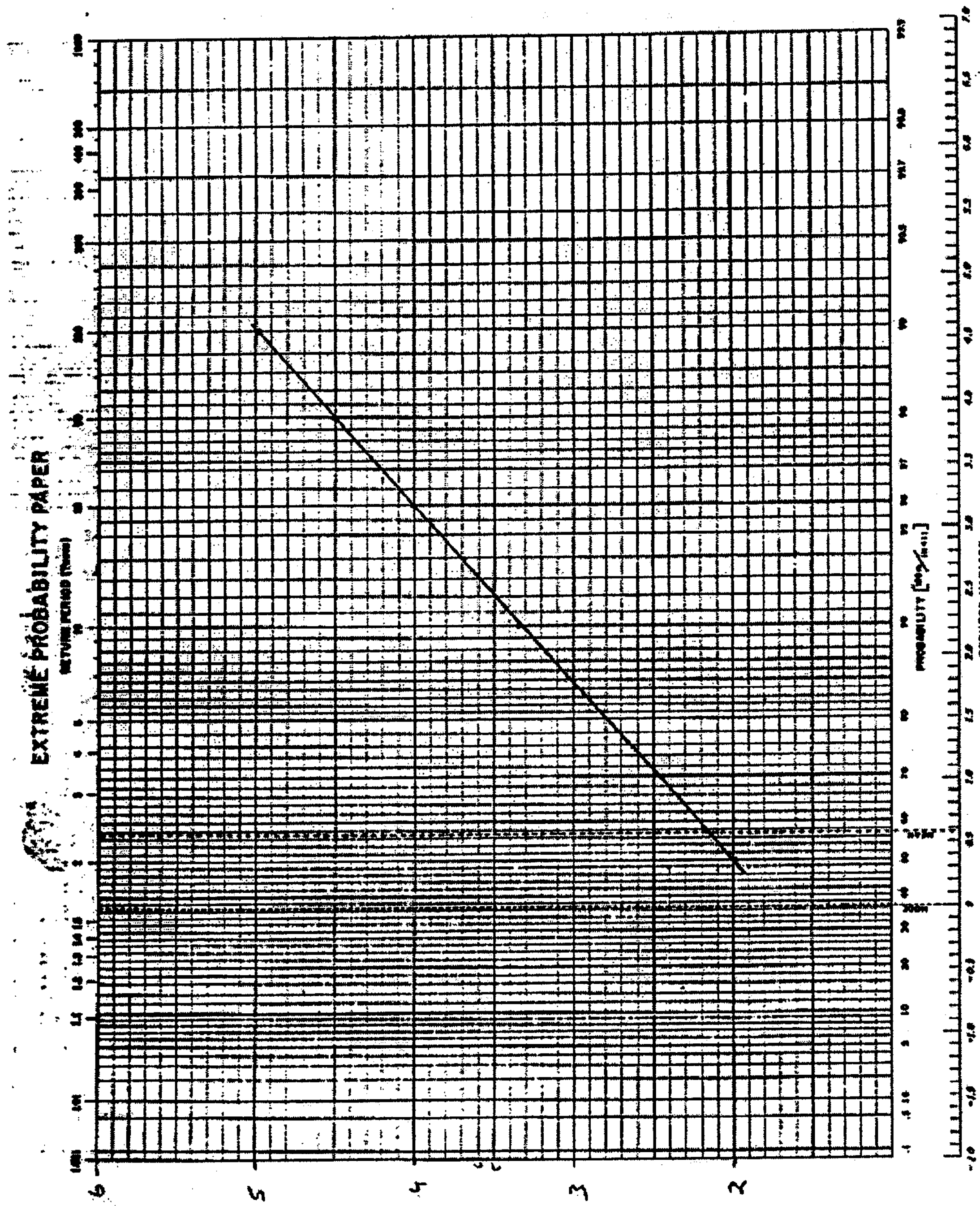

IV. Pre-Development Runoff Analysis

The pre-development peak discharges for the various storm frequencies is determined based in the following hydrologic parameters:

IV.1 Drainage Area:

The pre-development drainage area for the proposed development is equal to about 15.5 acres and is shown on sheet 5.

IV.2 Time of Concentration

The pre-development time of concentration flow path is also shown on sheet 5 and is calculated below using NRCS methodologies:

Segment A-B, Sheet Flow (Reference 1)

$$T_i = \frac{0.007(nl)^{0.8}}{P^{0.5}S^{0.4}}$$

Where:

n = Surface roughness, (0.24, Ref. 1, dense grass)
l = Length, (150 ft)
P= 2-yr, 24-hr depth (1.98 in.)
S = Slope, ($\frac{10-7.8}{150}$ =0.015)

$$T_i = \frac{0.007(0.24*150)^{0.8}}{1.98^{0.5}0.015^{0.4}} = 0.47 \text{ hour}$$

Segment B-C, Shallow Concentrated Flow, (Reference 2)

$$T_i = \frac{L}{3600V} \quad L = 785 \text{ ft. For } S = \frac{7.8-4.7}{785} = 0.004, \quad V = 1.02 \text{ fps (Ref. 2, Figure 3-1)}$$

$$T_i = \frac{780}{3600*1.02} = 0.21 \text{ hour}$$

$$T_c = \sum T_i = 0.47 + 0.21 = 0.68 \text{ hour}$$

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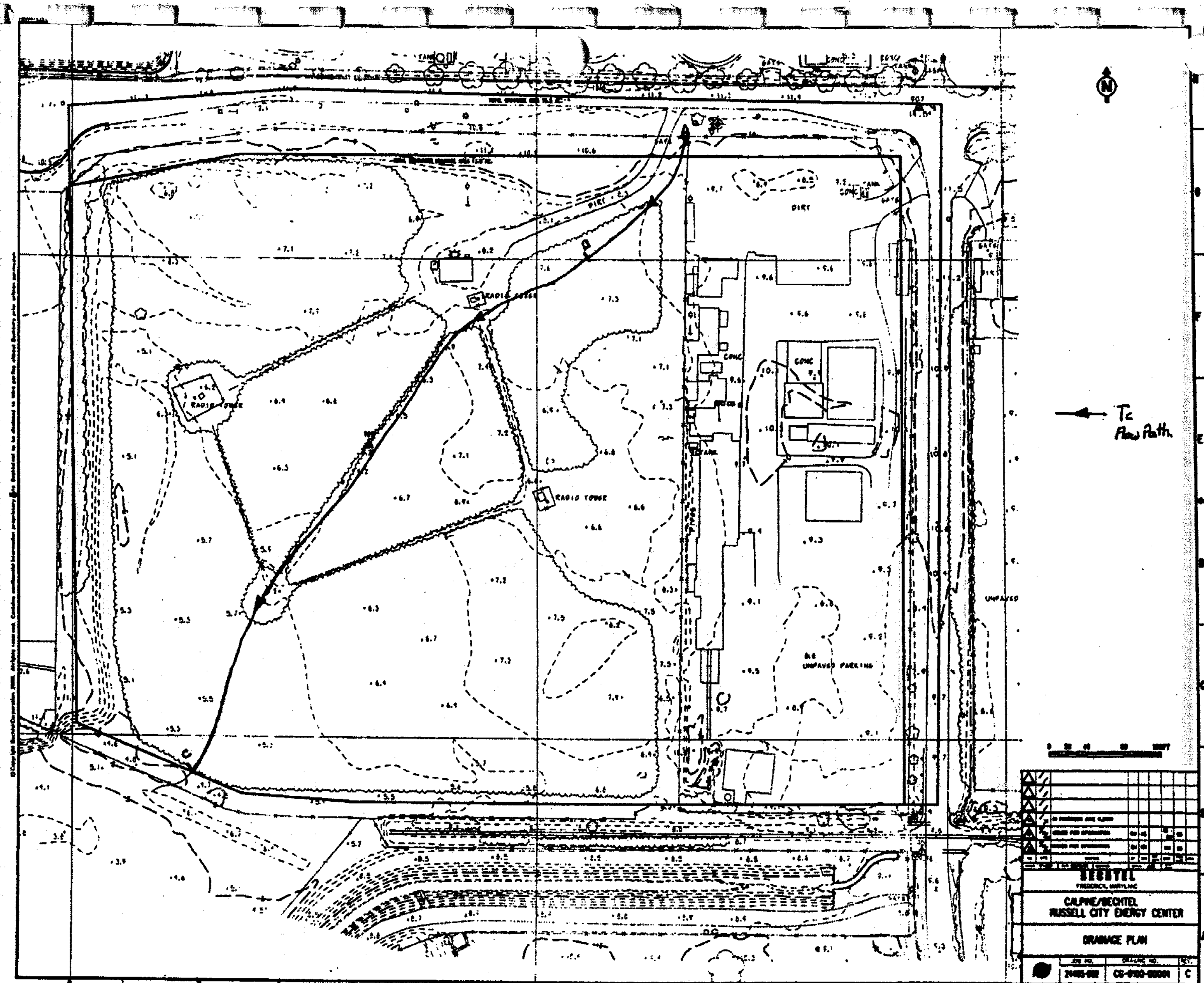

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IV.3 Runoff Curve Number

Approximately 4.8 acres of the eastern portion of the site is presently used for industrial purposes and is almost completely paved. The remaining site ground cover consists mainly of grasses and shrub. A runoff curve number of 74 (pasture grassland) is selected for the undeveloped portion and a curve number of 91(industrial) for the developed portion. The composite pre-development curve number is calculated below:

Land Cover	Area, (ac)	CN (Ref 3)	Area X CN
Pature	10.70	74	791.8
Impervious	4.80	91	436.8
Total	15.50		1228.6

Composite CN = Total Area X CN/ Total Area = 79.26

Use CN = 80

Based on NRCS methodologies using a curve number of 80, a 15-year, 24-hour precipitation depth of 3.63 inches, the runoff depth will be 1.74 inches. This is equivalent to a runoff coefficient of about 0.48.

IV.4 Peak Discharges

The pre-development peak discharges are determined using the NRCS computer program TR-20. Attachment 2 contains the pre-development output file from TR-20. The results are summarized below:

Return Period	Peak Discharge (cfs)
2-Yr	2.14
10-Yr	7.45
15-Yr	8.74
25-Yr	10.50
50-Yr	12.83
100-Yr	15.23

V. Post-Development Runoff Analysis

V.1 Drainage Area

The post-development drainage area is 11.8 acres and is shown on sheet 8. The drainage area does not include the Title 22 Water Treatment Facility (3.0 acres) or the cooling tower basin (0.70 acre). The runoff from the Title 22 facility will be handled by a separate storm water collection system. Precipitation over the cooling tower area will be collected in the cooling tower basin and thus there will be no runoff from this area.

V.2 Time of Concentration

The post-development time of concentration flow path is shown on sheet 6. The time of concentration is calculated below:

Segment A-B, Sheet Flow

$$T_i = \frac{0.007(nl)^{0.8}}{P^{0.5}S^{0.4}}$$

Where:

n = Surface roughness, (0.05 Loose Gravel Ref. 1)
l = Length, (150 ft)
P= 2-yr, 24-hr depth (1.98 in.)
S = Slope, (0.005)

$$T_i = \frac{0.007(0.05*150)^{0.8}}{1.98^{0.5}0.005^{0.4}} = 0.208 \text{ hour}$$

Segment B-C, Shallow Concentrated Flow

$$T_i = \frac{L}{3600V}$$ L = 52 ft. For S = 0.005, V = 1.14 fps

$$T_i = \frac{52}{3600*1.14} = 0.012 \text{ hour}$$

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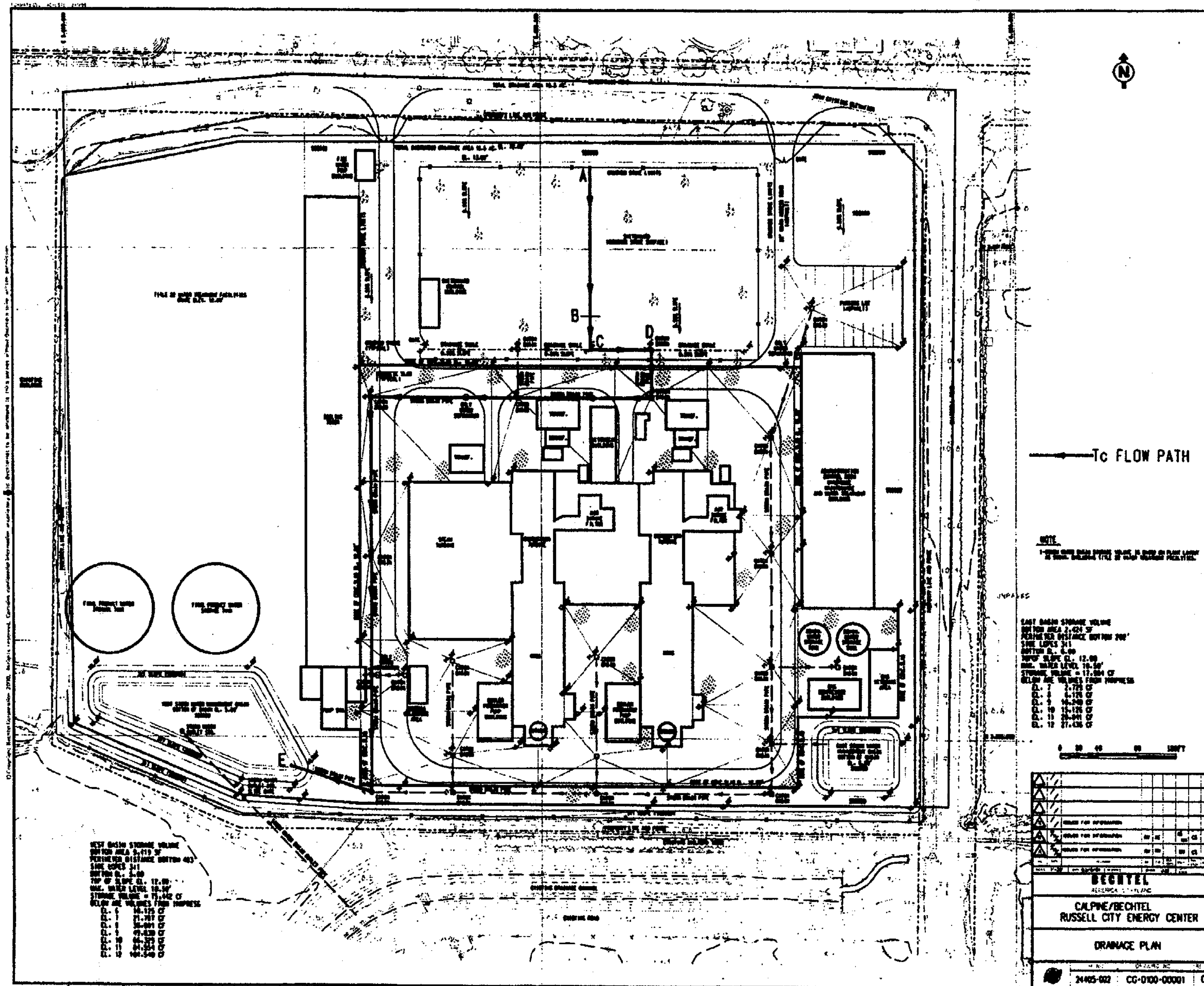

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Segment C-D, Swale Flow, estimate V = 3.0 fps, L = 74 ft

$$T_i = \frac{74}{3600*3.0} = 0.007 \text{ hour}$$

Segment D-E, Pipe Flow, estimate V = 4.0 fps, L = 850 feet

$$T_i = \frac{850}{3600*4.0} = 0.059 \text{ hour}$$

$$T_c = \sum T_i = 0.208 + 0.012 + 0.007 + 0.059 = 0.286 \text{ hour}$$

V.3 Runoff Curve Number

The post-development composite runoff curve number is calculated below based on hydrologic soil classification C.

Land Cover	Area, (ac)	CN (Ref 3)	Area X CN
Pond	0.70	100	70
Impervious	7.77	98	761.46
Grass	0.90	74	66.6
Gravel	2.43	85	206.6
Total	11.80		1104.6

Composite CN = Total Area X CN/ Total Area = 93.61
Use CN = 94

Note: Pond = 0.50 ac + 0.20 ac
Impervious = 5.0 ac + 0.1 ac + 0.05 ac + 0.45 ac + 0.17 ac + (15.5 ac - 13.5 ac)
Grass = 0.90 ac
Gravel = 11.80 ac - 0.7 ac - 7.77 ac - 0.90 ac

V.4 SWM Basin Stage-Storage

There are two storm water management basins, one located in the southwest corner of the site and the other in the southeast corner. The basins are interconnected by the plant storm drain piping system and thus will act together as a single storage facility. The basins will be treated as a single storage basin for the purposes of this calculation. The combined basin storage volume versus water level relationship is developed from information provided on sheet 8 and is summarized below:

Combined SWM Basin
Stage vs Storage Data

Basin Invert = 5.0 ft
Top of Basin 12.0 ft
Basin Side Slopes: 3 horizontal to 1 vertical

Elevation (ft)	Total Volume (ft^3)	Total Volume (ac-ft)
5.00	0.00	0.00
6.00	10125.00	0.23
7.00	24516.00	0.56
8.00	41127.00	0.94
9.00	60070.00	1.38
10.00	81455.00	1.87
11.00	105395.00	2.42
12.00	131976.00	3.03

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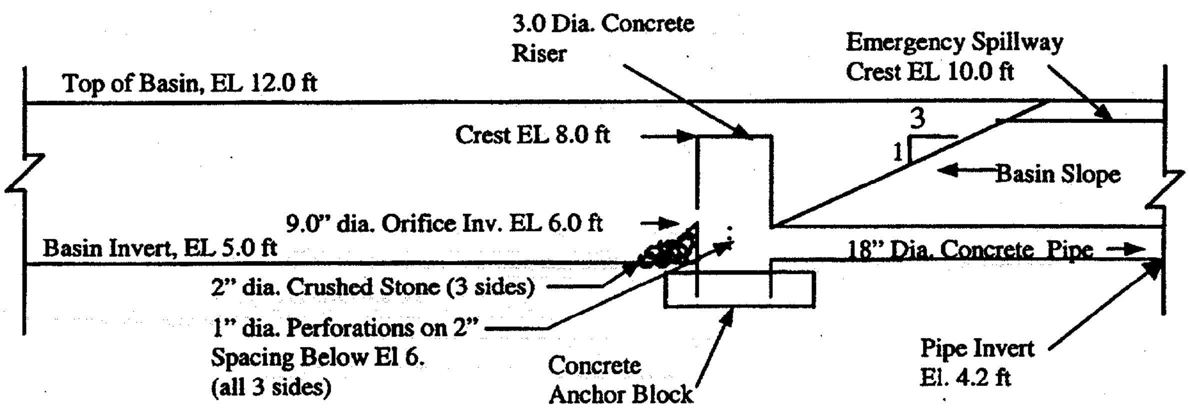
V.5 SWM Basin Stage-Discharge

The water level versus discharge flow rate is determined based on the configuration of the principal and emergency spillways for the basin. The basin outlets to the existing drainage canal along the south side of the site. Two tail water scenarios will be analyzed. For case 1, the tailwater elevation in the canal will be the design high water level which is estimated to be 7.4 ft (Ref 3.) The starting water level in the basin shall be elevation 6.0 at the beginning of the storm to account for sediment deposition. Due to the high tail water level, no discharge will occur from the basin until the water level reaches at least elevation 7.4 ft. The outlet will be equipped with a tide valve to prevent backflow into the basin. For Case 2, the tailwater elevation will be equal to the top of the outlet pipe at elevation 5.7 ft. to simulate a low flow condition in the canal. For Case 2, the starting water level in the basin will also be elevation 6.0 ft.

SWM Basin



In addition to the outlet structure shown above, there is also a 10 foot lined emergency spillway with a crest invert elevation of 10.0ft. The discharge versus elevation equations for each component of the structure are shown below:

Orifice Equation: (9.0" diameter orifice center line outlet at EL 6.375 ft.(for Case 1 El. 7.4 ft))

$$Q = CdA\sqrt{2gh}$$

Where:

$Cd = 0.6$

$A = \frac{0.75^2\pi}{4} = 0.442 \text{ ft}^2$

$h =$ W.L. EL. - 6.375* ft

$$Q = 2.127\ h^{1/2} \text{ cfs}$$

*Note: for Case 1 the value is 7.4 ft

Riser Weir Equation: (Weir crest at EL 8.0 ft.)

$$Q = CLH^{3/2}$$

Where:

$C = 2.8$

$L = 9.42$, ft.

$H =$ W. L. EL. - 8.0 ft

$$Q = 26.39H^{3/2} \text{ cfs}$$

Pipe Flow Equation:

The equation for pipe flow conditions is as follows:

$$h = \left(K_e + K_{ex} + \frac{29n^2L}{R^{4/3}}\right)\frac{Q_P{}^2/A^2}{2g}$$

$$h = \left(0.0233 + \frac{0.45n^2L}{R^{4/3}}\right)Q^2/A^2$$

$$h = 0.0309Q^2$$

$$Q = 5.69h^{1/2}$$

Where: $n = 0.013$ (concrete pipe)

$A = \frac{1.5^2\pi}{4} = 1.767 \text{ ft}^2$

$R = 1.5/4 = 0.375$ ft

$L = 260.0$ ft

$K_e = 0.5$ (entrance loss)

$K_{ex} = 1.0$ (exit loss)

$h =$ W. L. El – TW ft.

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Emergency Spillway Flow: (Crest EL 10.0 ft.)

$$Q = CLH^{3/2}$$

Where: $C = 2.8$, $L = 10.0$ ft, $H =$ W. L. EL - 10.0 ft

$$Q = 28.0H^{3/2} \text{ cfs}$$

The combined stage-discharge flow is summarized for each case below:

SWM Basin

Case 1 Stage Discharge Summary (TW = 7.4 ft.)

Elevation (ft)	Orifice Flow h (ft)	Orifice Flow Q (cfs)	Riser Weir Flow H (ft)	Riser Weir Flow Q (cfs)	Total Riser Flow (cfs)	Pipe Flow h (ft)	Pipe Flow Q (cfs)	Spillway Flow H (ft)	Spillway Flow Q (cfs)	Total Basin Flow* (cfs)
6.00					**0.00**					0.00
6.50	0.00	0.00			**0.00**					0.00
6.75	0.00	0.00			**0.00**					0.00
7.00	0.00	0.00			**0.00**					0.00
7.50	0.10	0.67			**0.67**	0.10	1.80			0.67
8.00	0.60	1.65	0.00	0.00	**1.65**	0.60	4.41			1.65
8.25	0.85	1.96	0.25	3.30	5.26	0.85	**5.25**			5.25
8.50			0.50	9.33	9.33	1.10	**5.97**			5.97
9.00			1.00	26.39	26.39	1.60	**7.20**			7.20
10.00			2.00	74.64	74.64	2.60	**9.17**	0.00	0.00	9.17
10.25			2.25	89.07	89.07	2.85	**9.61**	0.25	3.50	13.11
10.50			2.50	104.32	104.32	3.10	**10.02**	0.50	9.90	19.92
11.00			3.00	137.13	137.13	3.60	**10.80**	1.00	28.00	38.80
12.00			4.00	211.12	211.12	4.60	**12.20**	2.00	79.20	91.40

* Note: Total Basin Flow is determined by adding either the Total Riser Flow or Pipe Flow, which ever is controlling (bold type face indicates controlling flow), to the spillway flow

Total Riser Flow = Orifice + Weir Flow

Orifice flow is considered negligble once the orifice is submerged

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SWM Basin
Case 2 Stage Discharge Summary (TW = 5.7 ft.)

Elevation (ft)	Orifice Flow h (ft)	Orifice Flow Q (cfs)	Riser Weir Flow H (ft)	Riser Weir Flow Q (cfs)	Total Riser Flow (cfs)	Pipe Flow h (ft)	Pipe Flow Q (cfs)	Spillway Flow H (ft)	Spillway Flow Q (cfs)	Total Basin Flow* (cfs)
6.00					**0.00**					0.00
6.50	0.13	0.75			**0.75**					0.75
6.75	0.38	1.30			**1.30**					1.30
7.00	0.63	1.68			**1.68**					1.68
7.50	1.13	2.26			**2.26**	1.80	7.63			2.26
8.00	1.63	2.71	0.00	0.00	**2.71**	2.30	8.63			2.71
8.25	1.88	2.91	0.25	3.30	**6.21**	2.55	9.09			6.21
8.50			0.50	9.33	9.33	2.80	**9.52**			9.52
9.00			1.00	26.39	26.39	3.30	**10.34**			10.34
10.00			2.00	74.64	74.64	4.30	**11.80**	0.00	0.00	11.80
10.25			2.25	89.07	89.07	4.55	**12.14**	0.25	3.50	15.64
10.50			2.50	104.32	104.32	4.80	**12.47**	0.50	9.90	22.37
11.00			3.00	137.13	137.13	5.30	**13.10**	1.00	28.00	41.10
12.00			4.00	211.12	211.12	6.30	**14.28**	2.00	79.20	93.48

* Note: Total Basin Flow is determined by adding either the Total Riser Flow or Pipe Flow, which ever is controlling (bold type face indicates controlling flow), to the spillway flow

Total Riser Flow = Orifice + Weir Flow

Orifice flow is considered negligble once the orifice is submerged

V.6 Peak Discharge Results

The results of the post-development runoff analysis are contained in the TR-20 program output files included in Attachments 3 and 4. The results are also summarized in the following table:

Post-Development Runoff Summary
Case 1 Tailwater El. 7.4 ft

Storm Frequency (Year)	24 Hour Rainfall Depth (in)	Runoff Depth (in)	Peak Basin Inflow (cfs)	Peak Water Level (ft)	Peak Basin Outflow (cfs)	Pre-Development Peak Discharge (cfs)
2	1.98	1.38	7.46	7.75	1.17	2.14
10	3.34	2.68	14.44	8.53	6.05	7.45
15	3.63	2.96	15.92	8.73	6.52	8.74
25	4.01	3.33	17.86	8.98	7.15	10.50
50	4.50	3.81	20.35	9.27	7.74	12.83
100	4.98	4.29	22.78	9.56	8.30	15.23

Post-Development Runoff Summary
Case 2 Tailwater El. 5.7 ft

Storm Frequency (Year)	24 Hour Rainfall Depth (in)	Runoff Depth (in)	Peak Basin Inflow (cfs)	Peak Water Level (ft)	Peak Basin Outflow (cfs)	Pre-Development Peak Discharge (cfs)
2	1.98	1.38	7.46	7.23	1.94	2.14
10	3.34	2.68	14.44	8.19	5.36	7.45
15	3.63	2.96	15.92	8.30	6.84	8.74
25	4.01	3.33	17.86	8.45	8.85	10.50
50	4.50	3.81	20.35	8.67	9.80	12.83
100	4.98	4.29	22.78	8.93	10.23	15.23

V.7 Emergency Spillway Capacity

To determine the adequacy of the emergency spillway to pass the 100-year discharge without overtopping the basin embankment, the valve in the riser and pipe outlet structure will be closed such that at the outlet from the basin will be the emergency spillway. The starting water level in the basin will be elevation 6.0 ft. Only the 100-year storm will be modeled for this scenario. The results are contained in Attachment 5 and summarized in the following table. Note all flow over the emergency spillway will flow to the wetland area southwest of the site and not to the existing canal.

Post-Development Emergency Spillway Summary

Storm Frequency (Year)	24 Hour Rainfall Depth (in)	Runoff Depth (in)	Peak Basin Inflow (cfs)	Peak Water Level (ft)	Peak Basin Outflow (cfs)	Pre-Development Peak Discharge (cfs)
100	4.98	4.29	22.78	10.43	8.13	15.83

VI. Basin Draining Time

The basin draining time is computed to insure that the water level in the basin is returned to its original starting water level (Elevation 6.0 ft) within 24-hours of the design storm. The design storm is the 25-year, 24-hour storm. The basin draining time is only computed for the Case 2 tailwater condition where the tailwater level in the canal is below elevation 6.0 ft. For Case 1, the tailwater is at elevation 7.4 ft, and thus the basin water level will not fall below elevation 7.4 ft and drain to elevation 6.0 until the canal water level has fallen below elevation 6.0 ft.

The Case 2 peak water level for the 25-year, 24-hour storm is elevation 8.45 ft. From Attachment 4, this peak water level occurs at hour 10.3 (from the beginning of the rainstorm). Also from Attachment 4, at hour 29.9 the water level in the basin is elevation 6.07 ft or nearly at the invert elevation of the orifice and at the starting water level for the routing. This indicates that 19.6 hours after the peak water level the basin has been drained to the starting water level. It should be noted that at the time of the peak water level (hour 10.3) the basin is still receiving runoff inflow as the storm still continues until about hour 24. Attachment 4 considers this inflow in the basin storage routing and thus, the drainage time above also considers this inflow. If inflow into the basin is not considered, the basin draining time from the peak water level (Elevation 8.45) or from elevation 10.00, the crest of the emergency spillway, will be significantly less than 19.6 hours. In either case, the 24 hour basin draining time criteria set forth by the Alemeda County Flood Control and Water Conservation District is met.

VII. Results and Conclusions

Based on the pre- and post-development runoff calculations performed the following items can be concluded:

- For all storm frequencies in both Case 1 and Case 2, the post-development peak discharge rates from the site are lower than the pre-development peak discharges.
- For Case1, the post-development peak discharges for all storm frequencies are also lower than the estimated 15-year, pre-development peak discharge rate from the site into the existing canal of 9.0 cfs. Thus, the design capacity of the canal is not compromised by the development of the RCEC.
- For Case 2, only the 50- and 100-year, peak discharge rates are higher than the 9.0 cfs limit. Since the canal water level in Case 2 is low, then the upstream discharges must be below capacity and thus the capacity of the canal is not compromised during low flow events.
- The maximum 100-year, water level in the basin is elevation 9.56, which is 0.44 ft below the crest of the emergency spillway and 2.44 feet below the top of the basin embankment.
- The maximum 100-year water level with the principal spillway structure closed and all flow over the emergency spillway to the wetland area southeast of the site is elevation 10.43 which is 1.57 ft below the top of the basin embankment.
- The time to drain the basin from the 25-year peak water level, elevation 8.45 ft, to the starting water level at elevation 6.0 ft is approximately 19.6 hours. This draining time considers the remaining runoff inflow from the 25-year, 24-hour storm into the basin which occurs after the peak water level is reached.

VII. References

1. US Department of Agriculture, Soil Conservation Service, Technical Release 55, "Urban Hydrology for Small Watersheds", June 1986.

2. US Department of Agriculture, Soil Conservation Service, Technical Release 20 , "Project Formulation Hydrology", Computer Program, Version PC 09/83(.2).

3. Alameda County Flood Control and Water Conservation District, "Plans for Construction of Line F in the Vicinity of Whitesell Street", Alameda County, California, 1980

4. Alameda County Flood Control and Water Conservation District, "Hydrology and Hydraulics Criteria Summary, Western Alameda County, August 1989

8.15.1.1 Climate and Precipitation

The climate in the project area is Mediterranean (NOAA division CA-04: Central Coast) with moderate year-round temperatures and a winter rainy season.

Since 1958, normal temperatures in the area typically have exhibited a seasonal pattern ranging from winters of approximately 40-57°F (mean daily temperature of 49°F) in December and January, to summer temperatures ranging from 53-76°F (mean daily temperature of 65°F) in August and September. The average annual temperature is 59°F. The average annual evaporation pan rate is approximately 55 inches, indicating that the project site experiences evaporation rates significantly exceeding local precipitation.

The closest long-term precipitation gage is Station 62, located on the Hayward Corporation Yard, at an elevation of 55 feet msl. Between 1957 and 1992, the annual rainfall at that location averaged 17.9 inches per year. This amount is in very close agreement with the area rainfall map published for Alameda County and vicinity. As shown on this figure, the project site, with elevation of 14 feet msl, falls in an area that typically receives, on average, approximately 16 inches of rain per year. Most of this precipitation occurs during the months of October through April, while summers are relatively dry.

Table 8.15-1 lists the average rainfall amounts by month over a continuous 35-year period from 1957-1992 as recorded at Meteorological Station #62. (Frank Codd, Alameda County Public Works Agency, Flood Control and Water Conservation District, personal communication 2001.)

The California Department of Water resources and the Alameda County Public Works Agency have compiled precipitation frequency data for all of Alameda County. Table 8.15-2 summarizes the storm duration-recurrence data for the Hayward area for storm events ranging from the 2-y to the 100-year event (Jim Goodridge, California Department of Water Resources, personal communication 2001). These precipitation data are used in AFC Section 8.15.2.4 for estimating flooding impacts by calculating the expected stormwater runoff from the project site.

Table 8.15-1. Average monthly rainfall amounts at Station #62: Hayward, CA (inches)

Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
0.05	0.05	0.34	1.23	2.57	2.60	3.40	2.95	2.92	1.36	0.28	0.14

Annual Average =17.9 inchesSource: Frank Codd, Alameda County Flood Control and Water Conservation District.

Table 8.15-2. Storm duration-recurrence intervals - Station #62: Hayward Corporation Yard.

Recurrence (years)	Maximum precipitation (inches) 15-min.	1-hour	6-hour	12-hour	24-hour	Annual Mean
2	0.26	0.53	1.14	1.52	1.98	16.54
10	0.43	0.89	1.92	2.56	3.34	24.58
25	0.52	1.07	2.31	3.08	4.01	27.94
50	0.59	1.20	2.59	3.45	4.50	30.23
100	0.65	1.33	2.86	3.82	4.98	32.37

Sources: Alameda County Public Works Agency: Frank Codd; CA-DWR: Jim Goodridge

```
1

******************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY******************

JOB TR-20                    FULLPRINT          SUMMARY   NOPLOTS
TITLE 000 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS
TITLE     2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS
 6 RUNOFF 1 001       4 0.02422     80.        0.68         1 1   1   1
   ENDATA
 7 INCREM 6             0.1
 7 COMPUT 7 001   001   0.0         1.98       1.0          1 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         3.34       1.0          1 2  01  10
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         3.63       1.0          1 2  01  15
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         4.01       1.0          1 2  01  25
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         4.50       1.0          1 2  01  50
   ENDCMP 1
 7 COMPUT 7 001   001   0.0         4.98       1.0          1 2  01  99
   ENDCMP 1
   ENDJOB 2
0********************************END OF 80-80 LIST********************************
```

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 1
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 1

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
+ MAIN TIME INCREMENT = .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 1.98 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 80. TIME OF CONCENTRATION= .68 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0907 HOURS

PEAK TIME(HRS) 10.33 PEAK DISCHARGE(CFS) 2.14 PEAK ELEVATION(FEET) (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
9.00	DISCHG	.00	.00	.00	.01	.03	.05	.10	.21	.43	.78
10.00	DISCHG	1.21	1.65	1.99	2.13	2.10	1.98	1.83	1.69	1.55	1.42
11.00	DISCHG	1.31	1.21	1.13	1.06	1.00	.94	.90	.86	.83	.80
12.00	DISCHG	.78	.76	.75	.73	.72	.70	.69	.68	.67	.66
13.00	DISCHG	.66	.65	.64	.63	.62	.62	.61	.60	.59	.58
14.00	DISCHG	.57	.56	.56	.55	.54	.54	.53	.53	.53	.52
15.00	DISCHG	.52	.51	.51	.51	.51	.51	.51	.51	.51	.50
16.00	DISCHG	.50	.49	.49	.49	.48	.48	.47	.47	.46	.45
17.00	DISCHG	.45	.44	.44	.44	.44	.44	.44	.44	.43	.43
18.00	DISCHG	.42	.42	.41	.41	.40	.40	.39	.39	.39	.40
19.00	DISCHG	.40	.41	.41	.41	.40	.40	.39	.39	.38	.38
20.00	DISCHG	.37	.37	.36	.36	.36	.36	.36	.36	.36	.36
21.00	DISCHG	.36	.36	.36	.36	.36	.36	.36	.36	.35	.35
22.00	DISCHG	.34	.34	.34	.33	.33	.33	.33	.33	.33	.33
23.00	DISCHG	.33	.33	.33	.33	.33	.33	.33	.33	.33	.32
24.00	DISCHG	.31	.30	.28	.24	.19	.15	.10	.07	.05	.03
25.00	DISCHG	.02	.02	.01	.01	.01	.00				

RUNOFF VOLUME ABOVE BASEFLOW = .55 WATERSHED INCHES, 8.59 CFS-HRS, .71 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 1

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 2
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 2

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 3.34 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 80. TIME OF CONCENTRATION= .68 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0907 HOURS

PEAK TIME(HRS) 10.27 PEAK DISCHARGE(CFS) 7.45 PEAK ELEVATION(FEET) (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
7.00	DISCHG	.00	.00	.01	.01	.02	.04	.05	.07	.08	.10
8.00	DISCHG	.12	.14	.17	.19	.22	.26	.29	.34	.39	.45
9.00	DISCHG	.52	.59	.68	.78	.90	1.03	1.27	1.76	2.67	3.93
10.00	DISCHG	5.32	6.55	7.32	7.42	7.02	6.39	5.71	5.12	4.60	4.13

11.00	DISCHG	3.73	3.39	3.12	2.89	2.68	2.51	2.37	2.26	2.16	2.08
12.00	DISCHG	2.01	1.95	1.90	1.86	1.81	1.77	1.74	1.71	1.68	1.65
13.00	DISCHG	1.62	1.60	1.58	1.55	1.53	1.50	1.48	1.46	1.43	1.40
14.00	DISCHG	1.38	1.35	1.34	1.32	1.30	1.29	1.27	1.26	1.25	1.23
15.00	DISCHG	1.22	1.21	1.20	1.20	1.20	1.20	1.19	1.19	1.18	1.17
16.00	DISCHG	1.16	1.15	1.14	1.13	1.11	1.10	1.09	1.08	1.06	1.05
17.00	DISCHG	1.03	1.02	1.01	1.01	1.01	1.00	1.00	1.00	.99	.98
18.00	DISCHG	.96	.95	.94	.93	.91	.90	.89	.88	.89	.90
19.00	DISCHG	.91	.91	.92	.91	.90	.90	.89	.87	.86	.85
20.00	DISCHG	.83	.82	.81	.80	.80	.80	.80	.80	.80	.80
21.00	DISCHG	.80	.80	.80	.80	.80	.80	.80	.79	.78	.77
22.00	DISCHG	.76	.75	.74	.74	.73	.73	.73	.73	.73	.73
23.00	DISCHG	.73	.73	.73	.73	.73	.73	.73	.72	.71	.70
24.00	DISCHG	.69	.66	.61	.53	.42	.32	.23	.16	.11	.08
25.00	DISCHG	.05	.04	.02	.02	.01	.01	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 1.51 WATERSHED INCHES, 23.57 CFS-HRS, 1.95 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 2

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 3
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 3

CUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
+ TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 3.63 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=15 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 80. TIME OF CONCENTRATION= .68 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0907 HOURS

PEAK TIME(HRS) PEAK DISCHARGE(CFS) PEAK ELEVATION(FEET)
10.26 8.74 (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

6.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
7.00	DISCHG	.02	.03	.05	.06	.08	.10	.12	.14	.16	.18
8.00	DISCHG	.21	.23	.26	.29	.33	.37	.42	.47	.53	.61
9.00	DISCHG	.69	.78	.88	1.00	1.14	1.31	1.59	2.16	3.25	4.72
10.00	DISCHG	6.34	7.76	8.62	8.71	8.21	7.44	6.64	5.93	5.32	4.77
11.00	DISCHG	4.29	3.90	3.58	3.31	3.07	2.87	2.71	2.58	2.47	2.37
12.00	DISCHG	2.29	2.22	2.16	2.11	2.06	2.01	1.97	1.94	1.90	1.87
13.00	DISCHG	1.84	1.81	1.79	1.76	1.73	1.70	1.67	1.65	1.62	1.59
14.00	DISCHG	1.56	1.53	1.51	1.49	1.47	1.45	1.44	1.42	1.41	1.39
15.00	DISCHG	1.38	1.37	1.36	1.35	1.35	1.35	1.35	1.34	1.33	1.32
16.00	DISCHG	1.31	1.30	1.28	1.27	1.25	1.24	1.23	1.21	1.20	1.18
17.00	DISCHG	1.16	1.15	1.14	1.13	1.13	1.13	1.13	1.12	1.11	1.10
18.00	DISCHG	1.08	1.07	1.06	1.04	1.02	1.01	1.00	.99	1.00	1.01
19.00	DISCHG	1.02	1.03	1.03	1.02	1.01	1.00	.99	.98	.96	.95
20.00	DISCHG	.93	.92	.91	.90	.90	.89	.89	.89	.89	.89
21.00	DISCHG	.89	.89	.89	.89	.89	.89	.89	.89	.88	.86
22.00	DISCHG	.85	.84	.83	.82	.82	.82	.81	.81	.81	.81
23.00	DISCHG	.81	.81	.81	.81	.81	.81	.81	.81	.80	.78
24.00	DISCHG	.77	.74	.69	.59	.47	.36	.25	.18	.12	.08
25.00	DISCHG	.06	.04	.03	.02	.01	.01	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 27.16 CFS-HRS, 2.24 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 3

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 4
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 4

ATTACHMENT NO. 2

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing. Pre- and Post-Development Runoff

CALC NO H&H-1

REV. NO. 0

```
EXECUTIVE CONTROL OPERATION COMPUT                                                              RECORD ID
+                                     FROM XSECTION   1
+                                                    TO XSECTION   1
      STARTING TIME =    .00    RAIN DEPTH =  4.01   RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1          STORM NO.=25     MAIN TIME INCREMENT =    .10 HOURS

OPERATION RUNOFF    CROSS SECTION    1
         OUTPUT HYDROGRAPH=  4
         AREA=     .02 SQ MI    INPUT RUNOFF CURVE= 80.    TIME OF CONCENTRATION=    .68 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0907 HOURS

         PEAK TIME(HRS)               PEAK DISCHARGE(CFS)            PEAK ELEVATION(FEET)
            10.26                           10.50                         (RUNOFF)
```

TIME(HRS)		FIRST HYDROGRAPH POINT =	.00 HOURS		TIME INCREMENT =	.10 HOURS		DRAINAGE AREA =		.02 SQ.MI.
6.00	DISCHG	.00	.00	.00	.01	.01	.02	.03	.04	.06	.07
7.00	DISCHG	.09	.11	.13	.15	.17	.20	.22	.25	.27	.30
8.00	DISCHG	.33	.36	.40	.44	.49	.54	.59	.66	.74	.83
9.00	DISCHG	.94	1.04	1.17	1.32	1.49	1.68	2.03	2.73	4.04	5.81
10.00	DISCHG	7.74	9.40	10.38	10.44	9.80	8.86	7.87	7.01	6.27	5.61
11.00	DISCHG	5.04	4.57	4.19	3.87	3.59	3.35	3.16	3.00	2.87	2.75
12.00	DISCHG	2.66	2.58	2.51	2.45	2.39	2.33	2.28	2.24	2.20	2.16
13.00	DISCHG	2.13	2.09	2.06	2.03	1.99	1.96	1.93	1.90	1.87	1.83
14.00	DISCHG	1.80	1.76	1.74	1.71	1.69	1.67	1.65	1.64	1.62	1.60
15.00	DISCHG	1.58	1.57	1.56	1.55	1.55	1.55	1.55	1.54	1.53	1.52
16.00	DISCHG	1.50	1.49	1.47	1.46	1.44	1.42	1.40	1.39	1.37	1.35
17.00	DISCHG	1.33	1.32	1.31	1.30	1.29	1.29	1.29	1.28	1.27	1.25
18.00	DISCHG	1.24	1.22	1.21	1.19	1.17	1.15	1.14	1.13	1.14	1.15
19.00	DISCHG	1.16	1.17	1.18	1.17	1.16	1.15	1.13	1.12	1.10	1.08
20.00	DISCHG	1.06	1.05	1.04	1.03	1.02	1.02	1.02	1.02	1.02	1.02
21.00	DISCHG	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.00	.98
22.00	DISCHG	.97	.96	.94	.94	.93	.93	.93	.93	.93	.93
23.00	DISCHG	.93	.93	.93	.93	.93	.93	.93	.92	.91	.89
24.00	DISCHG	.87	.84	.78	.68	.54	.41	.29	.20	.14	.10
25.00	DISCHG	.07	.05	.03	.02	.01	.01	.01	.00		

```
  RUNOFF VOLUME ABOVE BASEFLOW =  2.05 WATERSHED INCHES,     31.99 CFS-HRS,     2.64 ACRE-FEET;   BASEFLOW =    .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                              RECORD ID
+                                     COMPUTATIONS COMPLETED FOR PASS    4

1

TR20 XEQ 06-14-01  15:47         RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS                           JOB   1    PASS    5
     REV PC 09/83(.2)            2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS                        PAGE    5

EXECUTIVE CONTROL OPERATION COMPUT                                                              RECORD ID
+                                     FROM XSECTION   1
+                                                    TO XSECTION   1
      STARTING TIME =    .00    RAIN DEPTH =  4.50   RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1          STORM NO.=50     MAIN TIME INCREMENT =    .10 HOURS

OPERATION RUNOFF    CROSS SECTION    1
         OUTPUT HYDROGRAPH=  4
         AREA=     .02 SQ MI    INPUT RUNOFF CURVE= 80.    TIME OF CONCENTRATION=    .68 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0907 HOURS

         PEAK TIME(HRS)               PEAK DISCHARGE(CFS)            PEAK ELEVATION(FEET)
            10.25                           12.83                         (RUNOFF)
            23.45                            1.07                         (RUNOFF)
```

TIME(HRS)		FIRST HYDROGRAPH POINT =	.00 HOURS		TIME INCREMENT =	.10 HOURS		DRAINAGE AREA =		.02 SQ.MI.
5.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
6.00	DISCHG	.02	.03	.05	.06	.08	.10	.11	.13	.15	.18
7.00	DISCHG	.20	.23	.25	.28	.31	.34	.37	.40	.44	.47
8.00	DISCHG	.51	.55	.59	.65	.71	.77	.84	.92	1.02	1.15
9.00	DISCHG	1.27	1.41	1.56	1.75	1.96	2.20	2.63	3.49	5.11	7.28
10.00	DISCHG	9.61	11.60	12.73	12.74	11.91	10.73	9.51	8.44	7.53	6.73
11.00	DISCHG	6.03	5.46	4.99	4.60	4.26	3.98	3.74	3.56	3.40	3.26
12.00	DISCHG	3.14	3.04	2.96	2.88	2.81	2.75	2.69	2.64	2.59	2.54
13.00	DISCHG	2.50	2.46	2.42	2.38	2.34	2.30	2.27	2.23	2.19	2.14
14.00	DISCHG	2.10	2.07	2.04	2.01	1.98	1.96	1.94	1.92	1.89	1.87
15.00	DISCHG	1.85	1.84	1.82	1.82	1.81	1.81	1.81	1.80	1.79	1.77
16.00	DISCHG	1.75	1.74	1.72	1.70	1.68	1.66	1.64	1.62	1.60	1.57

17.00	DISCHG	1.55	1.53	1.52	1.51	1.51	1.50	1.50	1.49	1.48	1.46
18.00	DISCHG	1.44	1.42	1.40	1.38	1.36	1.34	1.32	1.32	1.32	1.34
19.00	DISCHG	1.35	1.36	1.36	1.36	1.35	1.33	1.32	1.30	1.28	1.26
20.00	DISCHG	1.23	1.22	1.20	1.19	1.19	1.18	1.18	1.18	1.18	1.18
21.00	DISCHG	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.17	1.16	1.14
22.00	DISCHG	1.12	1.11	1.09	1.09	1.08	1.08	1.08	1.07	1.07	1.07
23.00	DISCHG	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.06	1.05	1.03
24.00	DISCHG	1.01	.97	.90	.78	.62	.47	.33	.23	.16	.11
25.00	DISCHG	.08	.05	.04	.03	.02	.01	.01	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 2.46 WATERSHED INCHES, 38.42 CFS-HRS, 3.17 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
\+ COMPUTATIONS COMPLETED FOR PASS 5

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 6
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 6

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
\+ FROM XSECTION 1
\+ TO XSECTION 1
STARTING TIME = .00 RAIN DEPTH = 4.98 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .10 HOURS

.ERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 80. TIME OF CONCENTRATION= .68 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0907 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.25	15.23	(RUNOFF)
23.45	1.22	(RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

5.00	DISCHG	.00	.00	.00	.00	.01	.01	.02	.04	.05	.07
6.00	DISCHG	.09	.11	.13	.16	.18	.20	.22	.24	.27	.30
7.00	DISCHG	.33	.36	.39	.42	.46	.49	.53	.57	.61	.65
8.00	DISCHG	.70	.75	.80	.86	.94	1.01	1.10	1.20	1.32	1.47
9.00	DISCHG	1.63	1.79	1.97	2.20	2.45	2.74	3.24	4.28	6.20	8.77
10.00	DISCHG	11.50	13.81	15.09	15.04	14.03	12.60	11.14	9.87	8.79	7.83
11.00	DISCHG	7.01	6.34	5.79	5.33	4.93	4.60	4.32	4.10	3.91	3.75
12.00	DISCHG	3.61	3.50	3.41	3.32	3.23	3.16	3.09	3.03	2.97	2.92
13.00	DISCHG	2.87	2.82	2.78	2.73	2.68	2.64	2.59	2.55	2.50	2.45
14.00	DISCHG	2.41	2.37	2.33	2.30	2.26	2.24	2.21	2.19	2.16	2.14
15.00	DISCHG	2.11	2.10	2.08	2.07	2.07	2.06	2.06	2.05	2.04	2.02
16.00	DISCHG	2.00	1.98	1.96	1.94	1.91	1.89	1.87	1.84	1.82	1.79
17.00	DISCHG	1.77	1.75	1.73	1.72	1.72	1.71	1.71	1.70	1.68	1.66
18.00	DISCHG	1.64	1.62	1.60	1.57	1.55	1.52	1.50	1.50	1.50	1.52
19.00	DISCHG	1.53	1.55	1.55	1.54	1.53	1.51	1.50	1.48	1.45	1.43
20.00	DISCHG	1.40	1.38	1.37	1.36	1.35	1.34	1.34	1.34	1.34	1.34
21.00	DISCHG	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.33	1.31	1.29
22.00	DISCHG	1.27	1.25	1.24	1.23	1.23	1.22	1.22	1.22	1.22	1.22
23.00	DISCHG	1.21	1.21	1.21	1.22	1.22	1.22	1.21	1.20	1.19	1.17
24.00	DISCHG	1.14	1.10	1.02	.88	.71	.53	.38	.26	.18	.13
25.00	DISCHG	.09	.06	.04	.03	.02	.01	.01	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 2.87 WATERSHED INCHES, 44.88 CFS-HRS, 3.71 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
\+ COMPUTATIONS COMPLETED FOR PASS 6

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 7

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1	STORM 2												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	1.98	24.00	.55	---	10.33	2.14	88.3
ALTERNATE 1	STORM 10												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.34	24.00	1.51	---	10.27	7.45	307.4
ALTERNATE 1	STORM 15												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.63	24.00	1.74	---	10.26	8.74	361.0
ALTERNATE 1	STORM 25												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.01	24.00	2.05	---	10.26	10.50	433.4
ALTERNATE 1	STORM 50												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.50	24.00	2.46	---	10.25	12.83	529.9
ALTERNATE 1	STORM 99												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.98	24.00	2.87	---	10.25	15.23	628.8

1

TR20 XEQ 06-14-01 15:47 RCEC PRE-DEVELOPMENT RUNOFF ANALYSIS JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STOMRS PAGE 8

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 2	10	15	25	50	99
0 XSECTION 1	.02						
+ ALTERNATE 1		2.14	7.45	8.74	10.50	12.83	15.23

1END OF 1 JOBS IN THIS RUN

ATTACHMENT NO. 3

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

SHEET NO 1 OF 11

REV. NO. 1

```
1

 *****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

 JOB TR-20                    FULLPRINT           SUMMARY   NOPLOTS
 TITLE 001 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1
 TITLE     2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS
   3 STRUCT     01
   8                   5.0        0.0         0.0
   8                   6.0        0.000001    0.23
   8                   7.0        0.000002    0.56
   8                   7.4        0.000003    0.71
   8                   7.5        0.67        0.75
   8                   8.0        1.65        0.94
   8                   8.25       5.25        1.05
   8                   8.50       5.97        1.16
   8                   9.0        7.20        1.38
   8                   10.0       9.17        1.87
   8                   10.25      13.11       2.01
   8                   10.50      19.92       2.15
   8                   11.0       38.8        2.42
   8                   12.0       91.4        3.03
   9 ENDTBL
   6 RUNOFF 1 001       4 0.0184     94.         0.286       1 1   1   1
   6 RESVOR 2    01 4   5 6.0                                1 1 1 1   1
     ENDATA
   7 INCREM 6           0.1
   7 COMPUT 7 001     01 0.0         1.98        1.0         1 2  01  02
     ENDCMP 1
   7 COMPUT 7 001     01 0.0         3.34        1.0         1 2  01  10
     ENDCMP 1
   7 COMPUT 7 001     01 0.0         3.63        1.0         1 2  01  15
     ENDCMP 1
   7 COMPUT 7 001     01 0.0         4.01        1.0         1 2  01  25
     ENDCMP 1
   7 COMPUT 7 001     01 0.0         4.50        1.0         1 2  01  50
     ENDCMP 1
   7 COMPUT 7 001     01 0.0         4.98        1.0         1 2  01  99
     ENDCMP 1
     ENDJOB 2
0*******************************END OF 80-80 LIST*******************************
```

ATTACHMENT NO. 3

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

REV. NO. 1

1

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TR20 XEQ 09-05-01  09:42        RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                 JOB  1    PASS   1
     REV PC 09/83(.2)           2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                      PAGE   1


EXECUTIVE CONTROL OPERATION INCREM                                                             RECORD ID
+                                        MAIN TIME INCREMENT =   .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT                                                             RECORD ID
+                                        FROM XSECTION   1
+                                                          TO STRUCTURE  1
        STARTING TIME =   .00    RAIN DEPTH =  1.98   RAIN DURATION=  1.00   RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1         STORM NO.= 2    MAIN TIME INCREMENT =   .10 HOURS

OPERATION RUNOFF   CROSS SECTION   1
           OUTPUT HYDROGRAPH=  4
           AREA=    .02 SQ MI   INPUT RUNOFF CURVE= 94.    TIME OF CONCENTRATION=    .29 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0381 HOURS

           PEAK TIME(HRS)                PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              10.01                            7.46                        (RUNOFF)
```

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
3.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
4.00	DISCHG	.02	.03	.03	.04	.05	.05	.06	.07	.08	.08
5.00	DISCHG	.09	.10	.11	.12	.12	.13	.14	.15	.16	.17
6.00	DISCHG	.18	.18	.19	.20	.21	.21	.22	.24	.26	.27
7.00	DISCHG	.28	.29	.31	.33	.34	.35	.37	.39	.41	.43
8.00	DISCHG	.44	.46	.52	.56	.59	.61	.65	.76	.85	.91
9.00	DISCHG	.94	1.01	1.18	1.33	1.41	1.47	2.16	4.15	5.94	6.90
10.00	DISCHG	7.45	7.14	5.36	3.84	3.18	2.90	2.66	2.23	1.90	1.75
11.00	DISCHG	1.70	1.63	1.48	1.36	1.30	1.28	1.26	1.20	1.15	1.13
12.00	DISCHG	1.12	1.10	1.06	1.02	1.01	1.00	.99	.96	.94	.93
13.00	DISCHG	.92	.91	.88	.86	.85	.84	.83	.80	.78	.77
14.00	DISCHG	.76	.76	.74	.73	.72	.72	.72	.70	.69	.68
15.00	DISCHG	.68	.68	.68	.68	.68	.68	.68	.66	.65	.65
16.00	DISCHG	.64	.64	.62	.61	.60	.60	.60	.58	.57	.56
17.00	DISCHG	.56	.56	.56	.56	.56	.56	.56	.54	.53	.52
18.00	DISCHG	.52	.51	.50	.49	.48	.48	.48	.50	.51	.52
19.00	DISCHG	.52	.51	.50	.49	.48	.48	.47	.46	.44	.44
20.00	DISCHG	.44	.44	.44	.44	.44	.44	.44	.44	.44	.44
21.00	DISCHG	.44	.44	.44	.44	.44	.44	.43	.42	.40	.40
22.00	DISCHG	.39	.39	.39	.39	.39	.39	.39	.39	.39	.39
23.00	DISCHG	.39	.39	.39	.39	.39	.39	.39	.37	.36	.36
24.00	DISCHG	.35	.31	.18	.08	.03	.01	.01	.00		

```
  RUNOFF VOLUME ABOVE BASEFLOW =  1.38 WATERSHED INCHES,     16.35 CFS-HRS,     1.35 ACRE-FEET;    BASEFLOW =    .00 CFS

OPERATION RESVOR   STRUCTURE  1
           INPUT HYDROGRAPH= 4      OUTPUT HYDROGRAPH= 5
           SURFACE ELEVATION=     6.00

           PEAK TIME(HRS)                PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              11.80                            1.17                        7.75
+                                               *                                 * FIRST POINT OF FLAT PEAK
1


TR20 XEQ 09-05-01  09:42        RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                 JOB  1    PASS   1
     REV PC 09/83(.2)           2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                      PAGE   2
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TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
10.00	DISCHG	.00	.00	.00	.53	.75	.85	.93	.99	1.03	1.07
10.00	ELEV	5.00	5.00	5.00	7.48	7.54	7.59	7.63	7.66	7.69	7.70
11.00	DISCHG	1.09	1.12	1.14	1.15	1.16	1.16	1.17	1.17	1.17	1.17
11.00	ELEV	7.72	7.73	7.74	7.74	7.75	7.75	7.75	7.75	7.75	7.75
12.00	DISCHG	1.17	1.16	1.16	1.16	1.15	1.14	1.14	1.13	1.12	1.12
12.00	ELEV	7.75	7.75	7.75	7.75	7.74	7.74	7.74	7.74	7.73	7.73
13.00	DISCHG	1.11	1.10	1.09	1.08	1.07	1.06	1.05	1.04	1.03	1.02
13.00	ELEV	7.72	7.72	7.71	7.71	7.71	7.70	7.70	7.69	7.69	7.68
14.00	DISCHG	1.01	1.00	.99	.98	.97	.96	.95	.94	.93	.92
14.00	ELEV	7.67	7.67	7.66	7.66	7.65	7.65	7.64	7.64	7.63	7.63
15.00	DISCHG	.91	.90	.89	.88	.87	.87	.86	.85	.84	.83
15.00	ELEV	7.62	7.62	7.61	7.61	7.60	7.60	7.60	7.59	7.59	7.58

16.00	DISCHG	.83	.82	.81	.80	.79	.79	.78	.77	.76	.75
16.00	ELEV	7.58	7.58	7.57	7.57	7.56	7.56	7.56	7.55	7.55	7.54
17.00	DISCHG	.75	.74	.73	.72	.72	.71	.70	.70	.69	.68
17.00	ELEV	7.54	7.53	7.53	7.53	7.52	7.52	7.52	7.51	7.51	7.51
18.00	DISCHG	.68	.67	.65	.63	.61	.59	.58	.57	.56	.55
18.00	ELEV	7.50	7.50	7.50	7.49	7.49	7.49	7.49	7.48	7.48	7.48
19.00	DISCHG	.55	.54	.54	.53	.53	.52	.52	.51	.50	.49
19.00	ELEV	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.47	7.47
20.00	DISCHG	.49	.48	.47	.47	.46	.46	.46	.45	.45	.45
20.00	ELEV	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47
21.00	DISCHG	.45	.45	.45	.44	.44	.44	.44	.44	.43	.43
21.00	ELEV	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.46	7.46
22.00	DISCHG	.43	.42	.42	.42	.41	.41	.41	.41	.40	.40
22.00	ELEV	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46
23.00	DISCHG	.40	.40	.40	.40	.40	.40	.40	.40	.39	.39
23.00	ELEV	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46
24.00	DISCHG	.38	.38	.36	.33	.29	.26	.23	.20	.17	.15
24.00	ELEV	7.46	7.46	7.45	7.45	7.44	7.44	7.43	7.43	7.43	7.42
25.00	DISCHG	.13	.11	.10	.09	.07	.07	.06	.05	.04	.04
25.00	ELEV	7.42	7.42	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.41
26.00	DISCHG	.03	.03	.02	.02	.02	.02	.01	.01	.01	.01
26.00	ELEV	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40
27.00	DISCHG	.01									
27.00	ELEV	7.40									

RUNOFF VOLUME ABOVE BASEFLOW = .89 WATERSHED INCHES, 10.54 CFS-HRS, .87 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 1

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 2
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 3.34 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
10.00	14.44	

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

2.00	DISCHG	.00	.00	.00	.00	.01	.02	.03	.05	.06	.08
3.00	DISCHG	.09	.11	.12	.13	.14	.16	.17	.19	.21	.22
4.00	DISCHG	.24	.25	.26	.27	.28	.29	.31	.33	.35	.37
5.00	DISCHG	.38	.39	.42	.44	.45	.47	.48	.51	.53	.55
6.00	DISCHG	.56	.57	.59	.60	.61	.62	.64	.68	.72	.74
7.00	DISCHG	.76	.78	.83	.87	.89	.91	.94	.99	1.03	1.06
8.00	DISCHG	1.07	1.12	1.24	1.33	1.38	1.41	1.51	1.74	1.93	2.03
9.00	DISCHG	2.09	2.23	2.58	2.87	3.01	3.11	4.50	8.48	11.93	13.59
10.00	DISCHG	14.44	13.65	10.17	7.23	5.95	5.39	4.93	4.12	3.50	3.23
11.00	DISCHG	3.12	2.99	2.70	2.48	2.38	2.34	2.29	2.18	2.09	2.05
12.00	DISCHG	2.04	2.00	1.92	1.85	1.83	1.81	1.79	1.74	1.69	1.67
13.00	DISCHG	1.67	1.64	1.59	1.54	1.53	1.52	1.50	1.44	1.40	1.38
14.00	DISCHG	1.37	1.36	1.33	1.31	1.30	1.29	1.28	1.25	1.23	1.22
15.00	DISCHG	1.22	1.22	1.22	1.22	1.22	1.22	1.21	1.18	1.16	1.15
16.00	DISCHG	1.15	1.14	1.11	1.09	1.08	1.07	1.06	1.03	1.01	1.00
17.00	DISCHG	1.00	.99	.99	.99	.99	.99	.98	.96	.93	.93
18.00	DISCHG	.92	.91	.88	.86	.85	.85	.85	.88	.90	.91
19.00	DISCHG	.92	.91	.88	.86	.85	.85	.84	.81	.78	.77
20.00	DISCHG	.77	.77	.77	.77	.77	.77	.77	.77	.77	.77
21.00	DISCHG	.77	.77	.77	.77	.77	.77	.76	.73	.71	.70
22.00	DISCHG	.70	.69	.69	.69	.69	.69	.69	.69	.69	.69
[illegible].00	DISCHG	.69	.69	.69	.69	.69	.69	.68	.66	.63	.62
[illegible].00	DISCHG	.62	.54	.32	.14	.06	.02	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 2.68 WATERSHED INCHES, 31.81 CFS-HRS, 2.63 ACRE-FEET; BASEFLOW = .00 CFS

```
OPERATION RESVOR    STRUCTURE  1
          INPUT HYDROGRAPH= 4       OUTPUT HYDROGRAPH= 5
          SURFACE ELEVATION=      6.00

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)              PEAK ELEVATION(FEET)
            10.41                           6.05                             8.53

TIME(HRS)         FIRST HYDROGRAPH POINT =    .00 HOURS     TIME INCREMENT =  .10 HOURS      DRAINAGE AREA =     .02 SQ.MI.
1


TR20 XEQ 09-05-01  09:42          RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                                     JOB  1     PASS   2
     REV PC 09/83(.2)             2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                                           PAGE   4
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9.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.71	1.10	1.59
9.00	ELEV	5.00	5.00	5.00	5.00	5.00	5.00	5.00	7.52	7.72	7.97
10.00	DISCHG	4.26	5.55	5.88	6.02	6.05	6.03	5.99	5.92	5.81	5.68
10.00	ELEV	8.18	8.35	8.47	8.52	8.53	8.52	8.51	8.48	8.44	8.40
11.00	DISCHG	5.55	5.41	5.28	4.74	4.19	3.76	3.41	3.13	2.89	2.70
11.00	ELEV	8.35	8.31	8.26	8.21	8.18	8.15	8.12	8.10	8.09	8.07
12.00	DISCHG	2.54	2.42	2.31	2.21	2.12	2.05	1.99	1.94	1.88	1.84
12.00	ELEV	8.06	8.05	8.05	8.04	8.03	8.03	8.02	8.02	8.02	8.01
13.00	DISCHG	1.80	1.76	1.73	1.69	1.65	1.65	1.64	1.63	1.62	1.61
13.00	ELEV	8.01	8.01	8.01	8.00	8.00	8.00	7.99	7.99	7.99	7.98
14.00	DISCHG	1.60	1.59	1.58	1.57	1.56	1.55	1.54	1.53	1.52	1.50
14.00	ELEV	7.98	7.97	7.97	7.96	7.95	7.95	7.94	7.94	7.93	7.93
15.00	DISCHG	1.49	1.48	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.40
15.00	ELEV	7.92	7.91	7.91	7.90	7.90	7.89	7.89	7.88	7.88	7.87
16.00	DISCHG	1.39	1.38	1.37	1.36	1.34	1.33	1.32	1.31	1.30	1.29
16.00	ELEV	7.87	7.86	7.86	7.85	7.84	7.84	7.83	7.83	7.82	7.81
17.00	DISCHG	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.20	1.19	1.18
17.00	ELEV	7.81	7.80	7.80	7.79	7.79	7.78	7.78	7.77	7.77	7.76
18.00	DISCHG	1.17	1.16	1.15	1.14	1.12	1.11	1.10	1.09	1.08	1.08
18.00	ELEV	7.75	7.75	7.74	7.74	7.73	7.73	7.72	7.72	7.71	7.71
19.00	DISCHG	1.07	1.06	1.06	1.05	1.04	1.03	1.02	1.02	1.01	1.00
19.00	ELEV	7.70	7.70	7.70	7.69	7.69	7.68	7.68	7.68	7.67	7.67
20.00	DISCHG	.99	.98	.97	.96	.95	.95	.94	.93	.92	.92
20.00	ELEV	7.66	7.66	7.65	7.65	7.64	7.64	7.64	7.63	7.63	7.63
21.00	DISCHG	.91	.91	.90	.89	.89	.88	.88	.87	.87	.86
21.00	ELEV	7.62	7.62	7.62	7.61	7.61	7.61	7.61	7.60	7.60	7.60
22.00	DISCHG	.85	.85	.84	.83	.83	.82	.82	.81	.81	.80
22.00	ELEV	7.59	7.59	7.59	7.58	7.58	7.58	7.58	7.57	7.57	7.57
23.00	DISCHG	.80	.79	.79	.79	.78	.78	.77	.77	.76	.76
23.00	ELEV	7.57	7.56	7.56	7.56	7.56	7.55	7.55	7.55	7.55	7.55
24.00	DISCHG	.75	.75	.73	.71	.69	.64	.56	.48	.42	.37
24.00	ELEV	7.54	7.54	7.53	7.52	7.51	7.49	7.48	7.47	7.46	7.45
25.00	DISCHG	.32	.28	.24	.21	.18	.16	.14	.12	.11	.09
25.00	ELEV	7.45	7.44	7.44	7.43	7.43	7.42	7.42	7.42	7.42	7.41
26.00	DISCHG	.08	.07	.06	.05	.05	.04	.03	.03	.03	.02
26.00	ELEV	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.40	7.40	7.40
27.00	DISCHG	.02	.02	.02	.01	.01	.01	.01			
27.00	ELEV	7.40	7.40	7.40	7.40	7.40	7.40	7.40			

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   RUNOFF VOLUME ABOVE BASEFLOW =  2.19 WATERSHED INCHES,      25.97 CFS-HRS,      2.15 ACRE-FEET;     BASEFLOW =      .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                                RECORD ID
+                                         COMPUTATIONS COMPLETED FOR PASS    2

1

TR20 XEQ 09-05-01  09:42          RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                                     JOB  1     PASS   3
     REV PC 09/83(.2)             2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                                           PAGE   5


EXECUTIVE CONTROL OPERATION COMPUT                                                                                RECORD ID
+                                         FROM XSECTION    1
+                                                            TO STRUCTURE   1
       STARTING TIME =    .00      RAIN DEPTH =  3.63    RAIN DURATION=  1.00     RAIN TABLE NO.= 1     ANT. MOIST. COND= 2
       ALTERNATE NO.= 1            STORM NO.=15      MAIN TIME INCREMENT =    .10 HOURS

OPERATION RUNOFF    CROSS SECTION    1
          OUTPUT HYDROGRAPH=   4
          AREA=     .02 SQ MI    INPUT RUNOFF CURVE= 94.     TIME OF CONCENTRATION=    .29 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=   .0381 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)              PEAK ELEVATION(FEET)
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ATTACHMENT NO. 3

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

SHEET NO 5 OF 11

REV. NO. 1

10.00 15.92 (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

2.00	DISCHG	.00	.00	.01	.02	.03	.05	.07	.08	.10	.12
3.00	DISCHG	.13	.15	.16	.18	.19	.20	.22	.24	.26	.28
4.00	DISCHG	.29	.31	.32	.33	.34	.36	.37	.40	.42	.44
5.00	DISCHG	.45	.47	.49	.52	.54	.55	.57	.60	.62	.64
6.00	DISCHG	.65	.67	.68	.69	.70	.71	.73	.78	.82	.85
7.00	DISCHG	.87	.89	.95	.99	1.02	1.04	1.06	1.12	1.17	1.20
8.00	DISCHG	1.22	1.27	1.40	1.50	1.56	1.59	1.70	1.95	2.17	2.28
9.00	DISCHG	2.34	2.50	2.88	3.20	3.36	3.47	5.00	9.41	13.20	15.01
10.00	DISCHG	15.92	15.03	11.19	7.94	6.53	5.92	5.40	4.52	3.84	3.54
11.00	DISCHG	3.42	3.27	2.96	2.72	2.61	2.57	2.51	2.39	2.29	2.25
12.00	DISCHG	2.23	2.19	2.10	2.03	2.00	1.99	1.96	1.90	1.85	1.83
13.00	DISCHG	1.82	1.80	1.74	1.69	1.67	1.66	1.64	1.58	1.53	1.51
14.00	DISCHG	1.50	1.48	1.45	1.43	1.42	1.41	1.40	1.37	1.35	1.34
15.00	DISCHG	1.33	1.33	1.33	1.33	1.33	1.33	1.32	1.29	1.27	1.26
16.00	DISCHG	1.25	1.24	1.21	1.19	1.17	1.17	1.16	1.13	1.10	1.09
17.00	DISCHG	1.09	1.09	1.09	1.09	1.09	1.09	1.08	1.05	1.02	1.01
18.00	DISCHG	1.01	.99	.96	.94	.93	.92	.93	.96	.99	1.00
19.00	DISCHG	1.00	.99	.96	.94	.93	.92	.91	.88	.86	.85
20.00	DISCHG	.84	.84	.84	.84	.84	.84	.84	.84	.84	.84
21.00	DISCHG	.84	.84	.84	.84	.84	.84	.83	.80	.77	.76
22.00	DISCHG	.76	.76	.76	.76	.76	.76	.76	.76	.76	.76
23.00	DISCHG	.76	.76	.76	.76	.76	.76	.75	.72	.69	.68
24.00	DISCHG	.67	.59	.35	.15	.06	.03	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 2.96 WATERSHED INCHES, 35.16 CFS-HRS, 2.91 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS) 10.42 PEAK DISCHARGE(CFS) 6.52 PEAK ELEVATION(FEET) 8.73

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.
1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 3
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 6

9.00	DISCHG	.00	.00	.00	.00	.03	.47	.76	1.03	1.46	3.58
9.00	ELEV	5.00	5.00	5.00	5.00	7.40	7.47	7.55	7.68	7.90	8.13
10.00	DISCHG	5.51	6.02	6.34	6.49	6.52	6.51	6.47	6.40	6.30	6.18
10.00	ELEV	8.34	8.52	8.65	8.71	8.72	8.72	8.70	8.68	8.64	8.59
11.00	DISCHG	6.06	5.93	5.79	5.63	5.47	5.32	4.91	4.33	3.85	3.47
11.00	ELEV	8.54	8.49	8.44	8.38	8.33	8.28	8.23	8.19	8.15	8.13
12.00	DISCHG	3.18	2.95	2.76	2.59	2.45	2.34	2.26	2.18	2.11	2.04
12.00	ELEV	8.11	8.09	8.08	8.07	8.06	8.05	8.04	8.04	8.03	8.03
13.00	DISCHG	1.99	1.95	1.91	1.86	1.82	1.78	1.75	1.71	1.68	1.65
13.00	ELEV	8.02	8.02	8.02	8.01	8.01	8.01	8.01	8.00	8.00	8.00
14.00	DISCHG	1.64	1.64	1.63	1.62	1.61	1.60	1.60	1.59	1.58	1.57
14.00	ELEV	8.00	7.99	7.99	7.99	7.98	7.98	7.97	7.97	7.96	7.96
15.00	DISCHG	1.56	1.55	1.54	1.53	1.52	1.51	1.51	1.50	1.49	1.48
15.00	ELEV	7.95	7.95	7.94	7.94	7.93	7.93	7.93	7.92	7.92	7.91
16.00	DISCHG	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.37
16.00	ELEV	7.91	7.90	7.90	7.90	7.89	7.89	7.88	7.87	7.86	7.86
17.00	DISCHG	1.36	1.35	1.34	1.33	1.32	1.31	1.30	1.29	1.28	1.27
17.00	ELEV	7.85	7.85	7.84	7.84	7.83	7.83	7.82	7.82	7.81	7.80
18.00	DISCHG	1.26	1.25	1.23	1.22	1.21	1.20	1.19	1.18	1.17	1.16
18.00	ELEV	7.80	7.79	7.79	7.78	7.78	7.77	7.76	7.76	7.75	7.75
19.00	DISCHG	1.15	1.15	1.14	1.13	1.12	1.12	1.11	1.10	1.09	1.08
19.00	ELEV	7.75	7.74	7.74	7.74	7.73	7.73	7.72	7.72	7.71	7.71
20.00	DISCHG	1.07	1.06	1.05	1.04	1.03	1.03	1.02	1.01	1.00	1.00
20.00	ELEV	7.70	7.70	7.69	7.69	7.69	7.68	7.68	7.67	7.67	7.67
21.00	DISCHG	.99	.98	.98	.97	.97	.96	.96	.95	.94	.94
21.00	ELEV	7.66	7.66	7.66	7.65	7.65	7.65	7.65	7.64	7.64	7.64
22.00	DISCHG	.93	.92	.91	.91	.90	.90	.89	.88	.88	.87
22.00	ELEV	7.63	7.63	7.62	7.62	7.62	7.61	7.61	7.61	7.61	7.60
23.00	DISCHG	.87	.86	.86	.85	.85	.85	.84	.84	.83	.83
23.00	ELEV	7.60	7.60	7.60	7.59	7.59	7.59	7.59	7.59	7.58	7.58
24.00	DISCHG	.82	.81	.80	.78	.75	.72	.69	.64	.56	.48
24.00	ELEV	7.58	7.57	7.57	7.55	7.54	7.52	7.51	7.50	7.48	7.47
25.00	DISCHG	.42	.37	.32	.28	.24	.21	.18	.16	.14	.12
.00	ELEV	7.46	7.45	7.45	7.44	7.44	7.43	7.43	7.42	7.42	7.42
.00	DISCHG	.11	.09	.08	.07	.06	.05	.05	.04	.03	.03
26.00	ELEV	7.42	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.40
27.00	DISCHG	.03	.02	.02	.02	.02	.01	.01	.01	.01	
27.00	ELEV	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	

RUNOFF VOLUME ABOVE BASEFLOW = 2.47 WATERSHED INCHES, 29.34 CFS-HRS, 2.42 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 3

1

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 4.01 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=25 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.00	17.86	(RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

2.00	DISCHG	.00	.02	.03	.05	.07	.09	.11	.13	.15	.17
3.00	DISCHG	.19	.21	.22	.24	.25	.27	.29	.31	.34	.35
4.00	DISCHG	.37	.39	.40	.41	.43	.44	.46	.49	.51	.53
5.00	DISCHG	.55	.57	.60	.62	.64	.66	.68	.71	.74	.76
6.00	DISCHG	.78	.79	.80	.81	.83	.84	.86	.92	.96	.99
7.00	DISCHG	1.01	1.04	1.10	1.15	1.18	1.20	1.24	1.30	1.35	1.38
8.00	DISCHG	1.40	1.46	1.61	1.73	1.79	1.83	1.95	2.24	2.48	2.60
9.00	DISCHG	2.67	2.85	3.28	3.64	3.81	3.93	5.66	10.63	14.88	16.88
10.00	DISCHG	17.86	16.83	12.52	8.88	7.30	6.61	6.03	5.04	4.28	3.94
11.00	DISCHG	3.81	3.65	3.30	3.03	2.91	2.86	2.79	2.66	2.55	2.50
12.00	DISCHG	2.48	2.44	2.34	2.26	2.22	2.21	2.18	2.11	2.06	2.04
13.00	DISCHG	2.03	2.00	1.93	1.88	1.86	1.85	1.82	1.75	1.70	1.67
14.00	DISCHG	1.66	1.65	1.61	1.59	1.58	1.57	1.56	1.52	1.50	1.49
15.00	DISCHG	1.48	1.48	1.48	1.48	1.48	1.48	1.47	1.43	1.41	1.40
16.00	DISCHG	1.39	1.38	1.34	1.32	1.30	1.30	1.29	1.25	1.22	1.21
17.00	DISCHG	1.21	1.21	1.21	1.20	1.20	1.20	1.19	1.16	1.13	1.12
18.00	DISCHG	1.12	1.10	1.07	1.04	1.03	1.02	1.03	1.07	1.09	1.11
19.00	DISCHG	1.11	1.10	1.07	1.04	1.03	1.03	1.01	.98	.95	.94
20.00	DISCHG	.93	.93	.93	.93	.93	.93	.93	.93	.93	.93
21.00	DISCHG	.93	.93	.93	.93	.93	.93	.92	.89	.86	.85
22.00	DISCHG	.84	.84	.84	.84	.84	.84	.84	.84	.84	.84
23.00	DISCHG	.84	.84	.84	.84	.84	.84	.83	.79	.77	.75
24.00	DISCHG	.75	.66	.39	.17	.07	.03	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 3.33 WATERSHED INCHES, 39.57 CFS-HRS, 3.27 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.43	7.15	8.98

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.
1

9.00	DISCHG	.00	.02	.41	.71	.84	.97	1.13	1.42	3.03	5.44
9.00	ELEV	5.00	7.40	7.46	7.52	7.59	7.65	7.73	7.88	8.10	8.31
10.00	DISCHG	6.05	6.56	6.93	7.10	7.14	7.13	7.10	7.03	6.92	6.79
10.00	ELEV	8.53	8.74	8.89	8.96	8.98	8.97	8.96	8.93	8.89	8.83
11.00	DISCHG	6.66	6.53	6.39	6.25	6.10	5.95	5.78	5.62	5.46	5.31
11.00	ELEV	8.78	8.73	8.67	8.61	8.55	8.49	8.44	8.38	8.32	8.27
12.00	DISCHG	4.85	4.28	3.83	3.46	3.17	2.94	2.77	2.62	2.49	2.39
12.00	ELEV	8.22	8.18	8.15	8.13	8.11	8.09	8.08	8.07	8.06	8.05
13.00	DISCHG	2.30	2.23	2.17	2.11	2.05	2.00	1.96	1.92	1.87	1.83

13.00	ELEV	8.05	8.04	8.04	8.03	8.03	8.02	8.02	8.02	8.02	8.01
14.00	DISCHG	1.79	1.76	1.73	1.70	1.67	1.65	1.65	1.64	1.64	1.63
14.00	ELEV	8.01	8.01	8.01	8.00	8.00	8.00	8.00	8.00	7.99	7.99
15.00	DISCHG	1.62	1.62	1.61	1.61	1.60	1.60	1.59	1.58	1.58	1.57
15.00	ELEV	7.99	7.98	7.98	7.98	7.98	7.97	7.97	7.97	7.96	7.96
16.00	DISCHG	1.56	1.56	1.55	1.54	1.53	1.52	1.51	1.50	1.49	1.48
16.00	ELEV	7.96	7.95	7.95	7.94	7.94	7.93	7.93	7.92	7.92	7.91
17.00	DISCHG	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.38
17.00	ELEV	7.91	7.90	7.90	7.89	7.89	7.88	7.88	7.87	7.87	7.86
18.00	DISCHG	1.37	1.36	1.34	1.33	1.32	1.31	1.30	1.29	1.28	1.27
18.00	ELEV	7.85	7.85	7.84	7.84	7.83	7.83	7.82	7.81	7.81	7.81
19.00	DISCHG	1.26	1.26	1.25	1.24	1.23	1.22	1.22	1.21	1.20	1.19
19.00	ELEV	7.80	7.80	7.80	7.79	7.79	7.78	7.78	7.77	7.77	7.76
20.00	DISCHG	1.18	1.16	1.16	1.15	1.14	1.13	1.12	1.11	1.10	1.10
20.00	ELEV	7.76	7.75	7.75	7.74	7.74	7.73	7.73	7.73	7.72	7.72
21.00	DISCHG	1.09	1.08	1.08	1.07	1.07	1.06	1.05	1.05	1.04	1.03
21.00	ELEV	7.71	7.71	7.71	7.70	7.70	7.70	7.70	7.69	7.69	7.68
22.00	DISCHG	1.02	1.02	1.01	1.00	1.00	.99	.98	.98	.97	.97
22.00	ELEV	7.68	7.68	7.67	7.67	7.67	7.66	7.66	7.66	7.65	7.65
23.00	DISCHG	.96	.96	.95	.95	.94	.94	.93	.93	.92	.91
23.00	ELEV	7.65	7.65	7.64	7.64	7.64	7.64	7.63	7.63	7.63	7.62
24.00	DISCHG	.91	.90	.88	.86	.83	.79	.76	.73	.70	.67
24.00	ELEV	7.62	7.62	7.61	7.60	7.58	7.56	7.55	7.53	7.52	7.50
25.00	DISCHG	.59	.51	.44	.39	.34	.29	.26	.22	.19	.17
25.00	ELEV	7.49	7.48	7.47	7.46	7.45	7.44	7.44	7.43	7.43	7.43
26.00	DISCHG	.15	.13	.11	.10	.08	.07	.06	.06	.05	.04
26.00	ELEV	7.42	7.42	7.42	7.41	7.41	7.41	7.41	7.41	7.41	7.41
27.00	DISCHG	.04	.03	.03	.02	.02	.02	.02	.01	.01	.01
27.00	ELEV	7.41	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40
28.00	DISCHG	.01	.01								
28.00	ELEV	7.40	7.40								

RUNOFF VOLUME ABOVE BASEFLOW = 2.84 WATERSHED INCHES, 33.76 CFS-HRS, 2.79 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+
COMPUTATIONS COMPLETED FOR PASS 4

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 5
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 9

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 4.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=50 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS) 10.00 PEAK DISCHARGE(CFS) 20.35 PEAK ELEVATION(FEET) (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
1.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02
2.00	DISCHG	.04	.06	.08	.11	.14	.16	.18	.21	.23	.25
3.00	DISCHG	.27	.29	.31	.32	.34	.36	.38	.41	.44	.46
4.00	DISCHG	.48	.50	.51	.53	.54	.56	.58	.61	.64	.66
5.00	DISCHG	.68	.70	.74	.77	.79	.81	.83	.87	.90	.92
6.00	DISCHG	.94	.95	.97	.98	.99	1.00	1.03	1.10	1.15	1.18
7.00	DISCHG	1.20	1.24	1.31	1.36	1.40	1.42	1.46	1.53	1.59	1.62
8.00	DISCHG	1.65	1.72	1.88	2.02	2.09	2.13	2.27	2.60	2.88	3.02
9.00	DISCHG	3.09	3.30	3.79	4.20	4.40	4.53	6.51	12.19	17.02	19.27
10.00	DISCHG	20.35	19.15	14.23	10.08	8.28	7.49	6.83	5.71	4.85	4.47
11.00	DISCHG	4.31	4.13	3.74	3.43	3.29	3.23	3.16	3.00	2.88	2.83
12.00	DISCHG	2.80	2.76	2.64	2.55	2.51	2.50	2.46	2.39	2.33	2.30
13.00	DISCHG	2.29	2.26	2.18	2.12	2.10	2.08	2.05	1.98	1.92	1.89
14.00	DISCHG	1.88	1.86	1.82	1.79	1.78	1.77	1.76	1.72	1.69	1.68
15.00	DISCHG	1.67	1.67	1.67	1.67	1.67	1.67	1.66	1.62	1.59	1.57
16.00	DISCHG	1.57	1.55	1.52	1.48	1.47	1.47	1.45	1.41	1.38	1.37
17.00	DISCHG	1.36	1.36	1.36	1.36	1.36	1.36	1.35	1.31	1.28	1.26
18.00	DISCHG	1.26	1.24	1.21	1.17	1.16	1.16	1.17	1.20	1.23	1.25
19.00	DISCHG	1.25	1.24	1.21	1.18	1.16	1.16	1.14	1.10	1.07	1.06
20.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

21.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.04	1.00	.97	.95
22.00	DISCHG	.95	.95	.94	.94	.94	.94	.94	.94	.94	.94
23.00	DISCHG	.94	.94	.94	.94	.95	.94	.93	.89	.86	.85
24.00	DISCHG	.84	.74	.44	.19	.08	.03	.01	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 3.81 WATERSHED INCHES, 45.29 CFS-HRS, 3.74 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS) 10.47 PEAK DISCHARGE(CFS) 7.74 PEAK ELEVATION(FEET) 9.27

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 5
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 10

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
8.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.36	.68
8.00	ELEV	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	7.45	7.50
9.00	DISCHG	.78	.88	.99	1.11	1.25	1.38	1.55	2.96	5.36	6.02
9.00	ELEV	7.55	7.61	7.66	7.73	7.79	7.86	7.95	8.09	8.29	8.52
10.00	DISCHG	6.64	7.23	7.54	7.69	7.74	7.74	7.72	7.67	7.60	7.50
10.00	ELEV	8.77	9.01	9.17	9.25	9.27	9.27	9.26	9.24	9.20	9.15
11.00	DISCHG	7.40	7.29	7.18	7.02	6.85	6.69	6.53	6.37	6.22	6.07
11.00	ELEV	9.10	9.05	8.99	8.93	8.86	8.79	8.73	8.66	8.60	8.54
12.00	DISCHG	5.91	5.75	5.59	5.43	5.28	4.71	4.18	3.76	3.43	3.16
12.00	ELEV	8.48	8.42	8.37	8.31	8.26	8.21	8.18	8.15	8.12	8.10
13.00	DISCHG	2.96	2.79	2.66	2.54	2.43	2.35	2.29	2.22	2.16	2.10
13.00	ELEV	8.09	8.08	8.07	8.06	8.05	8.05	8.04	8.04	8.04	8.03
14.00	DISCHG	2.05	2.00	1.97	1.93	1.89	1.87	1.84	1.82	1.79	1.76
14.00	ELEV	8.03	8.02	8.02	8.02	8.02	8.01	8.01	8.01	8.01	8.01
15.00	DISCHG	1.74	1.73	1.71	1.70	1.69	1.69	1.68	1.67	1.65	1.65
15.00	ELEV	8.01	8.01	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
16.00	DISCHG	1.64	1.64	1.64	1.63	1.62	1.62	1.61	1.60	1.60	1.59
16.00	ELEV	8.00	8.00	7.99	7.99	7.99	7.98	7.98	7.98	7.97	7.97
17.00	DISCHG	1.58	1.57	1.56	1.55	1.54	1.54	1.53	1.52	1.51	1.50
17.00	ELEV	7.96	7.96	7.95	7.95	7.95	7.94	7.94	7.93	7.93	7.92
18.00	DISCHG	1.49	1.48	1.47	1.46	1.45	1.43	1.42	1.41	1.40	1.40
18.00	ELEV	7.92	7.91	7.91	7.90	7.90	7.89	7.88	7.88	7.87	7.87
19.00	DISCHG	1.39	1.38	1.38	1.37	1.36	1.35	1.34	1.34	1.33	1.31
19.00	ELEV	7.87	7.86	7.86	7.86	7.85	7.85	7.84	7.84	7.83	7.83
20.00	DISCHG	1.30	1.29	1.28	1.27	1.26	1.25	1.25	1.24	1.23	1.22
20.00	ELEV	7.82	7.82	7.81	7.81	7.80	7.80	7.79	7.79	7.79	7.78
21.00	DISCHG	1.21	1.21	1.20	1.19	1.19	1.18	1.18	1.17	1.16	1.15
21.00	ELEV	7.78	7.77	7.77	7.77	7.76	7.76	7.76	7.76	7.75	7.75
22.00	DISCHG	1.15	1.14	1.13	1.12	1.11	1.11	1.10	1.09	1.09	1.08
22.00	ELEV	7.74	7.74	7.73	7.73	7.73	7.72	7.72	7.72	7.71	7.71
23.00	DISCHG	1.08	1.07	1.07	1.06	1.06	1.05	1.05	1.04	1.03	1.03
23.00	ELEV	7.71	7.70	7.70	7.70	7.70	7.69	7.69	7.69	7.69	7.68
24.00	DISCHG	1.02	1.01	.99	.96	.93	.89	.86	.82	.79	.75
24.00	ELEV	7.68	7.67	7.66	7.65	7.63	7.61	7.59	7.58	7.56	7.54
25.00	DISCHG	.72	.69	.65	.57	.49	.43	.37	.32	.28	.25
25.00	ELEV	7.53	7.51	7.50	7.48	7.47	7.46	7.46	7.45	7.44	7.44
26.00	DISCHG	.21	.19	.16	.14	.12	.11	.09	.08	.07	.06
26.00	ELEV	7.43	7.43	7.42	7.42	7.42	7.42	7.41	7.41	7.41	7.41
27.00	DISCHG	.05	.05	.04	.04	.03	.03	.02	.02	.02	.02
27.00	ELEV	7.41	7.41	7.41	7.41	7.40	7.40	7.40	7.40	7.40	7.40
28.00	DISCHG	.01	.01	.01	.01	.01					
28.00	ELEV	7.40	7.40	7.40	7.40	7.40					

RUNOFF VOLUME ABOVE BASEFLOW = 3.32 WATERSHED INCHES, 39.44 CFS-HRS, 3.26 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 5

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 6
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 11

1

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TR20 XEQ 09-05-01  09:42      RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                          JOB  1   PASS   6
     REV PC 09/83(.2)         2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                               PAGE  12

EXECUTIVE CONTROL OPERATION COMPUT                                                                     RECORD ID
+                                  FROM XSECTION   1
+                                                 TO STRUCTURE   1
          STARTING TIME =   .00    RAIN DEPTH =  4.98    RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
          ALTERNATE NO.= 1         STORM NO.=99    MAIN TIME INCREMENT =   .10 HOURS

OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  4
          AREA=    .02 SQ MI   INPUT RUNOFF CURVE= 94.    TIME OF CONCENTRATION=   .29 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0381 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)            PEAK ELEVATION(FEET)
             10.00                        22.78                        (RUNOFF)
             23.36                         1.05                        (RUNOFF)

TIME(HRS)        FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .10 HOURS      DRAINAGE AREA =    .02 SQ.MI.
    1.00   DISCHG       .00       .00       .00       .00       .00       .00       .00       .01       .03       .06
    2.00   DISCHG       .08       .11       .14       .17       .20       .23       .26       .28       .31       .33
    3.00   DISCHG       .35       .37       .39       .41       .43       .45       .47       .51       .54       .57
    4.00   DISCHG       .59       .61       .62       .64       .66       .67       .70       .73       .77       .79
    5.00   DISCHG       .81       .83       .87       .91       .93       .95       .98      1.02      1.06      1.08
    6.00   DISCHG      1.10      1.12      1.13      1.14      1.16      1.17      1.20      1.27      1.33      1.37
    7.00   DISCHG      1.39      1.43      1.51      1.57      1.61      1.64      1.68      1.76      1.82      1.86
    8.00   DISCHG      1.89      1.96      2.15      2.31      2.39      2.43      2.58      2.96      3.28      3.43
    9.00   DISCHG      3.51      3.74      4.29      4.75      4.97      5.12      7.33     13.71     19.12     21.60
   10.00   DISCHG     22.77     21.41     15.89     11.26      9.24      8.35      7.62      6.36      5.40      4.98
   11.00   DISCHG      4.80      4.60      4.16      3.81      3.66      3.60      3.52      3.34      3.21      3.14
   12.00   DISCHG      3.12      3.07      2.94      2.84      2.79      2.78      2.74      2.66      2.59      2.56
   13.00   DISCHG      2.55      2.51      2.43      2.36      2.33      2.32      2.28      2.20      2.13      2.10
   14.00   DISCHG      2.09      2.07      2.03      1.99      1.98      1.97      1.95      1.91      1.88      1.86
   15.00   DISCHG      1.86      1.85      1.85      1.85      1.85      1.85      1.84      1.80      1.76      1.75
   16.00   DISCHG      1.74      1.73      1.68      1.65      1.63      1.63      1.61      1.57      1.53      1.52
   17.00   DISCHG      1.51      1.51      1.51      1.51      1.51      1.51      1.49      1.45      1.42      1.40
   18.00   DISCHG      1.40      1.38      1.34      1.30      1.29      1.28      1.29      1.34      1.37      1.38
   19.00   DISCHG      1.39      1.38      1.34      1.30      1.29      1.28      1.27      1.22      1.19      1.17
   20.00   DISCHG      1.17      1.17      1.16      1.16      1.16      1.16      1.16      1.16      1.16      1.16
   21.00   DISCHG      1.16      1.16      1.16      1.16      1.16      1.16      1.15      1.11      1.07      1.06
   22.00   DISCHG      1.05      1.05      1.05      1.05      1.05      1.05      1.05      1.05      1.05      1.05
   23.00   DISCHG      1.05      1.05      1.05      1.05      1.05      1.05      1.03       .99       .96       .94
   24.00   DISCHG       .93       .82       .48       .21       .09       .04       .02       .01       .00

   RUNOFF VOLUME ABOVE BASEFLOW =  4.29 WATERSHED INCHES,      50.90 CFS-HRS,      4.21 ACRE-FEET;     BASEFLOW =     .00 CFS

OPERATION RESVOR    STRUCTURE  1
          INPUT HYDROGRAPH= 4      OUTPUT HYDROGRAPH= 5
          SURFACE ELEVATION=     6.00

          PEAK TIME(HRS)               PEAK DISCHARGE(CFS)             PEAK ELEVATION(FEET)
             10.51                          8.30                           9.56
1

TR20 XEQ 09-05-01  09:42      RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1                          JOB  1   PASS   6
     REV PC 09/83(.2)         2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                               PAGE  13

TIME(HRS)        FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .10 HOURS      DRAINAGE AREA =    .02 SQ.MI.
    8.00   DISCHG       .00       .00       .00       .04       .34       .61       .73       .81       .91      1.01
    8.00     ELEV      5.00      5.00      5.00      7.41      7.45      7.49      7.53      7.57      7.62      7.67
    9.00   DISCHG      1.12      1.22      1.34      1.47      1.61      2.25      3.19      4.94      5.79      6.47
    9.00     ELEV      7.73      7.78      7.84      7.91      7.98      8.04      8.11      8.23      8.44      8.70
   10.00   DISCHG      7.18      7.67      8.03      8.21      8.28      8.30      8.29      8.24      8.17      8.07
   10.00     ELEV      8.99      9.24      9.42      9.51      9.55      9.56      9.55      9.53      9.49      9.44
   11.00   DISCHG      7.97      7.86      7.74      7.62      7.49      7.37      7.24      7.09      6.92      6.75
   11.00     ELEV      9.39      9.33      9.28      9.21      9.15      9.09      9.02      8.95      8.88      8.82
   12.00   DISCHG      6.58      6.43      6.27      6.12      5.97      5.80      5.64      5.49      5.34      4.98
   12.00     ELEV      8.75      8.69      8.62      8.56      8.50      8.44      8.39      8.33      8.28      8.23
   13.00   DISCHG      4.40      3.96      3.60      3.31      3.08      2.90      2.76      2.64      2.52      2.43
   13.00     ELEV      8.19      8.16      8.14      8.12      8.10      8.09      8.08      8.07      8.06      8.05
   14.00   DISCHG      2.35      2.28      2.23      2.18      2.13      2.09      2.06      2.03      2.00      1.97
   14.00     ELEV      8.05      8.04      8.04      8.04      8.03      8.03      8.03      8.03      8.02      8.02
   15.00   DISCHG      1.94      1.92      1.91      1.89      1.88      1.88      1.87      1.86      1.84      1.82
   15.00     ELEV      8.02      8.02      8.02      8.02      8.02      8.02      8.02      8.01      8.01      8.01
   16.00   DISCHG      1.80      1.79      1.77      1.74      1.72      1.70      1.68      1.66      1.65      1.64
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ATTACHMENT NO. 3

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

SHEET NO 10 OF 11

REV. NO. 1

16.00	ELEV	8.01	8.01	8.01	8.01	8.00	8.00	8.00	8.00	8.00	8.00
17.00	DISCHG	1.64	1.63	1.63	1.62	1.62	1.61	1.61	1.60	1.60	1.59
17.00	ELEV	7.99	7.99	7.99	7.99	7.98	7.98	7.98	7.98	7.97	7.97
18.00	DISCHG	1.58	1.57	1.56	1.55	1.54	1.53	1.52	1.51	1.51	1.50
18.00	ELEV	7.96	7.96	7.96	7.95	7.94	7.94	7.93	7.93	7.93	7.92
19.00	DISCHG	1.50	1.49	1.49	1.48	1.47	1.46	1.46	1.45	1.44	1.43
19.00	ELEV	7.92	7.92	7.92	7.91	7.91	7.90	7.90	7.90	7.89	7.89
20.00	DISCHG	1.42	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.34
20.00	ELEV	7.88	7.88	7.87	7.87	7.86	7.86	7.85	7.85	7.84	7.84
21.00	DISCHG	1.33	1.32	1.31	1.31	1.30	1.30	1.29	1.28	1.28	1.27
21.00	ELEV	7.84	7.83	7.83	7.83	7.82	7.82	7.82	7.81	7.81	7.80
22.00	DISCHG	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.20	1.20	1.19
22.00	ELEV	7.80	7.80	7.79	7.79	7.78	7.78	7.78	7.77	7.77	7.77
23.00	DISCHG	1.19	1.18	1.17	1.17	1.16	1.16	1.15	1.15	1.14	1.13
23.00	ELEV	7.76	7.76	7.76	7.75	7.75	7.75	7.75	7.74	7.74	7.74
24.00	DISCHG	1.13	1.11	1.10	1.06	1.03	.99	.95	.91	.87	.83
24.00	ELEV	7.73	7.73	7.72	7.70	7.68	7.66	7.64	7.62	7.60	7.58
25.00	DISCHG	.80	.76	.73	.70	.67	.59	.52	.45	.39	.34
25.00	ELEV	7.57	7.55	7.53	7.52	7.50	7.49	7.48	7.47	7.46	7.45
26.00	DISCHG	.30	.26	.22	.20	.17	.15	.13	.11	.10	.08
26.00	ELEV	7.44	7.44	7.43	7.43	7.43	7.42	7.42	7.42	7.41	7.41
27.00	DISCHG	.07	.06	.06	.05	.04	.04	.03	.03	.02	.02
27.00	ELEV	7.41	7.41	7.41	7.41	7.41	7.41	7.40	7.40	7.40	7.40
28.00	DISCHG	.02	.02	.01	.01	.01	.01	.01			
28.00	ELEV	7.40	7.40	7.40	7.40	7.40	7.40	7.40			

RUNOFF VOLUME ABOVE BASEFLOW = 3.80 WATERSHED INCHES, 45.08 CFS-HRS, 3.73 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

+ COMPUTATIONS COMPLETED FOR PASS 6

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 PASS 7

REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 14

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 15

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	AMOUNT (IN)	DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
ALTERNATE 1	STORM 2												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	1.98	24.00	1.38	---	10.01	7.46	405.6
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	1.98	24.00	.89	7.75	11.80*	1.17*	63.5
ALTERNATE 1	STORM 10												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.34	24.00	2.68	---	10.00	14.44	784.8
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	3.34	24.00	2.19	8.53	10.41	6.05	328.7
ALTERNATE 1	STORM 15												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.63	24.00	2.96	---	10.00	15.92	865.4
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	3.63	24.00	2.47	8.73	10.42	6.52	354.5
ALTERNATE 1	STORM 25												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.01	24.00	3.33	---	10.00	17.86	970.6
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.01	24.00	2.84	8.98	10.43	7.15	388.3
ALTERNATE 1	STORM 50												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.50	24.00	3.81	---	10.00	20.35	1105.9
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.50	24.00	3.32	9.27	10.47	7.74	420.7
ALTERNATE 1	STORM 99												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.98	24.00	4.29	---	10.00	22.78	1237.8
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.98	24.00	3.80	9.56	10.51	8.30	450.9

1

TR20 XEQ 09-05-01 09:42 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 1 JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 16

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 2	10	15	25	50	99
0 STRUCTURE 1	.02						
+ ALTERNATE 1		1.17	6.05	6.52	7.15	7.74	8.30
0 XSECTION 1	.02						
+ ALTERNATE 1		7.46	14.44	15.92	17.86	20.35	22.78

1END OF 1 JOBS IN THIS RUN

1

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******************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                        FULLPRINT            SUMMARY    NOPLOTS
TITLE 001 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2
TITLE     2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS
 3 STRUCT      01
 8                      5.0         0.0         0.0
 8                      6.0         0.000001    0.23
 8                      6.5         0.75        0.40
 8                      6.75        1.30        0.48
 8                      7.0         1.68        0.56
 8                      7.5         2.26        0.75
 8                      8.0         2.71        0.94
 8                      8.25        6.21        1.05
 8                      8.50        9.52        1.16
 8                      9.0         10.34       1.38
 8                      10.0        11.80       1.87
 8                      10.25       15.64       2.01
 8                      10.50       22.37       2.15
 8                      11.0        41.10       2.42
 8                      12.0        93.48       3.03
 9 ENDTBL
 6 RUNOFF 1 001       4 0.0184      94.         0.286       1 1   1   1
 6 RESVOR 2    01 4   5 6.0                                 1 1 1 1   1
   ENDATA
 7 INCREM 6             0.1
 7 COMPUT 7 001      01 0.0         1.98        1.0         1 2  01  02
   ENDCMP 1
 7 COMPUT 7 001      01 0.0         3.34        1.0         1 2  01  10
   ENDCMP 1
 7 COMPUT 7 001      01 0.0         3.63        1.0         1 2  01  15
   ENDCMP 1
 7 COMPUT 7 001      01 0.0         4.01        1.0         1 2  01  25
   ENDCMP 1
 7 COMPUT 7 001      01 0.0         4.50        1.0         1 2  01  50
   ENDCMP 1
 7 COMPUT 7 001      01 0.0         4.98        1.0         1 2  01  99
   ENDCMP 1
   ENDJOB 2
0*******************************END OF 80-80 LIST*******************************
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1

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TR20 XEQ 09-05-01  09:43      RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2                    JOB  1    PASS  1
     REV PC 09/83(.2)         2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                         PAGE  1

EXECUTIVE CONTROL OPERATION INCREM                                                        RECORD ID
+                                  MAIN TIME INCREMENT =   .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT                                                        RECORD ID
+                                  FROM XSECTION    1
+                                                TO STRUCTURE  1
      STARTING TIME =    .00    RAIN DEPTH =  1.98    RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1          STORM NO.= 2    MAIN TIME INCREMENT =    .10 HOURS

OPERATION RUNOFF    CROSS SECTION    1
        OUTPUT HYDROGRAPH=  4
        AREA=     .02 SQ MI    INPUT RUNOFF CURVE= 94.    TIME OF CONCENTRATION=    .29 HOURS
        INTERNAL HYDROGRAPH TIME INCREMENT=  .0381 HOURS

        PEAK TIME(HRS)               PEAK DISCHARGE(CFS)              PEAK ELEVATION(FEET)
          10.01                            7.46                            (RUNOFF)
```

TIME(HRS) — FIRST HYDROGRAPH POINT = .00 HOURS — TIME INCREMENT = .10 HOURS — DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
3.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
4.00	DISCHG	.02	.03	.03	.04	.05	.05	.06	.07	.08	.08
5.00	DISCHG	.09	.10	.11	.12	.12	.13	.14	.15	.16	.17
6.00	DISCHG	.18	.18	.19	.20	.21	.21	.22	.24	.26	.27
7.00	DISCHG	.28	.29	.31	.33	.34	.35	.37	.39	.41	.43
8.00	DISCHG	.44	.46	.52	.56	.59	.61	.65	.76	.85	.91
9.00	DISCHG	.94	1.01	1.18	1.33	1.41	1.47	2.16	4.15	5.94	6.90
10.00	DISCHG	7.45	7.14	5.36	3.84	3.18	2.90	2.66	2.23	1.90	1.75
11.00	DISCHG	1.70	1.63	1.48	1.36	1.30	1.28	1.26	1.20	1.15	1.13
12.00	DISCHG	1.12	1.10	1.06	1.02	1.01	1.00	.99	.96	.94	.93
13.00	DISCHG	.92	.91	.88	.86	.85	.84	.83	.80	.78	.77
14.00	DISCHG	.76	.76	.74	.73	.72	.72	.72	.70	.69	.68
15.00	DISCHG	.68	.68	.68	.68	.68	.68	.68	.66	.65	.65
16.00	DISCHG	.64	.64	.62	.61	.60	.60	.60	.58	.57	.56
17.00	DISCHG	.56	.56	.56	.56	.56	.56	.56	.54	.53	.52
18.00	DISCHG	.52	.51	.50	.49	.48	.48	.48	.50	.51	.52
19.00	DISCHG	.52	.51	.50	.49	.48	.48	.47	.46	.44	.44
20.00	DISCHG	.44	.44	.44	.44	.44	.44	.44	.44	.44	.44
21.00	DISCHG	.44	.44	.44	.44	.44	.44	.43	.42	.40	.40
22.00	DISCHG	.39	.39	.39	.39	.39	.39	.39	.39	.39	.39
23.00	DISCHG	.39	.39	.39	.39	.39	.39	.39	.37	.36	.36
24.00	DISCHG	.35	.31	.18	.08	.03	.01	.01	.00		

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  RUNOFF VOLUME ABOVE BASEFLOW =  1.38 WATERSHED INCHES,     16.35 CFS-HRS,     1.35 ACRE-FEET;    BASEFLOW =    .00 CFS

OPERATION RESVOR    STRUCTURE  1
        INPUT HYDROGRAPH= 4      OUTPUT HYDROGRAPH= 5
        SURFACE ELEVATION=     6.00

        PEAK TIME(HRS)               PEAK DISCHARGE(CFS)              PEAK ELEVATION(FEET)
          10.80                            1.94                            7.23
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1

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TR20 XEQ 09-05-01  09:43      RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2                    JOB  1    PASS  1
     REV PC 09/83(.2)         2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS                         PAGE  2
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TIME(HRS) — FIRST HYDROGRAPH POINT = .00 HOURS — TIME INCREMENT = .10 HOURS — DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
4.00	DISCHG	.00	.00	.00	.00	.01	.01	.01	.01	.01	.02
4.00	ELEV	5.00	5.00	5.00	5.00	6.00	6.00	6.01	6.01	6.01	6.01
5.00	DISCHG	.02	.02	.02	.03	.03	.03	.04	.04	.05	.05
5.00	ELEV	6.01	6.01	6.02	6.02	6.02	6.02	6.02	6.03	6.03	6.03
6.00	DISCHG	.05	.06	.06	.07	.07	.08	.08	.09	.09	.10
6.00	ELEV	6.04	6.04	6.04	6.05	6.05	6.05	6.05	6.06	6.06	6.07
7.00	DISCHG	.11	.11	.12	.13	.13	.14	.15	.16	.17	.18
7.00	ELEV	6.07	6.07	6.08	6.08	6.09	6.09	6.10	6.11	6.11	6.12
8.00	DISCHG	.18	.19	.21	.22	.23	.24	.26	.27	.29	.31
8.00	ELEV	6.12	6.13	6.14	6.14	6.15	6.16	6.17	6.18	6.19	6.21
9.00	DISCHG	.34	.36	.38	.42	.45	.49	.53	.63	.80	1.11
9.00	ELEV	6.22	6.24	6.26	6.28	6.30	6.32	6.36	6.42	6.52	6.67
10.00	DISCHG	1.40	1.63	1.76	1.83	1.88	1.90	1.93	1.94	1.94	1.94

10.00	ELEV	6.82	6.97	7.07	7.13	7.17	7.19	7.21	7.22	7.23	7.22
11.00	DISCHG	1.93	1.93	1.92	1.91	1.89	1.88	1.86	1.85	1.83	1.81
11.00	ELEV	7.22	7.21	7.21	7.19	7.18	7.17	7.16	7.14	7.13	7.11
12.00	DISCHG	1.79	1.78	1.76	1.74	1.72	1.71	1.69	1.67	1.64	1.61
12.00	ELEV	7.10	7.08	7.07	7.05	7.04	7.02	7.01	6.99	6.97	6.95
13.00	DISCHG	1.58	1.56	1.53	1.51	1.48	1.46	1.43	1.41	1.39	1.36
13.00	ELEV	6.94	6.92	6.90	6.89	6.87	6.85	6.84	6.82	6.81	6.79
14.00	DISCHG	1.34	1.32	1.29	1.26	1.23	1.21	1.18	1.15	1.13	1.10
14.00	ELEV	6.78	6.76	6.75	6.73	6.72	6.71	6.69	6.68	6.67	6.66
15.00	DISCHG	1.08	1.06	1.04	1.02	1.00	.98	.97	.95	.93	.92
15.00	ELEV	6.65	6.64	6.63	6.62	6.61	6.61	6.60	6.59	6.58	6.58
16.00	DISCHG	.90	.89	.87	.86	.85	.83	.82	.81	.79	.78
16.00	ELEV	6.57	6.56	6.56	6.55	6.54	6.54	6.53	6.53	6.52	6.51
17.00	DISCHG	.77	.76	.75	.74	.73	.73	.72	.72	.71	.70
17.00	ELEV	6.51	6.50	6.50	6.49	6.49	6.49	6.48	6.48	6.47	6.47
18.00	DISCHG	.70	.69	.68	.68	.67	.66	.66	.65	.64	.64
18.00	ELEV	6.46	6.46	6.46	6.45	6.45	6.44	6.44	6.43	6.43	6.43
19.00	DISCHG	.64	.63	.63	.62	.62	.61	.61	.60	.60	.59
19.00	ELEV	6.42	6.42	6.42	6.41	6.41	6.41	6.40	6.40	6.40	6.39
20.00	DISCHG	.59	.58	.58	.57	.57	.56	.56	.55	.55	.54
20.00	ELEV	6.39	6.39	6.38	6.38	6.38	6.37	6.37	6.37	6.37	6.36
21.00	DISCHG	.54	.54	.53	.53	.53	.52	.52	.52	.51	.51
21.00	ELEV	6.36	6.36	6.36	6.35	6.35	6.35	6.35	6.34	6.34	6.34
22.00	DISCHG	.50	.50	.50	.49	.49	.49	.48	.48	.48	.47
22.00	ELEV	6.34	6.33	6.33	6.33	6.33	6.32	6.32	6.32	6.32	6.32
23.00	DISCHG	.47	.47	.47	.46	.46	.46	.46	.45	.45	.45
23.00	ELEV	6.31	6.31	6.31	6.31	6.31	6.31	6.30	6.30	6.30	6.30
24.00	DISCHG	.44	.44	.43	.42	.41	.39	.38	.37	.35	.34
24.00	ELEV	6.30	6.29	6.29	6.28	6.27	6.26	6.25	6.24	6.24	6.23
25.00	DISCHG	.33	.32	.31	.29	.28	.27	.26	.25	.25	.24
25.00	ELEV	6.22	6.21	6.20	6.20	6.19	6.18	6.18	6.17	6.16	6.16
26.00	DISCHG	.23	.22	.21	.20	.20	.19	.18	.18	.17	.16
26.00	ELEV	6.15	6.15	6.14	6.14	6.13	6.13	6.12	6.12	6.11	6.11
27.00	DISCHG	.16	.15	.15	.14	.14	.13	.13	.12	.12	.11

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 1
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 3

27.00	ELEV	6.11	6.10	6.10	6.09	6.09	6.09	6.09	6.08	6.08	6.08
28.00	DISCHG	.11	.11	.10	.10	.10	.09	.09	.09	.08	.08
28.00	ELEV	6.07	6.07	6.07	6.07	6.06	6.06	6.06	6.06	6.05	6.05
29.00	DISCHG	.08	.07	.07	.07	.07	.06	.06	.06	.06	.06
29.00	ELEV	6.05	6.05	6.05	6.05	6.04	6.04	6.04	6.04	6.04	6.04

RUNOFF VOLUME ABOVE BASEFLOW = 1.36 WATERSHED INCHES, 16.19 CFS-HRS, 1.34 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 1

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 2
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 4

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 3.34 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.00	14.44	(RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

2.00	DISCHG	.00	.00	.00	.00	.01	.02	.03	.05	.06	.08
3.00	DISCHG	.09	.11	.12	.13	.14	.16	.17	.19	.21	.22
4.00	DISCHG	.24	.25	.26	.27	.28	.29	.31	.33	.35	.37
5.00	DISCHG	.38	.39	.42	.44	.45	.47	.48	.51	.53	.55

6.00	DISCHG	.56	.57	.59	.60	.61	.62	.64	.68	.72	.74
7.00	DISCHG	.76	.78	.83	.87	.89	.91	.94	.99	1.03	1.06
8.00	DISCHG	1.07	1.12	1.24	1.33	1.38	1.41	1.51	1.74	1.93	2.03
9.00	DISCHG	2.09	2.23	2.58	2.87	3.01	3.11	4.50	8.48	11.93	13.59
10.00	DISCHG	14.44	13.65	10.17	7.23	5.95	5.39	4.93	4.12	3.50	3.23
11.00	DISCHG	3.12	2.99	2.70	2.48	2.38	2.34	2.29	2.18	2.09	2.05
12.00	DISCHG	2.04	2.00	1.92	1.85	1.83	1.81	1.79	1.74	1.69	1.67
13.00	DISCHG	1.67	1.64	1.59	1.54	1.53	1.52	1.50	1.44	1.40	1.38
14.00	DISCHG	1.37	1.36	1.33	1.31	1.30	1.29	1.28	1.25	1.23	1.22
15.00	DISCHG	1.22	1.22	1.22	1.22	1.22	1.22	1.21	1.18	1.16	1.15
16.00	DISCHG	1.15	1.14	1.11	1.09	1.08	1.07	1.06	1.03	1.01	1.00
17.00	DISCHG	1.00	.99	.99	.99	.99	.99	.98	.96	.93	.93
18.00	DISCHG	.92	.91	.88	.86	.85	.85	.85	.88	.90	.91
19.00	DISCHG	.92	.91	.88	.86	.85	.85	.84	.81	.78	.77
20.00	DISCHG	.77	.77	.77	.77	.77	.77	.77	.77	.77	.77
21.00	DISCHG	.77	.77	.77	.77	.77	.77	.76	.73	.71	.70
22.00	DISCHG	.70	.69	.69	.69	.69	.69	.69	.69	.69	.69
23.00	DISCHG	.69	.69	.69	.69	.69	.69	.68	.66	.63	.62
24.00	DISCHG	.62	.54	.32	.14	.06	.02	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 2.68 WATERSHED INCHES, 31.81 CFS-HRS, 2.63 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.52	5.36	8.19

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 2
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 5

2.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
2.00	ELEV	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00
3.00	DISCHG	.01	.01	.02	.02	.02	.03	.03	.04	.05	.05
3.00	ELEV	6.01	6.01	6.01	6.01	6.02	6.02	6.02	6.03	6.03	6.03
4.00	DISCHG	.06	.06	.07	.08	.09	.09	.10	.11	.12	.12
4.00	ELEV	6.04	6.04	6.05	6.05	6.06	6.06	6.07	6.07	6.08	6.08
5.00	DISCHG	.13	.14	.15	.16	.17	.18	.19	.20	.22	.23
5.00	ELEV	6.09	6.10	6.10	6.11	6.11	6.12	6.13	6.14	6.14	6.15
6.00	DISCHG	.24	.25	.26	.27	.29	.30	.31	.32	.34	.35
6.00	ELEV	6.16	6.17	6.17	6.18	6.19	6.20	6.21	6.21	6.22	6.23
7.00	DISCHG	.36	.38	.39	.41	.43	.44	.46	.48	.50	.52
7.00	ELEV	6.24	6.25	6.26	6.27	6.28	6.30	6.31	6.32	6.33	6.34
8.00	DISCHG	.54	.56	.58	.60	.63	.66	.69	.72	.77	.83
8.00	ELEV	6.36	6.37	6.39	6.40	6.42	6.44	6.46	6.48	6.51	6.54
9.00	DISCHG	.90	.97	1.05	1.14	1.24	1.33	1.42	1.62	1.86	2.13
9.00	ELEV	6.57	6.60	6.64	6.68	6.72	6.77	6.83	6.96	7.15	7.39
10.00	DISCHG	2.39	2.61	3.71	4.87	5.27	5.36	5.31	5.13	4.82	4.48
10.00	ELEV	7.64	7.89	8.07	8.15	8.18	8.19	8.19	8.17	8.15	8.13
11.00	DISCHG	4.18	3.92	3.67	3.42	3.19	3.00	2.84	2.71	2.70	2.69
11.00	ELEV	8.10	8.09	8.07	8.05	8.03	8.02	8.01	8.00	7.99	7.97
12.00	DISCHG	2.67	2.66	2.65	2.63	2.62	2.60	2.59	2.57	2.55	2.54
12.00	ELEV	7.96	7.95	7.93	7.91	7.90	7.88	7.86	7.84	7.83	7.81
13.00	DISCHG	2.52	2.50	2.49	2.47	2.45	2.43	2.41	2.40	2.38	2.36
13.00	ELEV	7.79	7.77	7.75	7.73	7.71	7.69	7.67	7.65	7.63	7.61
14.00	DISCHG	2.34	2.32	2.30	2.28	2.26	2.24	2.22	2.19	2.17	2.14
14.00	ELEV	7.59	7.57	7.55	7.52	7.50	7.48	7.46	7.44	7.42	7.40
15.00	DISCHG	2.12	2.10	2.08	2.06	2.04	2.01	1.99	1.97	1.95	1.93
15.00	ELEV	7.38	7.36	7.34	7.32	7.31	7.29	7.27	7.25	7.24	7.22
16.00	DISCHG	1.92	1.90	1.88	1.86	1.84	1.82	1.80	1.78	1.76	1.74
16.00	ELEV	7.20	7.19	7.17	7.15	7.14	7.12	7.10	7.09	7.07	7.05
17.00	DISCHG	1.72	1.71	1.69	1.67	1.64	1.62	1.59	1.57	1.54	1.52
17.00	ELEV	7.04	7.02	7.01	6.99	6.97	6.96	6.94	6.93	6.91	6.90
18.00	DISCHG	1.50	1.48	1.45	1.43	1.41	1.39	1.37	1.35	1.33	1.31
18.00	ELEV	6.88	6.87	6.85	6.84	6.82	6.81	6.79	6.78	6.77	6.76
19.00	DISCHG	1.30	1.28	1.25	1.23	1.21	1.19	1.17	1.15	1.13	1.11
19.00	ELEV	6.75	6.74	6.73	6.72	6.71	6.70	6.69	6.68	6.67	6.67
20.00	DISCHG	1.10	1.08	1.06	1.04	1.03	1.01	1.00	.99	.98	.96
20.00	ELEV	6.66	6.65	6.64	6.63	6.63	6.62	6.61	6.61	6.60	6.60
21.00	DISCHG	.95	.94	.93	.92	.92	.91	.90	.89	.88	.87
21.00	ELEV	6.59	6.59	6.58	6.58	6.58	6.57	6.57	6.56	6.56	6.56
22.00	DISCHG	.86	.85	.84	.84	.83	.82	.81	.81	.80	.79
22.00	ELEV	6.55	6.55	6.54	6.54	6.54	6.53	6.53	6.53	6.52	6.52
23.00	DISCHG	.79	.78	.78	.77	.77	.77	.76	.76	.75	.75
23.00	ELEV	6.52	6.52	6.51	6.51	6.51	6.51	6.50	6.50	6.50	6.50
24.00	DISCHG	.74	.74	.72	.71	.68	.66	.64	.62	.59	.57
24.00	ELEV	6.49	6.49	6.48	6.47	6.46	6.44	6.43	6.41	6.40	6.38

25.00	DISCHG	.55	.53	.51	.49	.48	.46	.44	.43	.41	.40
25.00	ELEV	6.37	6.35	6.34	6.33	6.32	6.31	6.30	6.29	6.27	6.27
26.00	DISCHG	.38	.37	.36	.34	.33	.32	.31	.30	.29	.28

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 2
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 6

26.00	ELEV	6.26	6.25	6.24	6.23	6.22	6.21	6.21	6.20	6.19	6.18
27.00	DISCHG	.27	.26	.25	.24	.23	.22	.21	.21	.20	.19
27.00	ELEV	6.18	6.17	6.17	6.16	6.15	6.15	6.14	6.14	6.13	6.13
28.00	DISCHG	.18	.18	.17	.17	.16	.15	.15	.14	.14	.13
28.00	ELEV	6.12	6.12	6.11	6.11	6.11	6.10	6.10	6.10	6.09	6.09
29.00	DISCHG	.13	.12	.12	.12	.11	.11	.10	.10	.10	.09
29.00	ELEV	6.09	6.08	6.08	6.08	6.07	6.07	6.07	6.07	6.06	6.06

RUNOFF VOLUME ABOVE BASEFLOW = 2.66 WATERSHED INCHES, 31.54 CFS-HRS, 2.61 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+ COMPUTATIONS COMPLETED FOR PASS 2

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 3
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 7

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 3.63 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=15 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS) 10.00 PEAK DISCHARGE(CFS) 15.92 PEAK ELEVATION(FEET) (RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
2.00	DISCHG	.00	.00	.01	.02	.03	.05	.07	.08	.10	.12
3.00	DISCHG	.13	.15	.16	.18	.19	.20	.22	.24	.26	.28
4.00	DISCHG	.29	.31	.32	.33	.34	.36	.37	.40	.42	.44
5.00	DISCHG	.45	.47	.49	.52	.54	.55	.57	.60	.62	.64
6.00	DISCHG	.65	.67	.68	.69	.70	.71	.73	.78	.82	.85
7.00	DISCHG	.87	.89	.95	.99	1.02	1.04	1.06	1.12	1.17	1.20
8.00	DISCHG	1.22	1.27	1.40	1.50	1.56	1.59	1.70	1.95	2.17	2.28
9.00	DISCHG	2.34	2.50	2.88	3.20	3.36	3.47	5.00	9.41	13.20	15.01
10.00	DISCHG	15.92	15.03	11.19	7.94	6.53	5.92	5.40	4.52	3.84	3.54
11.00	DISCHG	3.42	3.27	2.96	2.72	2.61	2.57	2.51	2.39	2.29	2.25
12.00	DISCHG	2.23	2.19	2.10	2.03	2.00	1.99	1.96	1.90	1.85	1.83
13.00	DISCHG	1.82	1.80	1.74	1.69	1.67	1.66	1.64	1.58	1.53	1.51
14.00	DISCHG	1.50	1.48	1.45	1.43	1.42	1.41	1.40	1.37	1.35	1.34
15.00	DISCHG	1.33	1.33	1.33	1.33	1.33	1.33	1.32	1.29	1.27	1.26
16.00	DISCHG	1.25	1.24	1.21	1.19	1.17	1.17	1.16	1.13	1.10	1.09
17.00	DISCHG	1.09	1.09	1.09	1.09	1.09	1.09	1.08	1.05	1.02	1.01
18.00	DISCHG	1.01	.99	.96	.94	.93	.92	.93	.96	.99	1.00
19.00	DISCHG	1.00	.99	.96	.94	.93	.92	.91	.88	.86	.85
20.00	DISCHG	.84	.84	.84	.84	.84	.84	.84	.84	.84	.84
21.00	DISCHG	.84	.84	.84	.84	.84	.84	.83	.80	.77	.76
22.00	DISCHG	.76	.76	.76	.76	.76	.76	.76	.76	.76	.76
23.00	DISCHG	.76	.76	.76	.76	.76	.76	.75	.72	.69	.68
24.00	DISCHG	.67	.59	.35	.15	.06	.03	.01	.00		

RUNOFF VOLUME ABOVE BASEFLOW = 2.96 WATERSHED INCHES, 35.16 CFS-HRS, 2.91 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS) 10.40 PEAK DISCHARGE(CFS) 6.84 PEAK ELEVATION(FEET) 8.30

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 3
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 8

2.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.01	.01	.01
2.00	ELEV	5.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.01	6.01
3.00	DISCHG	.02	.02	.03	.03	.04	.04	.05	.06	.06	.07
3.00	ELEV	6.01	6.01	6.02	6.02	6.02	6.03	6.03	6.04	6.04	6.05
4.00	DISCHG	.08	.09	.09	.10	.11	.12	.13	.14	.15	.16
4.00	ELEV	6.05	6.06	6.06	6.07	6.07	6.08	6.09	6.09	6.10	6.10
5.00	DISCHG	.17	.18	.19	.20	.21	.22	.24	.25	.26	.27
5.00	ELEV	6.11	6.12	6.13	6.13	6.14	6.15	6.16	6.17	6.17	6.18
6.00	DISCHG	.29	.30	.31	.33	.34	.35	.37	.38	.40	.41
6.00	ELEV	6.19	6.20	6.21	6.22	6.23	6.24	6.24	6.25	6.26	6.27
7.00	DISCHG	.43	.44	.46	.48	.50	.52	.54	.56	.58	.60
7.00	ELEV	6.28	6.30	6.31	6.32	6.33	6.34	6.36	6.37	6.38	6.40
8.00	DISCHG	.62	.64	.67	.70	.72	.76	.81	.86	.93	1.00
8.00	ELEV	6.41	6.43	6.44	6.46	6.48	6.50	6.53	6.55	6.58	6.61
9.00	DISCHG	1.07	1.15	1.23	1.32	1.40	1.48	1.58	1.76	1.99	2.29
9.00	ELEV	6.65	6.68	6.72	6.77	6.81	6.87	6.94	7.07	7.27	7.53
10.00	DISCHG	2.54	3.72	5.91	6.73	6.84	6.71	6.48	6.14	5.68	5.22
10.00	ELEV	7.82	8.07	8.23	8.29	8.30	8.29	8.27	8.24	8.21	8.18
11.00	DISCHG	4.81	4.47	4.16	3.85	3.58	3.35	3.16	2.99	2.84	2.71
11.00	ELEV	8.15	8.13	8.10	8.08	8.06	8.05	8.03	8.02	8.01	8.00
12.00	DISCHG	2.70	2.69	2.68	2.67	2.66	2.64	2.63	2.62	2.60	2.59
12.00	ELEV	7.99	7.98	7.97	7.95	7.94	7.93	7.91	7.90	7.88	7.86
13.00	DISCHG	2.57	2.56	2.54	2.53	2.51	2.49	2.48	2.46	2.44	2.42
3.00	ELEV	7.85	7.83	7.81	7.80	7.78	7.76	7.74	7.72	7.70	7.68
4.00	DISCHG	2.41	2.39	2.37	2.35	2.34	2.32	2.30	2.28	2.26	2.24
14.00	ELEV	7.66	7.64	7.62	7.60	7.58	7.56	7.54	7.52	7.50	7.48
15.00	DISCHG	2.22	2.20	2.18	2.15	2.13	2.11	2.09	2.08	2.06	2.04
15.00	ELEV	7.47	7.45	7.43	7.41	7.39	7.37	7.36	7.34	7.32	7.31
16.00	DISCHG	2.02	2.00	1.98	1.96	1.94	1.92	1.90	1.88	1.86	1.84
16.00	ELEV	7.29	7.27	7.26	7.24	7.22	7.21	7.19	7.17	7.16	7.14
17.00	DISCHG	1.83	1.81	1.79	1.77	1.75	1.74	1.72	1.70	1.69	1.67
17.00	ELEV	7.13	7.11	7.09	7.08	7.06	7.05	7.04	7.02	7.01	6.99
18.00	DISCHG	1.64	1.62	1.59	1.57	1.54	1.52	1.50	1.47	1.46	1.44
18.00	ELEV	6.97	6.96	6.94	6.93	6.91	6.89	6.88	6.87	6.85	6.84
19.00	DISCHG	1.42	1.40	1.39	1.37	1.35	1.34	1.32	1.31	1.28	1.26
19.00	ELEV	6.83	6.82	6.81	6.80	6.79	6.77	6.76	6.75	6.74	6.73
20.00	DISCHG	1.24	1.21	1.19	1.17	1.16	1.14	1.12	1.11	1.09	1.08
20.00	ELEV	6.72	6.71	6.70	6.69	6.68	6.68	6.67	6.66	6.66	6.65
21.00	DISCHG	1.06	1.05	1.04	1.03	1.02	1.01	1.00	.99	.98	.97
21.00	ELEV	6.64	6.64	6.63	6.63	6.62	6.62	6.61	6.61	6.60	6.60
22.00	DISCHG	.95	.94	.93	.92	.91	.91	.90	.89	.88	.88
22.00	ELEV	6.59	6.59	6.58	6.58	6.57	6.57	6.57	6.56	6.56	6.56
23.00	DISCHG	.87	.86	.86	.85	.85	.84	.84	.83	.82	.82
23.00	ELEV	6.55	6.55	6.55	6.55	6.54	6.54	6.54	6.54	6.53	6.53
24.00	DISCHG	.81	.80	.78	.75	.73	.70	.68	.65	.63	.61
24.00	ELEV	6.53	6.52	6.51	6.50	6.48	6.47	6.45	6.44	6.42	6.41
25.00	DISCHG	.59	.57	.55	.53	.51	.49	.47	.45	.44	.42
25.00	ELEV	6.39	6.38	6.36	6.35	6.34	6.33	6.31	6.30	6.29	6.28
26.00	DISCHG	.41	.39	.38	.37	.35	.34	.33	.32	.30	.29

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 3
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 9

26.00	ELEV	6.27	6.26	6.25	6.24	6.23	6.23	6.22	6.21	6.20	6.20
27.00	DISCHG	.28	.27	.26	.25	.24	.24	.23	.22	.21	.20
27.00	ELEV	6.19	6.18	6.18	6.17	6.16	6.16	6.15	6.15	6.14	6.14
28.00	DISCHG	.20	.19	.18	.18	.17	.16	.16	.15	.15	.14
28.00	ELEV	6.13	6.13	6.12	6.12	6.11	6.11	6.11	6.10	6.10	6.09
29.00	DISCHG	.14	.13	.13	.12	.12	.11	.11	.11	.10	.10
29.00	ELEV	6.09	6.09	6.08	6.08	6.08	6.08	6.07	6.07	6.07	6.07

RUNOFF VOLUME ABOVE BASEFLOW = 2.94 WATERSHED INCHES, 34.87 CFS-HRS, 2.88 ACRE-FEET; BASEFLOW = .00 CFS

CUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 3

1

ATTACHMENT NO. 4

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

SHEET NO 7 OF 12

REV. NO. 1

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EXECUTIVE CONTROL OPERATION COMPUT                                                           RECORD ID
+                                      FROM XSECTION    1
+                                                            TO STRUCTURE   1
        STARTING TIME =    .00     RAIN DEPTH =  4.01    RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1           STORM NO.=25     MAIN TIME INCREMENT =   .10 HOURS

OPERATION RUNOFF    CROSS SECTION   1
           OUTPUT HYDROGRAPH=  4
           AREA=     .02 SQ MI    INPUT RUNOFF CURVE= 94.    TIME OF CONCENTRATION=    .29 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0381 HOURS

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)             PEAK ELEVATION(FEET)
              10.00                         17.86                          (RUNOFF)
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TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
2.00	DISCHG	.00	.02	.03	.05	.07	.09	.11	.13	.15	.17
3.00	DISCHG	.19	.21	.22	.24	.25	.27	.29	.31	.34	.35
4.00	DISCHG	.37	.39	.40	.41	.43	.44	.46	.49	.51	.53
5.00	DISCHG	.55	.57	.60	.62	.64	.66	.68	.71	.74	.76
6.00	DISCHG	.78	.79	.80	.81	.83	.84	.86	.92	.96	.99
7.00	DISCHG	1.01	1.04	1.10	1.15	1.18	1.20	1.24	1.30	1.35	1.38
8.00	DISCHG	1.40	1.46	1.61	1.73	1.79	1.83	1.95	2.24	2.48	2.60
9.00	DISCHG	2.67	2.85	3.28	3.64	3.81	3.93	5.66	10.63	14.88	16.88
10.00	DISCHG	17.86	16.83	12.52	8.88	7.30	6.61	6.03	5.04	4.28	3.94
11.00	DISCHG	3.81	3.65	3.30	3.03	2.91	2.86	2.79	2.66	2.55	2.50
12.00	DISCHG	2.48	2.44	2.34	2.26	2.22	2.21	2.18	2.11	2.06	2.04
13.00	DISCHG	2.03	2.00	1.93	1.88	1.86	1.85	1.82	1.75	1.70	1.67
14.00	DISCHG	1.66	1.65	1.61	1.59	1.58	1.57	1.56	1.52	1.50	1.49
15.00	DISCHG	1.48	1.48	1.48	1.48	1.48	1.48	1.47	1.43	1.41	1.40
16.00	DISCHG	1.39	1.38	1.34	1.32	1.30	1.30	1.29	1.25	1.22	1.21
17.00	DISCHG	1.21	1.21	1.21	1.20	1.20	1.20	1.19	1.16	1.13	1.12
18.00	DISCHG	1.12	1.10	1.07	1.04	1.03	1.02	1.03	1.07	1.09	1.11
19.00	DISCHG	1.11	1.10	1.07	1.04	1.03	1.03	1.01	.98	.95	.94
20.00	DISCHG	.93	.93	.93	.93	.93	.93	.93	.93	.93	.93
21.00	DISCHG	.93	.93	.93	.93	.93	.93	.92	.89	.86	.85
22.00	DISCHG	.84	.84	.84	.84	.84	.84	.84	.84	.84	.84
23.00	DISCHG	.84	.84	.84	.84	.84	.84	.83	.79	.77	.75
24.00	DISCHG	.75	.66	.39	.17	.07	.03	.01	.00		

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  RUNOFF VOLUME ABOVE BASEFLOW =  3.33 WATERSHED INCHES,     39.57 CFS-HRS,     3.27 ACRE-FEET;    BASEFLOW =    .00 CFS

OPERATION RESVOR    STRUCTURE   1
           INPUT HYDROGRAPH= 4      OUTPUT HYDROGRAPH= 5
           SURFACE ELEVATION=     6.00

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)             PEAK ELEVATION(FEET)
              10.33                          8.85                           8.45

TIME(HRS)          FIRST HYDROGRAPH POINT =    .00 HOURS     TIME INCREMENT =  .10 HOURS      DRAINAGE AREA =    .02 SQ.MI.
1
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2.00	DISCHG	.00	.00	.00	.00	.00	.01	.01	.02	.02	.02
2.00	ELEV	5.00	5.00	5.00	5.00	5.00	6.01	6.01	6.01	6.01	6.02
3.00	DISCHG	.03	.04	.04	.05	.06	.06	.07	.08	.09	.10
3.00	ELEV	6.02	6.02	6.03	6.03	6.04	6.04	6.05	6.05	6.06	6.06
4.00	DISCHG	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20
4.00	ELEV	6.07	6.08	6.08	6.09	6.10	6.10	6.11	6.12	6.13	6.13
5.00	DISCHG	.21	.23	.24	.25	.27	.28	.29	.31	.32	.34
5.00	ELEV	6.14	6.15	6.16	6.17	6.18	6.19	6.20	6.21	6.22	6.23
6.00	DISCHG	.35	.37	.38	.40	.41	.43	.44	.46	.48	.50
6.00	ELEV	6.24	6.25	6.26	6.27	6.28	6.29	6.30	6.31	6.32	6.33
7.00	DISCHG	.51	.53	.55	.57	.59	.62	.64	.66	.68	.71
7.00	ELEV	6.34	6.35	6.37	6.38	6.40	6.41	6.42	6.44	6.46	6.47
8.00	DISCHG	.73	.76	.80	.85	.90	.95	1.00	1.06	1.14	1.21
8.00	ELEV	6.49	6.51	6.52	6.55	6.57	6.59	6.62	6.64	6.68	6.71
9.00	DISCHG	1.29	1.35	1.42	1.50	1.58	1.67	1.75	1.91	2.18	2.46
9.00	ELEV	6.75	6.78	6.83	6.88	6.93	6.99	7.06	7.20	7.43	7.73
10.00	DISCHG	3.22	6.49	8.30	8.83	8.67	8.29	7.85	7.34	6.75	6.16
10.00	ELEV	8.04	8.27	8.41	8.45	8.44	8.41	8.37	8.34	8.29	8.25
11.00	DISCHG	5.63	5.19	4.79	4.41	4.08	3.80	3.57	3.38	3.20	3.04

11.00	ELEV	8.21	8.18	8.15	8.12	8.10	8.08	8.06	8.05	8.03	8.02
12.00	DISCHG	2.91	2.81	2.71	2.70	2.69	2.68	2.67	2.66	2.65	2.64
12.00	ELEV	8.01	8.01	8.00	7.99	7.98	7.97	7.96	7.95	7.94	7.92
13.00	DISCHG	2.63	2.62	2.60	2.59	2.58	2.56	2.55	2.53	2.52	2.50
13.00	ELEV	7.91	7.90	7.88	7.87	7.85	7.84	7.82	7.80	7.79	7.77
14.00	DISCHG	2.49	2.47	2.45	2.44	2.42	2.40	2.39	2.37	2.35	2.34
14.00	ELEV	7.75	7.73	7.72	7.70	7.68	7.66	7.64	7.62	7.61	7.59
15.00	DISCHG	2.32	2.31	2.29	2.27	2.26	2.24	2.22	2.20	2.18	2.16
15.00	ELEV	7.57	7.55	7.53	7.51	7.50	7.48	7.46	7.45	7.43	7.41
16.00	DISCHG	2.14	2.12	2.10	2.08	2.07	2.05	2.03	2.01	1.99	1.97
16.00	ELEV	7.40	7.38	7.37	7.35	7.33	7.32	7.30	7.28	7.27	7.25
17.00	DISCHG	1.95	1.93	1.91	1.90	1.88	1.86	1.85	1.83	1.81	1.80
17.00	ELEV	7.23	7.22	7.20	7.19	7.17	7.16	7.14	7.13	7.11	7.10
18.00	DISCHG	1.78	1.76	1.75	1.73	1.71	1.69	1.68	1.65	1.63	1.61
18.00	ELEV	7.09	7.07	7.06	7.04	7.03	7.01	7.00	6.98	6.97	6.95
19.00	DISCHG	1.59	1.57	1.55	1.53	1.51	1.50	1.48	1.46	1.44	1.42
19.00	ELEV	6.94	6.93	6.92	6.90	6.89	6.88	6.87	6.85	6.84	6.83
20.00	DISCHG	1.40	1.38	1.37	1.35	1.33	1.32	1.30	1.28	1.26	1.25
20.00	ELEV	6.82	6.81	6.79	6.78	6.77	6.76	6.75	6.74	6.73	6.73
21.00	DISCHG	1.23	1.21	1.20	1.18	1.17	1.15	1.14	1.13	1.11	1.10
21.00	ELEV	6.72	6.71	6.70	6.70	6.69	6.68	6.68	6.67	6.67	6.66
22.00	DISCHG	1.09	1.07	1.06	1.05	1.04	1.02	1.01	1.00	1.00	.99
22.00	ELEV	6.65	6.65	6.64	6.64	6.63	6.62	6.62	6.62	6.61	6.61
23.00	DISCHG	.98	.97	.96	.96	.95	.94	.94	.93	.92	.91
23.00	ELEV	6.60	6.60	6.60	6.59	6.59	6.59	6.59	6.58	6.58	6.57
24.00	DISCHG	.90	.89	.87	.84	.80	.76	.73	.70	.68	.65
24.00	ELEV	6.57	6.57	6.56	6.54	6.52	6.50	6.49	6.47	6.45	6.44
25.00	DISCHG	.63	.61	.59	.57	.54	.53	.51	.49	.47	.45
25.00	ELEV	6.42	6.41	6.39	6.38	6.36	6.35	6.34	6.33	6.31	6.30
26.00	DISCHG	.44	.42	.41	.39	.38	.36	.35	.34	.33	.32

1

0 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 4
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 12

26.00	ELEV	6.29	6.28	6.27	6.26	6.25	6.24	6.23	6.23	6.22	6.21
27.00	DISCHG	.30	.29	.28	.27	.26	.25	.24	.24	.23	.22
27.00	ELEV	6.20	6.20	6.19	6.18	6.18	6.17	6.16	6.16	6.15	6.15
28.00	DISCHG	.21	.20	.20	.19	.18	.18	.17	.16	.16	.15
28.00	ELEV	6.14	6.14	6.13	6.13	6.12	6.12	6.11	6.11	6.11	6.10
29.00	DISCHG	.15	.14	.14	.13	.13	.12	.12	.11	.11	.11
29.00	ELEV	6.10	6.09	6.09	6.09	6.08	6.08	6.08	6.08	6.07	6.07

RUNOFF VOLUME ABOVE BASEFLOW = 3.31 WATERSHED INCHES, 39.29 CFS-HRS, 3.25 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
+
COMPUTATIONS COMPLETED FOR PASS 4

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 5
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 13

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
+ FROM XSECTION 1
+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 4.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=50 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS) PEAK DISCHARGE(CFS) PEAK ELEVATION(FEET)
10.00 20.35 (RUNOFF)

ME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

1.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02
2.00	DISCHG	.04	.06	.08	.11	.14	.16	.18	.21	.23	.25
3.00	DISCHG	.27	.29	.31	.32	.34	.36	.38	.41	.44	.46
4.00	DISCHG	.48	.50	.51	.53	.54	.56	.58	.61	.64	.66
5.00	DISCHG	.68	.70	.74	.77	.79	.81	.83	.87	.90	.92
6.00	DISCHG	.94	.95	.97	.98	.99	1.00	1.03	1.10	1.15	1.18

7.00	DISCHG	1.20	1.24	1.31	1.36	1.40	1.42	1.46	1.53	1.59	1.62
8.00	DISCHG	1.65	1.72	1.88	2.02	2.09	2.13	2.27	2.60	2.88	3.02
9.00	DISCHG	3.09	3.30	3.79	4.20	4.40	4.53	6.51	12.19	17.02	19.27
10.00	DISCHG	20.35	19.15	14.23	10.08	8.28	7.49	6.83	5.71	4.85	4.47
11.00	DISCHG	4.31	4.13	3.74	3.43	3.29	3.23	3.16	3.00	2.88	2.83
12.00	DISCHG	2.80	2.76	2.64	2.55	2.51	2.50	2.46	2.39	2.33	2.30
13.00	DISCHG	2.29	2.26	2.18	2.12	2.10	2.08	2.05	1.98	1.92	1.89
14.00	DISCHG	1.88	1.86	1.82	1.79	1.78	1.77	1.76	1.72	1.69	1.68
15.00	DISCHG	1.67	1.67	1.67	1.67	1.67	1.67	1.66	1.62	1.59	1.57
16.00	DISCHG	1.57	1.55	1.52	1.48	1.47	1.47	1.45	1.41	1.38	1.37
17.00	DISCHG	1.36	1.36	1.36	1.36	1.36	1.36	1.35	1.31	1.28	1.26
18.00	DISCHG	1.26	1.24	1.21	1.17	1.16	1.16	1.17	1.20	1.23	1.25
19.00	DISCHG	1.25	1.24	1.21	1.18	1.16	1.16	1.14	1.10	1.07	1.06
20.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
21.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.04	1.00	.97	.95
22.00	DISCHG	.95	.95	.94	.94	.94	.94	.94	.94	.94	.94
23.00	DISCHG	.94	.94	.94	.94	.95	.94	.93	.89	.86	.85
24.00	DISCHG	.84	.74	.44	.19	.08	.03	.01	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 3.81 WATERSHED INCHES, 45.29 CFS-HRS, 3.74 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.33	9.80	8.67

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TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 5
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 14

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

2.00	DISCHG	.00	.00	.01	.01	.01	.02	.02	.03	.04	.04
2.00	ELEV	5.00	5.00	6.00	6.01	6.01	6.01	6.02	6.02	6.02	6.03
3.00	DISCHG	.05	.06	.07	.08	.09	.09	.10	.12	.13	.14
3.00	ELEV	6.03	6.04	6.04	6.05	6.06	6.06	6.07	6.08	6.08	6.09
4.00	DISCHG	.15	.16	.17	.19	.20	.21	.22	.24	.25	.27
4.00	ELEV	6.10	6.11	6.12	6.12	6.13	6.14	6.15	6.16	6.17	6.18
5.00	DISCHG	.28	.29	.31	.33	.34	.36	.37	.39	.41	.43
5.00	ELEV	6.19	6.20	6.21	6.22	6.23	6.24	6.25	6.26	6.27	6.28
6.00	DISCHG	.44	.46	.48	.50	.52	.53	.55	.57	.59	.61
6.00	ELEV	6.30	6.31	6.32	6.33	6.34	6.36	6.37	6.38	6.39	6.41
7.00	DISCHG	.63	.65	.67	.70	.72	.75	.78	.82	.86	.90
7.00	ELEV	6.42	6.43	6.45	6.46	6.48	6.50	6.51	6.53	6.55	6.57
8.00	DISCHG	.94	.98	1.03	1.08	1.13	1.19	1.24	1.31	1.36	1.42
8.00	ELEV	6.59	6.61	6.63	6.65	6.67	6.70	6.72	6.75	6.79	6.83
9.00	DISCHG	1.49	1.55	1.63	1.71	1.77	1.84	1.93	2.11	2.39	2.69
9.00	ELEV	6.87	6.92	6.97	7.02	7.08	7.14	7.22	7.37	7.64	7.98
10.00	DISCHG	6.48	9.42	9.73	9.80	9.78	9.72	9.65	9.54	8.75	7.84
10.00	ELEV	8.27	8.49	8.63	8.67	8.66	8.62	8.58	8.51	8.44	8.37
11.00	DISCHG	7.08	6.45	5.87	5.34	4.88	4.50	4.20	3.94	3.71	3.51
11.00	ELEV	8.32	8.27	8.23	8.19	8.16	8.13	8.11	8.09	8.07	8.06
12.00	DISCHG	3.35	3.22	3.10	2.98	2.88	2.79	2.72	2.70	2.70	2.69
12.00	ELEV	8.05	8.04	8.03	8.02	8.01	8.01	8.00	7.99	7.99	7.98
13.00	DISCHG	2.68	2.68	2.67	2.66	2.65	2.63	2.62	2.61	2.60	2.59
13.00	ELEV	7.97	7.96	7.95	7.94	7.93	7.92	7.90	7.89	7.88	7.86
14.00	DISCHG	2.57	2.56	2.54	2.53	2.52	2.50	2.49	2.47	2.46	2.44
14.00	ELEV	7.85	7.83	7.82	7.80	7.78	7.77	7.75	7.74	7.72	7.70
15.00	DISCHG	2.43	2.41	2.40	2.38	2.37	2.36	2.34	2.33	2.32	2.30
15.00	ELEV	7.69	7.67	7.65	7.64	7.62	7.61	7.59	7.58	7.56	7.55
16.00	DISCHG	2.29	2.27	2.26	2.24	2.22	2.20	2.18	2.16	2.15	2.13
16.00	ELEV	7.53	7.51	7.50	7.48	7.47	7.45	7.43	7.42	7.40	7.39
17.00	DISCHG	2.11	2.09	2.07	2.05	2.04	2.02	2.00	1.99	1.97	1.95
17.00	ELEV	7.37	7.35	7.34	7.32	7.31	7.29	7.28	7.26	7.25	7.23
18.00	DISCHG	1.93	1.92	1.90	1.88	1.86	1.85	1.83	1.81	1.80	1.78
18.00	ELEV	7.22	7.20	7.19	7.17	7.16	7.14	7.13	7.11	7.10	7.09
19.00	DISCHG	1.77	1.76	1.74	1.73	1.72	1.70	1.69	1.67	1.65	1.63
19.00	ELEV	7.08	7.07	7.06	7.04	7.03	7.02	7.01	7.00	6.98	6.97
20.00	DISCHG	1.61	1.58	1.56	1.54	1.52	1.51	1.49	1.47	1.46	1.44
20.00	ELEV	6.95	6.94	6.92	6.91	6.90	6.89	6.87	6.86	6.85	6.84
21.00	DISCHG	1.42	1.41	1.40	1.38	1.37	1.36	1.35	1.33	1.32	1.31
21.00	ELEV	6.83	6.82	6.81	6.80	6.80	6.79	6.78	6.77	6.76	6.75
22.00	DISCHG	1.29	1.27	1.25	1.23	1.22	1.20	1.19	1.18	1.16	1.15
22.00	ELEV	6.74	6.74	6.73	6.72	6.71	6.71	6.70	6.69	6.69	6.68
23.00	DISCHG	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.05
23.00	ELEV	6.68	6.67	6.67	6.66	6.66	6.66	6.65	6.65	6.64	6.64
24.00	DISCHG	1.04	1.03	1.00	.96	.92	.87	.82	.78	.74	.71
24.00	ELEV	6.63	6.63	6.61	6.60	6.58	6.55	6.53	6.51	6.49	6.48
25.00	DISCHG	.69	.66	.64	.62	.60	.57	.55	.53	.51	.50

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TR20 XEQ 09-05-01 09:43 REV PC 09/83(.2) RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS JOB 1 PASS 5 PAGE 15

25.00	ELEV	6.46	6.44	6.43	6.41	6.40	6.38	6.37	6.36	6.34	6.33
26.00	DISCHG	.48	.46	.44	.43	.41	.40	.38	.37	.36	.34
26.00	ELEV	6.32	6.31	6.30	6.29	6.28	6.27	6.26	6.25	6.24	6.23
27.00	DISCHG	.33	.32	.31	.30	.29	.28	.27	.26	.25	.24
27.00	ELEV	6.22	6.21	6.21	6.20	6.19	6.18	6.18	6.17	6.17	6.16
28.00	DISCHG	.23	.22	.21	.21	.20	.19	.19	.18	.17	.17
28.00	ELEV	6.15	6.15	6.14	6.14	6.13	6.13	6.12	6.12	6.11	6.11
29.00	DISCHG	.16	.15	.15	.14	.14	.13	.13	.12	.12	.12
29.00	ELEV	6.11	6.10	6.10	6.10	6.09	6.09	6.09	6.08	6.08	6.08

RUNOFF VOLUME ABOVE BASEFLOW = 3.78 WATERSHED INCHES, 44.94 CFS-HRS, 3.71 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
\+ COMPUTATIONS COMPLETED FOR PASS 5

1

TR20 XEQ 09-05-01 09:43 REV PC 09/83(.2) RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS JOB 1 PASS 6 PAGE 16

..ECUTIVE CONTROL OPERATION COMPUT RECORD ID
\+ FROM XSECTION 1
\+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 4.98 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.00	22.78	(RUNOFF)
23.36	1.05	(RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

1.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.01	.03	.06
2.00	DISCHG	.08	.11	.14	.17	.20	.23	.26	.28	.31	.33
3.00	DISCHG	.35	.37	.39	.41	.43	.45	.47	.51	.54	.57
4.00	DISCHG	.59	.61	.62	.64	.66	.67	.70	.73	.77	.79
5.00	DISCHG	.81	.83	.87	.91	.93	.95	.98	1.02	1.06	1.08
6.00	DISCHG	1.10	1.12	1.13	1.14	1.16	1.17	1.20	1.27	1.33	1.37
7.00	DISCHG	1.39	1.43	1.51	1.57	1.61	1.64	1.68	1.76	1.82	1.86
8.00	DISCHG	1.89	1.96	2.15	2.31	2.39	2.43	2.58	2.96	3.28	3.43
9.00	DISCHG	3.51	3.74	4.29	4.75	4.97	5.12	7.33	13.71	19.12	21.60
10.00	DISCHG	22.77	21.41	15.89	11.26	9.24	8.35	7.62	6.36	5.40	4.98
11.00	DISCHG	4.80	4.60	4.16	3.81	3.66	3.60	3.52	3.34	3.21	3.14
12.00	DISCHG	3.12	3.07	2.94	2.84	2.79	2.78	2.74	2.66	2.59	2.56
13.00	DISCHG	2.55	2.51	2.43	2.36	2.33	2.32	2.28	2.20	2.13	2.10
14.00	DISCHG	2.09	2.07	2.03	1.99	1.98	1.97	1.95	1.91	1.88	1.86
15.00	DISCHG	1.86	1.85	1.85	1.85	1.85	1.85	1.84	1.80	1.76	1.75
16.00	DISCHG	1.74	1.73	1.68	1.65	1.63	1.63	1.61	1.57	1.53	1.52
17.00	DISCHG	1.51	1.51	1.51	1.51	1.51	1.51	1.49	1.45	1.42	1.40
18.00	DISCHG	1.40	1.38	1.34	1.30	1.29	1.28	1.29	1.34	1.37	1.38
19.00	DISCHG	1.39	1.38	1.34	1.30	1.29	1.28	1.27	1.22	1.19	1.17
20.00	DISCHG	1.17	1.17	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
21.00	DISCHG	1.16	1.16	1.16	1.16	1.16	1.16	1.15	1.11	1.07	1.06
22.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
23.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.03	.99	.96	.94
24.00	DISCHG	.93	.82	.48	.21	.09	.04	.02	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 4.29 WATERSHED INCHES, 50.90 CFS-HRS, 4.21 ACRE-FEET; BASEFLOW = .00 CFS

..RATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

PEAK TIME(HRS) PEAK DISCHARGE(CFS) PEAK ELEVATION(FEET)

10.35 10.23 8.93

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 6
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 17

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

TIME(HRS)											
2.00	DISCHG	.01	.01	.01	.02	.02	.03	.04	.05	.06	.06
2.00	ELEV	6.00	6.01	6.01	6.01	6.02	6.02	6.03	6.03	6.04	6.04
3.00	DISCHG	.07	.09	.10	.11	.12	.13	.14	.15	.17	.18
3.00	ELEV	6.05	6.06	6.06	6.07	6.08	6.09	6.09	6.10	6.11	6.12
4.00	DISCHG	.20	.21	.22	.24	.25	.27	.28	.30	.31	.33
4.00	ELEV	6.13	6.14	6.15	6.16	6.17	6.18	6.19	6.20	6.21	6.22
5.00	DISCHG	.35	.37	.38	.40	.42	.44	.46	.48	.50	.52
5.00	ELEV	6.23	6.24	6.26	6.27	6.28	6.29	6.30	6.32	6.33	6.35
6.00	DISCHG	.54	.56	.58	.60	.62	.64	.66	.68	.70	.72
6.00	ELEV	6.36	6.37	6.39	6.40	6.41	6.43	6.44	6.45	6.47	6.48
7.00	DISCHG	.75	.78	.82	.86	.90	.94	.98	1.02	1.06	1.11
7.00	ELEV	6.50	6.51	6.53	6.55	6.57	6.59	6.60	6.62	6.64	6.66
8.00	DISCHG	1.15	1.19	1.24	1.29	1.34	1.38	1.42	1.47	1.54	1.61
8.00	ELEV	6.68	6.70	6.72	6.75	6.77	6.80	6.83	6.86	6.91	6.95
9.00	DISCHG	1.68	1.73	1.78	1.85	1.93	2.01	2.11	2.31	2.58	5.29
9.00	ELEV	7.00	7.04	7.09	7.15	7.21	7.28	7.37	7.55	7.86	8.18
10.00	DISCHG	9.07	9.85	10.12	10.22	10.23	10.18	10.12	10.02	9.90	9.75
10.00	ELEV	8.47	8.70	8.87	8.93	8.93	8.90	8.86	8.81	8.73	8.64
11.00	DISCHG	9.60	9.05	8.02	7.13	6.38	5.75	5.24	4.82	4.46	4.16
11.00	ELEV	8.55	8.46	8.39	8.32	8.26	8.22	8.18	8.15	8.12	8.10
12.00	DISCHG	3.92	3.73	3.56	3.40	3.27	3.16	3.06	2.98	2.90	2.82
12.00	ELEV	8.09	8.07	8.06	8.05	8.04	8.03	8.03	8.02	8.01	8.01
13.00	DISCHG	2.76	2.71	2.70	2.70	2.69	2.68	2.68	2.67	2.66	2.65
13.00	ELEV	8.00	8.00	7.99	7.99	7.98	7.97	7.96	7.95	7.94	7.93
14.00	DISCHG	2.64	2.63	2.62	2.60	2.59	2.58	2.57	2.56	2.54	2.53
14.00	ELEV	7.92	7.91	7.90	7.88	7.87	7.86	7.84	7.83	7.81	7.80
15.00	DISCHG	2.52	2.50	2.49	2.48	2.47	2.46	2.44	2.43	2.42	2.41
15.00	ELEV	7.79	7.77	7.76	7.74	7.73	7.72	7.70	7.69	7.68	7.66
16.00	DISCHG	2.39	2.38	2.37	2.35	2.34	2.33	2.31	2.30	2.28	2.27
16.00	ELEV	7.65	7.63	7.62	7.60	7.59	7.57	7.56	7.54	7.53	7.51
17.00	DISCHG	2.25	2.23	2.22	2.20	2.18	2.16	2.15	2.13	2.11	2.10
17.00	ELEV	7.49	7.48	7.46	7.45	7.43	7.42	7.40	7.39	7.37	7.36
18.00	DISCHG	2.08	2.06	2.04	2.03	2.01	1.99	1.97	1.96	1.94	1.93
18.00	ELEV	7.34	7.33	7.31	7.30	7.28	7.27	7.25	7.24	7.23	7.21
19.00	DISCHG	1.91	1.90	1.89	1.87	1.86	1.84	1.83	1.82	1.80	1.79
19.00	ELEV	7.20	7.19	7.18	7.17	7.15	7.14	7.13	7.12	7.10	7.09
20.00	DISCHG	1.77	1.75	1.74	1.73	1.71	1.70	1.68	1.67	1.65	1.63
20.00	ELEV	7.08	7.06	7.05	7.04	7.03	7.02	7.00	6.99	6.98	6.97
21.00	DISCHG	1.61	1.59	1.58	1.56	1.55	1.53	1.52	1.50	1.49	1.47
21.00	ELEV	6.95	6.94	6.93	6.92	6.91	6.90	6.89	6.88	6.87	6.86
22.00	DISCHG	1.45	1.44	1.42	1.41	1.40	1.38	1.37	1.36	1.35	1.33
22.00	ELEV	6.85	6.84	6.83	6.82	6.81	6.80	6.80	6.79	6.78	6.77
23.00	DISCHG	1.32	1.31	1.30	1.29	1.28	1.26	1.25	1.24	1.22	1.21
23.00	ELEV	6.76	6.76	6.75	6.74	6.74	6.73	6.73	6.72	6.72	6.71
24.00	DISCHG	1.19	1.18	1.15	1.10	1.05	1.00	.94	.89	.84	.79
24.00	ELEV	6.70	6.69	6.68	6.66	6.64	6.61	6.59	6.56	6.54	6.52
25.00	DISCHG	.75	.72	.70	.67	.65	.63	.60	.58	.56	.54

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TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 PASS 6
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 18

25.00	ELEV	6.50	6.48	6.47	6.45	6.43	6.42	6.40	6.39	6.37	6.36
26.00	DISCHG	.52	.50	.48	.47	.45	.43	.42	.40	.39	.38
26.00	ELEV	6.35	6.34	6.32	6.31	6.30	6.29	6.28	6.27	6.26	6.25
27.00	DISCHG	.36	.35	.34	.32	.31	.30	.29	.28	.27	.26
27.00	ELEV	6.24	6.23	6.22	6.22	6.21	6.20	6.19	6.19	6.18	6.17
28.00	DISCHG	.25	.24	.23	.23	.22	.21	.20	.19	.19	.18
28.00	ELEV	6.17	6.16	6.16	6.15	6.14	6.14	6.13	6.13	6.13	6.12
29.00	DISCHG	.17	.17	.16	.16	.15	.15	.14	.14	.13	.13
29.00	ELEV	6.12	6.11	6.11	6.10	6.10	6.10	6.09	6.09	6.09	6.08

RUNOFF VOLUME ABOVE BASEFLOW = 4.26 WATERSHED INCHES, 50.53 CFS-HRS, 4.18 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 6

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 19

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1	STORM 2												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	1.98	24.00	1.38	---	10.01	7.46	405.6
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	1.98	24.00	1.36	7.23	10.80	1.94	105.6
ALTERNATE 1	STORM 10												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.34	24.00	2.68	---	10.00	14.44	784.8
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	3.34	24.00	2.66	8.19	10.52	5.36	291.4
ALTERNATE 1	STORM 15												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	3.63	24.00	2.96	---	10.00	15.92	865.4
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	3.63	24.00	2.94	8.30	10.40	6.84	371.9
ALTERNATE 1	STORM 25												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.01	24.00	3.33	---	10.00	17.86	970.6
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.01	24.00	3.31	8.45	10.33	8.85	481.2
ALTERNATE 1	STORM 50												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.50	24.00	3.81	---	10.00	20.35	1105.9
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.50	24.00	3.78	8.67	10.33	9.80	532.8
ALTERNATE 1	STORM 99												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.98	24.00	4.29	---	10.00	22.78	1237.8
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.98	24.00	4.26	8.93	10.35	10.23	556.0

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TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS, CASE 2 JOB 1 SUMMARY
REV PC 09/83(.2) 2-, 10-, 15-, 25-, 50-, & 100-YEAR, 24-HOUR STORMS PAGE 20

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 2	10	15	25	50	99
0 STRUCTURE 1	.02						
+ ALTERNATE 1		1.94	5.36	6.84	8.85	9.80	10.23
0 XSECTION 1	.02						
+ ALTERNATE 1		7.46	14.44	15.92	17.86	20.35	22.78

1END OF 1 JOBS IN THIS RUN

ATTACHMENT NO. 5

PROJECT Russell City Energy Center

JOB NUMBER 24405

SUBJECT Storm Water Management Basin Sizing, Pre- and Post-Development Runoff

CALC NO H&H-1

SHEET NO 1 OF 4

REV. NO. 1

1

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******************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY******************

JOB TR-20                      FULLPRINT          SUMMARY   NOPLOTS
TITLE 001 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS
TITLE     EMERGENCY SPILLWAY  100-YEAR, 24-HOUR STORM
 3 STRUCT      01
 8                       5.0         0.0          0.0
 8                       6.0         0.000001     0.23
 8                       7.0         0.000002     0.56
 8                       7.4         0.000003     0.71
 8                       7.5         0.000004     0.75
 8                       8.0         0.000005     0.94
 8                       8.25        0.000006     1.05
 8                       8.50        0.000007     1.16
 8                       9.0         0.000008     1.38
 8                       10.0        0.000009     1.87
 8                       10.25       3.50         2.01
 8                       10.50       9.90         2.15
 8                       11.0        28.00        2.42
 8                       12.0        79.20        3.03
 9 ENDTBL
 6 RUNOFF 1 001       4 0.0184       94.          0.286          1 1   1   1
 6 RESVOR 2     01 4  5 6.0                                      1 1 1 1   1
   ENDATA
 7 INCREM 6             0.1
 7 COMPUT 7 001      01 0.0          4.98         1.0            1 2  01  99
   ENDCMP 1
   ENDJOB 2
0*******************************END OF 80-80 LIST*******************************
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1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 1
REV PC 09/83(.2) EMERGENCY SPILLWAY 100-YEAR, 24-HOUR STORM PAGE 1

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
\+ MAIN TIME INCREMENT = .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
\+ FROM XSECTION 1
\+ TO STRUCTURE 1
STARTING TIME = .00 RAIN DEPTH = 4.98 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 4
AREA= .02 SQ MI INPUT RUNOFF CURVE= 94. TIME OF CONCENTRATION= .29 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0381 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.00	22.78	(RUNOFF)
23.36	1.05	(RUNOFF)

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

1.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	.01	.03	.06
2.00	DISCHG	.08	.11	.14	.17	.20	.23	.26	.28	.31	.33
3.00	DISCHG	.35	.37	.39	.41	.43	.45	.47	.51	.54	.57
4.00	DISCHG	.59	.61	.62	.64	.66	.67	.70	.73	.77	.79
5.00	DISCHG	.81	.83	.87	.91	.93	.95	.98	1.02	1.06	1.08
6.00	DISCHG	1.10	1.12	1.13	1.14	1.16	1.17	1.20	1.27	1.33	1.37
7.00	DISCHG	1.39	1.43	1.51	1.57	1.61	1.64	1.68	1.76	1.82	1.86
8.00	DISCHG	1.89	1.96	2.15	2.31	2.39	2.43	2.58	2.96	3.28	3.43
9.00	DISCHG	3.51	3.74	4.29	4.75	4.97	5.12	7.33	13.71	19.12	21.60
10.00	DISCHG	22.77	21.41	15.89	11.26	9.24	8.35	7.62	6.36	5.40	4.98
11.00	DISCHG	4.80	4.60	4.16	3.81	3.66	3.60	3.52	3.34	3.21	3.14
12.00	DISCHG	3.12	3.07	2.94	2.84	2.79	2.78	2.74	2.66	2.59	2.56
13.00	DISCHG	2.55	2.51	2.43	2.36	2.33	2.32	2.28	2.20	2.13	2.10
14.00	DISCHG	2.09	2.07	2.03	1.99	1.98	1.97	1.95	1.91	1.88	1.86
15.00	DISCHG	1.86	1.85	1.85	1.85	1.85	1.85	1.84	1.80	1.76	1.75
16.00	DISCHG	1.74	1.73	1.68	1.65	1.63	1.63	1.61	1.57	1.53	1.52
17.00	DISCHG	1.51	1.51	1.51	1.51	1.51	1.51	1.49	1.45	1.42	1.40
18.00	DISCHG	1.40	1.38	1.34	1.30	1.29	1.28	1.29	1.34	1.37	1.38
19.00	DISCHG	1.39	1.38	1.34	1.30	1.29	1.28	1.27	1.22	1.19	1.17
20.00	DISCHG	1.17	1.17	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
21.00	DISCHG	1.16	1.16	1.16	1.16	1.16	1.16	1.15	1.11	1.07	1.06
22.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
23.00	DISCHG	1.05	1.05	1.05	1.05	1.05	1.05	1.03	.99	.96	.94
24.00	DISCHG	.93	.82	.48	.21	.09	.04	.02	.01	.00	

RUNOFF VOLUME ABOVE BASEFLOW = 4.29 WATERSHED INCHES, 50.90 CFS-HRS, 4.21 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 4 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 6.00

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 1
REV PC 09/83(.2) EMERGENCY SPILLWAY 100-YEAR, 24-HOUR STORM PAGE 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
10.54	8.13	10.43
19.13	1.37	10.10

TIME(HRS) FIRST HYDROGRAPH POINT = .00 HOURS TIME INCREMENT = .10 HOURS DRAINAGE AREA = .02 SQ.MI.

10.00	DISCHG	.00	.00	3.45	6.64	7.78	8.11	8.07	7.73	7.14	6.52
10.00	ELEV	5.00	5.00	10.25	10.37	10.42	10.43	10.43	10.42	10.39	10.37
11.00	DISCHG	6.00	5.59	5.20	4.82	4.47	4.21	4.00	3.82	3.65	3.50
11.00	ELEV	10.35	10.33	10.32	10.30	10.29	10.28	10.27	10.26	10.26	10.25
12.00	DISCHG	3.43	3.37	3.30	3.22	3.15	3.08	3.02	2.96	2.90	2.83
12.00	ELEV	10.24	10.24	10.24	10.23	10.22	10.22	10.22	10.21	10.21	10.20
13.00	DISCHG	2.78	2.73	2.68	2.63	2.58	2.53	2.49	2.44	2.39	2.34
13.00	ELEV	10.20	10.20	10.19	10.19	10.18	10.18	10.18	10.17	10.17	10.17
14.00	DISCHG	2.29	2.25	2.21	2.18	2.14	2.11	2.08	2.05	2.02	1.99

14.00	ELEV	10.16	10.16	10.16	10.16	10.15	10.15	10.15	10.15	10.14	10.14
15.00	DISCHG	1.97	1.95	1.93	1.92	1.90	1.89	1.89	1.87	1.86	1.84
15.00	ELEV	10.14	10.14	10.14	10.14	10.14	10.14	10.13	10.13	10.13	10.13
16.00	DISCHG	1.82	1.80	1.79	1.76	1.74	1.72	1.70	1.68	1.66	1.63
16.00	ELEV	10.13	10.13	10.13	10.13	10.12	10.12	10.12	10.12	10.12	10.12
17.00	DISCHG	1.61	1.59	1.58	1.56	1.55	1.55	1.54	1.53	1.51	1.49
17.00	ELEV	10.12	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11
18.00	DISCHG	1.47	1.46	1.44	1.42	1.39	1.37	1.36	1.35	1.35	1.36
18.00	ELEV	10.11	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10
19.00	DISCHG	1.36	1.37	1.36	1.36	1.35	1.33	1.32	1.31	1.29	1.27
19.00	ELEV	10.10	10.10	10.10	10.10	10.10	10.10	10.09	10.09	10.09	10.09
20.00	DISCHG	1.25	1.24	1.22	1.21	1.20	1.19	1.19	1.18	1.18	1.18
20.00	ELEV	10.09	10.09	10.09	10.09	10.09	10.09	10.08	10.08	10.08	10.08
21.00	DISCHG	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.16	1.15	1.13
21.00	ELEV	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08
22.00	DISCHG	1.12	1.10	1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.06
22.00	ELEV	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08	10.08
23.00	DISCHG	1.06	1.06	1.05	1.05	1.05	1.05	1.05	1.04	1.03	1.02
23.00	ELEV	10.08	10.08	10.08	10.08	10.08	10.08	10.07	10.07	10.07	10.07
24.00	DISCHG	1.00	.98	.92	.81	.69	.57	.47	.38	.31	.25
24.00	ELEV	10.07	10.07	10.07	10.06	10.05	10.04	10.03	10.03	10.02	10.02
25.00	DISCHG	.21	.17	.14	.11	.09	.07	.06	.05	.04	.03
25.00	ELEV	10.01	10.01	10.01	10.01	10.01	10.01	10.00	10.00	10.00	10.00
26.00	DISCHG	.03	.02	.02	.01	.01	.01	.01			
26.00	ELEV	10.00	10.00	10.00	10.00	10.00	10.00	10.00			

RUNOFF VOLUME ABOVE BASEFLOW = 2.61 WATERSHED INCHES, 31.01 CFS-HRS, 2.56 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

+ COMPUTATIONS COMPLETED FOR PASS 1

1

TR20 XEQ 09-05-01 09:43 RCEC POST-DEVELOPMENT RUNOFF ANALYSIS JOB 1 PASS 2

REV PC 09/83(.2) EMERGENCY SPILLWAY 100-YEAR, 24-HOUR STORM PAGE 3

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

1

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TR20 XEQ 09-05-01  09:43      RCEC POST-DEVELOPMENT RUNOFF ANALYSIS                  JOB  1   SUMMARY
     REV PC 09/83(.2)         EMERGENCY SPILLWAY  100-YEAR, 24-HOUR STORM                     PAGE   4
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SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1	STORM 99												
+ XSECTION 1	RUNOFF	.02	1	2	.10	.0	4.98	24.00	4.29	---	10.00	22.78	1237.8
STRUCTURE 1	RESVOR	.02	1	2	.10	.0	4.98	24.00	2.61	10.43	10.54	8.13	442.0

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     REV PC 09/83(.2)         EMERGENCY SPILLWAY  100-YEAR, 24-HOUR STORM                     PAGE   5
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SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

SECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 99
0 STRUCTURE 1	.02	
+ ALTERNATE 1		8.13
0 XSECTION 1	.02	
+ ALTERNATE 1		22.78

1END OF 1 JOBS IN THIS RUN

Additional Information Item 246

RESPONSES TO QUESTIONS FROM THE CITY OF HAYWARD, ACFCD, AND FEMA REGARDING STORM WATER MANAGEMENT

Russell City Energy Center
Responses to Questions from City of Hayward, ACFCD, and FEMA
Regarding Storm Water Management

Site Drainage Plans and Details are shown on Bechtel Drawings CG-0100-0001, Rev. C and CG-0090-00002, Rev. A. The design depicted on these drawings is based on the criteria and assumptions defined below.

Potential contamination of runoff from non-process areas

Runoff from non-process areas such as "ammonia unloading" and "parking lot" areas may be subject to contamination by oil that may leak from vehicles. For this reason, all runoff from such areas will be treated in oil-water separators before discharge to the plant drainage system.

Process area drainage

All outdoor process equipment that will contain oils that could contaminate runoff will be curbed to contain the runoff produced by the 25-year, 24-hour storm in addition to the entire oil inventory of the equipment. These curbed areas will drain through valved outlets to oil-water separators, then into a holding tank. The estimated aggregate total process area is approximately 7,000 square feet. The 25-year, 24-hour rainfall depth is 4.01 inches. Because all of the curbed areas will be impermeable, a runoff coefficient of 1.0 is appropriate for the total process area. The resulting estimated runoff volume is approximately 17,500 gallons. A 21,000 gallon holding tank will therefore be provided. After testing to confirm that the captured runoff is not contaminated, compliant storm water will be discharged to the headworks of the WPCF via the City sewer (ref. Para. 8.15.2.5, p. 8,15-20 of the AFC). Applicant requests approval of the option to discharge such compliant stormwater to the plant non-process storm water system if such discharge would not result in exceedance of any established limit on total discharge through that system.

For storm events greater than the 25-year, storm the curbed process areas may overflow. In this case the runoff will drain to the plant storm drain system and directly to the storm water management basin. It should be noted though, that more than the first four inches of runoff will have been captured in the holding tank. Any possible oil contamination will have been collected in the first 4 inches of runoff and the likelihood of any remaining contamination in the overflow is slight. Additionally, the peak water level in the storm water management basin for the 100-year storm is lower than the emergency spillway crest elevation when the outlet valve from the riser structure is open. When closed, the 100-year storm runoff will pass over the emergency spillway into the marsh area immediately south of the RCEC site.

Basin draining time

The design storm for the storm water management basin is the 25-year, 24-hour storm. The assumed initial water level in the basin is elevation 6.0 AMSL: the invert elevation of the orifice in the outlet riser. The time required to drain the basin to this level is calculated in the Storm Water Management Basin Sizing Calculation (Calculation number H&H-1, Rev. 1, dated Sept. 6, 2001). The peak water level in the storm water management basin during the storm is elevation 8.45 ft. AMSL. The time required to drain the basin from this elevation to elevation 6.0 ft. is estimated to be 19.6 hours. This draining time accounts for the fact that runoff will continue to enter the basin during the storm. If no inflow into the basin is assumed, the draining time will be significantly less than 19.6 hours. In either case, the basin draining time is less than the 24-hours required by the Alameda County Flood Control and Water Conservation District. It should be noted that the draining time is based on a low water level condition in the Alameda County Flood Control Channel at the basin discharge point. If a high water conditions exists, the water level in the basin will not drain below the water level in the canal until the canal water level is lowered.

STATE OF CALIFORNIA

Energy Resources Conservation
and Development Commission

In the Matter of: Application for Certification for the Russell City Energy Center Project	)))))	Docket No. 01-AFC-7

PROOF OF SERVICE

I, Connie Stark, declare that on September 12, 2001, I deposited copies of the attached *Responses to CEC Staff Data Requests and Additional Information in Support of the Application for Certification for the Russell City Energy Center, Hayward California* in the United States mail in Sacramento, California, with first-class postage thereon fully prepaid and addressed to all parties on the attached service list.

I declare under the penalty of perjury that the foregoing is true and correct.

Connie Stark

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