WENCK File #3053-0041
October 2016

SKB Environmental Cloquet Landfill Run-on/Run-off Control and Closure Plan and Post Closure Plan Updates

Prepared for:

SKB Environmental Cloquet Landfill, Inc.
f/n/a Shamrock Landfill, Inc.

251 Starkey Street
St. Paul, Minnesota
55107

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

Prepared by:

WENCK Associates, Inc.
1800 Pioneer Creek Center
Maple Plain, MN 55359
Phone: 763-479-4200
Fax: 763-479-4242

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APPENDICES

1.0 Introduction

1.1 PURPOSE

This report consists of the following documents that meet the requirements of the new federal rules regarding land disposal of a Coal Combustion Residual (CCR) material.

- Section 2 - Run-on and Run-off Control Plan (Rule § 257.81)
- Section 3 – Criteria for Conducting Closure or Retrofit of CCR units (Rule § 257.102)
- Section 4 - Post Closure Care Requirements (Rule § 257.104)

Many requirements of this report are addressed by the previously prepared and submitted Closure Plan, Post-Closure Plan, and Contingency Action Plan (Closure/Post Closure Plan) for the SKB Environmental Cloquet Landfill (SKB Environmental Cloquet), f/n/a Shamrock Landfill, Inc. prepared by Wenck Associates, Inc. in July, 2015 as part of the State solid waste permit and included as Appendix A. Where requirements of this report are addressed in this July, 2015 Closure/Post Closure plan, the section within that plan that addresses the rule requirement is referenced.

1.2 FACILITY DESCRIPTION

SKB Environmental Cloquet Landfill, Inc., owns and operates the SKB Environmental Cloquet Landfill. The site is an industrial waste landfill located on an approximately 59 acre parcel of land located at Section 25, Township 49 North, Range 17 West, Carlton County with a street address of 761 MN Highway 45 in Cloquet, Minnesota. Approximately 9.5 acres of a total permitted 41.5 acres of the site are currently being utilized for landfill activities, with 5.4 acres of new disposal area recently constructed (Phases 3 and 4).

The facility is operating under the MPCA Solid Waste Permit SW-399, issued on December 21, 2010.

The landfill facility, as permitted, will be developed in nine (9) Phases. Currently, Phases 1 through 4 are permitted. Phases 1 through 4 are the active disposal area at the site. As specified in MPCA Permit SW-399, the landfill is currently permitted to receive 1,311,000 cubic yards (Phases 1 through 4) of industrial waste co-disposed with demolition and construction debris. The current landfill has an ultimate disposal capacity for industrial waste of 3,544,000 cubic yards (Phases 1 through 9). CCR materials are disposed of under the sites Industrial Solid Waste Management Plan, and as of the time of this report, there have been approximately 45,000 cubic yards of CCR material landfilled at the site.

The attached Figure 1 presents a site location and a site layout is provided on Figure 2.

2.0 Run-on and Run-off Control (Rule § 257.81)

2.1 RUN-ON AND RUN-OFF CONTROL SYSTEMS

SKB Environmental Cloquet has developed a run-on and run-off control system to prevent flow onto and off of the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm in accordance with this requirement.

This section satisfies the requirements of Rule 257.81(a)(1) and Rule 257.81(a)(2).

2.2 RUN-OFF HANDLING REQUIREMENTS

Run-off from the active portion of the CCR unit will be handled in accordance with the surface water requirements under Rule 257.3-3, by complying with the following requirements.

The facility will comply with the requirements of its National Pollutant Discharge Elimination System (NPDES) permit, Permit #BNR05399B, and their MPCA Solid Waste Permit (SW-399). SKB Environmental Cloquet shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended, nor will it cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an area wide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

This section satisfies the requirements of Rule 257.81(b).

2.3 RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

2.3.1 Initial Plan

As part of its MPCA solid waste permit, SKB Environmental Cloquet has prepared initial run-on and run-off control system plans for the CCR disposal areas. They will amend the plan whenever there is a change that would substantially affect this plan and will revise the plan every five years beginning with the effective date of this plan. The effective date of this plan is the date it is placed into the facility's operating record as required by Rule 257.105(g)(3).

Calculations and figures demonstrating that the sites run-on and run-off control systems manage the peak discharge from a 25 year 24 hour storm event are provided in Appendix B.

This section satisfies the requirements of Rule 257.81(c)(1).

2.3.2 Amendment of the Plan

Amendments to the plan will be made whenever there's a change that would substantially affect this plan.

This section satisfies the requirements of Rule 257.81(c)(2).

2.3.3 Timeframes for Preparing the Initial Plan

The site meets the definition of an Existing CCR Landfill and therefore this plan will be placed into the facilities operating record on or before October 17, 2016 as required by Rule 257.281(c)(3).

2.3.4 Frequency for Revising the Plan

This plan will be revised every 5 years as required by Rule 257.281(c)(4) and placed into the facilities operating record as required by Rule 257.281(g)(3).

2.3.5 Certification

This report, including the initial run-on and run-off control plan is signed by a professional engineer registered in the state of Minnesota, meeting the certification requirements of Rule 257.81(c)(5).

2.4 RECORDKEEPING REQUIREMENTS

Recordkeeping requirements are outlined in Section 5 of this report.

3.0 Closure of CCR Units (Rule § 257.102)

3.1 CLOSURE AND POST CLOSURE PLAN

Closure of the landfill will be completed by leaving the CCR in place and installing a final cover system, in accordance with Rule 257.102(b) and 257.102 (d)-(j). Rule 257.102(c) addresses closure by removal of CCR. This rule is not applicable to the site and is not discussed further herein.

Section 2.6 of the July, 2015 Closure/Post Closure plan describes the final cover system proposed.

3.2 CONTENT OF CLOSURE PLAN

The content of the Closure Plan (Plan) is discussed below.

3.2.1 Rule 257.102(b)(1)(i) Closure Narrative

Closure of the CCR unit will be in accordance with the procedures described in Section 2.6 of the July, 2015 Closure/Post Closure plan and as described in the subsequent portions of Section 3.1.1 of this Plan.

3.2.2 Rule 257.102(b)(1)(ii) Removal of CCR

SKB Environmental Cloquet does not plan to complete the closure through removal of CCR and decontamination of the unit. If, in the future, SKB Environmental Cloquet decides to consider closure in this manner, the Plan will be amended to include a new procedure for the closure.

3.2.3 Rule 257.102(b)(1)(iii) Leaving CCR in Place

Closure of the landfill will be completed by leaving the CCR in place and installing a final cover system, as described in Section 2.6 of the July, 2015 Closure/Post Closure Plan.

3.2.4 Rule 257.102(b)(1)(iv) Volume of CCR

The estimated maximum inventory of CCR ever on site over the active life of the unit is 800,000 cubic yards, which is based on an assumed disposal rate of 40,000 cubic yards per year over the remaining 20 years of permitted site life.

3.2.5 Rule 257.102(b)(1)(v) Largest Closure Area

The site may be closed in phases, however the largest closure area anticipated over the life of the site is the entire footprint, which is 44 acres.

3.2.6 Rule 257.102(b)(1)(vi) Schedule

The CCR unit at the SKB Environmental Cloquet will be closed in phases as fill progresses to final waste grades. Each closure project's anticipated milestone schedule is shown below.

MILESTONE	DURATION
Prepare Construction Documents	2 months
Submit for Review	2 Weeks
Solicit bids/retain contractor (concurrent with MPCA review)	1 month
Complete Construction	2-3 months
Prepare Certification Report and Place in facility Operating Record	2 Weeks
Obtain MPCA Approval of Certification Report	2 Weeks

The MPCA will be provided a copy of the plans and specifications for each closure project in accordance with the requirements of Solid Waste Permit SW-399 and each closure project is anticipated to take two (2) to three (3) months to complete.

Final closure is anticipated in 2036.

3.2.7 Timeframe for Preparing the Initial Closure Plan

The site meets the definition of an Existing CCR Landfill and therefore this Plan will be placed into the facilities operating record on or before October 17, 2016 as required by Rule 257.102(b)(2).

3.2.8 Amendment of Closure Plan

SKB Environmental Cloquet will amend this Plan whenever:

- There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or
- Before or after closure activities have commenced; or
- Unanticipated events necessitate a revision of the written closure plan.

SKB Environmental Cloquet will amend this plan at least 60 days prior to a planned change in the operation of the landfill, or no later than 60 days after an unanticipated event requires the need to revise the existing Closure Plan.

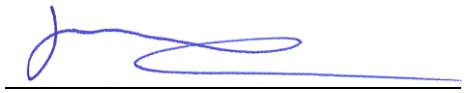
If this Plan is revised after closure activities have commenced, SKB Environmental Cloquet will amend this Closure Plan within 30 days of the triggering event. Additionally at a minimum, the Closure Plan will be reviewed and updated, if needed, at the time of MPCA Solid Waste Permit renewal (every 10 years).

This section satisfies the requirements of Rule 257.81(102)(b)(3).

3.2.9 Professional Engineer Certification

This report is signed by a professional engineer, meeting the certification requirements of Rule 257.102 (b)(4) as provided below:

I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Minnesota.



David M. Parenteau
PE # 41243

October 11, 2016

3.3 CLOSURE PERFORMANCE STANDARD WHEN LEAVING CCR IN PLACE

3.3.1 Manner of Closure

The planned closure meets the requirements of subparts i-iv of Rule 257.102(d)(1), as described below.

3.3.1.1 Rule 257.102(d)(1)(i) Minimize Infiltration

The final cover system described within the July, 2015 Closure Post Closure Plan above is designed to minimize infiltration of liquids into the waste to the extent possible. Stormwater generated by the landfill will be controlled on-site. Runoff will be controlled and routed by drainage swales, downslope structures, and four infiltration basins as shown in the drawings. Drainage routing features have all been sized to minimize erosion from the site.

3.3.1.2 Rule 257.102(d)(1)(ii) Future Impoundment

The expected differential settlement that could result in future impoundment of water on the final cover is minimized by the final cover geometry (slopes ranging from 3% to 25%) and the fact that there is negligible settlement of the waste expected.

3.3.1.3 Rule 257.102(d)(1)(iii) Slope Stability

The final cover system utilizes a textured geomembrane and a double sided geonet geocomposite drainage layer on the side slopes, resulting in a final cover system that typically provides a factor of safety of 1.5 or greater against sloughing or movement of the final cover system over the life of the site.

3.3.1.4 Rule 257.102(d)(1)(iv) Maintenance

All closure systems, including but not limited to: the final cover system, the leachate collection system, the groundwater monitoring system and the infiltration basin system, are designed to require as little future maintenance as possible. Regular inspections will be

completed to identify any maintenance requirements to fix any issues in a timely manner. In addition, the MPCA requires that there be financial assurance and contingency action plans in place for the duration of the 20 year post closure care period.

3.3.1.5 Rule 257.102(d)(1)(v) Schedule

The closure will be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

3.4 STABILIZATION OF WASTE FOR CCR IMPOUNDMENT

The requirement of rule 257.102(d)(2) is not applicable. SKB Environmental Cloquet does not operate a CCR surface impoundment.

3.5 FINAL COVER SYSTEM

3.5.1.1 Rule 257.102(d)(3)(i) Final Cover System Design

SKB Environmental Cloquet is proposing an alternate final cover system, therefore the requirements of Rule 257.102(d)(3)(i) are replaced with the requirements Rule 257.102(d)(3)(ii) described in the next paragraphs.

3.5.1.2 Rule 257.102(d)(3)(ii) Alternate Final Cover System Design

The proposed final cover system is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of Rule 257.102(d)(3)(ii) for an alternate final cover system.

Rule 257.102(d)(3)(ii) requires the alternate final cover system to meet the following criteria:

- Infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in Rule 257.102(d)(3)(i)(A) and (B).
- Erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in Rule 257.102(d)(3)(i)(C).
- Rule 257.102(d)(The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Rule 257.102(d)(3)(i)(A) requires that the permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ cm/sec, whichever is less.

This requirement is met by the use of a 40 mil LLDPE geomembrane or proposed clay barrier layer component.

Rule 257.102(d)(3)(i)(B) requires that the infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

This requirement is met due to the proposed final cover systems each having an efficiency that approaches 99% and include 18 inches of cover soils above the LLDPE or clay barrier, and the final cover system includes a drainage layer.

Rule 257.102(d)(3)(i)(C) requires that erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

The proposed 6-inch topsoil layer within the final cover system meets this requirement.

Due to the nature of the site soils and the waste, settlement and subsidence at the site are expected to be minimal with negligible effects on the final cover system.

3.5.1.3 Rule 257.102(d)(3)(iii) Certification

The design of the final cover system in the site permitting documents was signed by a professional engineer and this plan will also be signed by a professional engineer.

3.6 INITIATION OF CLOSURE ACTIVITIES

Closure time frames were discussed in Section 3.1.1.1 of this report and meets the requirements of Rule 257.102(e)(1). Since the timeframes of Rule 257.102(e)(1) will be met, the requirements of Rule 257.102(e)(2) do not apply.

Should SKB Environmental Cloquet anticipate a period of two (2) years or longer without receipt of CCR, and without commencing closure, this Plan may be amended, with the appropriate documentation and justification.

According to Rule 257.102(e)(3) closure commencement occurs when SKB Environmental Cloquet performs any of the following:

i. Takes any steps necessary to implement the written closure plan
ii. Submits a completed application for any required state or agency permit or permit modification; or
iii. Takes any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR unit.

3.6.1 Rule 257.102(e)(4) Timeframe Exceptions

Rule 257.102(e)(4) states that the timeframes outlined above do not apply to any of the following owners or operators:

i. An owner or operator of an inactive CCR surface impoundment closing the CCR unit as required by Rule 257.100(b);
ii. An owner or operator of an existing unlined CCR surface impoundment closing the CCR unit as required by Rule 257.101(a);
iii. An owner or operator of an existing CCR surface impoundment closing the CCR unit as required by Rule 257.101(b);
iv. An owner or operator of a new CCR surface impoundment closing the CCR unit as required by Rule 257.101(c); or
v. An owner or operator of an existing CCR landfill closing the CCR unit as required by Rule 257.101(d).

Subparts (e)(4)(i) through (iv) do not apply as SKB Environmental Cloquet does not operate a CCR surface impoundment. Subpart (e)(4)(v) does not apply because SKB Environmental Cloquet is in compliance with the location restriction for unstable areas specified in Rule 257.64(a).

This section meets the requirements of Rule 257.102(e) and its subparts.

3.7 COMPLETION OF CLOSURE ACTIVITIES

The closure schedules described herein meet the requirements of Rule 257.102(f)(i) for existing CCR landfills. Should an extension be required, the procedures outlined in Rule 257.102(f)(ii) will be followed.

3.7.1 Rule 257.102(f)(3) Professional Engineer Certification

Upon completion of the closure a professional engineer will certify a report, verifying that the closure was completed in accordance with this closure plan and other approved closure plan documents.

3.8 NOTIFICATION OF INTENT TO CLOSE A CCR UNIT

As required by Rule 257.102(g); prior to closure of a CCR unit, SKB Environmental Cloquet will complete the notification of intent to close a CCR unit, including the professional engineer certification as required.

3.9 NOTIFICATION OF CLOSURE

As required by Rule 257.102(h); within 30 days of completion of closure of a CCR unit, SKB Environmental Cloquet will complete the notification of closure of a CCR unit, including the professional engineer certification as required. The notification will be placed into the facility's operating record as required by Rule 257.105(i)(8).

3.10 DEED NOTATIONS

As required by Rule 257.102(i), the following notations will be made on the deed or other instrument normally examined during a title search:

- The notation on the deed will in perpetuity notify any potential purchaser of the property that:
  (i) The land has been used as a CCR unit; and
  (ii) Its use is restricted under the post- closure care requirements as provided by Rule 257.104(d)(1)(iii).
- Within 30 days of recording a notation on the deed to the property, SKB Environmental Cloquet will prepare a notification stating that the notation has been recorded. The notification is complete when it has been placed in the facility's operating record as required by Rule 257.105(i)(9).

3.11 RULE 257.102(J) RECORDKEEPING

Recordkeeping requirements are outlined in Section 5 of this report.

4.0 Post-Closure Care Requirements (Rule § 257.104)

4.1 APPLICABILITY

SKB Environmental Cloquet is not closing by removing the CCR, and is not an inactive surface impoundment; therefore the requirements of Rule 257.104 apply.

4.2 RULE 257.104(B) POST-CLOSURE CARE MAINTENANCE REQUIREMENTS

Following closure of the landfill, SKB Environmental Cloquet will conduct post-closure care for the site which is described in Section 3 of the July, 2015 Closure/Post Closure Plan.

4.2.1 Rule 257.104(b)(1) Final Cover System

Section 3.5 of the July, 2015 Closure/Post Closure Plan addresses this requirement.

4.2.2 Rule 257.104(b)(2) Leachate Collection and Removal System

Section 3.6 of the July, 2015 Closure/Post Closure Plan addresses this requirement.

4.2.3 Rule 257.104(b)(3) Groundwater Monitoring System

There are six (6) downgradient wells from the fill area as well as one (1) upgradient well serving as the environmental monitoring system. The relative position of each monitoring point to the existing and future waste disposal areas is based on the predominant easterly groundwater flow direction. Modifications to the monitoring points will be made for future planned Phases 6 and 7. The existing MPCA approved monitoring system, along with any modifications, will continue to provide for groundwater quality monitoring and early detection of potential detections that may be related to waste disposal at the facility.

Any revisions and enhancements to the sites monitoring network, sampling and analysis plan and Contingency Action Plans, required to meet the requirements of Rules 257.90 through 257.98 will be implemented no later than October 17, 2017

4.3 POST-CLOSURE CARE PERIOD

4.3.1 Rule 257.104(c)(1) Post-Closure Care Timeframe

SKB Environmental Cloquet will conduct post-closure care for 30 years in accordance with this section.

4.3.2 Rule 257.104(c)(2) Assessment Monitoring Requirement

If assessment monitoring in accordance with Rule 257.95 becomes necessary, SKB Environmental Cloquet will continue to conduct post-closure care and follow the Contingency Action Plan until the site can return to routine detection monitoring.

4.4 RULE 257.104(D) WRITTEN POST-CLOSURE PLAN

4.4.1 Rule 257.104(d)(1) Content of the Plan

SKB Environmental Cloquet has prepared this written post-closure plan that includes, the information specified in Rule 257.104(d)(1)(i) through (iii).

i. A description of the monitoring and maintenance activities required for the CCR unit, and the frequency at which these activities will be performed;

   This is presented in Section 3 of the July, 2015 Closure/Post Closure Plan.

ii. Contact after closure is:

   Mr. John Domke
   Division Vice President
   SKB Environmental Cloquet Landfill, Inc.
   251 Starkey Street
   St. Paul, MN 55107

iii. Ultimate Land Use

This is presented in Section 3.8 of the July, 2015 Closure/Post Closure Plan.

4.4.2 Rule 257.104(d)(2) Deadline to Prepare Initial Written Post-Closure Plan

SKB Environmental Cloquet will prepare the initial written closure plan prior to October 17, 2016. The written post-closure plan, with certification, will be placed in the facility's operating record once complete.

4.4.3 Rule 257.104(d)(3) Amendment of a Written Post-Closure Plan

SKB Environmental Cloquet will amend the written post-closure plan whenever:

- There is a change in the operation of the landfill that would substantially affect the written post-closure plan in effect; or
- After post-closure activities have commenced, unanticipated events necessitate a revision of the written post-closure plan.

SKB Environmental Cloquet will amend its Post Closure plan at least 60 days prior to a planned change in the operation of the landfill, or no later than 60 days after an unanticipated event requires the need to revise the existing Post Closure Plan.

If a written closure plan is revised after closure activities have commenced, SKB Environmental Cloquet will amend this Post Closure Plan within 30 days of the triggering event. Additionally at a minimum, the Closure Plan will be reviewed and updated, if needed, at the time of MPCA Solid Waste Permit renewal (every 10 years).

This section satisfies the requirements of Rule 257.81(104)(d)(3).

4.4.4 Rule 257.104(d)(4) Professional Engineer Certification

This report is signed by a professional engineer, meeting the certification requirements of Rule 257.104(d)(4).

4.5 RULE 257.104(E) NOTIFICATION OF COMPLETION OF POST-CLOSURE CARE PERIOD

As required by Rule 257.104(e); Within 60 days of completion of Post Closure care period, SKB Environmental Cloquet will complete a notification that Post Closure Care has been completed The notification will include the certification by a professional engineer verifying that post-closure care has been completed in accordance with the Closure Plan and the Post Closure Plan. The owner or operator has will place the notification in the facility's operating record as required by Rule 257.105(i)(13).

4.6 RULE 257.104(F) RECORDKEEPING

Recordkeeping requirements are outlined in Section 5 of this report.

5.0 Recordkeeping Requirements (Rule § 257.105(g))

5.1 RECORD KEEPING REQUIREMENTS

As required by Rule 257.105 (g), the owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

- The Runoff/Run-on Control Plan, Closure Plan and Post Closure Plan, and any subsequent amendment of the plans, except that only the most recent plans must be maintained in the facility's operating record.

Each owner or operator of a CCR unit subject to the requirements of this subpart must maintain files of all information required by this section in a written operating record at their facility.

- Unless specified otherwise, each file must be retained for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study.
- An owner or operator of more than one CCR unit subject to the provisions of this subpart may comply with the requirements of this section in one recordkeeping system provided the system identifies each file by the name of each CCR unit. The files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

The owner or operator of a CCR unit must submit to the State Director and/or appropriate Tribal authority any demonstration or documentation required by this subpart, if requested, when such information is not otherwise available on the owner or operator's publicly accessible Internet site.

5.2 NOTIFICATION REQUIREMENTS

As required by Rule 257.106(g), the owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must:

- Provide notification of the availability of the Runoff/Runon Control Plan, Closure Plan and Post Closure Plan, and any subsequent amendment of the plans.

The notifications must be sent to the relevant State Director and/or appropriate Tribal authority before the close of business on the day the notification is required to be completed. Before the close of business means the notification must be postmarked or sent by electronic mail (email). If a notification deadline falls on a weekend or federal holiday, the notification deadline is automatically extended to the next business day.

5.3 INTERNET REQUIREMENTS

As required by Rule 257.107(g), the owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

- The Runoff/Runon Control Plan, Closure Plan and Post Closure Plan, and any subsequent amendment of the plans, except that only the most recent plans must be maintained in the facility's operating record.

The owner or operator's Web site must be titled ''CCR Rule Compliance Data and Information.'' The same internet site may be used for multiple CCR units provided the CCR Web site clearly delineates information by the name or identification number of each unit.

The information required to be posted to the CCR Web site must be made available to the public for at least five years following the date on which the information was first posted to the CCR Web site. The information must be posted to the CCR Web site within 30 days of placing the pertinent information in the operating record.

Figures

SHAMROCK ENVIRONMENTAL LANDFILL

Site Location Map

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

JULY 2016

Figure 1

202,500 N
202,000 N
201,500 N
201,000 N
200,500 N
560,000 E
560,500 E
561,000 E
561,500 E
562,000 E
562,500 E
563,000 E

CENTERLINE INTERSTATE 35
INTERSTATE 35 RIGHT-OF WAY
OFFICE
SCALE
PROPERTY LINE
SECTION LINE
CULVERT (TYP.)
EXISTING ACCESS ROAD
LOADOUT PAD
EXISTING FORCEMAIN
EXISTING TELEPHONE LINE
EXISTING WASTE DISPOSAL AREA
PROPOSED WASTE LIMITS
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
PHASE 6
PHASE 7
PHASE 8
PHASE 9
EXISTING IN-PLACE WASTE AREA
CONTRACTOR ACCESS ROUTE TO CONSTRUCTION AREA
CONSTRUCTION AREA FOR PHASES 3 & 4
SEALED MONITORING WELL
SITE ENTRANCE
18" METAL
P-1
P-2
P-3
P-4
P-4R
P-5
P-6
P-7
SE/4
N½
S½

0 150 300
GRAPHIC SCALE IN FEET

LEGEND
- EXISTING CONTOURS
- EXISTING ROAD
- EXISTING MONITORING WELL
- PROPERTY LINE/ COMPLIANCE BOUNDARY
- PROPOSED WASTE LIMITS
- PHASE BOUNDARY
- EXISTING FORCEMAIN
- TELEPHONE
- ELECTRICAL
- RAILROAD
- TREES
- CONSTRUCTION AREA

NOTEs:

1. COORDINATES ARE BASED ON CARLTON COUNTY COORDINATE SYSTEM.
2. EXISTING CONTOURS BASED ON 2014 LIDAR DATA UPDATED FROM JAN. 2015 SURVEY BY WENCK ASSCOCIATES.

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
C	ISSUED FOR CONSTRUCTION RECORD DRAWINGS	JVB	TJS	08/28/15
B	MODIFACATION FOR GCL	DNO	TJS	04/20/15
A	ISSUED FOR APPROVAL	DNO	TJS	03/13/15

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME THOMAS J. SHUSTARICH

SIGNATURE

DATE 08/28/2015 LICENSE # 21210

SUB CONSULTANT

PRIME CONSULTANT

WENCK ASSOCIATES
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PROJECT TITLE
CONSTRUCTION RECORD DRAWINGS FOR PHASES 3 AND 4

SHAMROCK ENVIRONMENAL LANFILL

SHEET TITLE
EXISTING CONDITIONS

DWN BY	CHK'D	APP'D	DWG DATE
JVB	SH	TJS	FEB. 2015

SCALE AS NOTED

PROJECT NO. 1101-0015

SHEET NO. C-101

REV NO. C

Appendix A

July 2015, Closure Post Closure Plan

Wenck File #1101-0016
June 2015

Closure, Post-Closure and Contingency Action Plan Application for Landfill Permit Renewal Permit #SW-399

Prepared for:

Shamrock Landfill, Inc.

761 MN Highway 45
Cloquet, Minnesota
55720

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

Prepared by:

WENCK Associates, Inc.
1800 Pioneer Creek Center
Maple Plain, MN 55359
Phone: 763-479-4200
Fax: 763-479-4242

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TABLES

1.0 Introduction

This report consists of a Closure Plan, Post-Closure Plan, and Contingency Action Plan for the Shamrock Environmental Landfill (Shamrock) facility. In addition, the required financial assurance cost estimates are also included in this section. This report complies with the Minnesota Pollution Control Agency (MPCA) requirements for closure (Minnesota Solid Waste Rules, Part 7035.2625), post-closure (Parts 7035.2645 and 7035.2655), and contingency action (Part 7035.2615). The objective of the Closure, Post-Closure, and Contingency Action Plans is to establish procedures to be followed during each of the activities.

Section 2.0 of this document presents the Closure Plan for the disposal facility. This plan includes MPCA notification, schedule, procedures and certification. Section 3.0 of this document defines a Post-Closure Plan which evaluates maintenance, monitoring, and reporting requirements. Section 4.0 of this document presents a Contingency Action Plan and evaluates possible options associated with each contingency. Section 5.0 presents the financial assurance cost estimates for site closure, post-closure care and contingency action.

2.0 Closure Plan

2.1 GENERAL

The Shamrock facility will be constructed in nine phases. The closure of each of these phases is the responsibility of Shamrock Landfill, Inc. Closure activities will take place sequentially as each phase is brought to final grade. A copy of the MPCA-approved Closure Plan and all revisions will be maintained at the facility until final closure is completed and certified.

Contact after closure is:

Mr. John Domke
Division Vice President
SKB Environmental Cloquet Landfill, Inc.
251 Starkey Street
St. Paul, MN 55107

2.2 NOTIFICATION OF CELL/PHASE CLOSURE

The MPCA will be notified of an upcoming phase closure at least one month prior to initiation of closure activities. Project plans and specifications will be submitted to the MPCA for review.

2.3 NOTIFICATION OF FINAL CLOSURE

Closure of the facility will begin as soon as practical after receiving the last shipment of waste. The MPCA Commissioner and the general public will be notified 90 days before closure activities begin.

2.4 CLOSURE SCHEDULE

Closure for the facility is dependent on the quantity of waste produced and the final design. The design of the facility is such that the final grades will be achieved in individual phases as quickly as possible, thus allowing intermediate or final cover to be placed on the exterior slopes sequentially. Intermediate cover will be placed on interior slopes that will receive waste during future phases of development. This approach results in only the operating portion of the cell being exposed to the environment.

2.5 QUANTITY OF STORAGE

No storage of waste will take place at this facility other than several containers for municipal solid waste and bulky waste generated on-site and removed from loads. Recyclable materials will be stored on-site.

2.6 CLOSURE PROCEDURES

Closure will be initiated sequentially as final grades are achieved, and as sufficient area is available to place final cover. Closure will consist of placement of a low permeability cover system with a summary of the design (from the top down) as follows:

1. Vegetative cover;
2. Six inches of vegetation-supporting top soil;
3. Eighteen inches of common borrow material ; and
4. Geonet geocomposite drainage layer (or sand drainage layer);
5. 40-mil linear low density polyethylene (LLDPE) membrane.

Shamrock is also proposing an alternative cover design in which the 40-mil LLDPE membrane, geonet geocomposite, and eighteen inches of common borrow would be replaced from top to bottom by six inches of common borrow material and one foot of clay or low permeable soil for a natural final cover system.

The proposed final contours have been developed to promote moderate sheet flow of run-off from the site. Erosion of the slopes will be controlled through a series of drainage swales and reinforced downslope structures as shown in the Plan drawings.

Construction of the final cover will proceed as follows:

1. Grade and smooth intermediate cover soil layer, as needed;
2. Install LLDPE layer or one foot of clay;
3. Place uncompacted cover soil and topsoil;
4. Seed and mulch.

All temporary and final cover materials will comply with the requirements of all applicable rules.

2.7 CERTIFICATION OF FINAL CELL/PHASE CLOSURE

Upon completion of activities for final closure of any phase/cell, a closure documentation report will be submitted to the MPCA. This will be signed by an authorized officer of Shamrock and a professional engineer registered in Minnesota, and will state that the cell or phase has been closed in accordance with MPCA-approved plans and specifications.

Testing of the various components of the cover will be conducted and documented in accordance with the Construction Quality Assurance/Quality Control Plan in effect at the time of final closure, and in accordance with all applicable rules. The closure and construction documentation will be submitted to the MPCA within 60 days of closure. The report will contain record drawings, testing data and a description of the construction process with photographs.

In addition, upon final closure of the facility, a detailed description, including a plat, will be recorded with the Carlton County Recorder. The description will include types and location of wastes, depth of fill, and other information that may be of interest to future land owners. A copy of Record Drawings will be submitted to the Carlton County Recorder and the MPCA.

2.8 DEED NOTATION

A notation will be made on the deed or other instrument normally examined during a title search. The notation will include record drawings and notify potential purchasers of any special conditions or limitations for use of the site. A copy of the notation carrying the Carlton County Recorder's seal will be included with the certification.

2.9 AMENDMENT OF CLOSURE PLAN

If any event or change affects the plan, a modified Closure Plan will be prepared and submitted to the MPCA. This applies to any change in the Operations and Maintenance Plan, facility design, or estimated year of closure. At a minimum, the Closure Plan will be reviewed and updated, if needed, at the time of re-permitting (every 10 years).

3.0 Post-Closure Plan

3.1 GENERAL

The owner and any successor will be responsible for the post-closure care of the site. MPCA Solid Waste Management Rules, Parts 7035.2645 and 7035.2655 were used as a guide to determine post-closure requirements. The post-closure period for each disposal area begins on the date of MPCA approval of final closure certification for that area, and continues for at least 5 years. A summary of the post-closure program is provided in the following text.

3.2 INSPECTION AND MAINTENANCE

Routine inspection of the site will occur at least four times a year (spring, summer, fall and winter). These inspections will include observations of the cover integrity (for example, settlement or vegetation quality); erosion and surface water drainage; the leachate management system; monitoring systems; and site security features. Inspection may also be performed after severe weather.

If the site inspection reveals any problems or potential problems, appropriate corrective measures will be performed as outlined in the Contingency Action Plan. Routine maintenance, such as mowing to prevent tree growth and to maintain drainageway flow capacity, will be performed as needed. All features including, but not limited to, security fencing, monitoring wells, leachate collection systems, and surface water control structures will be properly maintained.

Inspection and maintenance practices for specific facility features are defined below.

3.3 MONITORING

There are six (6) downgradient wells from the fill area as well as one (1) upgradient well serving as the environmental monitoring system.

3.4 SURFACE WATER RUN-OFF CONTROL FACILITIES

Drainage swales and the downslope structures will be inspected quarterly and after major storm events. Maintenance needed will be performed within four weeks, weather permitting.

3.5 FINAL COVER SURFACE

The landfill surface will be inspected quarterly and after major storm events. Supplemental cover soil will be placed to repair the effects of erosion or settlement within four weeks. Seeding, fertilizing, and mulching of bare soil will be performed as required. These areas will be inspected periodically to ensure that vegetative growth has been re-established. If weather or other conditions cause a delay, the MPCA will be informed of the estimated schedule.

3.6 LEACHATE MANAGEMENT SYSTEM

Leachate will be collected, removed, and managed, according to the MPCA-approved Leachate Management Plan provided as Section 3.0 in the Operations and Maintenance Plan section of this submittal, throughout the post-closure period for this facility. The collection system pipes will be cleaned as necessary.

3.7 REPORTING

An annual report describing inspections, conditions observed, corrective actions, maintenance activities, monitoring activities, and results will be prepared and submitted to the MPCA on or before February 1. The corporate contact for the facility during the post-closure period will be:

Mr. John Domke
Division Vice President
SKB Environmental Cloquet Landfill, Inc.
251 Starkey Street
St. Paul, MN 55107

3.8 ULTIMATE LAND USE

Currently, it is assumed that Shamrock will retain control of the site, so there will be no disturbance to the covers, base liner, leachate collection system, or monitoring system unless approval is obtained from the MPCA. If the property is sold, the deed will document any restrictions.

3.9 AMENDMENT OF POST-CLOSURE PLAN

If any event significantly affects the Post-Closure Plan, a modified Plan will be prepared and submitted to the MPCA for approval. This applies to, but is not limited to, any significant change in the monitoring system or procedures. At a minimum, the plan will be amended when the permit is renewed (every ten years).

4.0 Contingency Action Plan

4.1 GENERAL

This Contingency Action Plan has been prepared for the facility in accordance with Part 7035.2615 of the MPCA Solid Waste Rules. The former disposal areas are not covered in this plan because they will not stay open for operations, but select waste will be removed and transferred to the lined disposal area. Therefore, they are covered adequately in the Closure and Post-Closure Plans, Sections 2.0 and 3.0. The purpose of the Contingency Action Plan is to:

- Identify occurrences, such as natural disasters, vandalism, accidents, or failures of constructed features that could lead to uncontrolled release of waste or leachate and endanger human health or the environment.
- Establish the sequence and timing of actions to minimize hazards to human health or the environment.
- Identify possible prior arrangements to be made with contractors to assure an effective response action.

A copy of this plan will be kept at the facility for reference by operators and regulatory personnel. Each contingency set forth in this plan has a number of possible solutions and no contingency action plan can address all circumstances encountered.

Therefore, the MPCA will be promptly notified of all incidents, proposed actions, and response status.

4.2 CONTINGENCIES

Certain events at the facility could lead to an uncontrolled release of waste or leachate into the environment. These could be the result of natural disasters, accidents, vandalism, or failure of constructed features. The contingencies identified in this plan have been divided into three categories:

4.2.1 Event-Triggered

Event-triggered contingencies may include severe rainfall, uncontrolled leachate release, fire or other unanticipated events. Table 1 lists some possible events and strategies to deal with them.

4.2.2 Inspection-Triggered

Inspection-triggered contingencies may include signs of distress in the landfill vegetative cover, erosion, leachate detected in the leak detection system, surface drainage problems, or other findings observed during routine inspections. These are included in Table 2.

4.2.3 Monitoring-Triggered

Identified monitoring-triggered contingencies include contamination above action levels of groundwater (e.g., the HRLs) or other findings observed during routine facility monitoring. These are listed in Table 3.

Each of the above-referenced tables lists the respective contingencies, potential effects, and gives possible response actions.

4.3 CORRECTIVE ACTIONS

4.3.1 Emergency Actions

Many of the event-triggered contingencies, such as natural disasters, vandalism, fire, embankment failure, or an uncontrolled release of leachate, require an emergency response. Such responses are required to be implemented immediately, and may involve resources not available during normal facility operation. These include fire and police, as well as additional equipment and personnel. The following paragraphs describe the general emergency actions which Table 1 summarizes.

4.3.1.1 General

In the event of emergencies at the site during operations or the post-closure maintenance period, Shamrock personnel must be contacted. The Shamrock operator to contact will be:

Mr. John Domke
Division Vice President
SKB Environmental Cloquet Landfill, Inc.
251 Starkey Street
St. Paul, MN 55107

4.3.1.2 Severe Rainfall

As soon as weather permits, the site will be inspected to determine the extent of any damage to the vegetation, berms, cover, surface water controls, or monitoring systems. Examples of mitigating an erosion problem is the placement of temporary erosion controls, such as hay bales, soil fill, or mulch, to minimize further damage. Also, sand bags or riprap could be placed to stabilize facility features or temporary piping could be installed to allow run-off controls to function. Excess sediment may require removal from berms, swales, and outlets.

4.3.1.3 Uncontrolled Leachate Release

Immediately retrieve any free liquid by pumping into the leachate manhole, tanker trucks or steel drums and apply absorbent materials to absorb unpumpable liquid. Immediately contact the MPCA Duty Officer at 651-649-5451. This event is most likely to occur when facility personnel are on-site, pumping leachate from the manhole, or involved in other similar activities. In such case, emergency actions will be implemented immediately. In addition, during post-closure the tanker truck operator will inspect the site when he collects

leachate for disposal or treatment, and will specifically check the leachate collection system for evidence of leaks or spills.

4.3.1.4 Grass Fire

Personnel may attempt to extinguish the fire using water, extinguishers, or soil, but if the fire cannot be quickly extinguished, they will contact the City of Cloquet Fire Department for assistance. Roads should be closed to facilitate emergency vehicle access.

4.3.1.5 Vandalism

For acts of vandalism, appropriate temporary repairs should be performed as soon as possible. These issues will also be addressed by Shamrock personnel.

Within four weeks a written description describing the emergency and corrective action procedures will be submitted to the MPCA.

4.3.2 Follow-up to Emergency Actions

A detailed inspection of the affected areas will be performed as soon as possible. A team consisting of members from site operations, and possibly other technical advisors, will assess the degree and extent of damage to the final cover, surface water controls, leachate management system, monitoring systems, access roads, fencing, etc. Any damage will be described in detailed inspection notes and photographed.

Following the inspection, a brief report will be prepared by the operator's technical staff, describing the effects of damage on the intended purposes of the engineering features of the facility, and subsequent repairs. The inspection report and repair schedule will be submitted to the MPCA.

4.3.3 Events Not Requiring Emergency Actions

Examples of inspection-triggered and monitoring-triggered contingencies that will generally not require an emergency response are small cracks in embankments or the cover, settlement, leachate seeps, minor erosion, reduced performance of the leachate management system, surface drainage problems, or water quality violations. However, these contingencies may require interim response actions, continued or enhanced monitoring, assessment of the extent of the problem, and/or evaluation of the design prior to implementation of repairs or remedial actions. Actions for inspection- and monitoring-triggered contingencies are summarized in Tables 2 and 3, respectively. In addition, water quality concerns are discussed in the following section.

Water Quality

Actions to be followed include:

- If a water quality action level (defined by the Minnesota Rules) is exceeded, the MPCA will be notified in writing.
- All sampling and analytical procedures will be reviewed to verify that proper techniques were used.
- Potential implications of the elevated parameters will be determined by examining regional and historical data, background data and seasonal trends, as well as determining if the occurrence is localized.
- Resampling will be performed, if necessary, to verify results.
- If initial results are verified, the potential impact to human health or the environment will be evaluated.
- The determination will be made if immediate action is required or if continued monitoring is sufficient.
- Possible sources will be investigated.

During the time period covered by the above actions, routine water monitoring will continue.

Once the evaluation is completed, and if it is concluded that a problem exists, the extent of the problem must be determined. This may be done by continued monitoring of existing locations or by installing additional monitoring points. The information gathered during this period of investigation will be submitted to the MPCA. These results will be used for a feasibility study to determine any required remedial actions. Remedial actions could consist of:

1) Continued monitoring of groundwater and, if necessary, expansion of the monitoring system;
2) Repairing the identified features causing the problem (for example the cover or leachate management system); or
3) Installation of a groundwater remediation system.

4.4 ACTION LEVELS

Water quality action levels will be established by comparison to the MDH HRLs and MPCA's Intervention Limits (IL), as well as site-specific water quality pertaining to background levels. These action levels are updated periodically by the MPCA and may change throughout the operating life of the facility and the post-closure period. Any changes will be noted in the annual monitoring report.

4.5 AMENDMENT OF CONTINGENCY ACTION PLAN

A modified Contingency Action Plan will be prepared and submitted to the MPCA when the facility permit is amended; the design, construction, operation, or maintenance of the facility is significantly changed; or when release or failure of design features indicate revised procedures are necessary.

5.0 Financial Assurance Requirements

In accordance with Minnesota Pollution Control Agency (MPCA) Permit SW-399 for Shamrock Landfill, Inc., Shamrock is required to provide financial assurance for this facility. Cost estimates for site closure, post-closure care and contingency actions at this facility in Cloquet, Minnesota are attached. As reported in the 2014 Annual Report for this facility, the dedicated long-term care trust fund had an account balance on December 31, 2014 of $292,441.74. The 2014 payment rate into the trust fund was $0.60 per cubic yard.

Table 4 reflects current construction costs for five acres of closure at the facility. Table 5 provides a summary of annual post-closure care costs reflecting 2015 costs.

Table 6 presents the contingency action costs. Costs are based on the expected value of the worst-case series of events. This calculation was performed using a contingency costs total and an expected worst case scenario based on 60% of the total contingency action item costs.

For the purposes of this Permit Renewal Application, the following are the costs as reflected in Tables 4-6.

Closure Costs for five acres of closure (Alternative Closure Option) ($247,400)	$360,000
Annual Post-Closure Costs	$46,100
Contingency Action Costs	$161,580

Appendix B

Run-on/Run-off Calculations

SURFACE WATER MANAGEMENT

Stormwater generated by the landfill will be controlled on-site. Runoff will be controlled and routed by drainage swales, downslope structures, and four infiltration basins as shown on the attached Figure. Drainage routing features have all been sized to minimize erosion from the site and control the 25 yr, 24 hour design storm event of 4.73 inches.

Stormwater generated from the final cover will infiltrate in the designed basins. There will be no off-site runoff routed to the site. The infiltration basins are located around the perimeter of the landfill. They are designed to infiltrate the 25 yr storm event of 4.73 inches in 48 hours.

HydroCADD stormwater modeling, using the SCS curve number method, was performed to calculate hydrographs for the final landfill configuration. To determine surface water run-off for this analysis, the landfill was divided into subwatersheds depending on the contributing drainage areas. Peak flows from the subwatersheds were calculated for the design storm event. A run-off curve number of 76 was used for the landfill top and sideslopes. A conservative time of concentration value of 6 minutes was entered into the model as direct entry for each subwatershed. HydroCADD model results (Attachment 1), a map showing the runoff subwatersheds (Figure 1), and infiltratration basin calculations are provided in this memorandum.

The run-off data was used for sizing the various components of the surface water management system discussed below.

Drainage Swales

Drainage swales are placed periodically to minimize erosion and direct the runoff to the appropriate downslope structure. The drainage swales were designed to handle the flow for each contributing subarea and are spaced at calculated intervals around the perimeter of the landfill. The attached subwatershed map shows the location of each drainage swale. Drainage swales are adjusted to handle flow rates and side slopes for the landfill. The range of characteristics is shown below:

- Bed Slope: 1% to 2% depending on location
- Inside Sideslope: 4H:1V
- Outside Sideslope: 2H:1V
- Mannings n: 0.025
- Design Depth 2.0 ft
- Flow Rate Q: Varies from 2.1 cfs to 39.8 cfs

Flow Rate	Q (Cfs)	Flow Depth (feet)	Velocity (ft/sec)	Erosion Control Measures
Low	2.1	0.39	4.5	Vegetated Erosion Control Mat
High	39.8	1.40	5.2	Vegetated Erosion Control Mat

The peak flow depth will not exceed the depth of the swale, and where velocities will exceed 5 feet/second, the swales will be protected with erosion control mat capable of withstanding the higher velocities; therefore, the drainage terraces design is acceptable. Design parameters for the erosion control protection will be determined at the time of construction.

Downslope Structures

There are three downslope structures at strategic locations on the final cover. The downslope structures were designed to handle each subwatershed's flow from the contributing drainage swales.

Each segment of each downslope structure is designed to handle the peak flow for the respective subwatershed. The plan sheets show the location of each downslope structure. and swale. Calculations provided below and in the model output show the range of velocity and computed water depth for flows during the 25 year, 24 hour event for the following parameters:

- Bed Slope: 25%
- Bottom Width: 6 or 8 feet depending on location (exact width will be determined during construction event for each structure)
- Sideslope: 3H:1V
- Mannings n: 0.04
- Flow Rate Q: Varies from 15 cfs to 67 cfs
- Velocity: Varies from 6.9 to 11.5 ft/sec

Flow Rate	Q (Cfs)	Depth (feet)	Sheer Stress (lb/ft^2)	Velocity (ft/sec)
Low	15	0.25	3.9	6.94
High	67	0.59	9.2	11.53

The downslope structures will either be gabion-lined, rip-rapped, or reinforced with cable concrete capable of the design conditions for velocity and shear stress. The exact construction materials will be determined during construction event for each structure. Energy will be dissipated with a line of gabions perpendicular to flow or pre-cast concrete energy dissipater at the toe of the slope. Flow will be forced to flow over the gabions and dissipate on gabion splash pads. Road crossings will be constructed of cable concrete to enable access across the flow path during routine landfill operations.

Infiltration Basins

The proposed Landfill design utilizes four infiltration basins; larger basins on the north and west sides of the site take most of the runoff from the facility and smaller basins on the northeast and south sides of the landfill manage the remaining runoff.

The infiltration basins are designed in accordance with Appendix C of the Multi-Sector General Permit for Stormwater Activity requirements and will infiltrate the 25 yr, 24 hr storm event of 4.73 inches in 48 hours. The infiltration basins are also designed to the following parameters:

<u>Assumption/Design Parameters</u>

- Infiltration basins should provide an infiltration storage volume that will infiltrate the entire volume of run-off, up to and including, the 2-year, 24-hour storm event, within 48 hours. **For the purposes of this permit application, a 25-year, 24-hour storm event of 4.73 inches was used.**
- Infiltration pond shall be designed and operated to infiltrate at a long term expected rate of 0.2 to 1.63 inches per hour. Based on soil boring data, the ponds will be constructed in a sandy soil type area. Assuming a 30 mm per hour infiltration rate, or 1.2 inches/hour, 4.8 feet may be infiltrated in a 48 hour period (1.2 inches/hr x 1 ft/12 inch = 0.099 ft/hr x 48 hours = 4.8 feet).

- The volume of run-off directed to each infiltration basin was determined from the HydroCADD model output.
- The Minnesota Stormwater Manual Design Criteria for Infiltration Basins was used as the guidance for sizing of the basins. Based on this criteria, the surface area of an infiltration practice is given by the equation $A_s = V_w/D_o$ where:
    - V_w = the water treatment volume of the area contributing runoff to the practice *(taken from the Hydrocadd Model)*
    - D_o = the storage depth of ponded water in the practice *(minimum 4.8 feet based on the assumed infiltration rate of 1.2 inches/hour)*
    - $A_s = (A_o + A_m)/2$ where A_o is the surface area at the overflow and A_m is the surface area at the top of the infiltration media (the bottom of the basin)

North Basin – sized at approximately 32,825 SF of total infiltration surface area (A_s)

V_w = 2.866 ac-ft
A_s = 32,825 SF
D_o = (2.866*43,560/32,825) = 3.8 ft <4.8 ft OK

Northeast Basin - sized at approximately 5,766 SF of total infiltration surface area

V_w = 0.639 ac-ft
A_s = 5,766 SF
D_o = (0.639*43,560/5,766) = 4.8 ft = 4.8 ft OK

South Basin - sized at approximately 8,617 SF of total infiltration surface area

V_w = 0.866 ac-ft
A_s = 8,617 SF
D_o = (0.866*43,560/8,617) = 4.4 ft <4.8 ft OK

West Basin - sized at approximately 38,061 SF of total infiltration surface area

V_w = 4.124 ac-ft
A_s = 38,061 SF
D_o = (4.124*43,560/38,061) = 4.7 ft <4.8 ft OK

Active Area Runoff

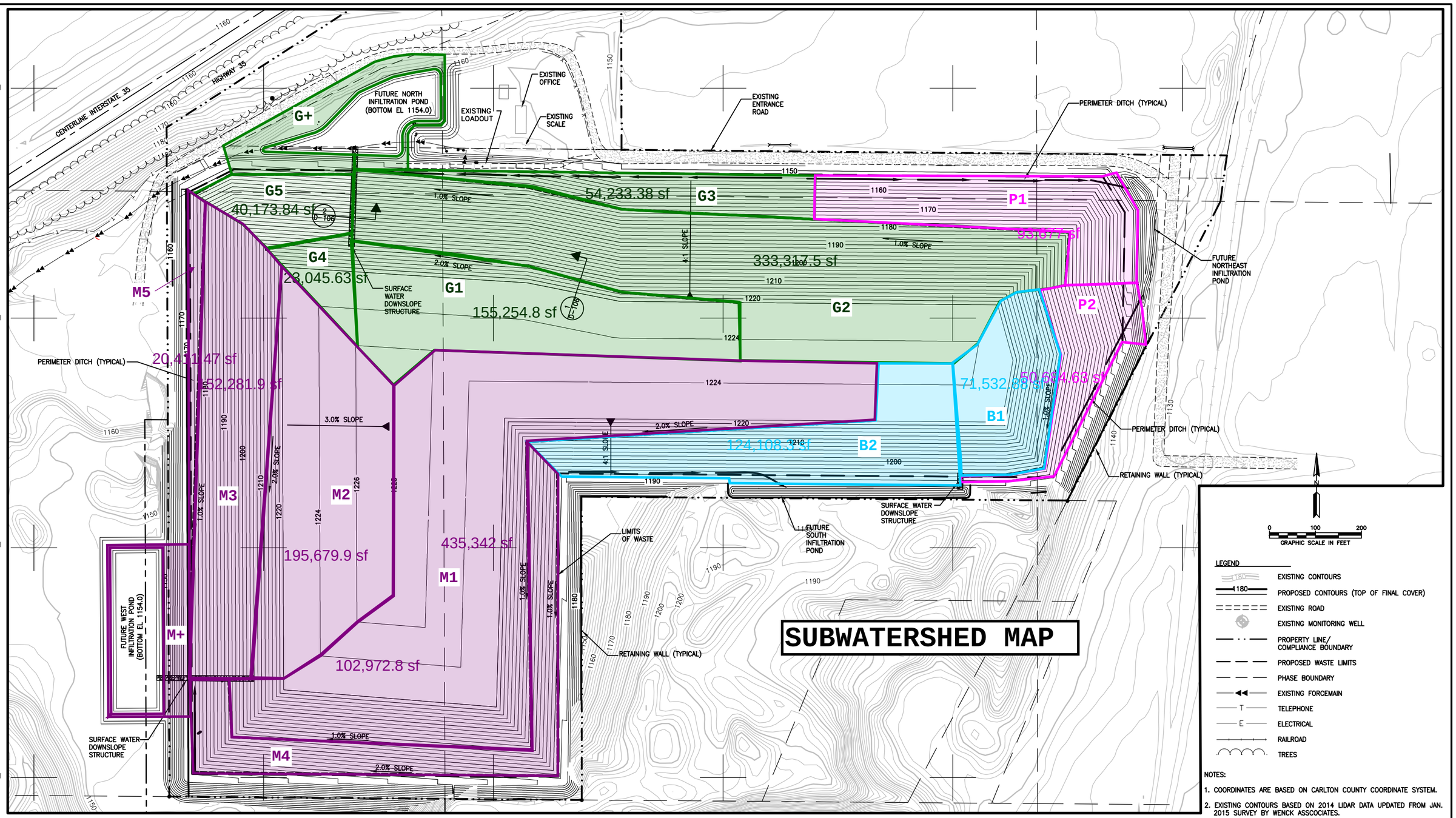
Figure 2 shows the infiltration/detention area for the current active area. This is based on a runoff curve number of 80, which produces 2.65 inches of runoff from the 4.73" 25 year 24 hour storm. Based on the size of the active area, a 2' deep depression that is approximately 1.5 acres in size will be required to completely contain the runoff from a 25 year 24 hour storm. This internal storage could also be achieved by the creation of small soil berms that create the same 3 acre-feet of storage.

Run-On Control

The perimeter berms are 6-8 feet height above existing grade, therefore adequate run-on control exists. The site has been operational since XXXX and there has never been a run-on event, providing evidence that the berm height is sufficient to prevent run-on.

Figures

Plot Date & Time: 16 June 2015 12:00 PM



NOTES:

1. COORDINATES ARE BASED ON CARLTON COUNTY COORDINATE SYSTEM.
2. EXISTING CONTOURS BASED ON 2014 LIDAR DATA UPDATED FROM JAN. 2015 SURVEY BY WENCK ASSCOCIATES.

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
B	ISSUED TO MPCA	JVB	TJS	06/18/15
A	ISSUED FOR CLIENT REVIEW	JVB	TJS	06/04/15

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME THOMAS J. SHUSTARICH

SIGNATURE

DATE 06/18/2015 LICENSE # 21210

SUB CONSULTANT

PRIME CONSULTANT

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

PROJECT TITLE
PERMIT RENEWAL APPLICATION
SHAMROCK INDUSTRIAL LANDFILL

SHAMROCK ENVIRONMENTAL LANDFILL

SHEET TITLE
SURFACE WATER MANAGEMENT PLAN

DWN BY	CHK'D	APP'D	DWG DATE
JVB	SH	TJS	FEB. 2015

SCALE AS NOTED

PROJECT NO.	SHEET NO.	REV NO.
1101-0016	C-106	A

M:\1101\0016 Repermit 2015\Cad\civ permit\C-106 surface water.dwg

Plot Date & Time: 27 August 2015 10:00 AM

202,500 N
202,000 N
201,500 N
201,000 N
200,500 N

560,000 E
560,500 E
561,000 E
561,500 E
562,000 E
562,500 E
563,000 E

CENTERLINE INTERSTATE 35
INTERSTATE 35 RIGHT-OF-WAY
OFFICE
SCALE
P-1
PROPERTY LINE
SECTION LINE
CULVERT (TYP.)
EXISTING ACCESS ROAD
LOADOUT PAD
EXISTING FORCEMAIN
EXISTING TELEPHONE LINE
13.4 Acre Active Area
EXISTING WASTE DISPOSAL AREA
PHASE 1
PROPOSED WASTE LIMITS
CONTRACTOR ACCESS ROUTE TO CONSTRUCTION AREA
PHASE 3
PHASE 4
PHASE 5
PHASE 6
PHASE 9
EXISTING IN-PLACE WASTE AREA
P-2
P-3
P-4
P-6
P-7
SITE ENTRANCE
18" METAL
CONSTRUCTION AR
FOR PHASES 3 &

Runoff Curve # for Ash = 80
Runoff from 25 year 24 hour storm = 2.68"

Volume of runoff from active area from 25 year 24 hour storm = 3 acre feet.

1.5 acre x 2' deep depression for detention of runoff from active area

N

0 150 300
GRAPHIC SCALE IN FEET

LEGEND
- EXISTING CONTOURS
- EXISTING ROAD
- EXISTING MONITORING WELL
- PROPERTY LINE/ COMPLIANCE BOUNDARY
- PROPOSED WASTE LIMITS
- PHASE BOUNDARY
- EXISTING FORCEMAIN
- TELEPHONE
- ELECTRICAL
- RAILROAD
- TREES
- CONSTRUCTION AREA

NOTEs:
1. COORDINATES ARE BASED ON CARLTON COUNTY COORDINATE SYSTEM.
2. EXISTING CONTOURS BASED ON 2014 LIDAR DATA UPDATED FROM JAN. 2015 SURVEY BY WENCK ASSCOCIATES.

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
C	ISSUED FOR CONSTRUCTION RECORD DRAWINGS	JVB	TJS	08/28/15
B	MODIFACATION FOR GCL	DNO	TJS	04/20/15
A	ISSUED FOR APPROVAL	DNO	TJS	03/13/15

SEAL
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
PRINT NAME THOMAS J. SHUSTARICH
SIGNATURE
DATE 08/28/2015 LICENSE # 21210

SUB CONSULTANT

PRIME CONSULTANT
WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

PROJECT TITLE
CONSTRUCTION RECORD DRAWINGS FOR PHASES 3 AND 4

SHAMROCK ENVIRONMENAL LANFILL

SHEET TITLE
EXISTING CONDITIONS

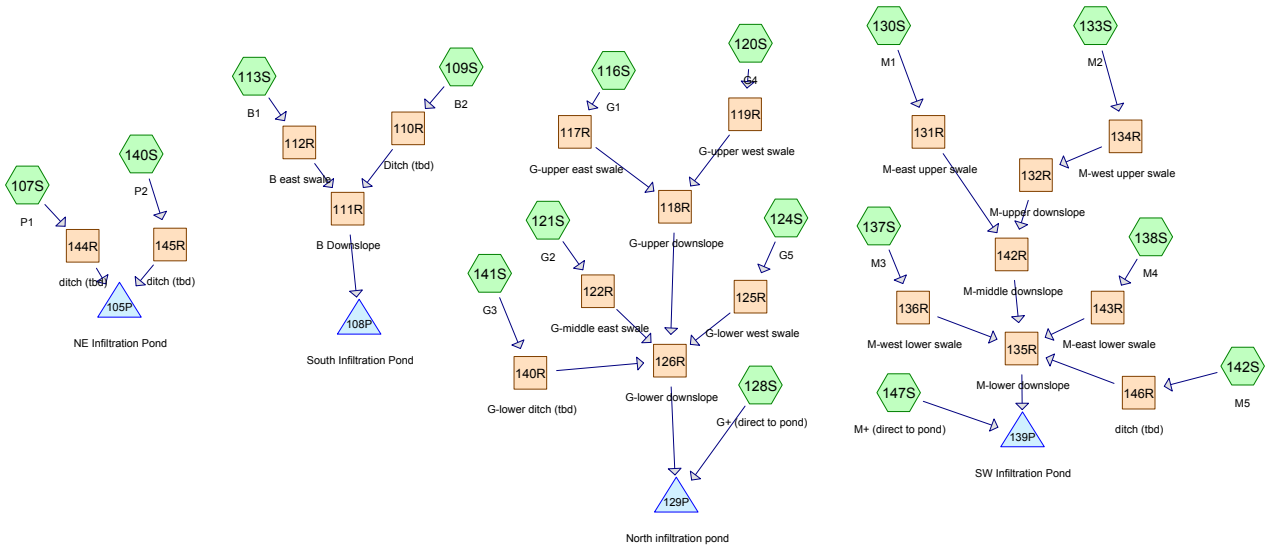
DWN BY	CHK'D	APP'D	DWG DATE	FEB. 2015
JVB	SH	TJS	SCALE	AS NOTED

PROJECT NO.	SHEET NO.	REV NO.
1101-0015	C-101	C

M:\1101\0015\cad\Record Drawings\civil\C-101 Existing Condition.dwg

Attachment A

Hydrocadd Model



Subcat Reach Pond Link

Routing Diagram for sw model 2015_REV

Prepared by {enter your company name here}, Printed 6/16/2015

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
44.040	76	(107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S)
44.040	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
44.040	Other	107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S
44.040		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	44.040	44.040		107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S
0.000	**0.000**	**0.000**	**0.000**	**44.040**	**44.040**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment107S: P1 Runoff Area=2.150 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=8.57 cfs 0.415 af

Subcatchment109S: B2 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=11.36 cfs 0.550 af

Subcatchment113S: B1 Runoff Area=1.640 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=6.54 cfs 0.316 af

Subcatchment116S: G1 Runoff Area=3.560 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=14.20 cfs 0.687 af

Subcatchment120S: G4 Runoff Area=0.530 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=2.11 cfs 0.102 af

Subcatchment121S: G2 Runoff Area=7.650 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=30.51 cfs 1.476 af

Subcatchment124S: G5 Runoff Area=0.920 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=3.67 cfs 0.177 af

Subcatchment128S: G+ (direct to pond) Runoff Area=0.950 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=3.79 cfs 0.183 af

Subcatchment130S: M1 Runoff Area=9.990 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=39.84 cfs 1.927 af

Subcatchment133S: M2 Runoff Area=4.490 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=17.90 cfs 0.866 af

Subcatchment137S: M3 Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=13.96 cfs 0.675 af

Subcatchment138S: M4 Runoff Area=2.360 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=9.41 cfs 0.455 af

Subcatchment140S: P2 Runoff Area=1.160 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=4.63 cfs 0.224 af

Subcatchment141S: G3 Runoff Area=1.250 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=4.98 cfs 0.241 af

Subcatchment142S: M5 Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=1.87 cfs 0.091 af

Subcatchment147S: M+ (direct to pond) Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=2.27 cfs 0.110 af

Reach 110R: Ditch (tbd) Inflow=11.36 cfs 0.550 af
Outflow=11.36 cfs 0.550 af

Reach 111R: B Downslope Avg. Flow Depth=0.32' Max Vel=7.80 fps Inflow=17.26 cfs 0.866 af
n=0.040 L=20.0' S=0.2500 '/' Capacity=527.44 cfs Outflow=17.25 cfs 0.867 af

Reach 112R: B east swale Avg. Flow Depth=0.80' Max Vel=3.15 fps Inflow=6.54 cfs 0.316 af
n=0.025 L=580.0' S=0.0103 '/' Capacity=69.79 cfs Outflow=6.04 cfs 0.316 af

Reach 117R: G-upper east swale Avg. Flow Depth=0.96' Max Vel=4.80 fps Inflow=14.20 cfs 0.687 af
n=0.025 L=850.0' S=0.0188 '/' Capacity=94.14 cfs Outflow=13.17 cfs 0.687 af

Reach 118R: G-upper downslope Avg. Flow Depth=0.25' Max Vel=6.94 fps Inflow=15.19 cfs 0.789 af
n=0.040 L=137.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=15.16 cfs 0.789 af

Reach 119R: G-upper west swale Avg. Flow Depth=0.39' Max Vel=4.51 fps Inflow=2.11 cfs 0.102 af
n=0.025 L=180.0' S=0.0556 '/' Capacity=161.73 cfs Outflow=2.08 cfs 0.102 af

Reach 122R: G-middle east swale Avg. Flow Depth=1.34' Max Vel=4.54 fps Inflow=30.51 cfs 1.476 af
n=0.025 L=1,650.0' S=0.0109 '/' Capacity=71.67 cfs Outflow=24.53 cfs 1.476 af

Reach 125R: G-lower west swale Avg. Flow Depth=0.63' Max Vel=3.04 fps Inflow=3.67 cfs 0.177 af
n=0.025 L=300.0' S=0.0133 '/' Capacity=79.23 cfs Outflow=3.59 cfs 0.177 af

Reach 126R: G-lower downslope Avg. Flow Depth=0.49' Max Vel=10.32 fps Inflow=47.55 cfs 2.683 af
n=0.040 L=60.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=47.53 cfs 2.683 af

Reach 131R: M-east upper swale Avg. Flow Depth=1.40' Max Vel=5.24 fps Inflow=39.84 cfs 1.927 af
n=0.025 L=2,200.0' S=0.0136 '/' Capacity=80.13 cfs Outflow=30.75 cfs 1.927 af

Reach 132R: M-upper downslope Avg. Flow Depth=0.26' Max Vel=7.17 fps Inflow=16.64 cfs 0.866 af
n=0.040 L=50.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=16.63 cfs 0.866 af

Reach 134R: M-west upper swale Avg. Flow Depth=1.04' Max Vel=5.15 fps Inflow=17.90 cfs 0.866 af
n=0.025 L=900.0' S=0.0194 '/' Capacity=95.68 cfs Outflow=16.64 cfs 0.866 af

Reach 135R: M-lower downslope Avg. Flow Depth=0.59' Max Vel=11.53 fps Inflow=67.47 cfs 4.014 af
n=0.040 L=54.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=67.44 cfs 4.014 af

Reach 136R: M-west lower swale Avg. Flow Depth=1.04' Max Vel=3.64 fps Inflow=13.96 cfs 0.675 af
n=0.025 L=1,030.0' S=0.0097 '/' Capacity=67.61 cfs Outflow=11.95 cfs 0.675 af

Reach 140R: G-lower ditch (tbd) Inflow=4.98 cfs 0.241 af
Outflow=4.98 cfs 0.241 af

Reach 142R: M-middle downslope Avg. Flow Depth=0.48' Max Vel=10.22 fps Inflow=46.99 cfs 2.793 af
n=0.040 L=88.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=46.96 cfs 2.793 af

Reach 143R: M-east lower swale Avg. Flow Depth=0.89' Max Vel=3.56 fps Inflow=9.41 cfs 0.455 af
n=0.025 L=1,650.0' S=0.0121 '/' Capacity=61.14 cfs Outflow=7.04 cfs 0.455 af

Reach 144R: ditch (tbd) Inflow=8.57 cfs 0.415 af
Outflow=8.57 cfs 0.415 af

Reach 145R: ditch (tbd) Inflow=4.63 cfs 0.224 af
Outflow=4.63 cfs 0.224 af

Reach 146R: ditch (tbd) Inflow=1.87 cfs 0.091 af
Outflow=1.87 cfs 0.091 af

Pond 105P: NE Infiltration Pond Inflow=13.20 cfs 0.639 af
Primary=13.20 cfs 0.639 af

Pond 108P: South Infiltration Pond Peak Elev=1,188.20' Storage=0.597 af Inflow=17.25 cfs 0.867 af
Outflow=0.29 cfs 0.732 af

Pond 129P: North infiltration pond Peak Elev=1,157.02' Storage=1.957 af Inflow=51.05 cfs 2.867 af
Outflow=0.90 cfs 2.559 af

Pond 139P: SW Infiltration Pond Peak Elev=1,157.70' Storage=2.945 af Inflow=69.39 cfs 4.124 af
Outflow=1.10 cfs 3.191 af

Total Runoff Area = 44.040 ac Runoff Volume = 8.495 af Average Runoff Depth = 2.31"
100.00% Pervious = 44.040 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 107S: P1

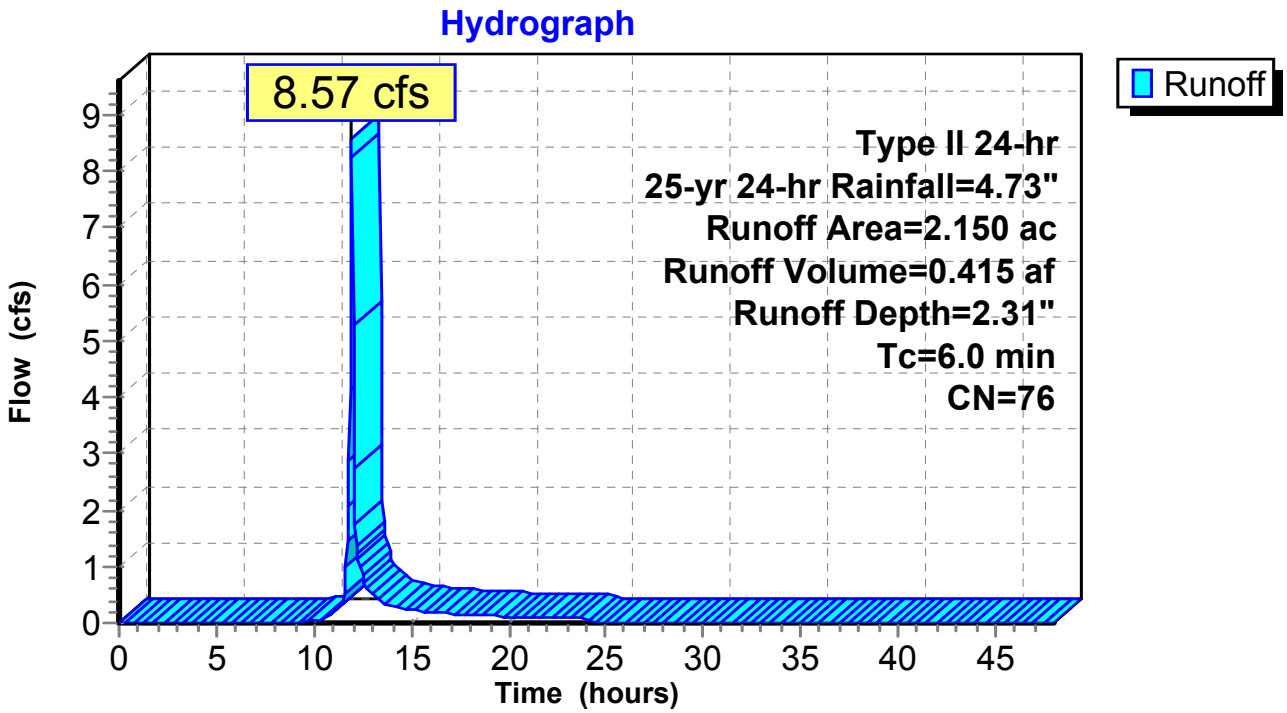
Runoff = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.150	76	
	2.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 107S: P1



Summary for Subcatchment 109S: B2

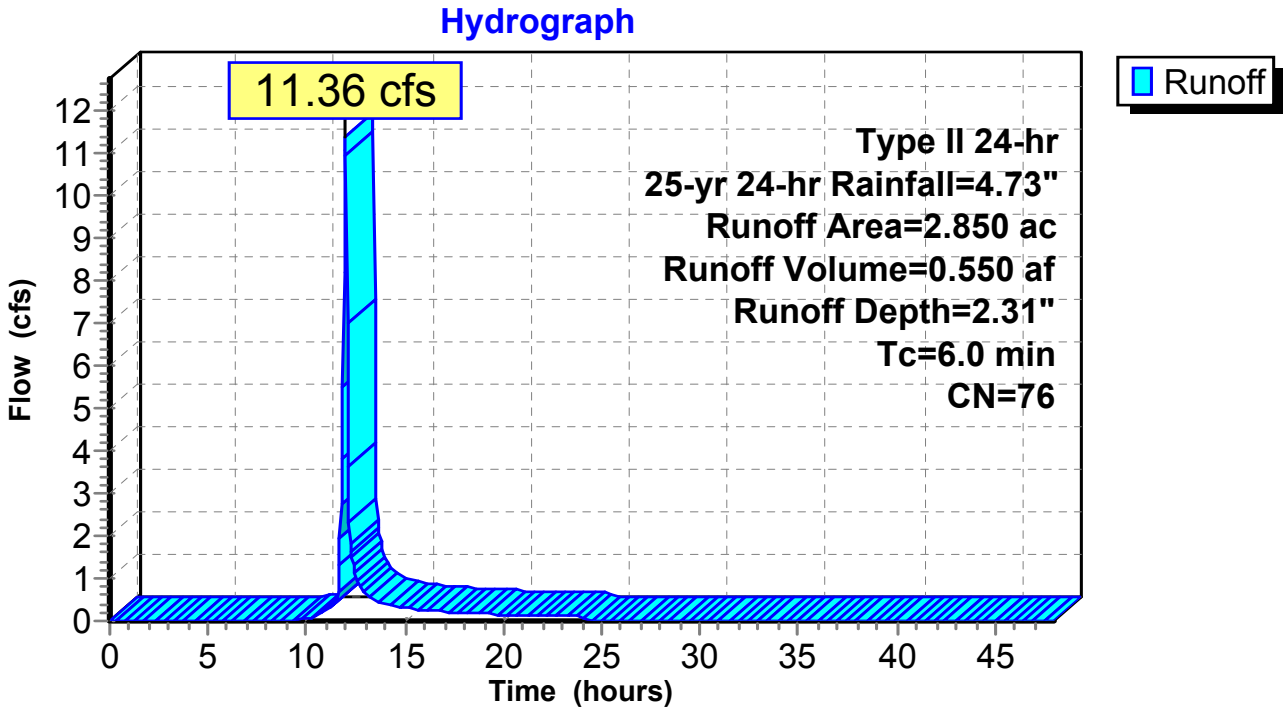
Runoff = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.850	76	
	2.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 109S: B2



Summary for Subcatchment 113S: B1

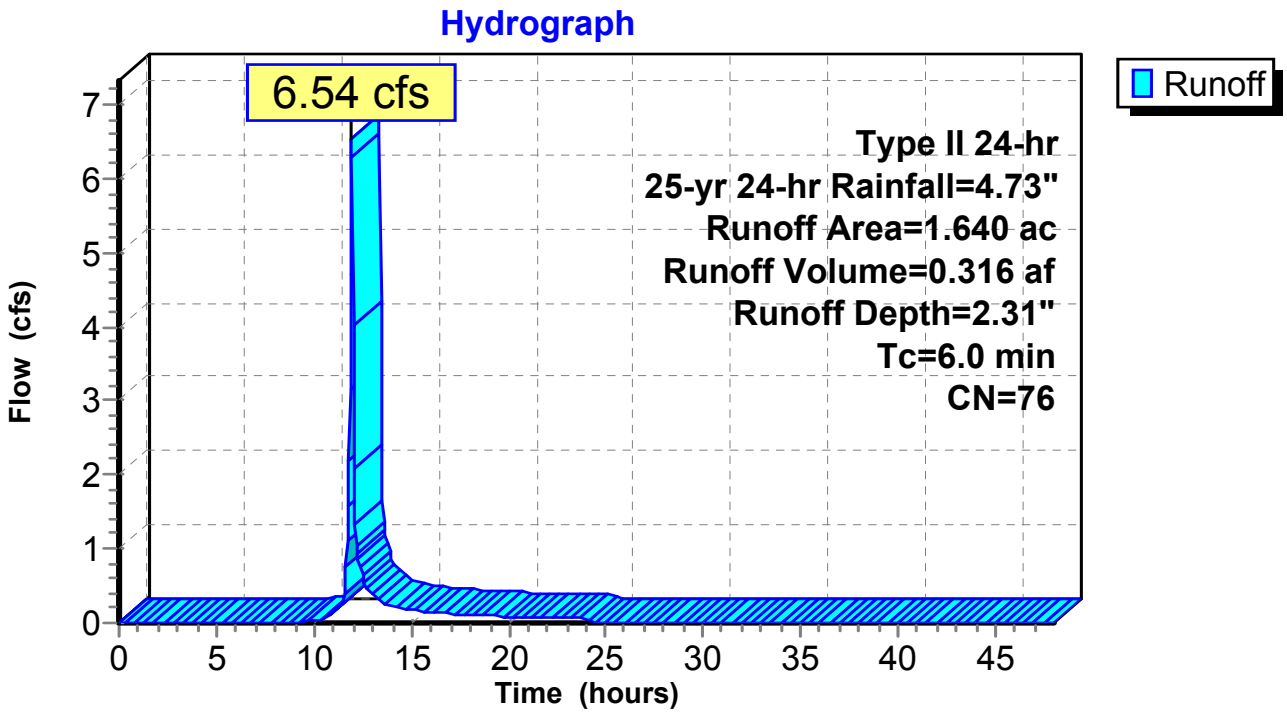
Runoff = 6.54 cfs @ 11.97 hrs, Volume= 0.316 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.640	76	
	1.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 113S: B1



Summary for Subcatchment 116S: G1

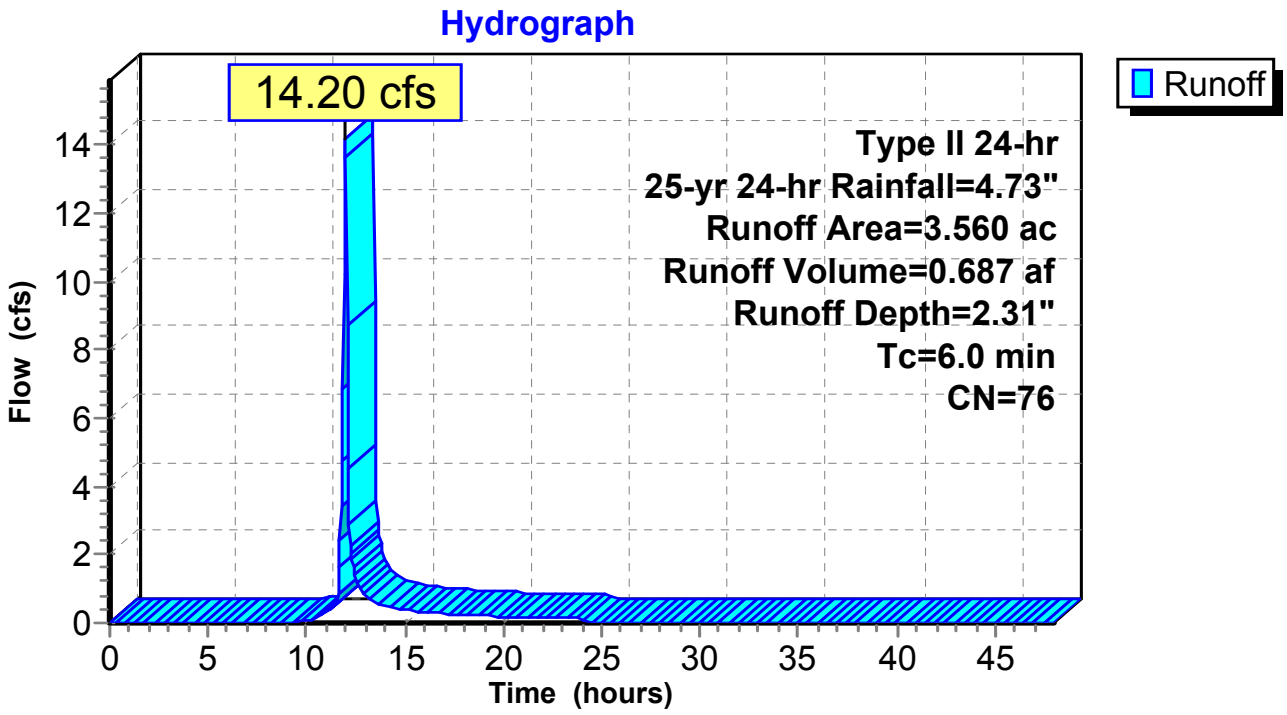
Runoff = 14.20 cfs @ 11.97 hrs, Volume= 0.687 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	3.560	76	
	3.560		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 116S: G1



Summary for Subcatchment 120S: G4

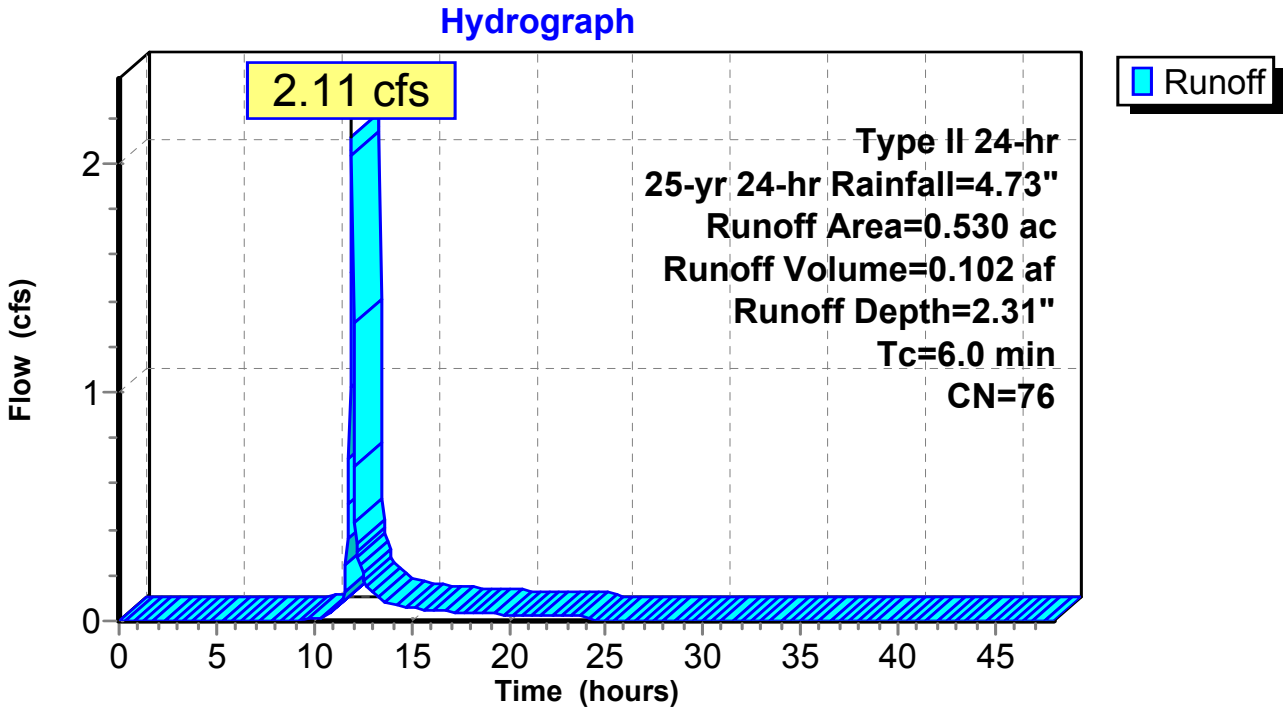
Runoff = 2.11 cfs @ 11.97 hrs, Volume= 0.102 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.530	76	
	0.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 120S: G4



Summary for Subcatchment 121S: G2

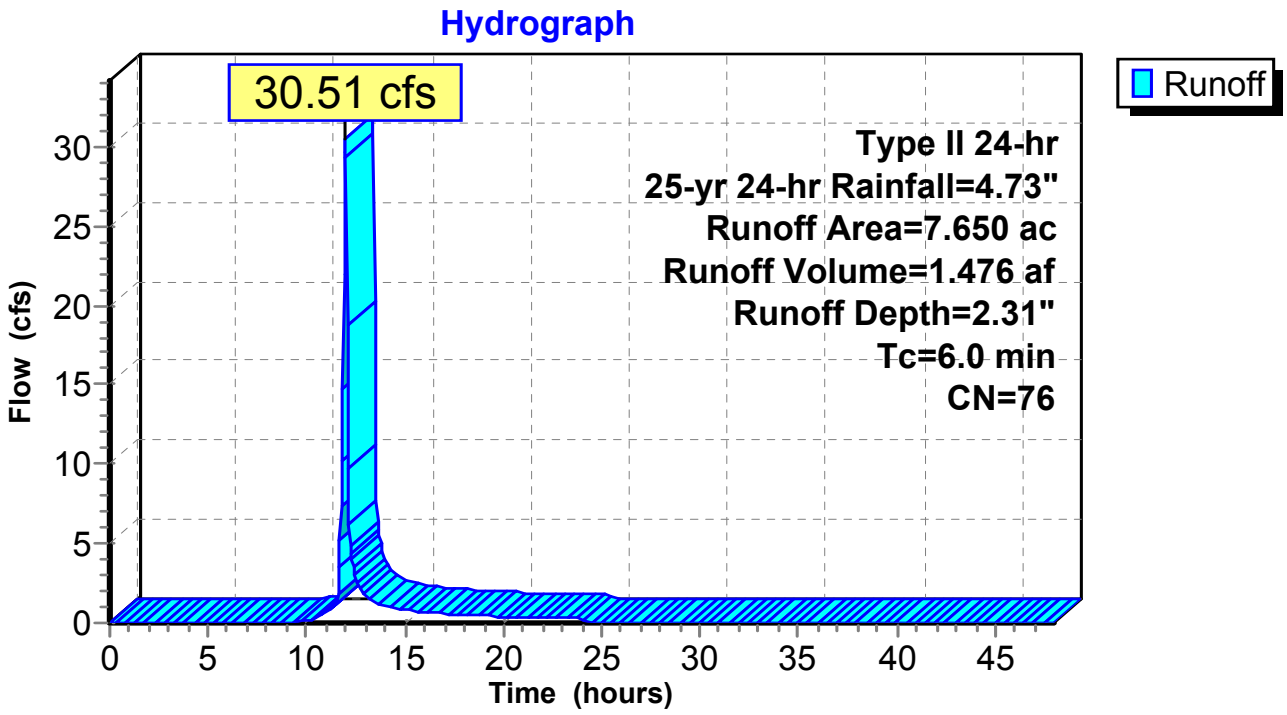
Runoff = 30.51 cfs @ 11.97 hrs, Volume= 1.476 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	7.650	76	
	7.650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 121S: G2



Summary for Subcatchment 124S: G5

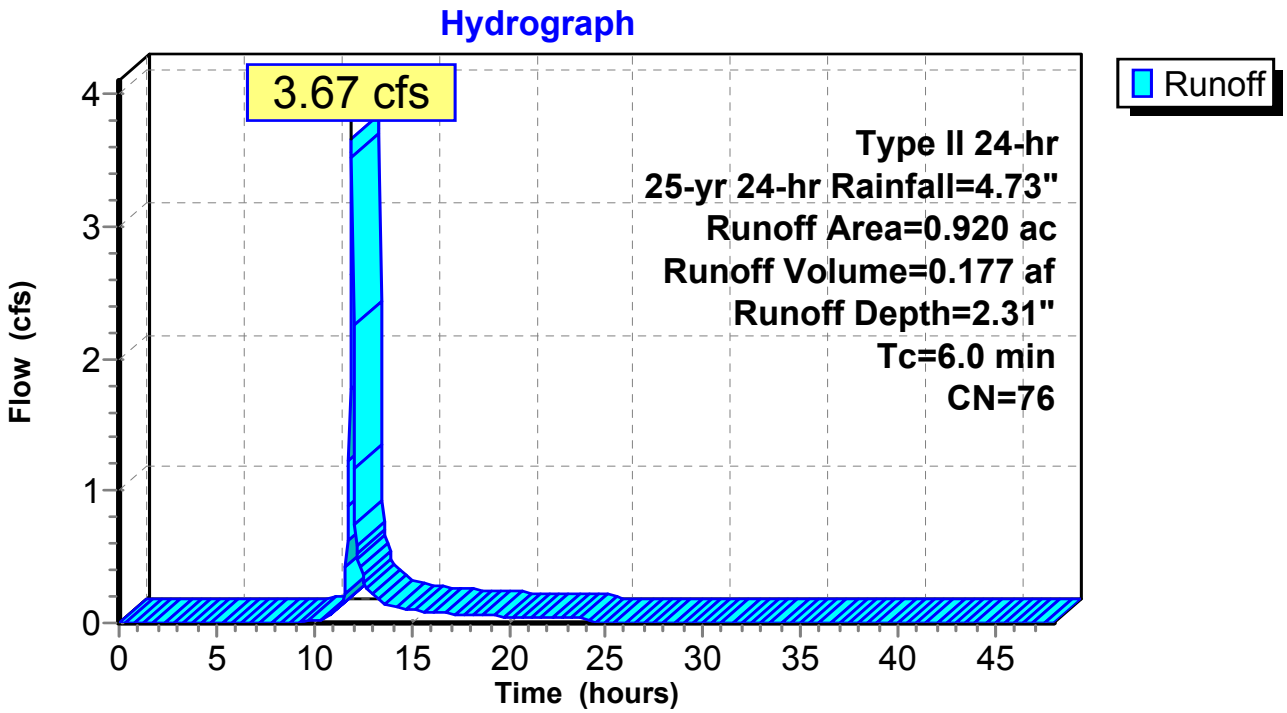
Runoff = 3.67 cfs @ 11.97 hrs, Volume= 0.177 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.920	76	
	0.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 124S: G5



Summary for Subcatchment 128S: G+ (direct to pond)

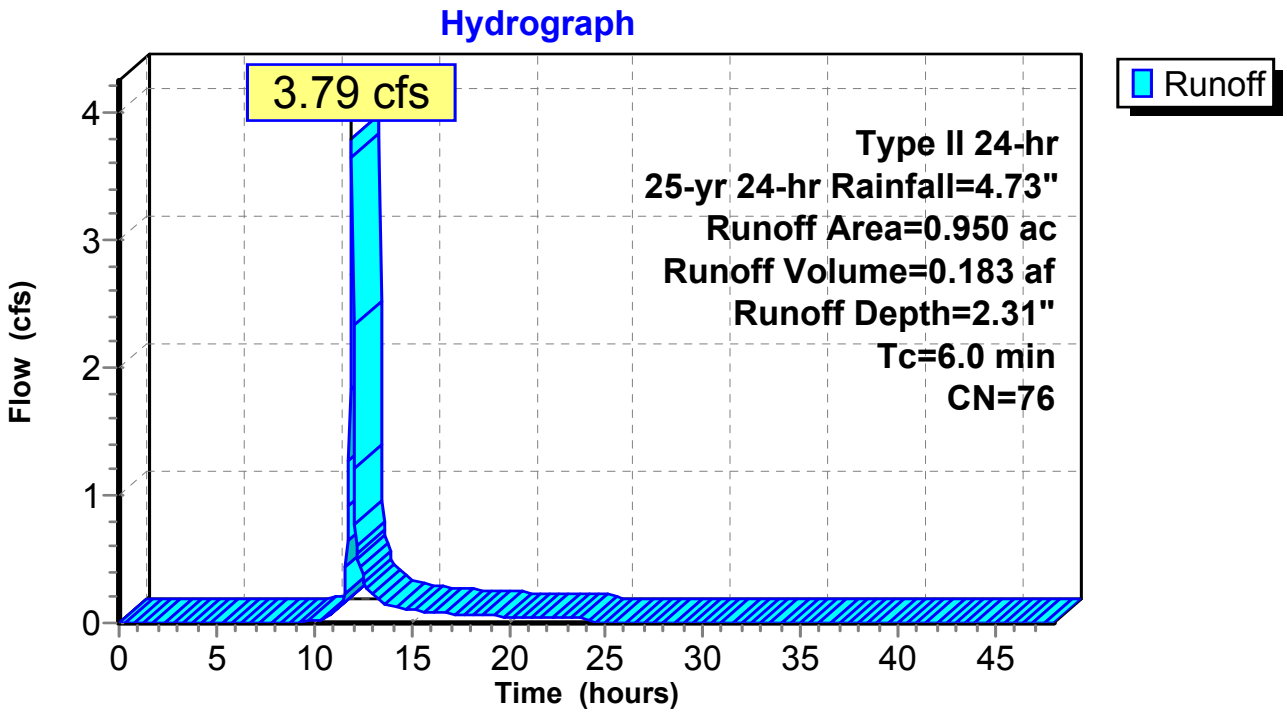
Runoff = 3.79 cfs @ 11.97 hrs, Volume= 0.183 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.950	76	
	0.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 128S: G+ (direct to pond)



Summary for Subcatchment 130S: M1

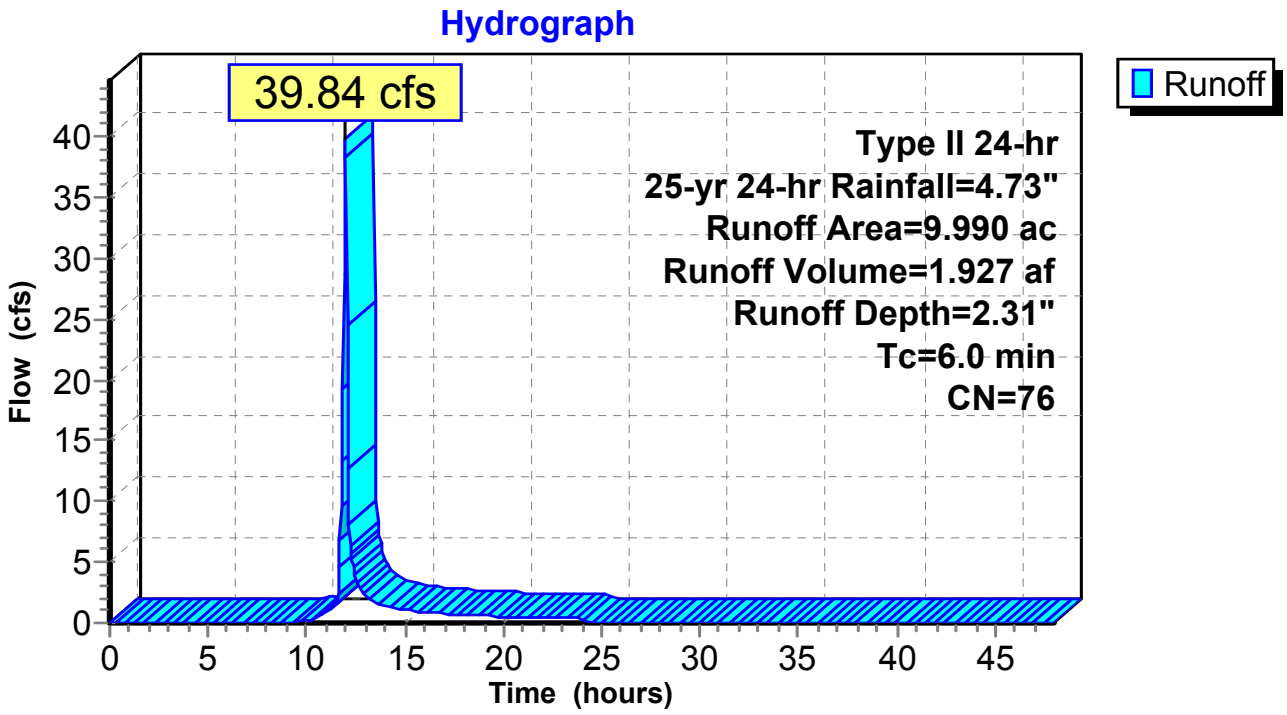
Runoff = 39.84 cfs @ 11.97 hrs, Volume= 1.927 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	9.990	76	
	9.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 130S: M1



Summary for Subcatchment 133S: M2

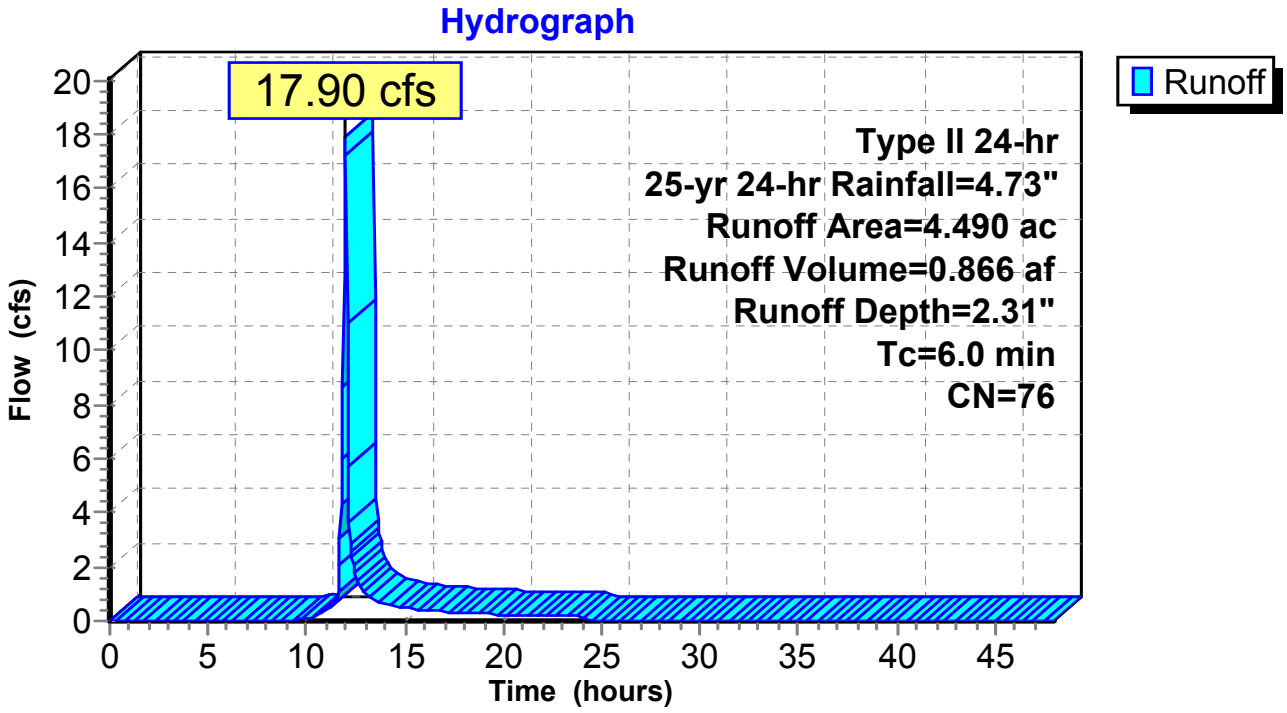
Runoff = 17.90 cfs @ 11.97 hrs, Volume= 0.866 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	4.490	76	
	4.490		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 133S: M2



Summary for Subcatchment 137S: M3

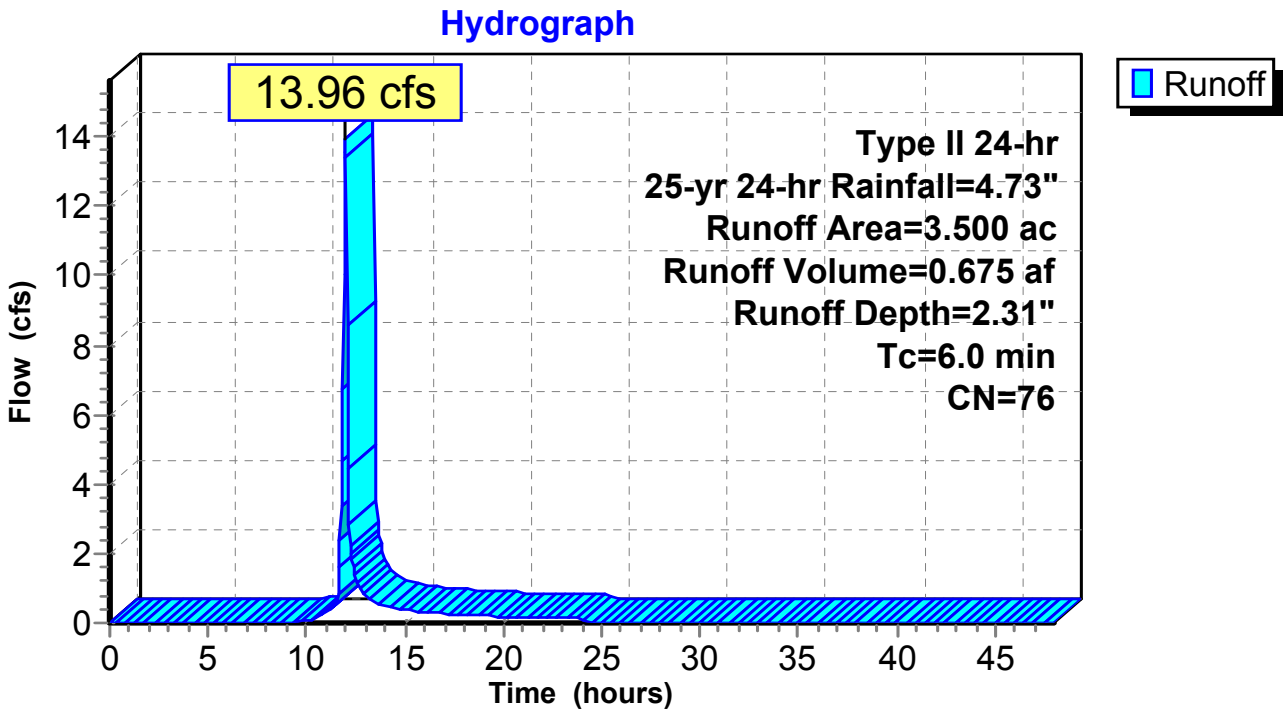
Runoff = 13.96 cfs @ 11.97 hrs, Volume= 0.675 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	3.500	76	
	3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 137S: M3



Summary for Subcatchment 138S: M4

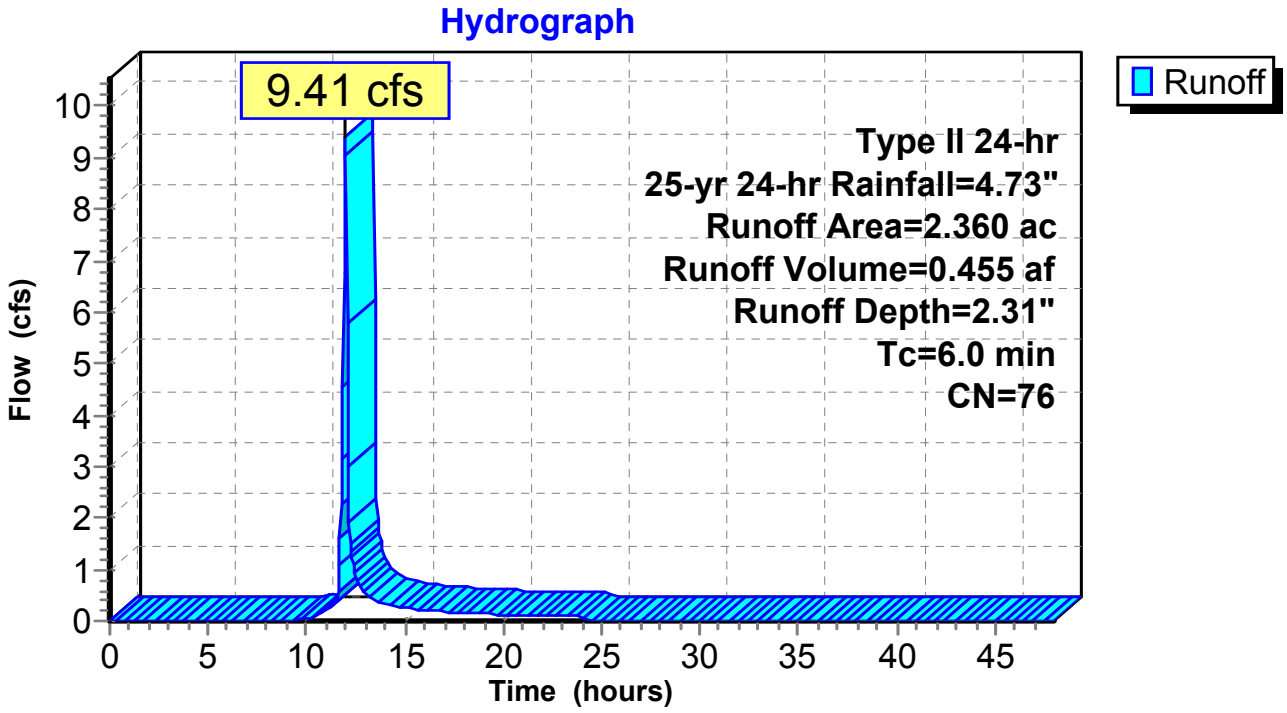
Runoff = 9.41 cfs @ 11.97 hrs, Volume= 0.455 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.360	76	
	2.360		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 138S: M4



Summary for Subcatchment 140S: P2

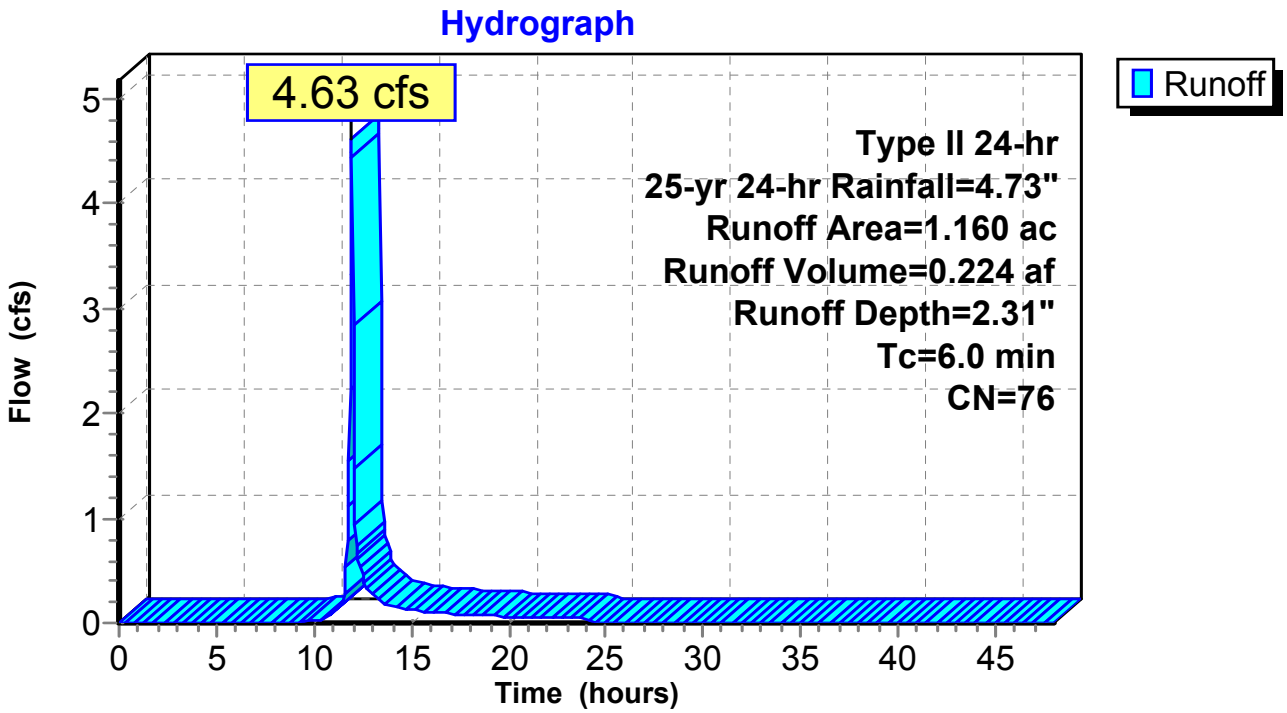
Runoff = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.160	76	
	1.160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 140S: P2



Summary for Subcatchment 141S: G3

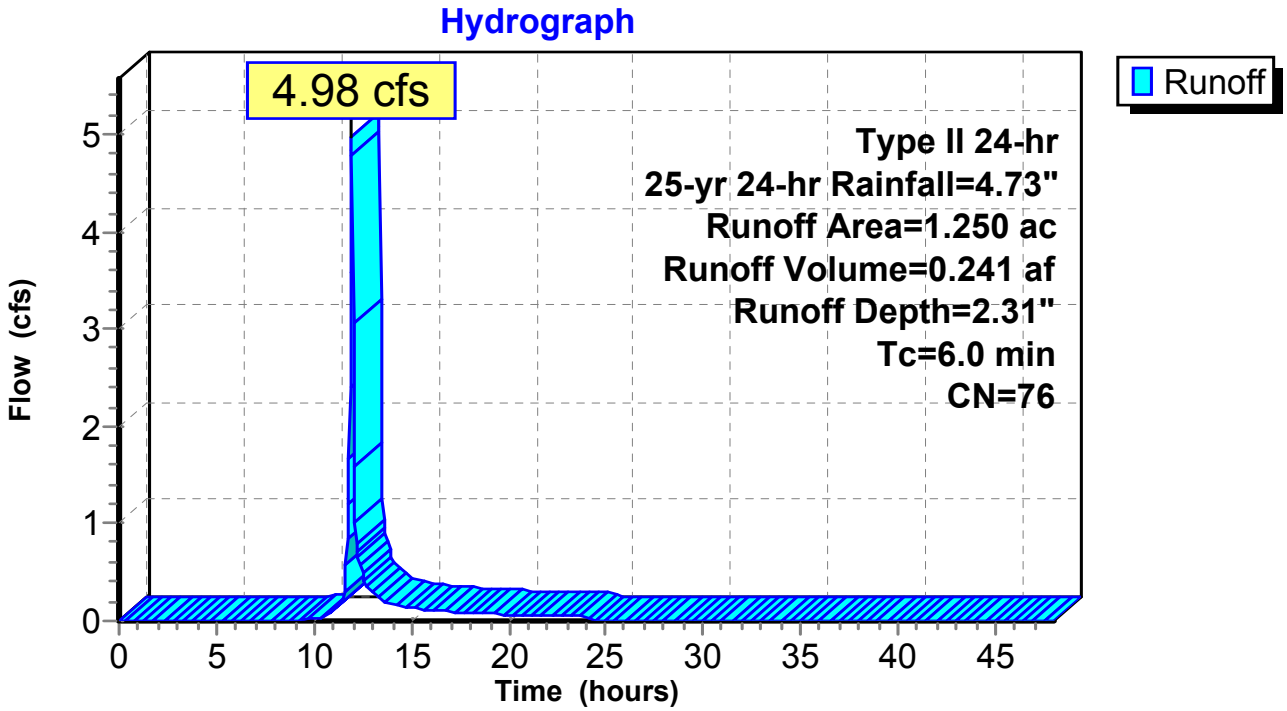
Runoff = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.250	76	
	1.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 141S: G3



Summary for Subcatchment 142S: M5

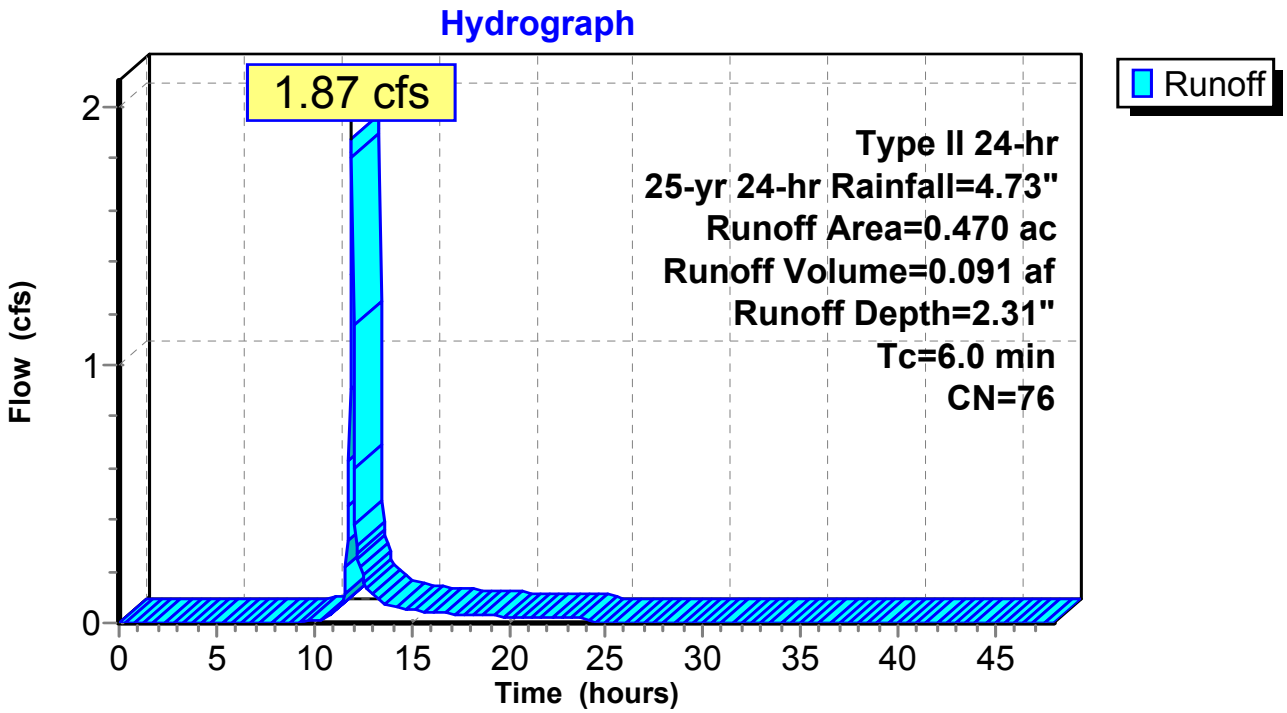
Runoff = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.470	76	
	0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 142S: M5



Summary for Subcatchment 147S: M+ (direct to pond)

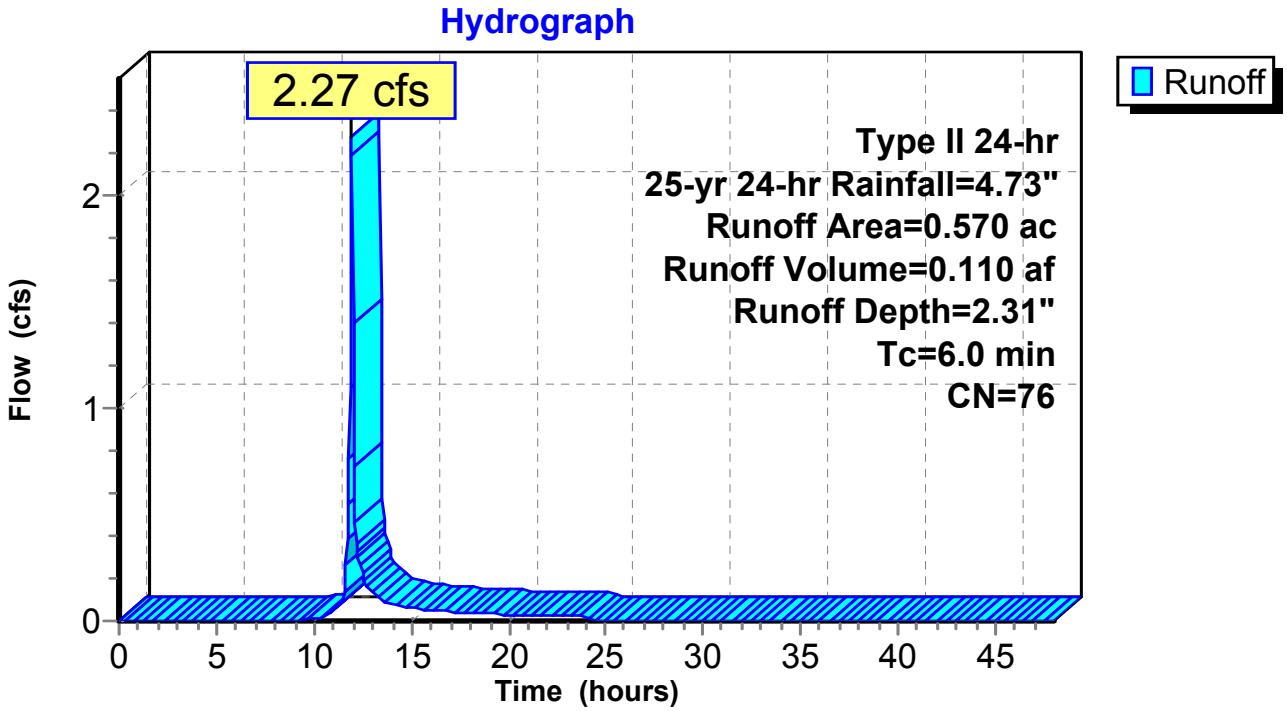
Runoff = 2.27 cfs @ 11.97 hrs, Volume= 0.110 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.570	76	
	0.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 147S: M+ (direct to pond)

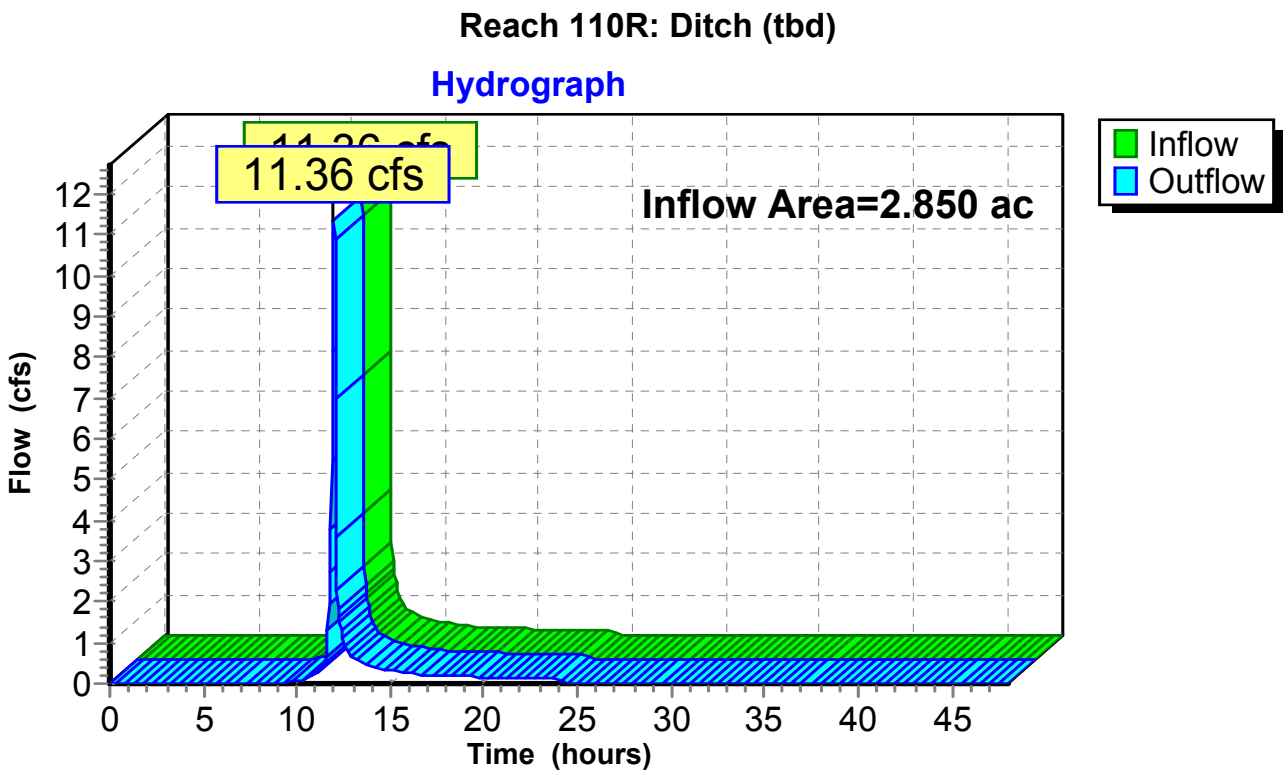


Summary for Reach 110R: Ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af
Outflow = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



Summary for Reach 111R: B Downslope

[61] Hint: Exceeded Reach 112R outlet invert by 0.31' @ 12.00 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 17.26 cfs @ 11.98 hrs, Volume= 0.866 af
Outflow = 17.25 cfs @ 11.98 hrs, Volume= 0.867 af, Atten= 0%, Lag= 0.0 min

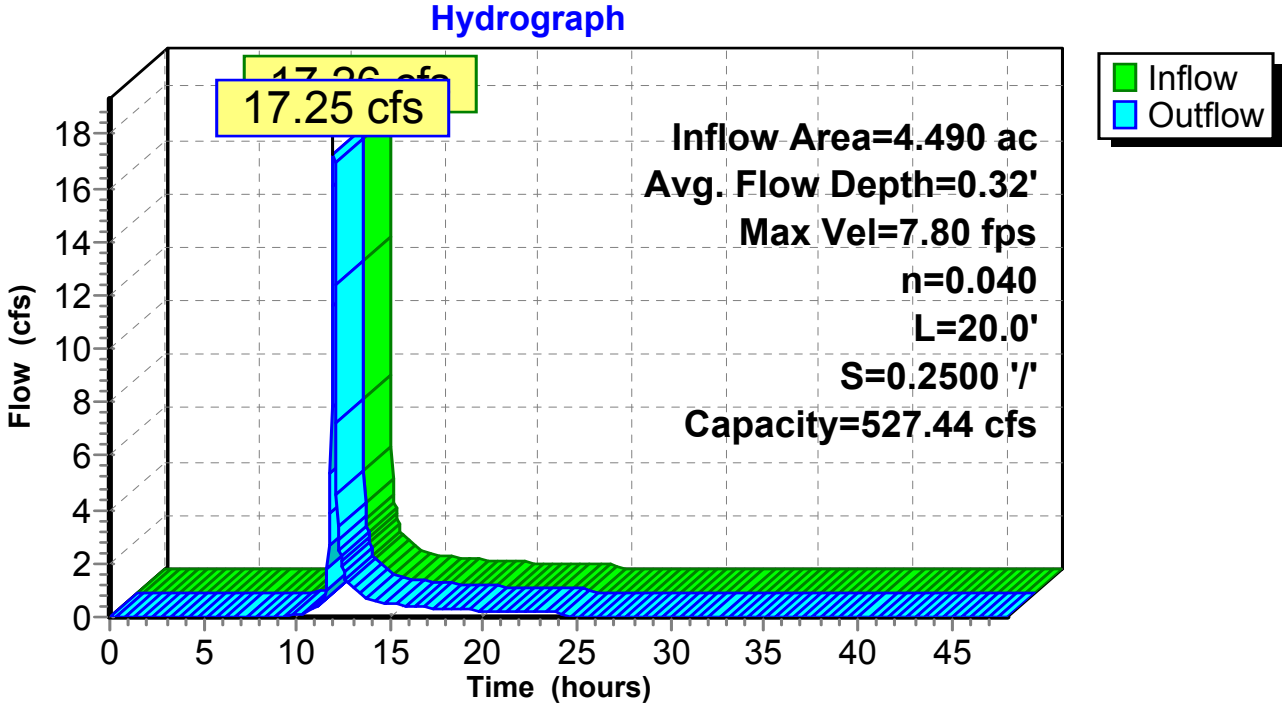
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 7.80 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 0.2 min

Peak Storage= 44 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 527.44 cfs

6.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 20.0' Slope= 0.2500 '/'
Inlet Invert= 1,192.00', Outlet Invert= 1,187.00'

‡

Reach 111R: B Downslope



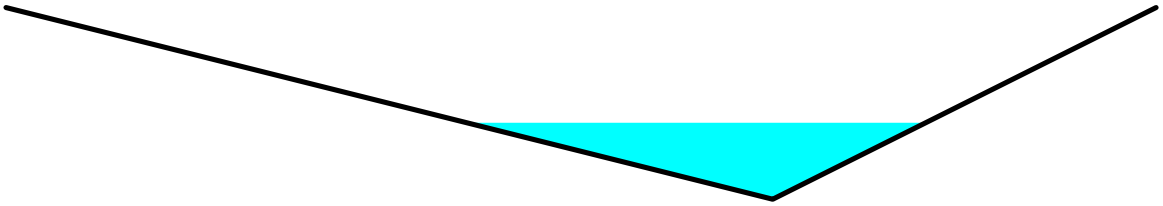
Summary for Reach 112R: B east swale

Inflow Area = 1.640 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 6.54 cfs @ 11.97 hrs, Volume= 0.316 af
Outflow = 6.04 cfs @ 12.01 hrs, Volume= 0.316 af, Atten= 8%, Lag= 1.9 min

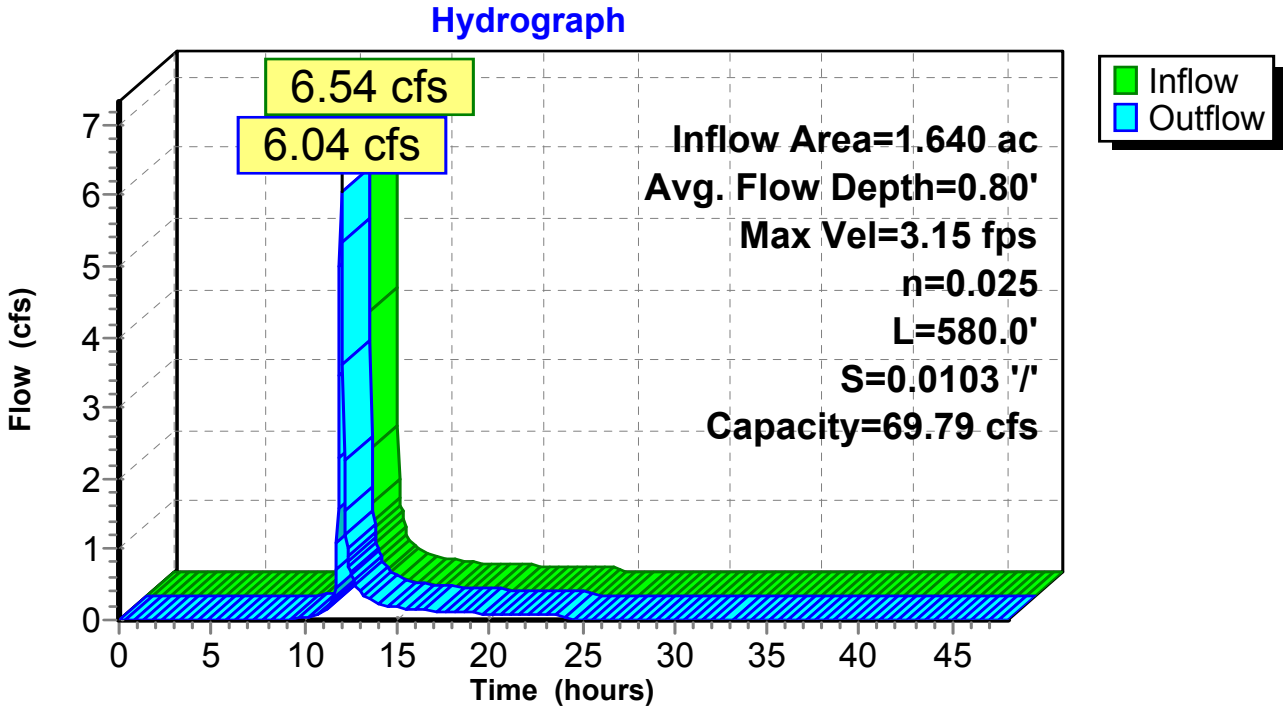
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.15 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 8.9 min

Peak Storage= 1,110 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.80'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 69.79 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 580.0' Slope= 0.0103 '/'
Inlet Invert= 1,198.00', Outlet Invert= 1,192.00'



Reach 112R: B east swale



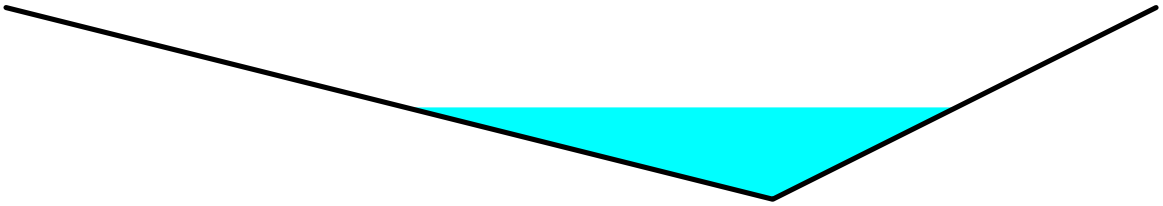
Summary for Reach 117R: G-upper east swale

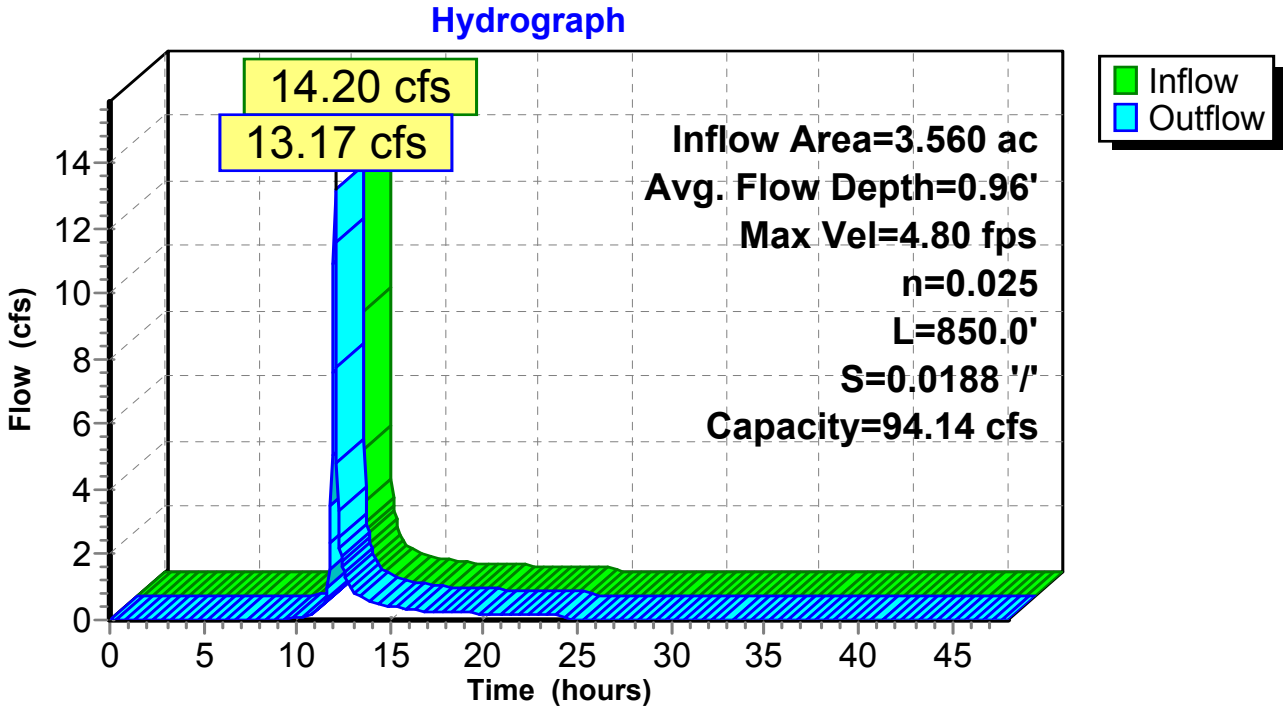
Inflow Area = 3.560 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 14.20 cfs @ 11.97 hrs, Volume= 0.687 af
Outflow = 13.17 cfs @ 12.00 hrs, Volume= 0.687 af, Atten= 7%, Lag= 1.9 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 8.8 min

Peak Storage= 2,334 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 94.14 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,206.00'





Summary for Reach 118R: G-upper downslope

[61] Hint: Exceeded Reach 117R outlet invert by 0.25' @ 12.00 hrs
[62] Hint: Exceeded Reach 119R OUTLET depth by 4.00' @ 24.65 hrs

Inflow Area = 4.090 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 15.19 cfs @ 12.00 hrs, Volume= 0.789 af
Outflow = 15.16 cfs @ 12.00 hrs, Volume= 0.789 af, Atten= 0%, Lag= 0.2 min

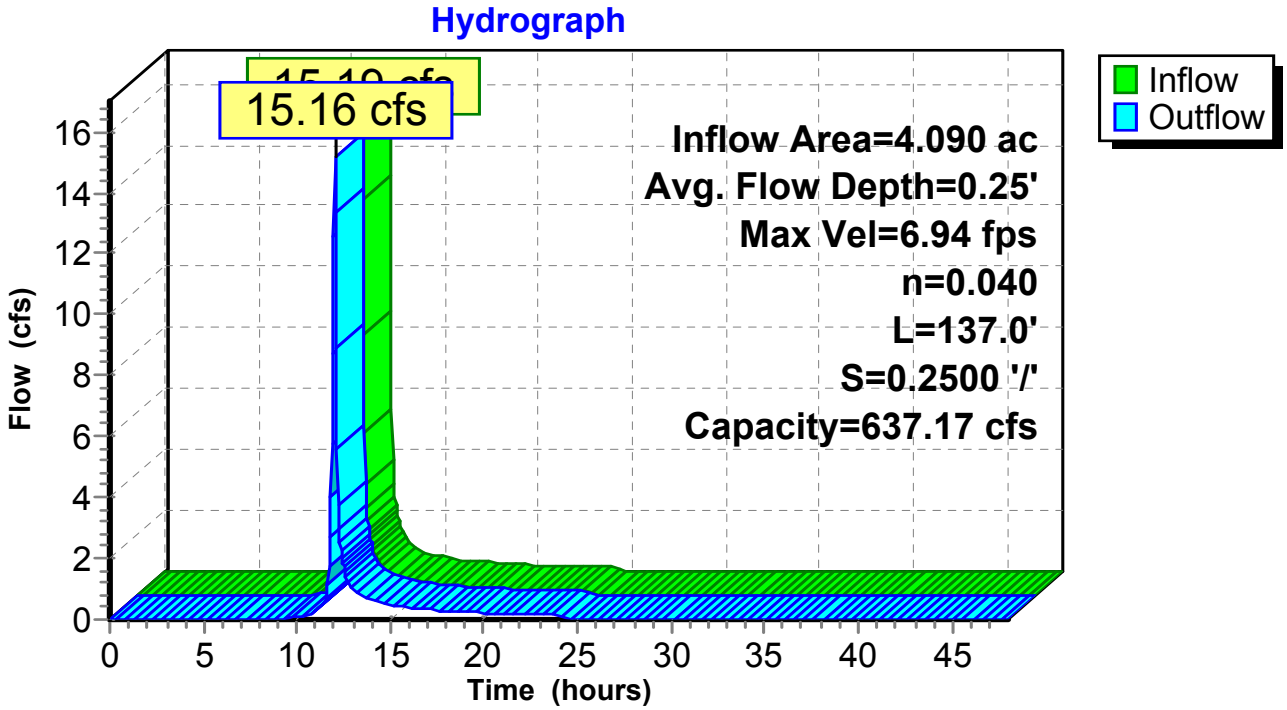
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.94 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 1.3 min

Peak Storage= 299 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 137.0' Slope= 0.2500 '/'
Inlet Invert= 1,206.00', Outlet Invert= 1,171.75'

‡

Reach 118R: G-upper downslope



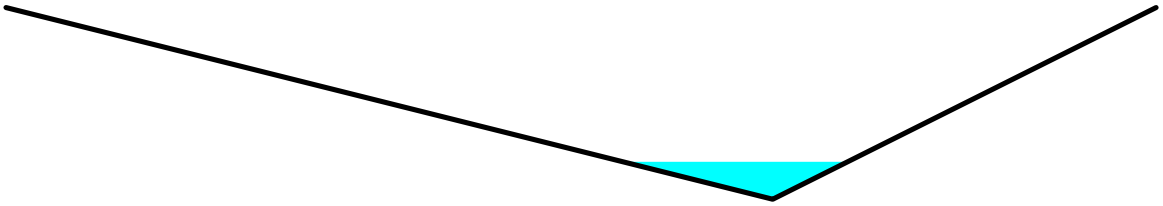
Summary for Reach 119R: G-upper west swale

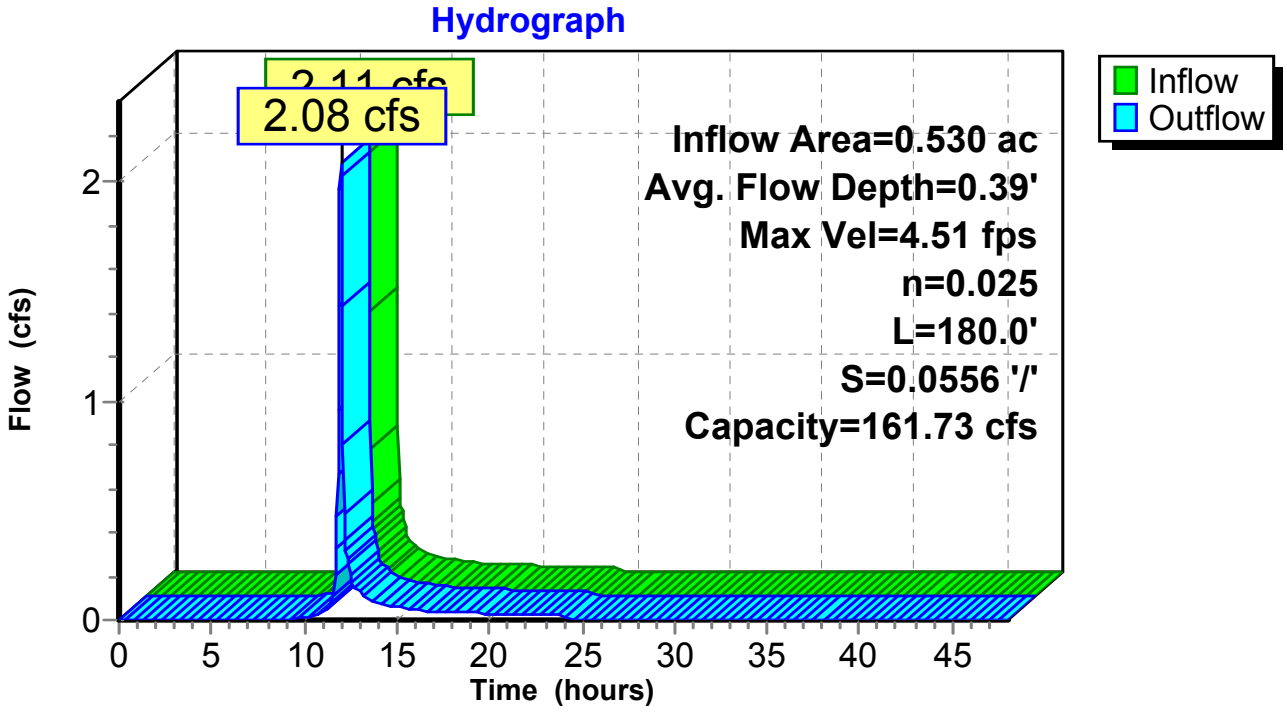
Inflow Area = 0.530 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 2.11 cfs @ 11.97 hrs, Volume= 0.102 af
Outflow = 2.08 cfs @ 11.98 hrs, Volume= 0.102 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 4.51 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 1.8 min

Peak Storage= 83 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 161.73 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 180.0' Slope= 0.0556 '/'
Inlet Invert= 1,212.00', Outlet Invert= 1,202.00'





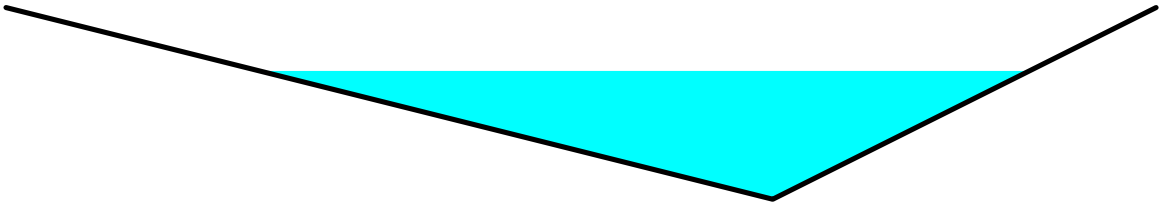
Summary for Reach 122R: G-middle east swale

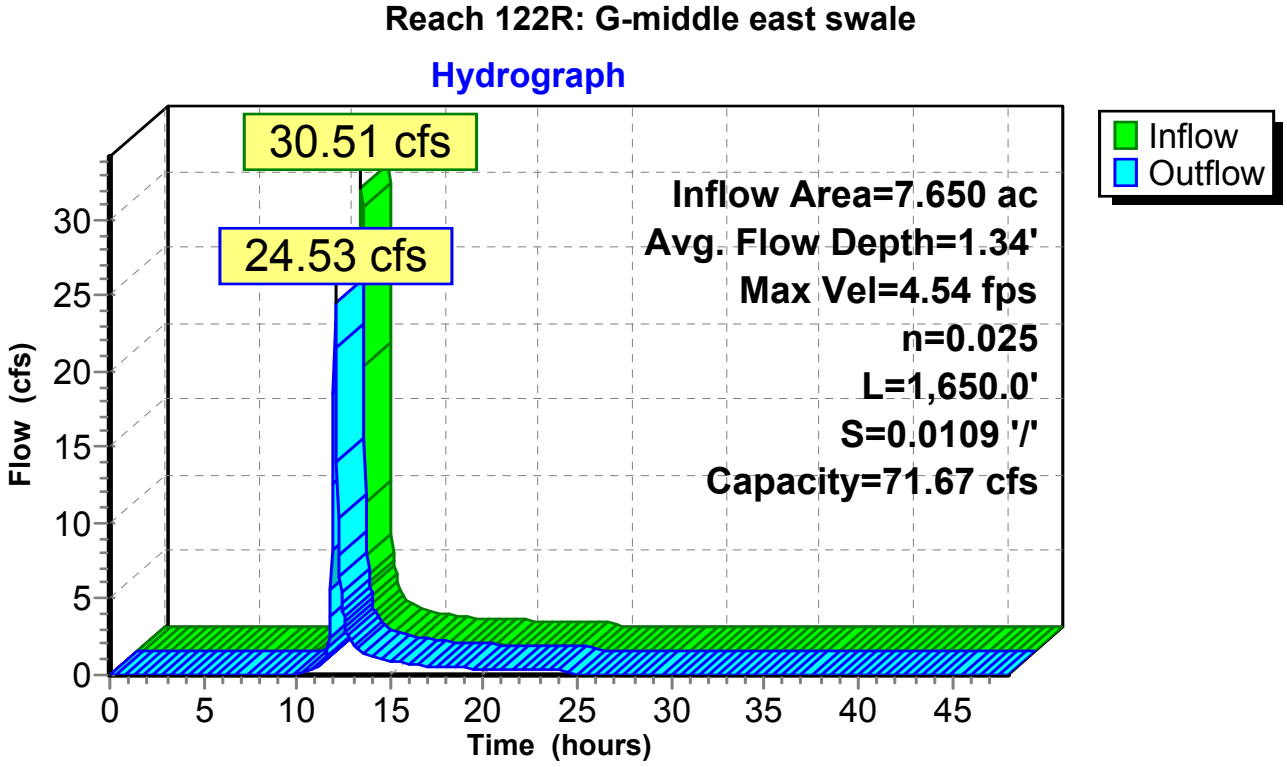
Inflow Area = 7.650 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 30.51 cfs @ 11.97 hrs, Volume= 1.476 af
Outflow = 24.53 cfs @ 12.03 hrs, Volume= 1.476 af, Atten= 20%, Lag= 3.2 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.54 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 20.6 min

Peak Storage= 8,864 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.34'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 71.67 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 1,650.0' Slope= 0.0109 '/'
Inlet Invert= 1,184.00', Outlet Invert= 1,166.00'





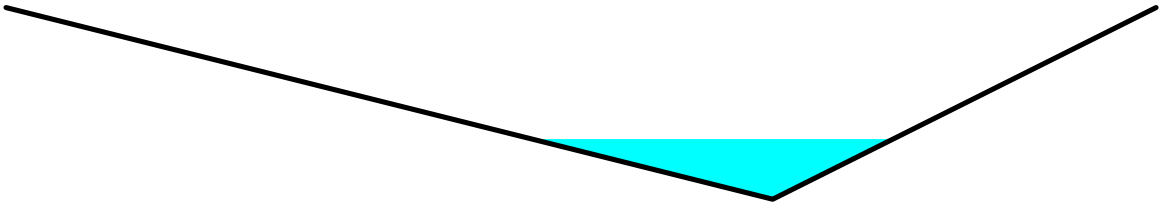
Summary for Reach 125R: G-lower west swale

Inflow Area = 0.920 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 3.67 cfs @ 11.97 hrs, Volume= 0.177 af
Outflow = 3.59 cfs @ 11.99 hrs, Volume= 0.177 af, Atten= 2%, Lag= 1.2 min

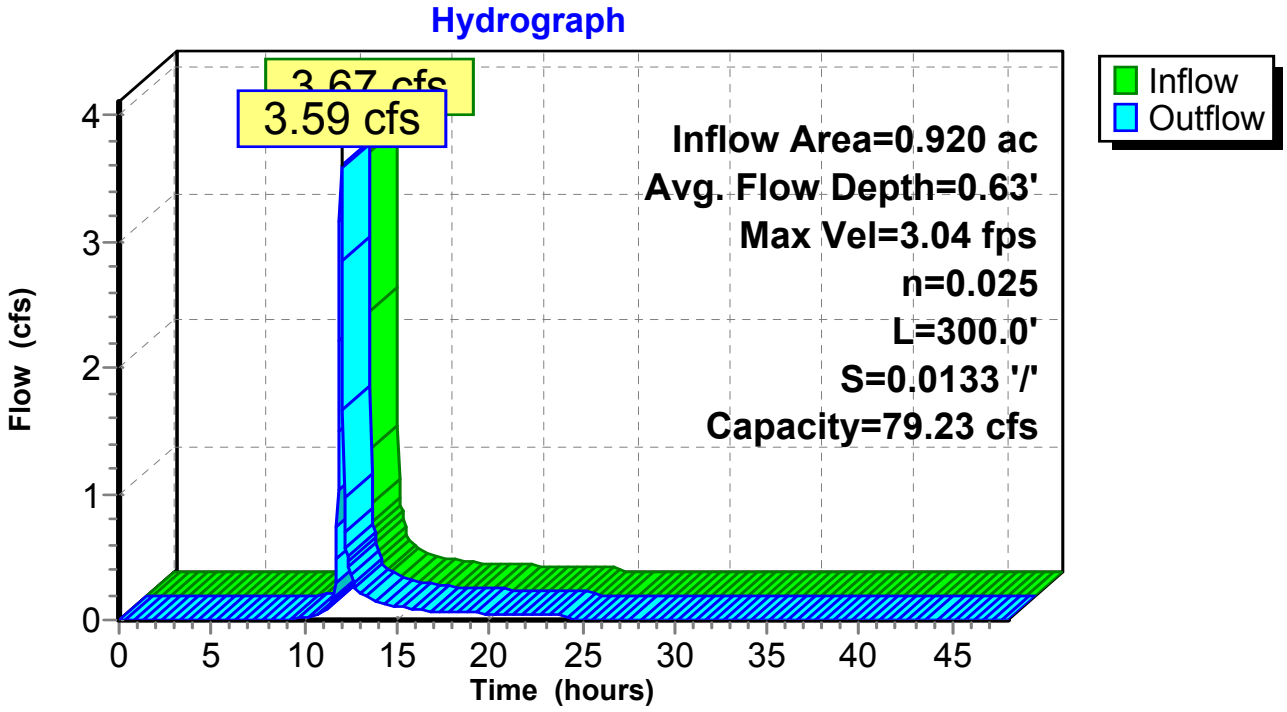
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.04 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 4.5 min

Peak Storage= 354 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 79.23 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 300.0' Slope= 0.0133 '/'
Inlet Invert= 1,174.00', Outlet Invert= 1,170.00'



Reach 125R: G-lower west swale



Summary for Reach 126R: G-lower downslope

[62] Hint: Exceeded Reach 118R OUTLET depth by 0.24' @ 12.00 hrs
[62] Hint: Exceeded Reach 122R OUTLET depth by 5.75' @ 0.00 hrs
[62] Hint: Exceeded Reach 125R OUTLET depth by 1.75' @ 26.00 hrs

Inflow Area = 13.910 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 47.55 cfs @ 12.01 hrs, Volume= 2.683 af
Outflow = 47.53 cfs @ 12.01 hrs, Volume= 2.683 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.32 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 0.4 min

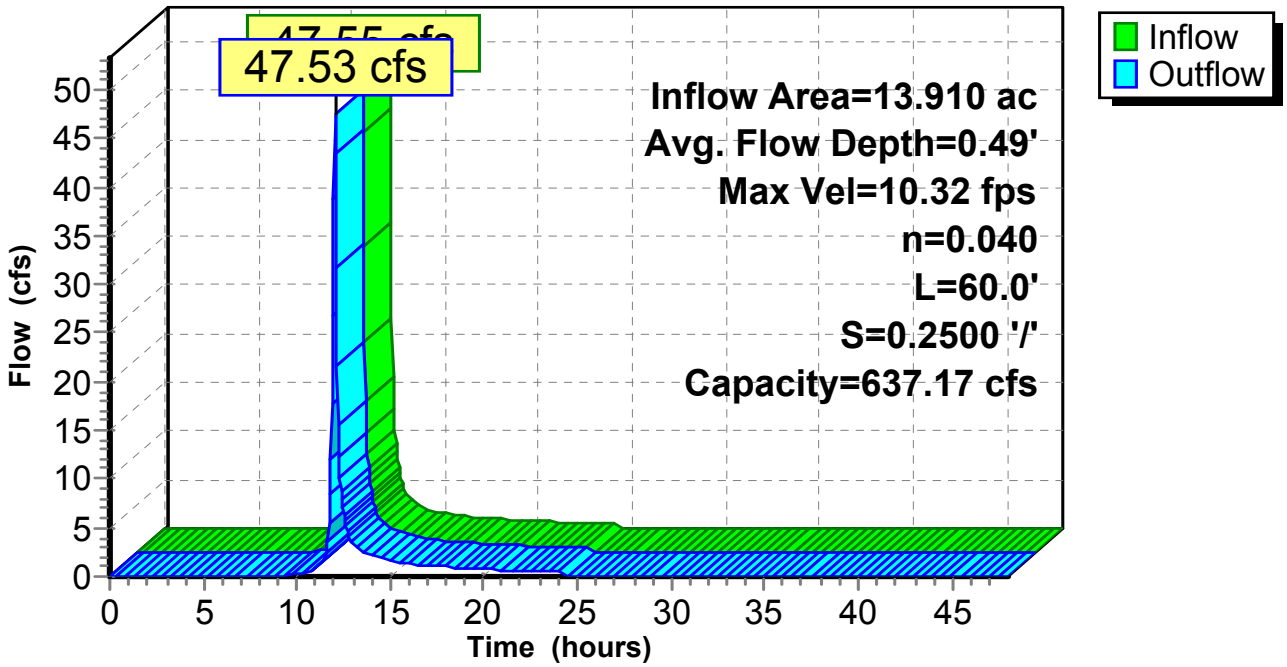
Peak Storage= 276 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 60.0' Slope= 0.2500 '/'
Inlet Invert= 1,171.75', Outlet Invert= 1,156.75'

‡

Reach 126R: G-lower downslope

Hydrograph



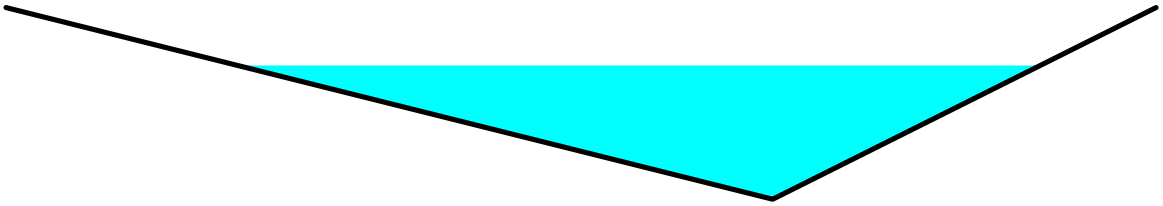
Summary for Reach 131R: M-east upper swale

Inflow Area = 9.990 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 39.84 cfs @ 11.97 hrs, Volume= 1.927 af
Outflow = 30.75 cfs @ 12.03 hrs, Volume= 1.927 af, Atten= 23%, Lag= 3.6 min

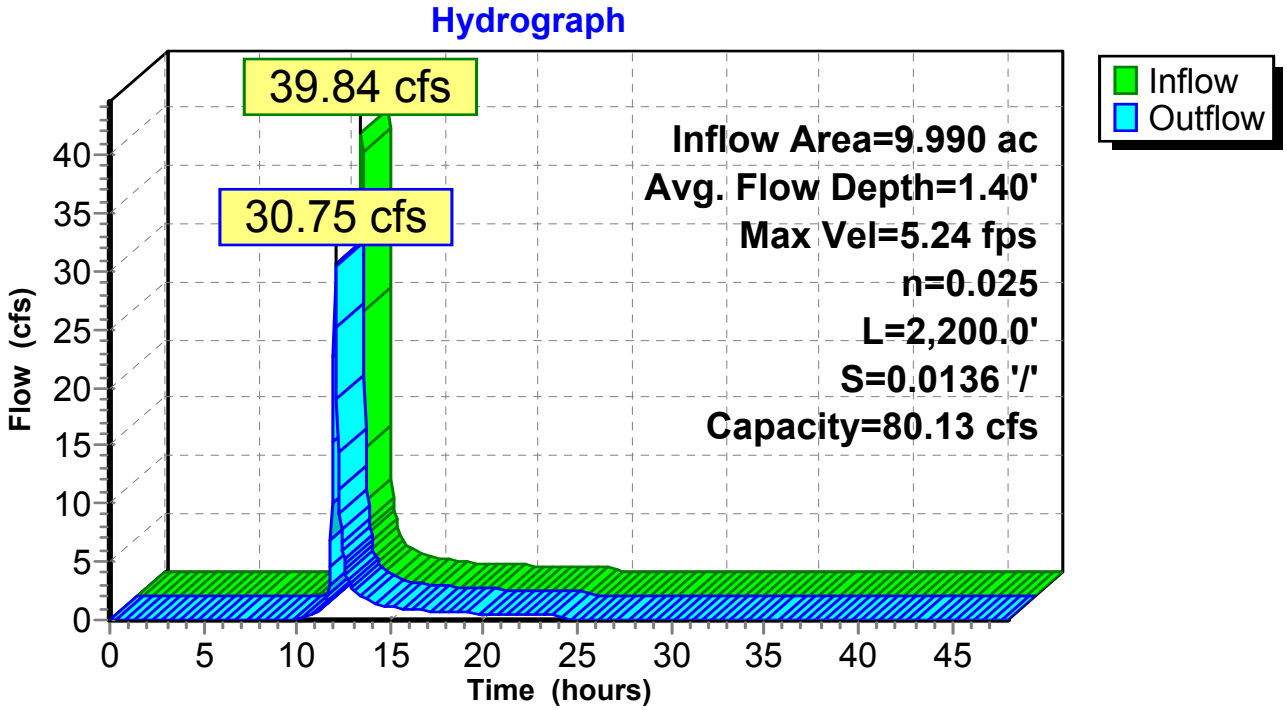
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.24 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 24.8 min

Peak Storage= 12,875 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.40'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 80.13 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 2,200.0' Slope= 0.0136 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,192.00'



Reach 131R: M-east upper swale



Summary for Reach 132R: M-upper downslope

[61] Hint: Exceeded Reach 134R outlet invert by 0.26' @ 12.00 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 16.64 cfs @ 12.00 hrs, Volume= 0.866 af
Outflow = 16.63 cfs @ 12.01 hrs, Volume= 0.866 af, Atten= 0%, Lag= 0.1 min

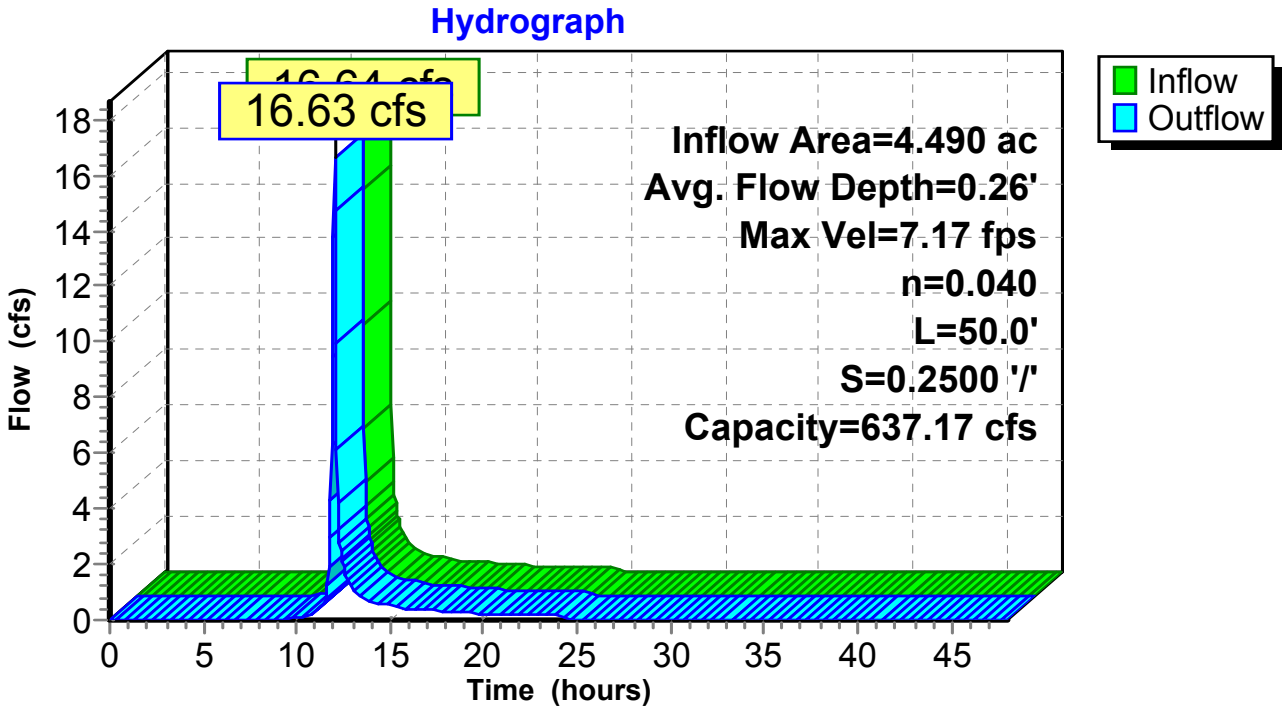
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.17 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 0.5 min

Peak Storage= 116 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 50.0' Slope= 0.2500 '/'
Inlet Invert= 1,204.50', Outlet Invert= 1,192.00'

‡

Reach 132R: M-upper downslope



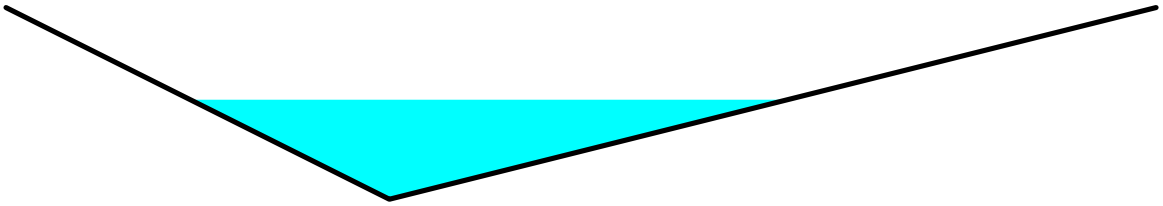
Summary for Reach 134R: M-west upper swale

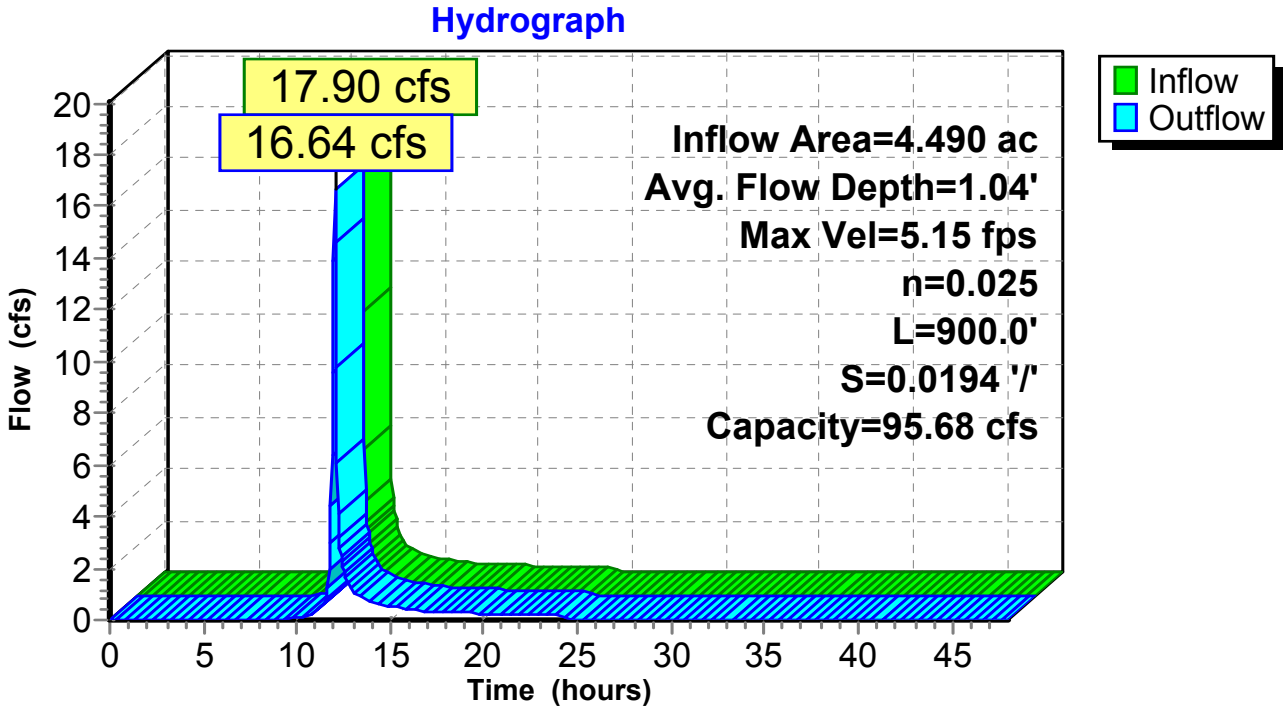
Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 17.90 cfs @ 11.97 hrs, Volume= 0.866 af
Outflow = 16.64 cfs @ 12.00 hrs, Volume= 0.866 af, Atten= 7%, Lag= 1.9 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.15 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 8.7 min

Peak Storage= 2,909 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 95.68 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 900.0' Slope= 0.0194 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,204.50'





Summary for Reach 135R: M-lower downslope

[61] Hint: Exceeded Reach 136R outlet invert by 0.59' @ 12.00 hrs
[62] Hint: Exceeded Reach 142R OUTLET depth by 0.11' @ 12.00 hrs
[61] Hint: Exceeded Reach 143R outlet invert by 0.59' @ 12.00 hrs

Inflow Area = 20.810 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 67.47 cfs @ 12.02 hrs, Volume= 4.014 af
Outflow = 67.44 cfs @ 12.02 hrs, Volume= 4.014 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 0.3 min

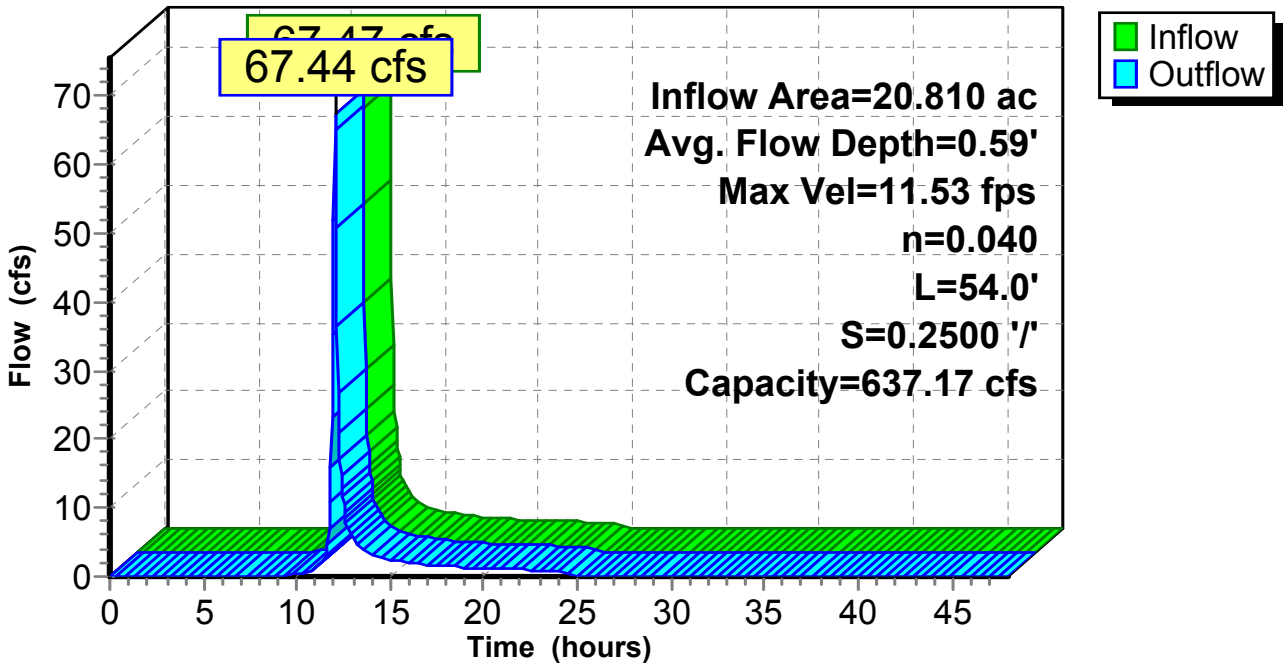
Peak Storage= 314 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 54.0' Slope= 0.2500 '/'
Inlet Invert= 1,170.00', Outlet Invert= 1,156.50'

‡

Reach 135R: M-lower downslope

Hydrograph



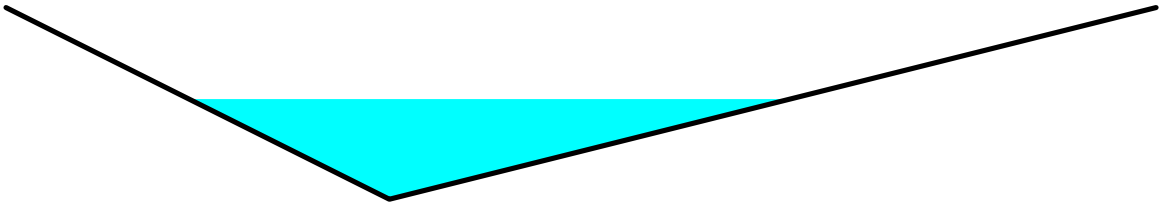
Summary for Reach 136R: M-west lower swale

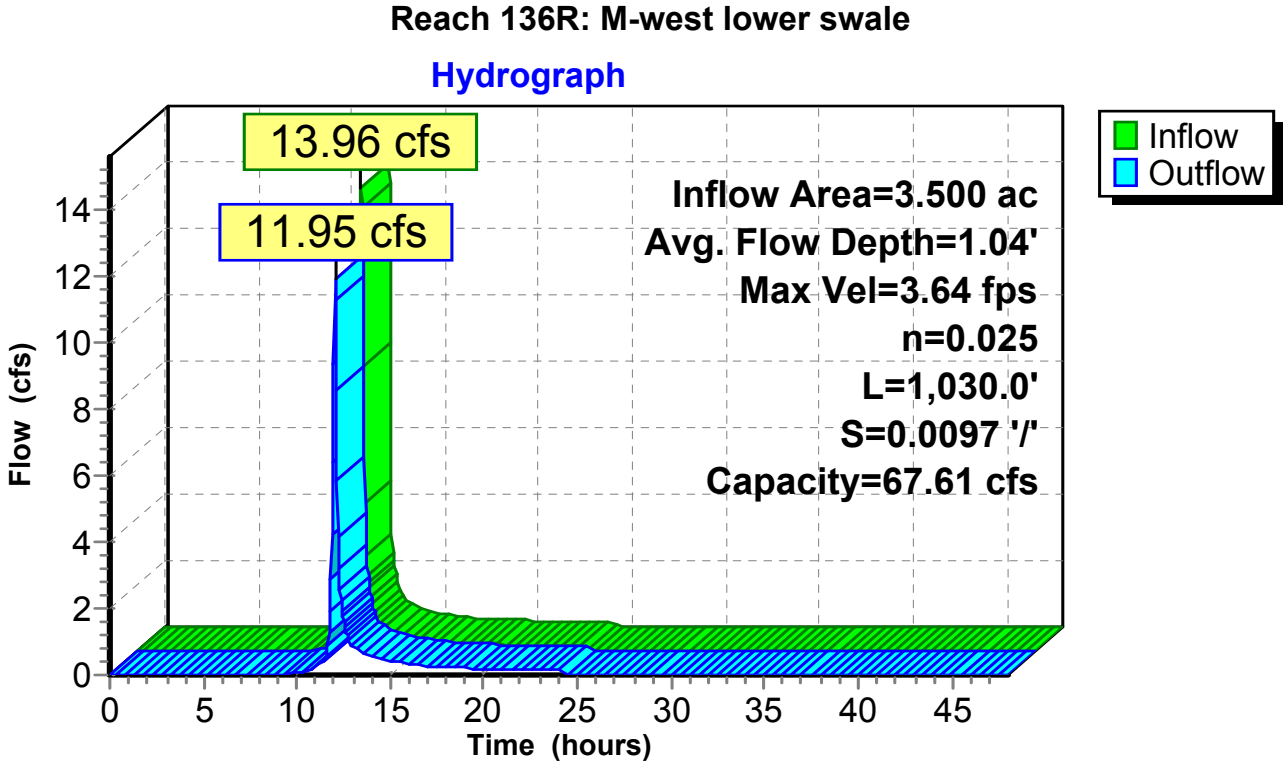
Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 13.96 cfs @ 11.97 hrs, Volume= 0.675 af
Outflow = 11.95 cfs @ 12.02 hrs, Volume= 0.675 af, Atten= 14%, Lag= 2.6 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 14.7 min

Peak Storage= 3,370 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.61 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 1,030.0' Slope= 0.0097 '/'
Inlet Invert= 1,180.00', Outlet Invert= 1,170.00'



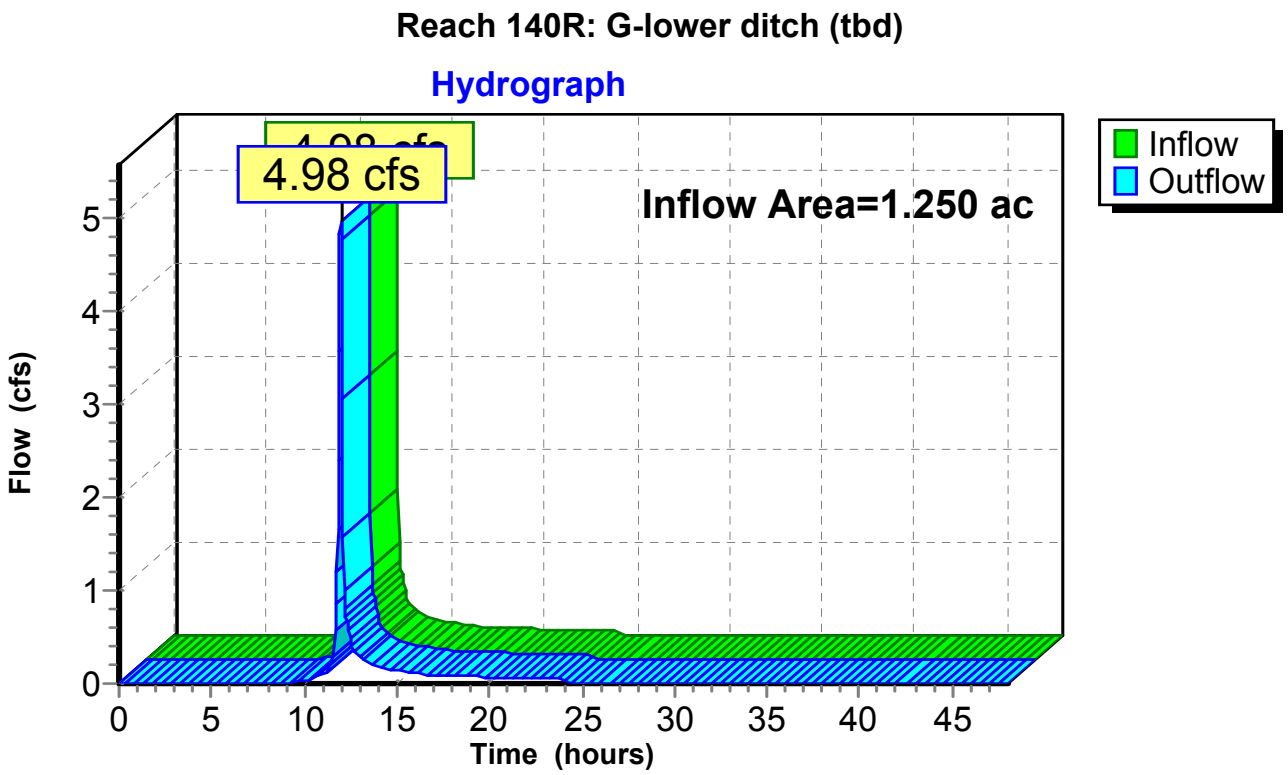


Summary for Reach 140R: G-lower ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.250 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af
Outflow = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



Summary for Reach 142R: M-middle downslope

[61] Hint: Exceeded Reach 131R outlet invert by 0.48' @ 12.00 hrs
[62] Hint: Exceeded Reach 132R OUTLET depth by 0.23' @ 12.05 hrs

Inflow Area = 14.480 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 46.99 cfs @ 12.02 hrs, Volume= 2.793 af
Outflow = 46.96 cfs @ 12.02 hrs, Volume= 2.793 af, Atten= 0%, Lag= 0.1 min

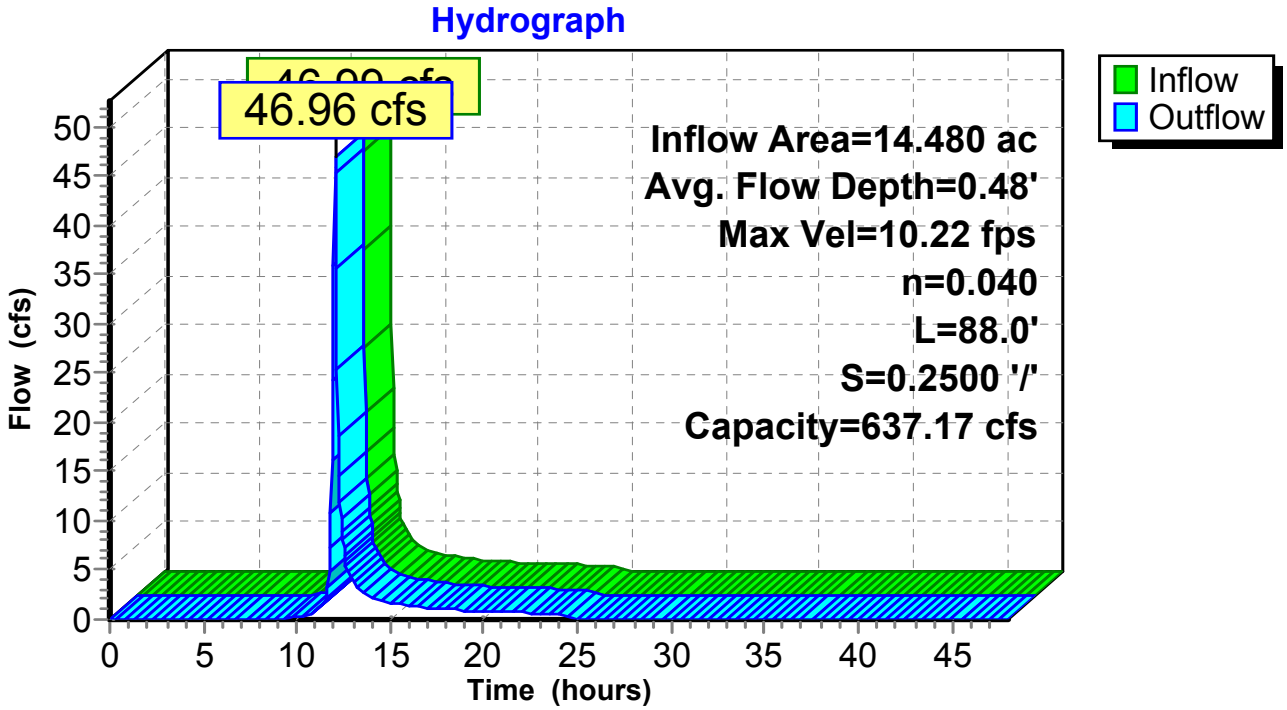
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.22 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.6 min

Peak Storage= 402 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 88.0' Slope= 0.2500 '/'
Inlet Invert= 1,192.00', Outlet Invert= 1,170.00'

‡

Reach 142R: M-middle downslope



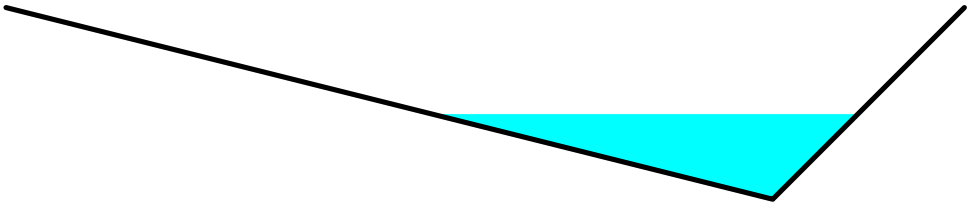
Summary for Reach 143R: M-east lower swale

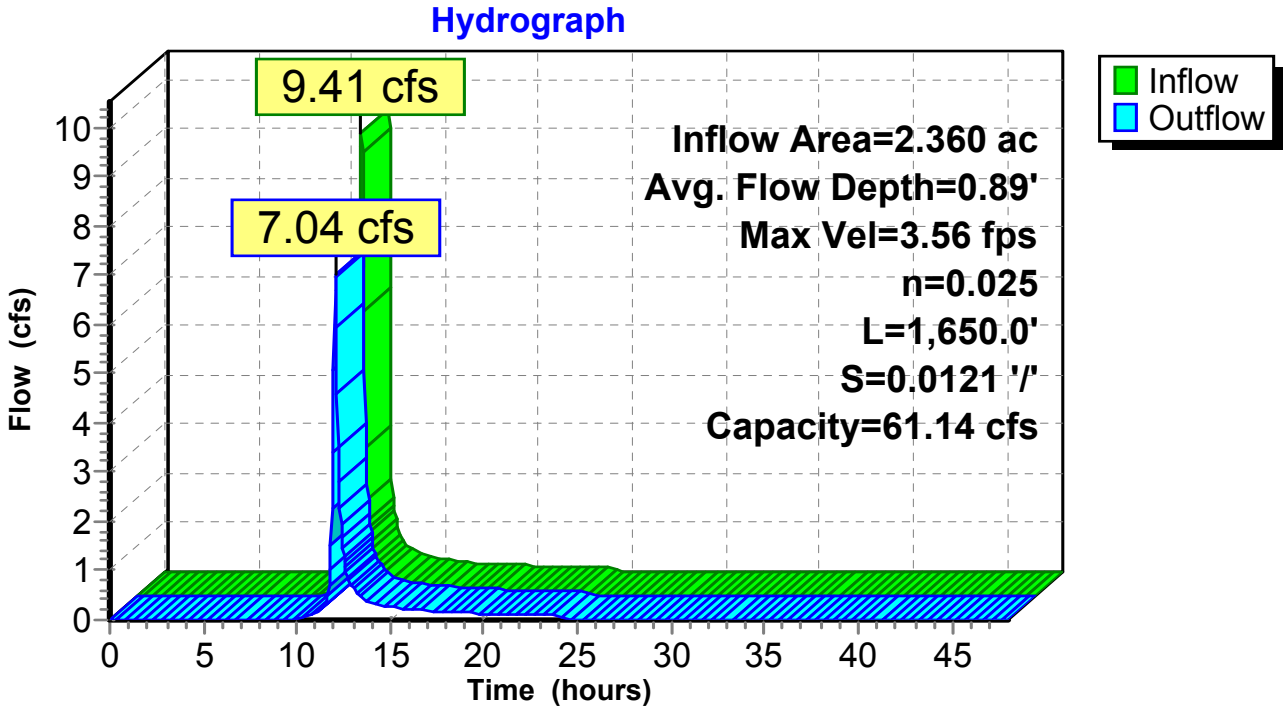
Inflow Area = 2.360 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 9.41 cfs @ 11.97 hrs, Volume= 0.455 af
Outflow = 7.04 cfs @ 12.04 hrs, Volume= 0.455 af, Atten= 25%, Lag= 3.8 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.56 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 1.11 fps, Avg. Travel Time= 24.8 min

Peak Storage= 3,262 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.89'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 61.14 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 1.0 '/' Top Width= 10.00'
Length= 1,650.0' Slope= 0.0121 '/'
Inlet Invert= 1,190.00', Outlet Invert= 1,170.00'



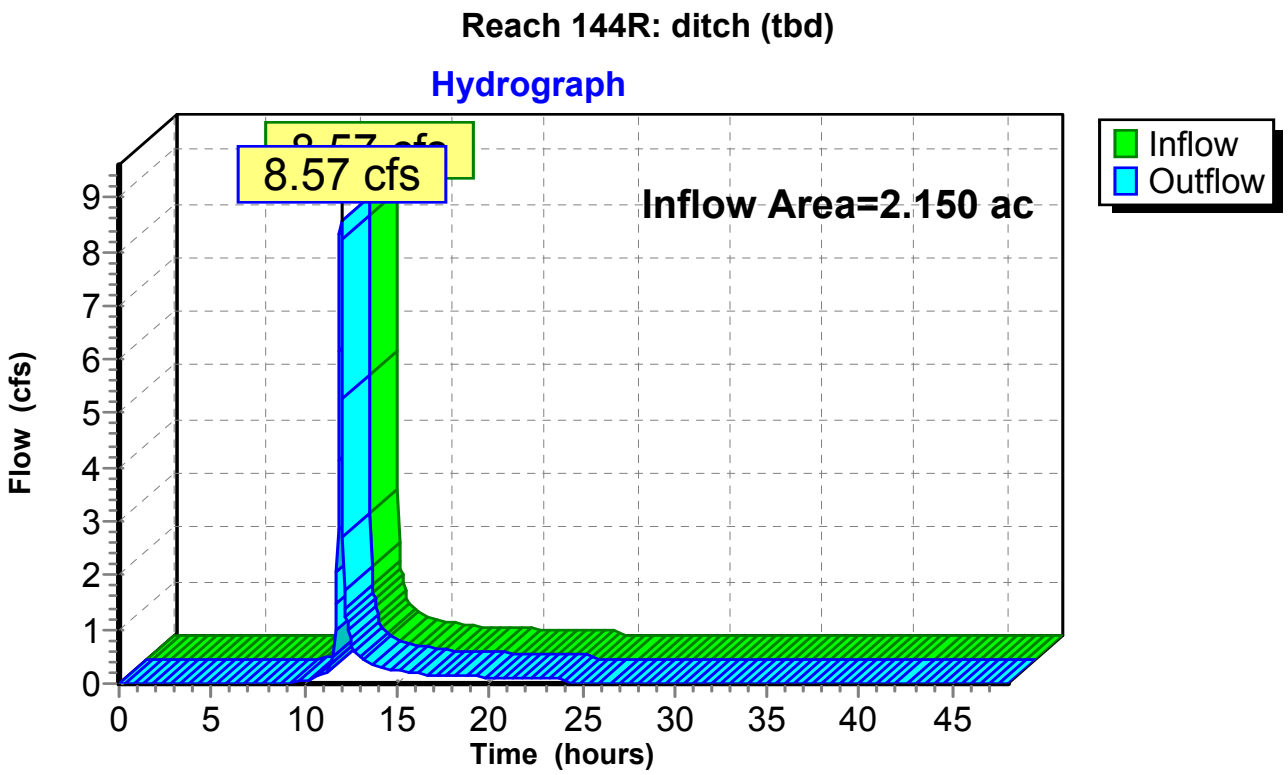


Summary for Reach 144R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.150 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af
Outflow = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

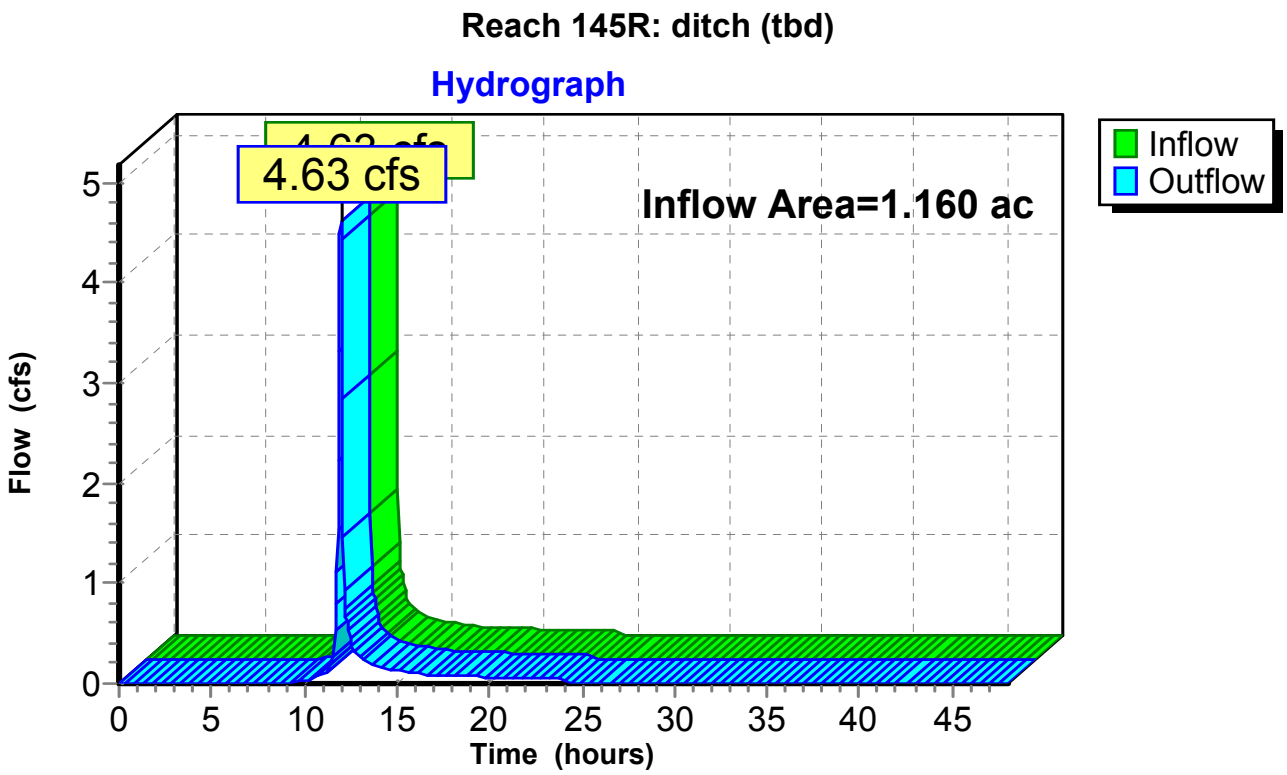


Summary for Reach 145R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.160 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af
Outflow = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

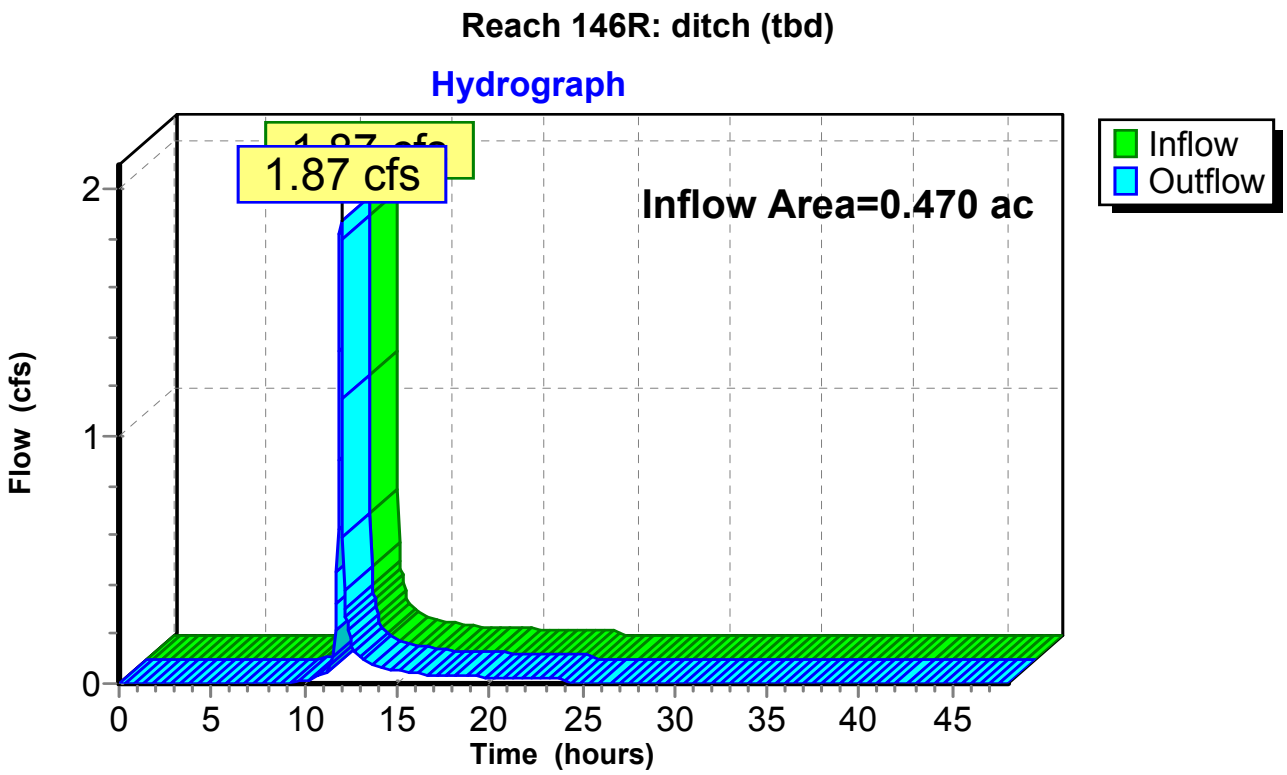


Summary for Reach 146R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af
Outflow = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



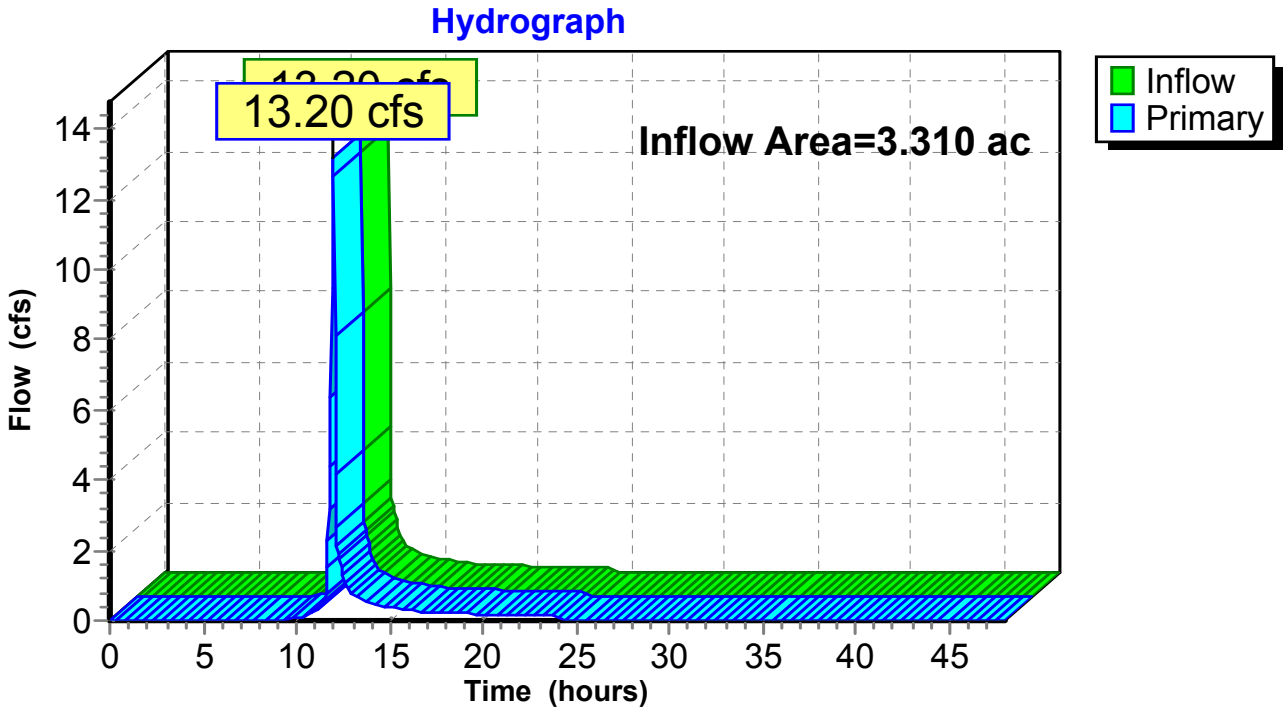
Summary for Pond 105P: NE Infiltration Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.310 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 13.20 cfs @ 11.97 hrs, Volume= 0.639 af
Primary = 13.20 cfs @ 11.97 hrs, Volume= 0.639 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2

Pond 105P: NE Infiltration Pond



Summary for Pond 108P: South Infiltration Pond

[62] Hint: Exceeded Reach 111R OUTLET depth by 1.17' @ 18.55 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.32" for 25-yr 24-hr event
Inflow = 17.25 cfs @ 11.98 hrs, Volume= 0.867 af
Outflow = 0.29 cfs @ 18.40 hrs, Volume= 0.732 af, Atten= 98%, Lag= 385.1 min
Discarded = 0.29 cfs @ 18.40 hrs, Volume= 0.732 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,188.20' @ 18.40 hrs Surf.Area= 0.243 ac Storage= 0.597 af

Plug-Flow detention time= 909.7 min calculated for 0.732 af (84% of inflow)
Center-of-Mass det. time= 838.1 min (1,671.9 - 833.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,184.00'	1.130 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

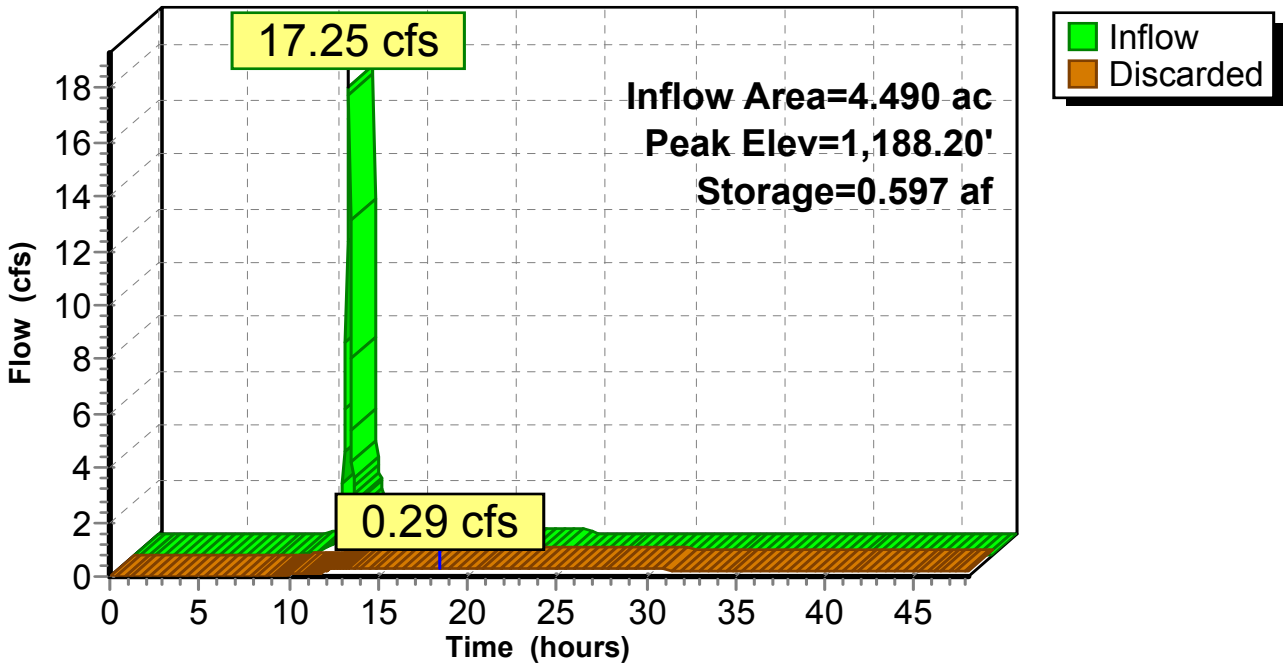
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,184.00	0.044	1,015.5	0.000	0.000	0.044
1,186.00	0.144	1,036.2	0.178	0.178	0.135
1,188.00	0.232	1,062.1	0.373	0.551	0.245
1,190.00	0.351	1,100.9	0.579	1.130	0.406

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,184.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 18.40 hrs HW=1,188.20' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Pond 108P: South Infiltration Pond

Hydrograph



Summary for Pond 129P: North infiltration pond

[62] Hint: Exceeded Reach 126R OUTLET depth by 0.22' @ 19.25 hrs

Inflow Area = 14.860 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 51.05 cfs @ 12.01 hrs, Volume= 2.867 af
Outflow = 0.90 cfs @ 19.01 hrs, Volume= 2.559 af, Atten= 98%, Lag= 420.3 min
Discarded = 0.90 cfs @ 19.01 hrs, Volume= 2.559 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,157.02' @ 19.01 hrs Surf.Area= 0.746 ac Storage= 1.957 af

Plug-Flow detention time= 937.0 min calculated for 2.556 af (89% of inflow)
Center-of-Mass det. time= 883.1 min (1,722.4 - 839.3)

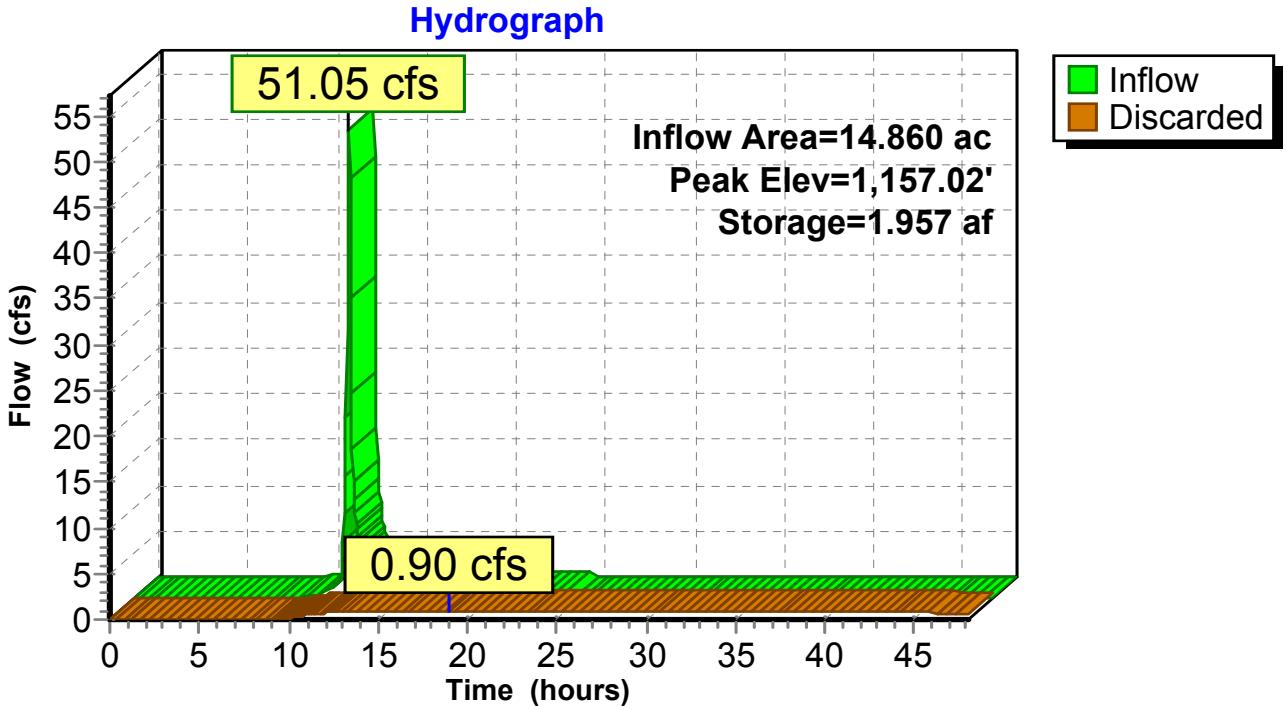
Volume	Invert	Avail.Storage	Storage Description
#1	1,154.00'	4.485 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,154.00	0.556	822.6	0.000	0.000	0.556
1,156.00	0.678	917.0	1.232	1.232	0.859
1,158.00	0.814	988.4	1.490	2.722	1.111
1,160.00	0.951	1,021.8	1.763	4.485	1.242

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,154.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.90 cfs @ 19.01 hrs HW=1,157.02' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.90 cfs)

Pond 129P: North infiltration pond



Summary for Pond 139P: SW Infiltration Pond

[62] Hint: Exceeded Reach 135R OUTLET depth by 1.15' @ 20.30 hrs

Inflow Area = 21.380 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 69.39 cfs @ 12.02 hrs, Volume= 4.124 af
Outflow = 1.10 cfs @ 20.06 hrs, Volume= 3.191 af, Atten= 98%, Lag= 482.5 min
Discarded = 1.10 cfs @ 20.06 hrs, Volume= 3.191 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,157.70' @ 20.06 hrs Surf.Area= 0.912 ac Storage= 2.945 af

Plug-Flow detention time= 984.0 min calculated for 3.191 af (77% of inflow)
Center-of-Mass det. time= 891.4 min (1,733.5 - 842.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,154.00'	5.215 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

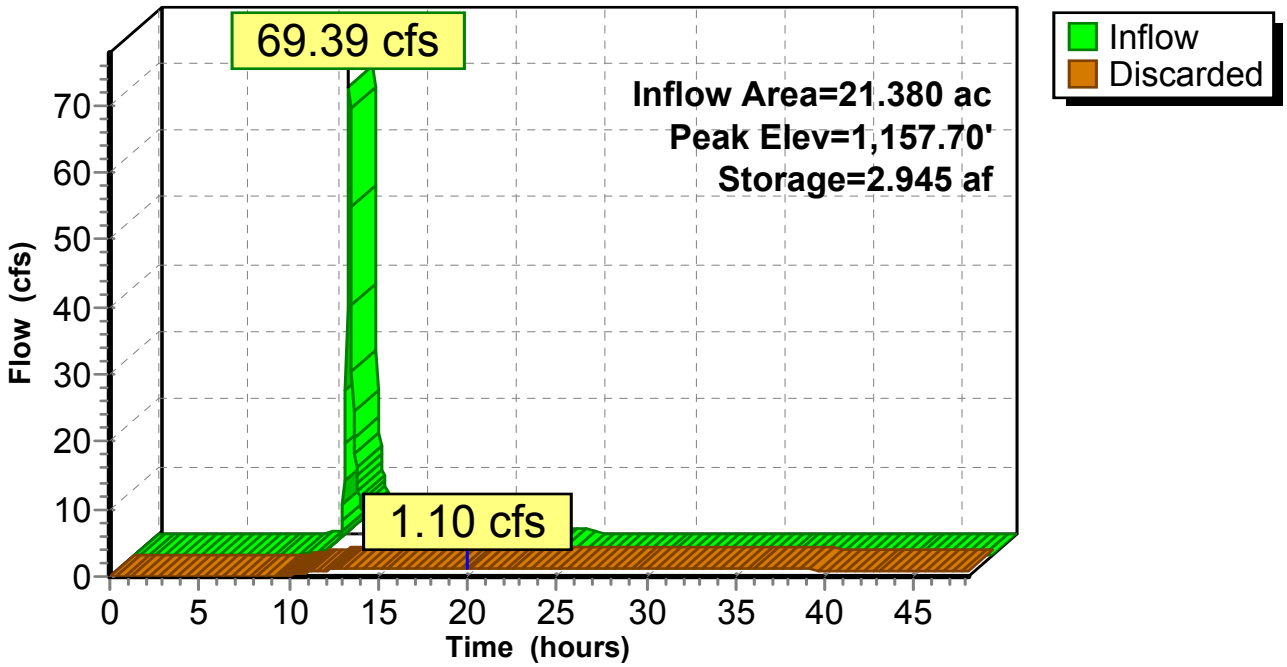
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,154.00	0.683	847.3	0.000	0.000	0.683
1,156.00	0.804	899.1	1.485	1.485	0.853
1,158.00	0.932	948.1	1.734	3.220	1.024
1,160.00	1.065	993.3	1.996	5.215	1.190

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,154.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.10 cfs @ 20.06 hrs HW=1,157.70' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.10 cfs)

Pond 139P: SW Infiltration Pond

Hydrograph



Plot Date & Time: 27 August 2015 10:00 AM

202,500 N
202,000 N
201,500 N
201,000 N
200,500 N

560,000 E
560,500 E
561,000 E
561,500 E
562,000 E
562,500 E
563,000 E

CENTERLINE INTERSTATE 35
INTERSTATE 35 RIGHT-OF-WAY
OFFICE
SCALE
P-1
PROPERTY LINE
SECTION LINE
CULVERT (TYP.)
EXISTING ACCESS ROAD
LOADOUT PAD
EXISTING FORCEMAIN
EXISTING TELEPHONE LINE
13.4 Acre Active Area
EXISTING WASTE DISPOSAL AREA
PHASE 1
PROPOSED WASTE LIMITS
CONTRACTOR ACCESS ROUTE TO CONSTRUCTION AREA
PHASE 3
PHASE 4
PHASE 5
PHASE 6
PHASE 9
EXISTING IN-PLACE WASTE AREA
P-2
P-3
P-4
P-6
P-7
SITE ENTRANCE
18" METAL
CONSTRUCTION AR
FOR PHASES 3 &

Runoff Curve # for Ash = 80
Runoff from 25 year 24 hour storm = 2.68"

Volume of runoff from active area from 25 year 24 hour storm = 3 acre feet.

1.5 acre x 2' deep depression for detention of runoff from active area

N

0 150 300
GRAPHIC SCALE IN FEET

LEGEND
- EXISTING CONTOURS
- EXISTING ROAD
- EXISTING MONITORING WELL
- PROPERTY LINE/ COMPLIANCE BOUNDARY
- PROPOSED WASTE LIMITS
- PHASE BOUNDARY
- EXISTING FORCEMAIN
- TELEPHONE
- ELECTRICAL
- RAILROAD
- TREES
- CONSTRUCTION AREA

NOTEs:
1. COORDINATES ARE BASED ON CARLTON COUNTY COORDINATE SYSTEM.
2. EXISTING CONTOURS BASED ON 2014 LIDAR DATA UPDATED FROM JAN. 2015 SURVEY BY WENCK ASSCOCIATES.

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
C	ISSUED FOR CONSTRUCTION RECORD DRAWINGS	JVB	TJS	08/28/15
B	MODIFACATION FOR GCL	DNO	TJS	04/20/15
A	ISSUED FOR APPROVAL	DNO	TJS	03/13/15

SEAL
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
PRINT NAME THOMAS J. SHUSTARICH
SIGNATURE
DATE 08/28/2015 LICENSE # 21210

SUB CONSULTANT

PRIME CONSULTANT
WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

PROJECT TITLE
CONSTRUCTION RECORD DRAWINGS FOR PHASES 3 AND 4

SHAMROCK ENVIRONMENAL LANFILL

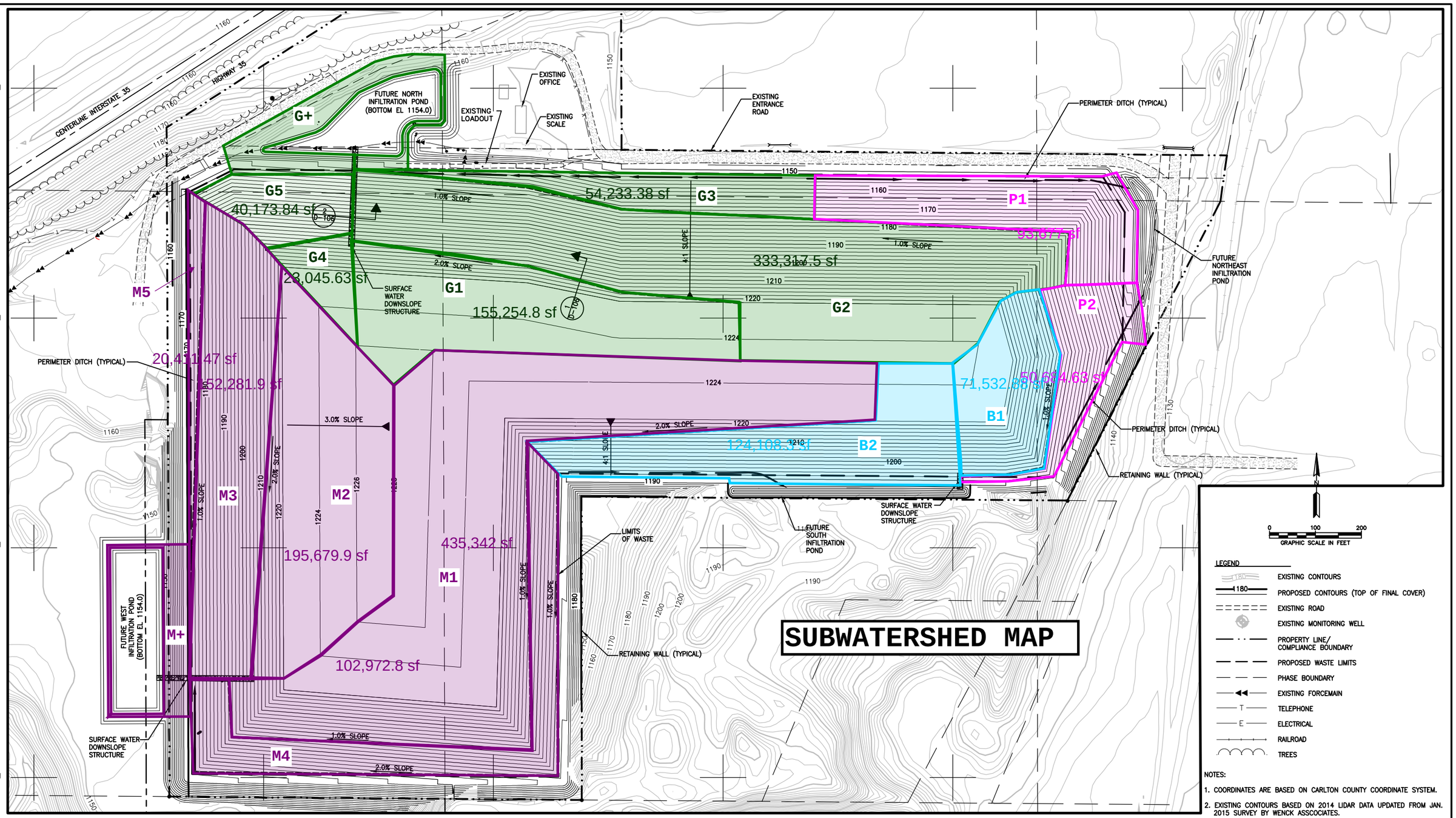
SHEET TITLE
EXISTING CONDITIONS

DWN BY	CHK'D	APP'D	DWG DATE	FEB. 2015
JVB	SH	TJS	SCALE	AS NOTED

PROJECT NO.	SHEET NO.	REV NO.
1101-0015	C-101	C

M:\1101\0015\cad\Record Drawings\civil\C-101 Existing Condition.dwg

Plot Date & Time: 16 June 2015 12:00 PM



NOTES:

1. COORDINATES ARE BASED ON CARLTON COUNTY COORDINATE SYSTEM.
2. EXISTING CONTOURS BASED ON 2014 LIDAR DATA UPDATED FROM JAN. 2015 SURVEY BY WENCK ASSCOCIATES.

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
B	ISSUED TO MPCA	JVB	TJS	06/18/15
A	ISSUED FOR CLIENT REVIEW	JVB	TJS	06/04/15

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME THOMAS J. SHUSTARICH

SIGNATURE

DATE 06/18/2015 LICENSE # 21210

SUB CONSULTANT

PRIME CONSULTANT

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

PROJECT TITLE
PERMIT RENEWAL APPLICATION
SHAMROCK INDUSTRIAL LANDFILL

SHAMROCK ENVIRONMENTAL LANDFILL

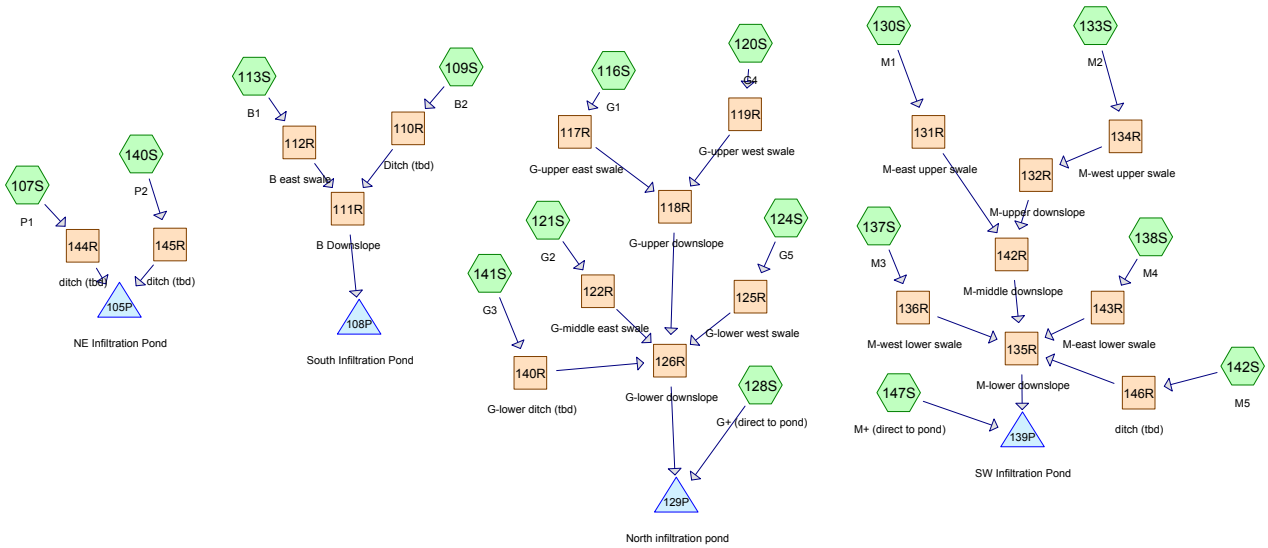
SHEET TITLE
SURFACE WATER MANAGEMENT PLAN

DWN BY	CHK'D	APP'D	DWG DATE
JVB	SH	TJS	FEB. 2015

SCALE AS NOTED

PROJECT NO.	SHEET NO.	REV NO.
1101-0016	C-106	A

M:\1101\0016 Repermit 2015\Cad\civ permit\C-106 surface water.dwg



Subcat Reach Pond Link

Routing Diagram for sw model 2015_REV

Prepared by {enter your company name here}, Printed 6/16/2015

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
44.040	76	(107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S)
44.040	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
44.040	Other	107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S
44.040		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	44.040	44.040		107S, 109S, 113S, 116S, 120S, 121S, 124S, 128S, 130S, 133S, 137S, 138S, 140S, 141S, 142S, 147S
0.000	**0.000**	**0.000**	**0.000**	**44.040**	**44.040**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment107S: P1 Runoff Area=2.150 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=8.57 cfs 0.415 af

Subcatchment109S: B2 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=11.36 cfs 0.550 af

Subcatchment113S: B1 Runoff Area=1.640 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=6.54 cfs 0.316 af

Subcatchment116S: G1 Runoff Area=3.560 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=14.20 cfs 0.687 af

Subcatchment120S: G4 Runoff Area=0.530 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=2.11 cfs 0.102 af

Subcatchment121S: G2 Runoff Area=7.650 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=30.51 cfs 1.476 af

Subcatchment124S: G5 Runoff Area=0.920 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=3.67 cfs 0.177 af

Subcatchment128S: G+ (direct to pond) Runoff Area=0.950 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=3.79 cfs 0.183 af

Subcatchment130S: M1 Runoff Area=9.990 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=39.84 cfs 1.927 af

Subcatchment133S: M2 Runoff Area=4.490 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=17.90 cfs 0.866 af

Subcatchment137S: M3 Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=13.96 cfs 0.675 af

Subcatchment138S: M4 Runoff Area=2.360 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=9.41 cfs 0.455 af

Subcatchment140S: P2 Runoff Area=1.160 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=4.63 cfs 0.224 af

Subcatchment141S: G3 Runoff Area=1.250 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=4.98 cfs 0.241 af

Subcatchment142S: M5 Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=1.87 cfs 0.091 af

Subcatchment147S: M+ (direct to pond) Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=76 Runoff=2.27 cfs 0.110 af

Reach 110R: Ditch (tbd) Inflow=11.36 cfs 0.550 af
Outflow=11.36 cfs 0.550 af

Reach 111R: B Downslope Avg. Flow Depth=0.32' Max Vel=7.80 fps Inflow=17.26 cfs 0.866 af
n=0.040 L=20.0' S=0.2500 '/' Capacity=527.44 cfs Outflow=17.25 cfs 0.867 af

Reach 112R: B east swale Avg. Flow Depth=0.80' Max Vel=3.15 fps Inflow=6.54 cfs 0.316 af
n=0.025 L=580.0' S=0.0103 '/' Capacity=69.79 cfs Outflow=6.04 cfs 0.316 af

Reach 117R: G-upper east swale Avg. Flow Depth=0.96' Max Vel=4.80 fps Inflow=14.20 cfs 0.687 af
n=0.025 L=850.0' S=0.0188 '/' Capacity=94.14 cfs Outflow=13.17 cfs 0.687 af

Reach 118R: G-upper downslope Avg. Flow Depth=0.25' Max Vel=6.94 fps Inflow=15.19 cfs 0.789 af
n=0.040 L=137.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=15.16 cfs 0.789 af

Reach 119R: G-upper west swale Avg. Flow Depth=0.39' Max Vel=4.51 fps Inflow=2.11 cfs 0.102 af
n=0.025 L=180.0' S=0.0556 '/' Capacity=161.73 cfs Outflow=2.08 cfs 0.102 af

Reach 122R: G-middle east swale Avg. Flow Depth=1.34' Max Vel=4.54 fps Inflow=30.51 cfs 1.476 af
n=0.025 L=1,650.0' S=0.0109 '/' Capacity=71.67 cfs Outflow=24.53 cfs 1.476 af

Reach 125R: G-lower west swale Avg. Flow Depth=0.63' Max Vel=3.04 fps Inflow=3.67 cfs 0.177 af
n=0.025 L=300.0' S=0.0133 '/' Capacity=79.23 cfs Outflow=3.59 cfs 0.177 af

Reach 126R: G-lower downslope Avg. Flow Depth=0.49' Max Vel=10.32 fps Inflow=47.55 cfs 2.683 af
n=0.040 L=60.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=47.53 cfs 2.683 af

Reach 131R: M-east upper swale Avg. Flow Depth=1.40' Max Vel=5.24 fps Inflow=39.84 cfs 1.927 af
n=0.025 L=2,200.0' S=0.0136 '/' Capacity=80.13 cfs Outflow=30.75 cfs 1.927 af

Reach 132R: M-upper downslope Avg. Flow Depth=0.26' Max Vel=7.17 fps Inflow=16.64 cfs 0.866 af
n=0.040 L=50.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=16.63 cfs 0.866 af

Reach 134R: M-west upper swale Avg. Flow Depth=1.04' Max Vel=5.15 fps Inflow=17.90 cfs 0.866 af
n=0.025 L=900.0' S=0.0194 '/' Capacity=95.68 cfs Outflow=16.64 cfs 0.866 af

Reach 135R: M-lower downslope Avg. Flow Depth=0.59' Max Vel=11.53 fps Inflow=67.47 cfs 4.014 af
n=0.040 L=54.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=67.44 cfs 4.014 af

Reach 136R: M-west lower swale Avg. Flow Depth=1.04' Max Vel=3.64 fps Inflow=13.96 cfs 0.675 af
n=0.025 L=1,030.0' S=0.0097 '/' Capacity=67.61 cfs Outflow=11.95 cfs 0.675 af

Reach 140R: G-lower ditch (tbd) Inflow=4.98 cfs 0.241 af
Outflow=4.98 cfs 0.241 af

Reach 142R: M-middle downslope Avg. Flow Depth=0.48' Max Vel=10.22 fps Inflow=46.99 cfs 2.793 af
n=0.040 L=88.0' S=0.2500 '/' Capacity=637.17 cfs Outflow=46.96 cfs 2.793 af

Reach 143R: M-east lower swale Avg. Flow Depth=0.89' Max Vel=3.56 fps Inflow=9.41 cfs 0.455 af
n=0.025 L=1,650.0' S=0.0121 '/' Capacity=61.14 cfs Outflow=7.04 cfs 0.455 af

Reach 144R: ditch (tbd) Inflow=8.57 cfs 0.415 af
Outflow=8.57 cfs 0.415 af

Reach 145R: ditch (tbd) Inflow=4.63 cfs 0.224 af
Outflow=4.63 cfs 0.224 af

Reach 146R: ditch (tbd) Inflow=1.87 cfs 0.091 af
Outflow=1.87 cfs 0.091 af

Pond 105P: NE Infiltration Pond Inflow=13.20 cfs 0.639 af
Primary=13.20 cfs 0.639 af

Pond 108P: South Infiltration Pond Peak Elev=1,188.20' Storage=0.597 af Inflow=17.25 cfs 0.867 af
Outflow=0.29 cfs 0.732 af

Pond 129P: North infiltration pond Peak Elev=1,157.02' Storage=1.957 af Inflow=51.05 cfs 2.867 af
Outflow=0.90 cfs 2.559 af

Pond 139P: SW Infiltration Pond Peak Elev=1,157.70' Storage=2.945 af Inflow=69.39 cfs 4.124 af
Outflow=1.10 cfs 3.191 af

Total Runoff Area = 44.040 ac Runoff Volume = 8.495 af Average Runoff Depth = 2.31"
100.00% Pervious = 44.040 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 107S: P1

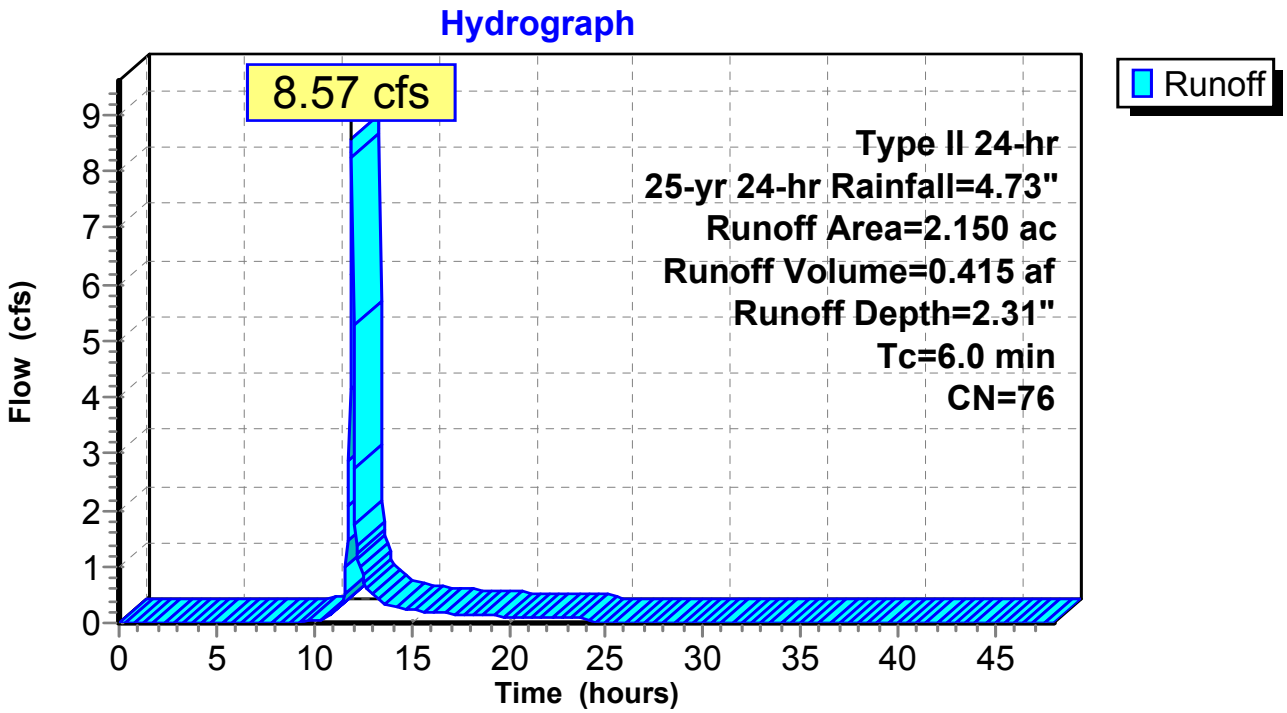
Runoff = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.150	76	
	2.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 107S: P1



Summary for Subcatchment 109S: B2

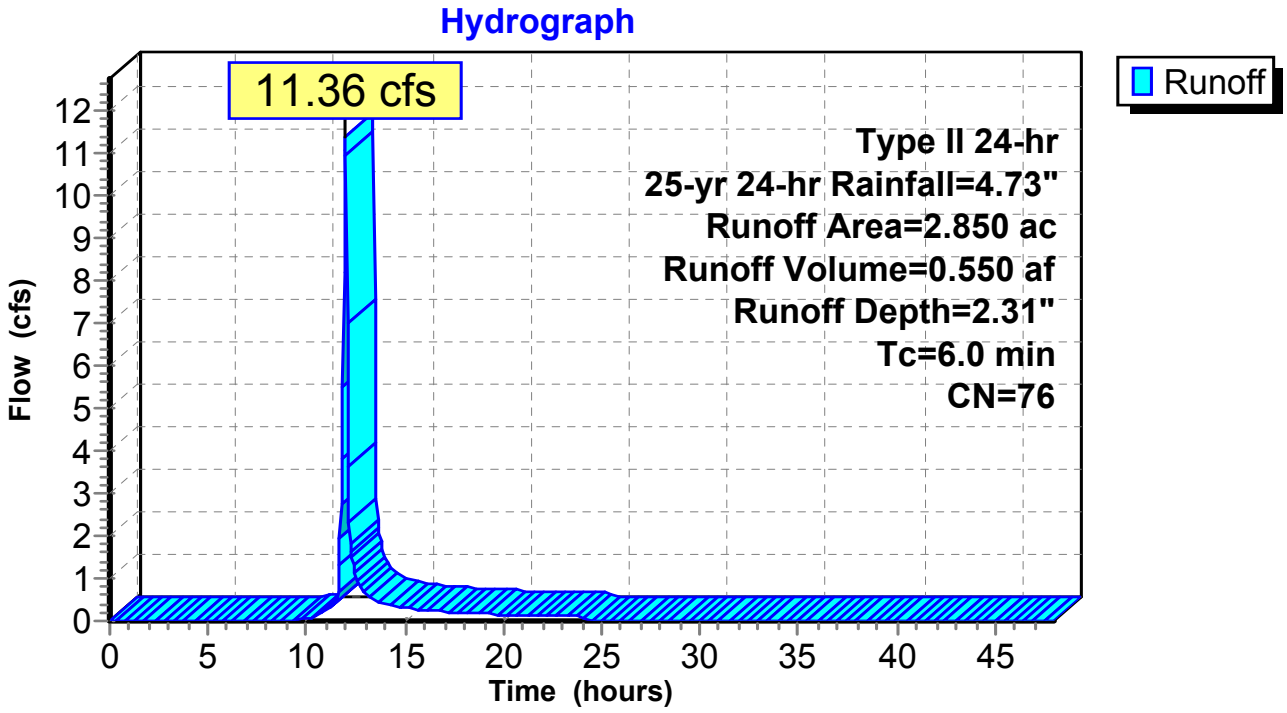
Runoff = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.850	76	
	2.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 109S: B2



Summary for Subcatchment 113S: B1

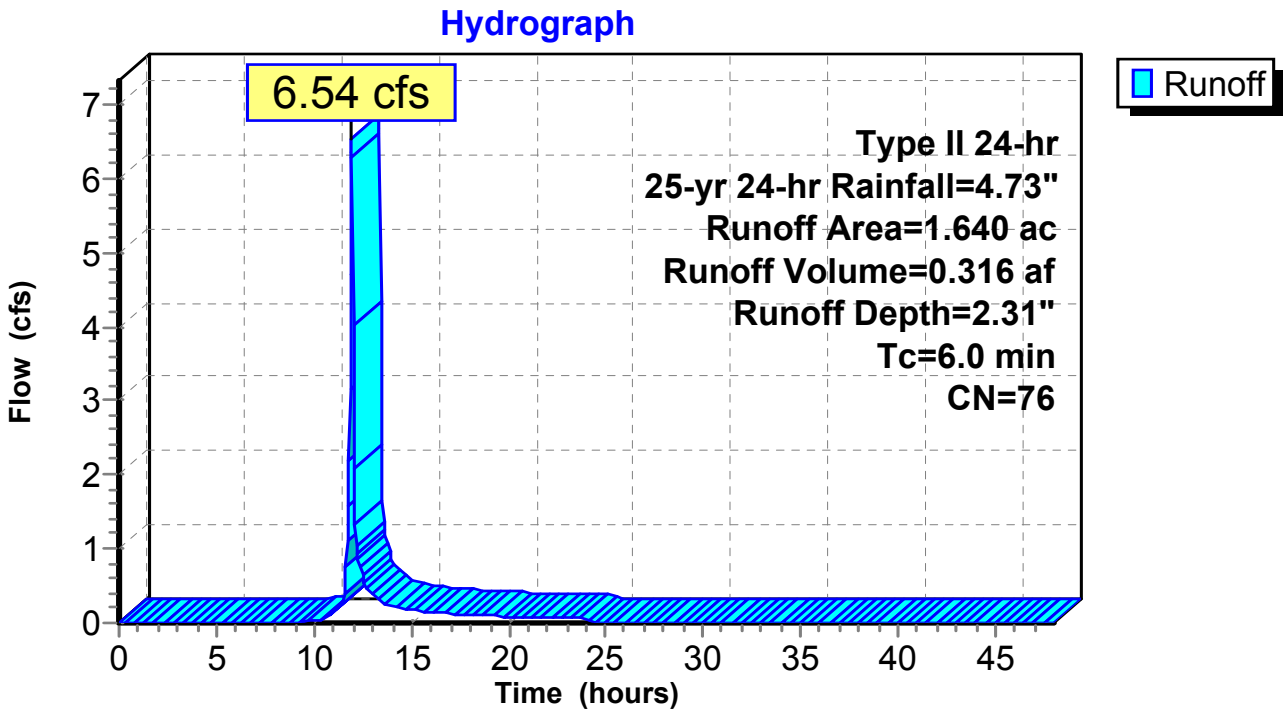
Runoff = 6.54 cfs @ 11.97 hrs, Volume= 0.316 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.640	76	
	1.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 113S: B1



Summary for Subcatchment 116S: G1

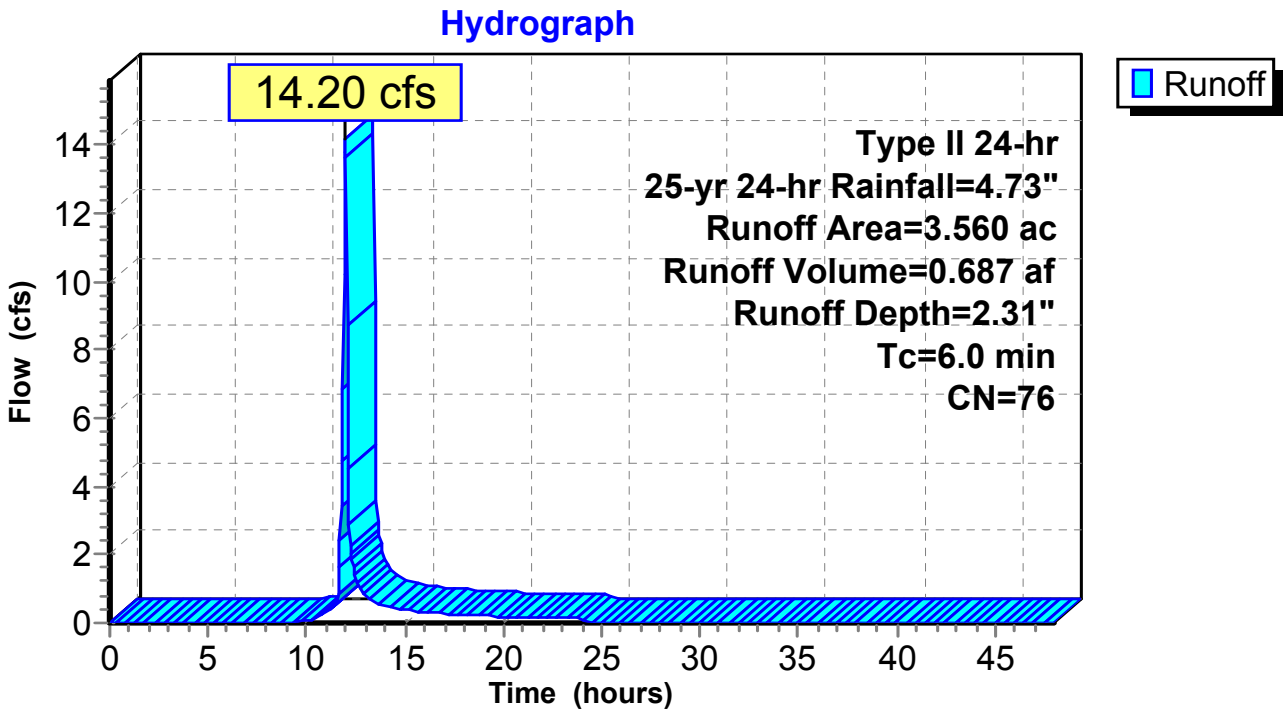
Runoff = 14.20 cfs @ 11.97 hrs, Volume= 0.687 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	3.560	76	
	3.560		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 116S: G1



Summary for Subcatchment 120S: G4

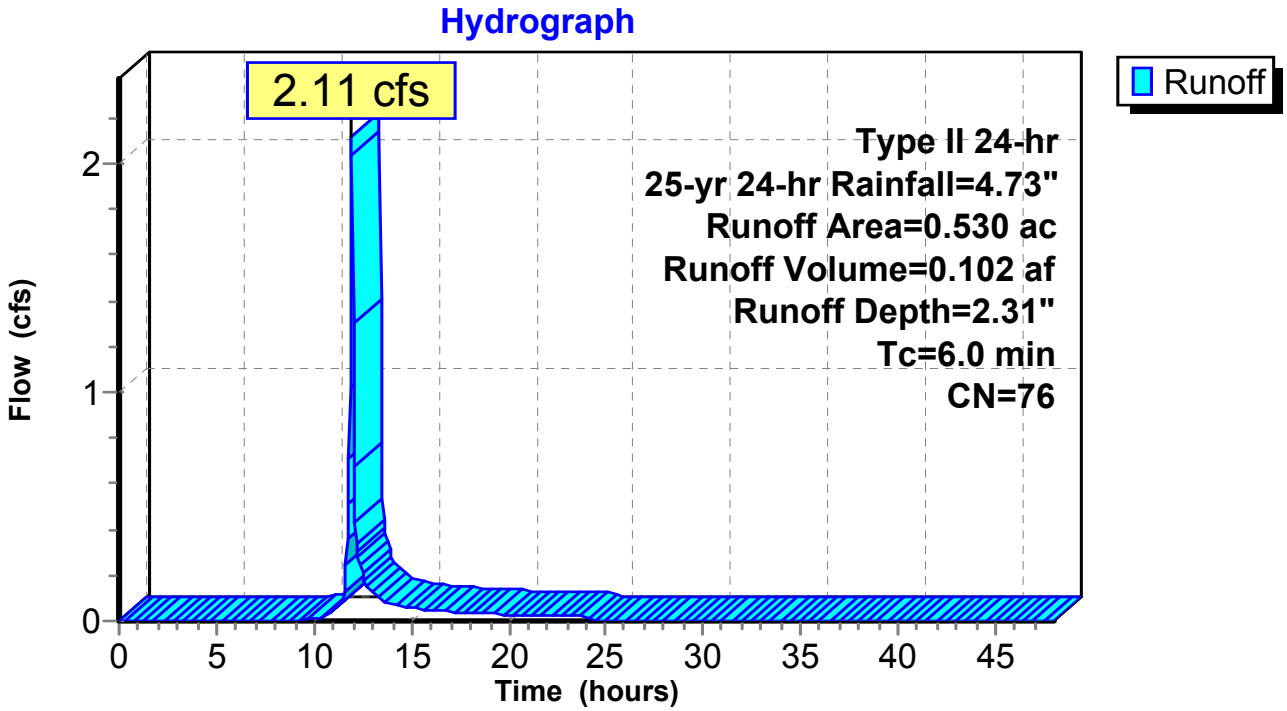
Runoff = 2.11 cfs @ 11.97 hrs, Volume= 0.102 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.530	76	
	0.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 120S: G4



Summary for Subcatchment 121S: G2

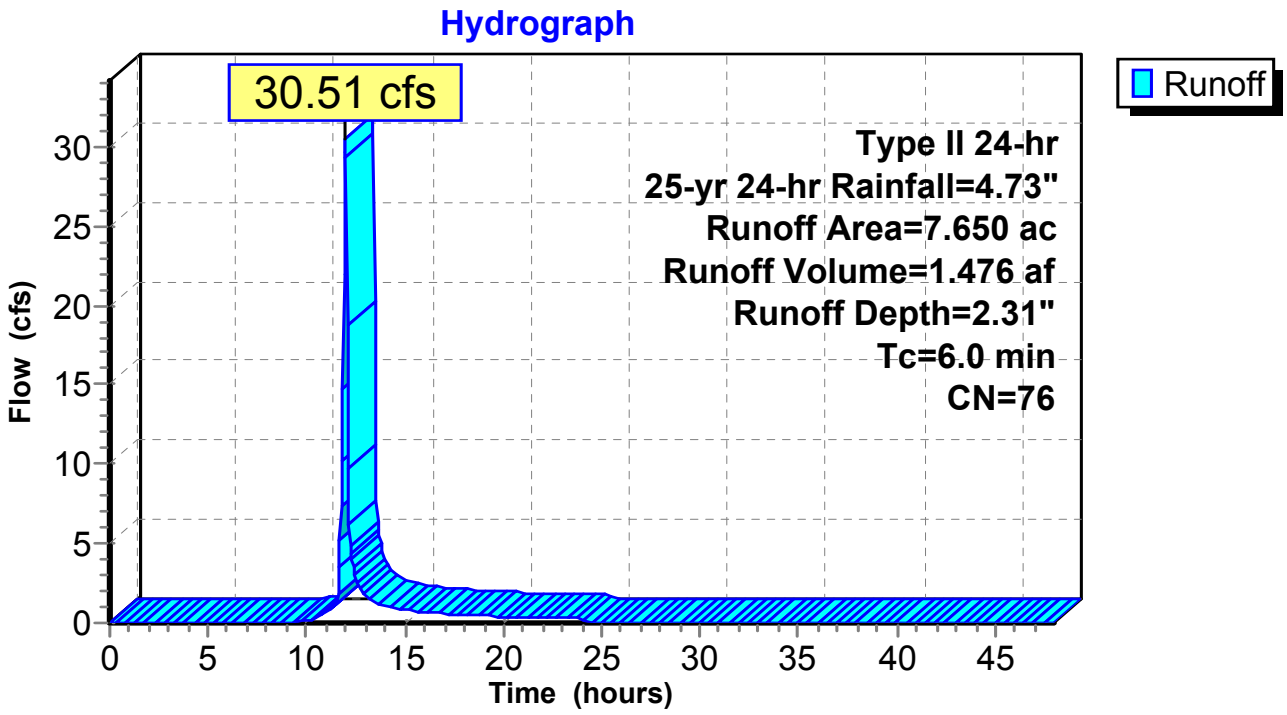
Runoff = 30.51 cfs @ 11.97 hrs, Volume= 1.476 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	7.650	76	
	7.650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 121S: G2



Summary for Subcatchment 124S: G5

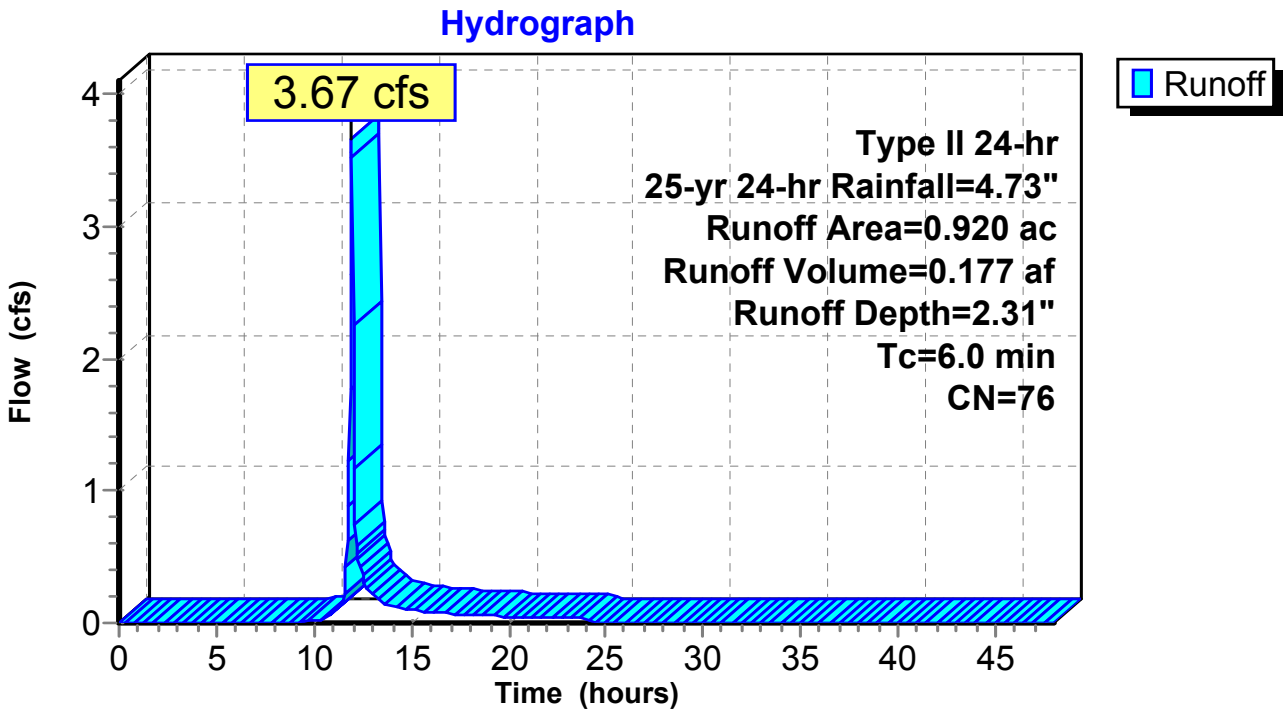
Runoff = 3.67 cfs @ 11.97 hrs, Volume= 0.177 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.920	76	
	0.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 124S: G5



Summary for Subcatchment 128S: G+ (direct to pond)

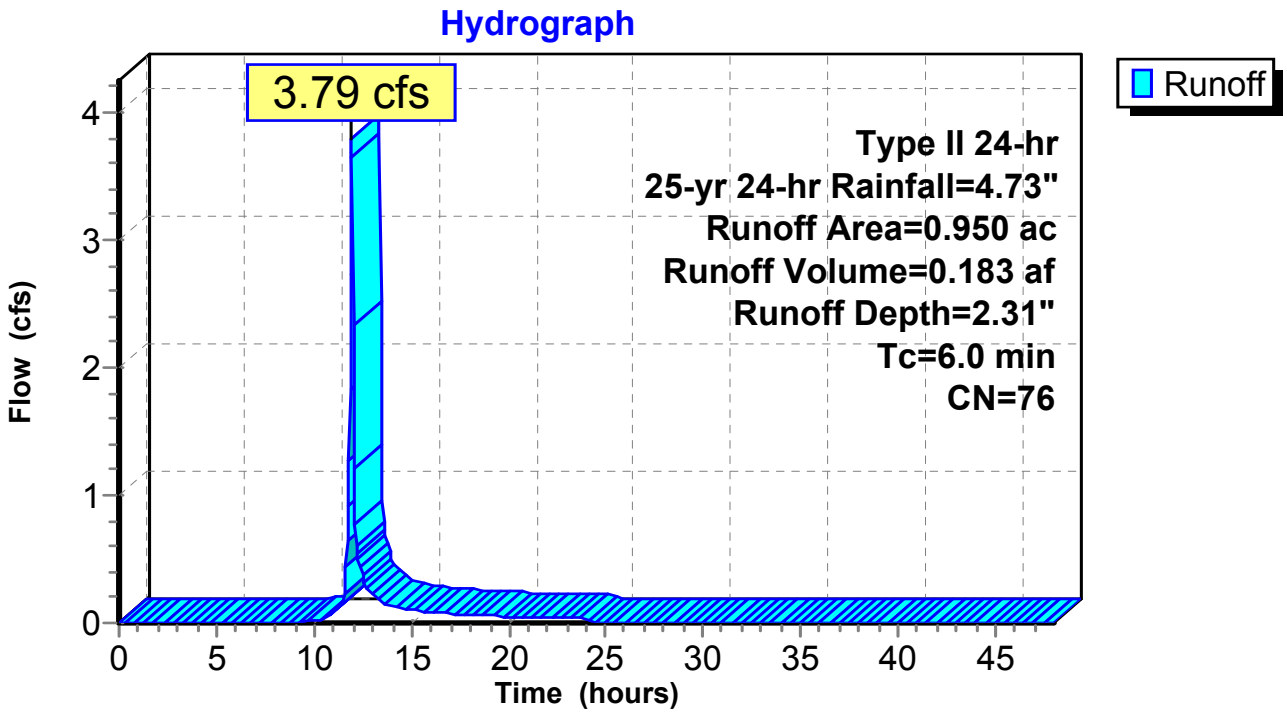
Runoff = 3.79 cfs @ 11.97 hrs, Volume= 0.183 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.950	76	
	0.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 128S: G+ (direct to pond)



Summary for Subcatchment 130S: M1

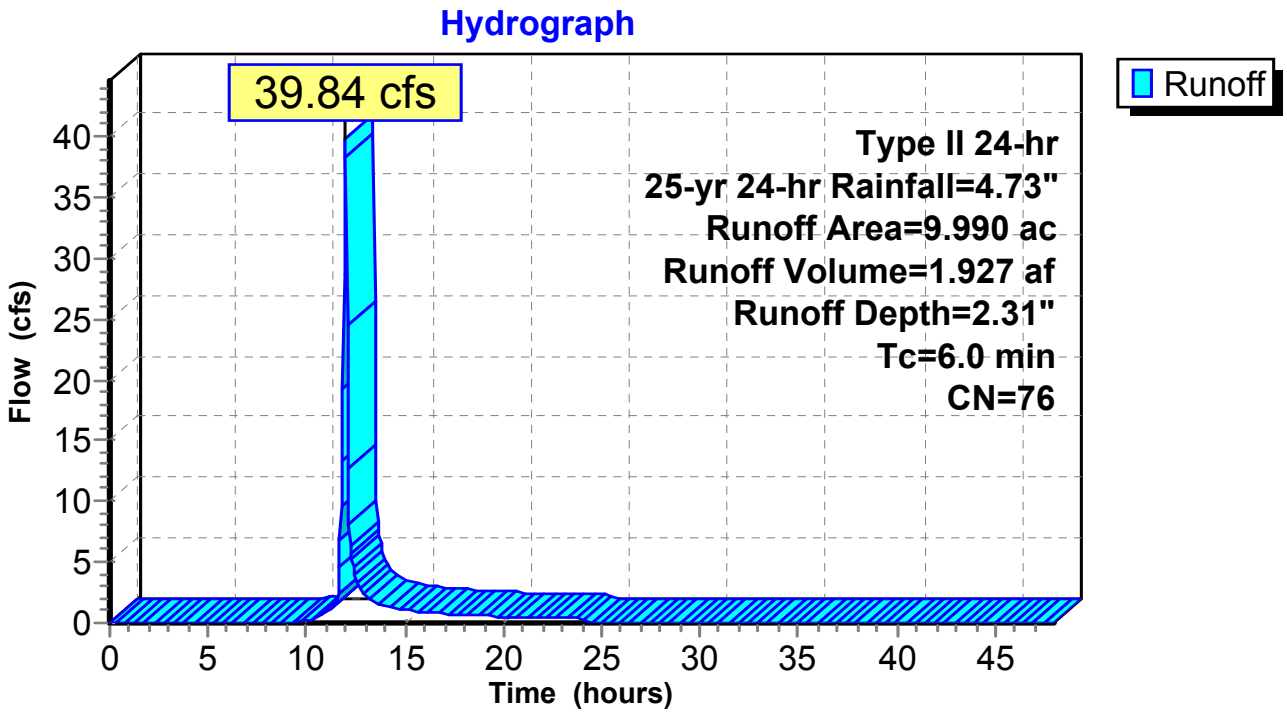
Runoff = 39.84 cfs @ 11.97 hrs, Volume= 1.927 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	9.990	76	
	9.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 130S: M1



Summary for Subcatchment 133S: M2

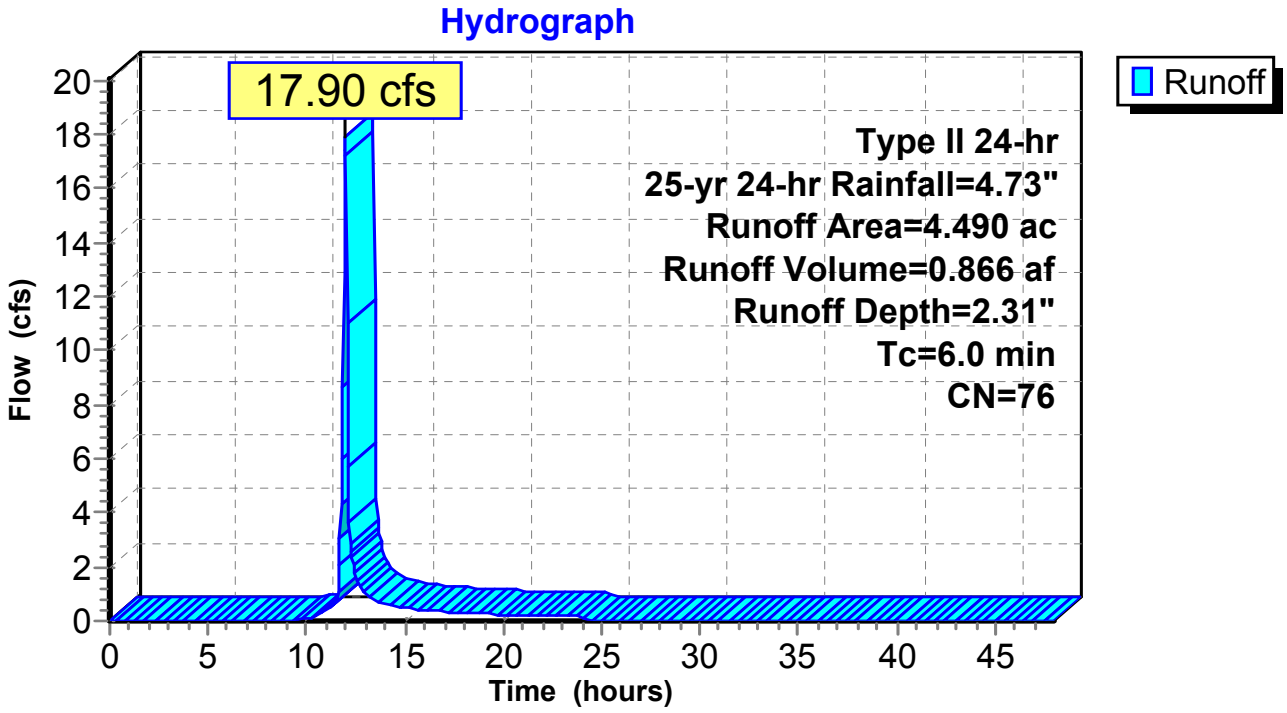
Runoff = 17.90 cfs @ 11.97 hrs, Volume= 0.866 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	4.490	76	
	4.490		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 133S: M2



Summary for Subcatchment 137S: M3

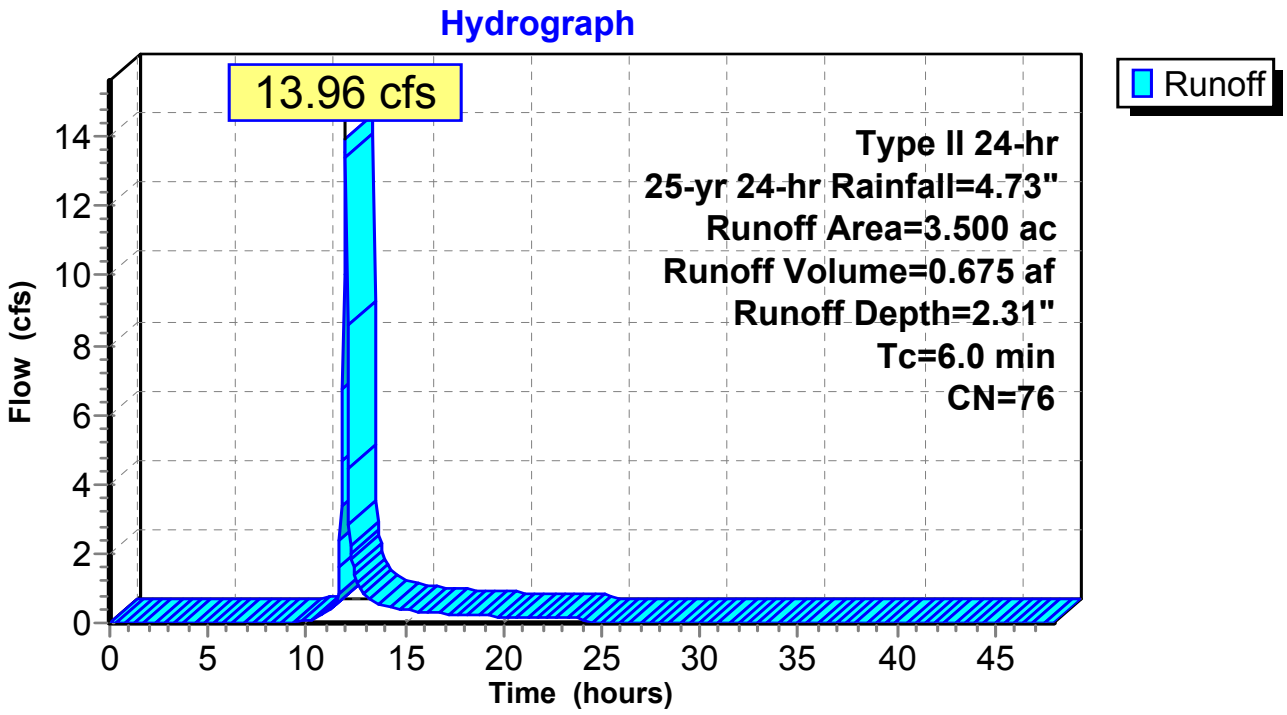
Runoff = 13.96 cfs @ 11.97 hrs, Volume= 0.675 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	3.500	76	
	3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 137S: M3



Summary for Subcatchment 138S: M4

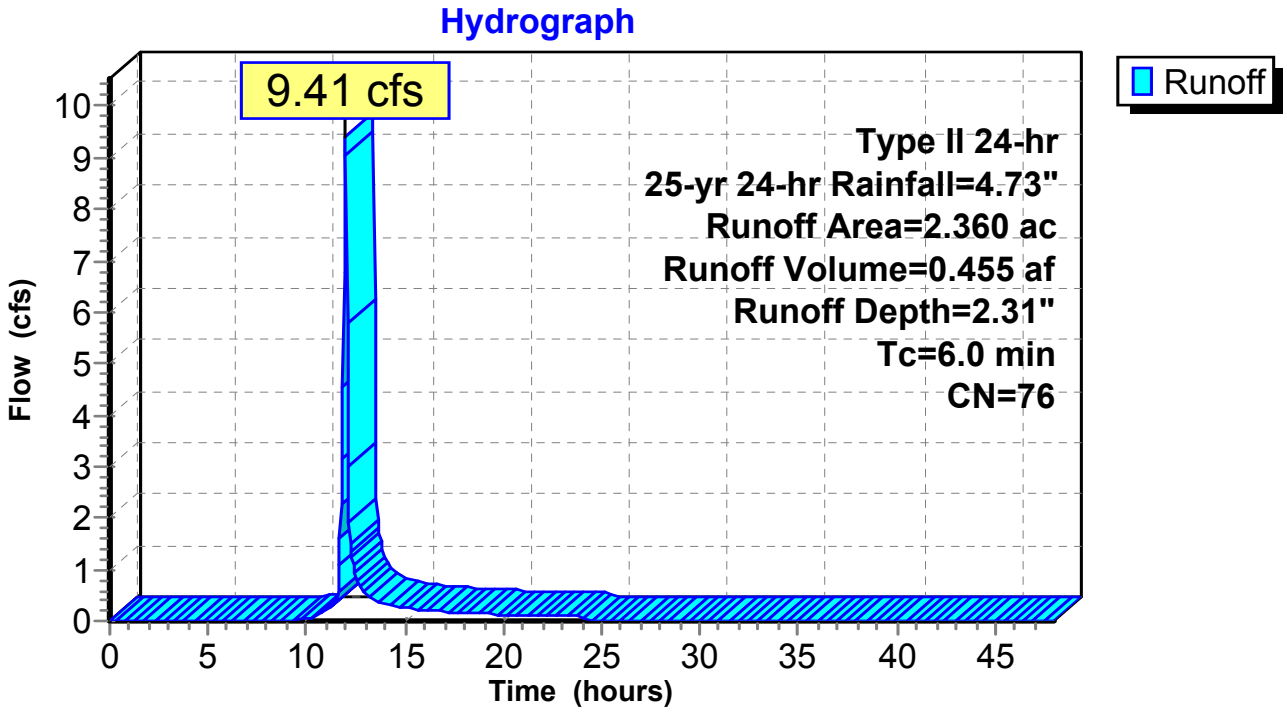
Runoff = 9.41 cfs @ 11.97 hrs, Volume= 0.455 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	2.360	76	
	2.360		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 138S: M4



Summary for Subcatchment 140S: P2

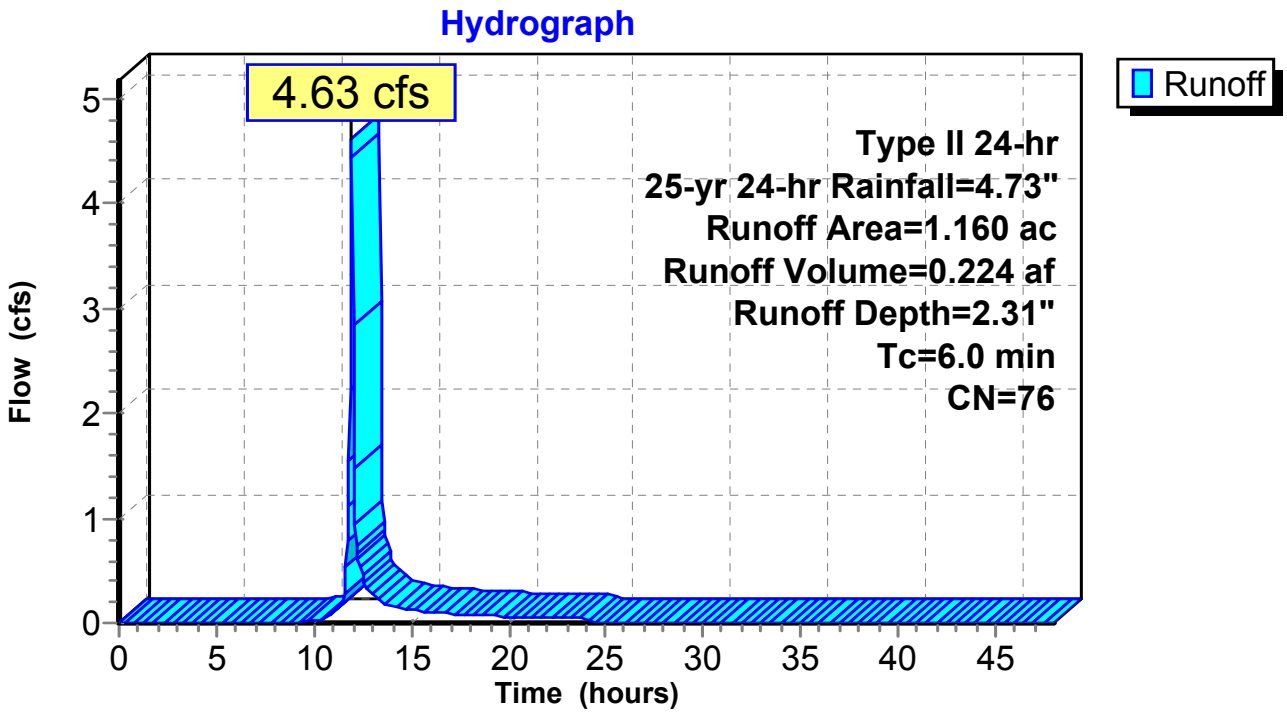
Runoff = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.160	76	
	1.160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 140S: P2



Summary for Subcatchment 141S: G3

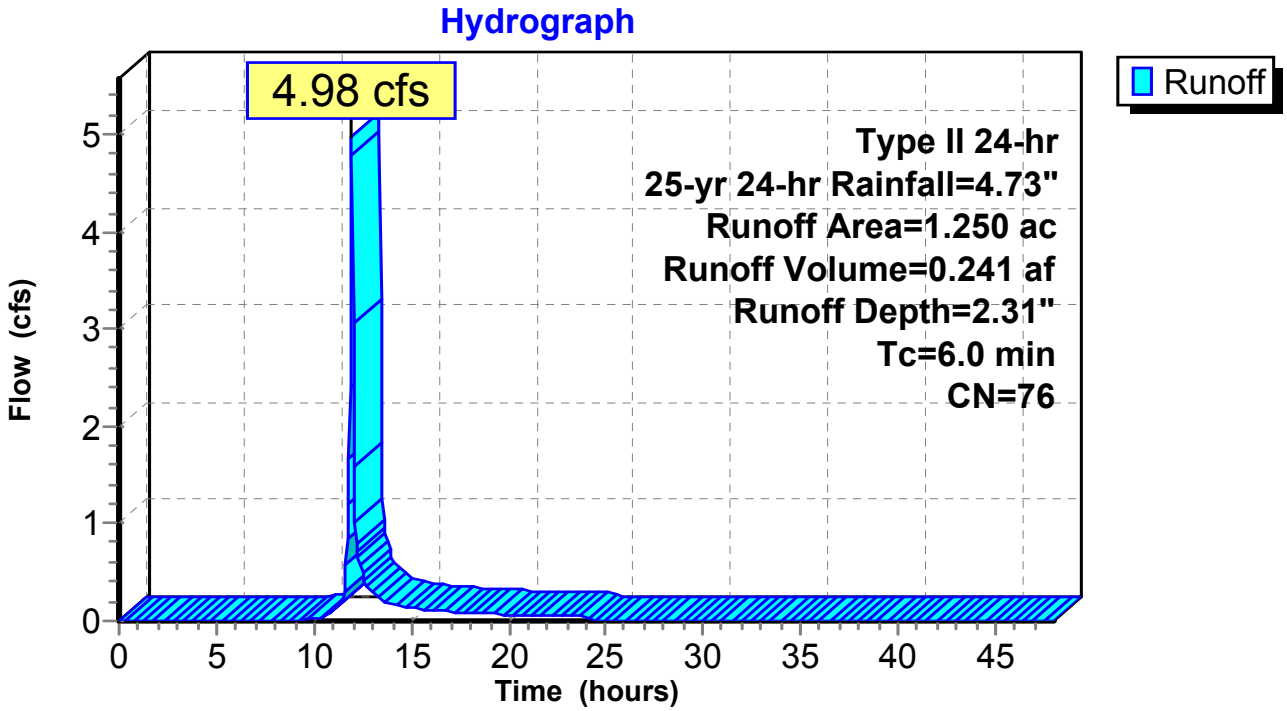
Runoff = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	1.250	76	
	1.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 141S: G3



Summary for Subcatchment 142S: M5

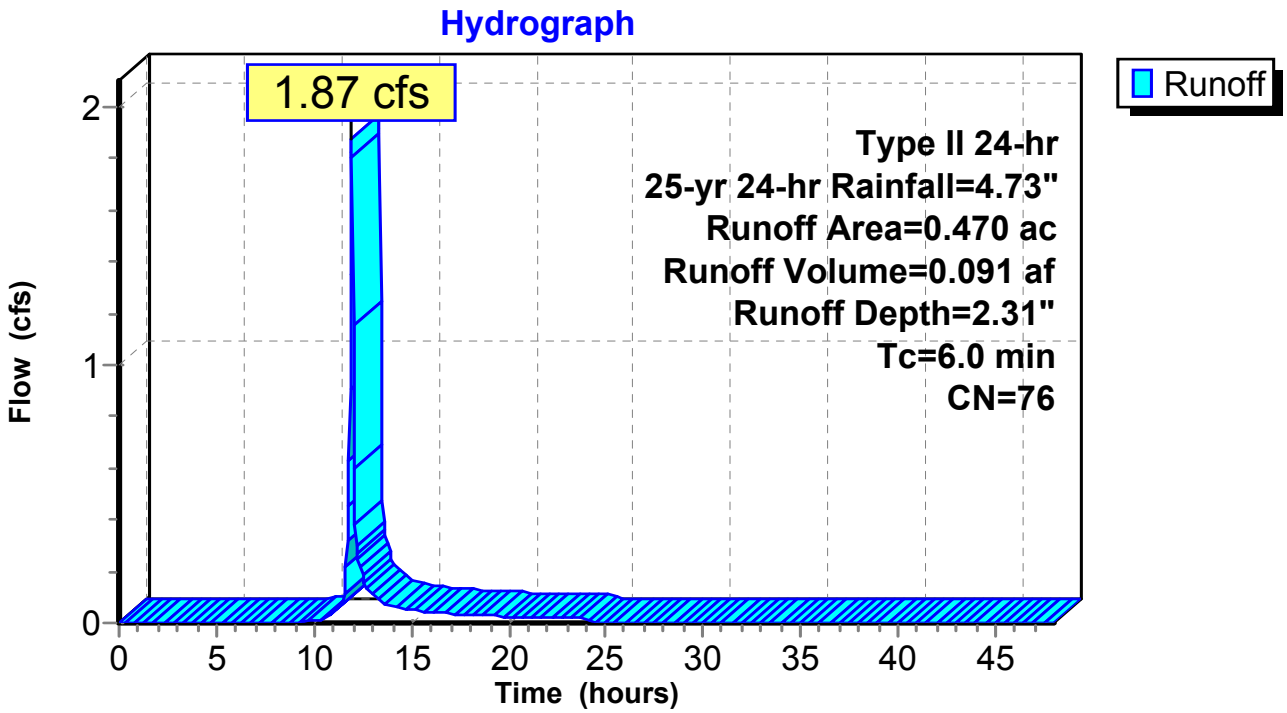
Runoff = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.470	76	
	0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 142S: M5



Summary for Subcatchment 147S: M+ (direct to pond)

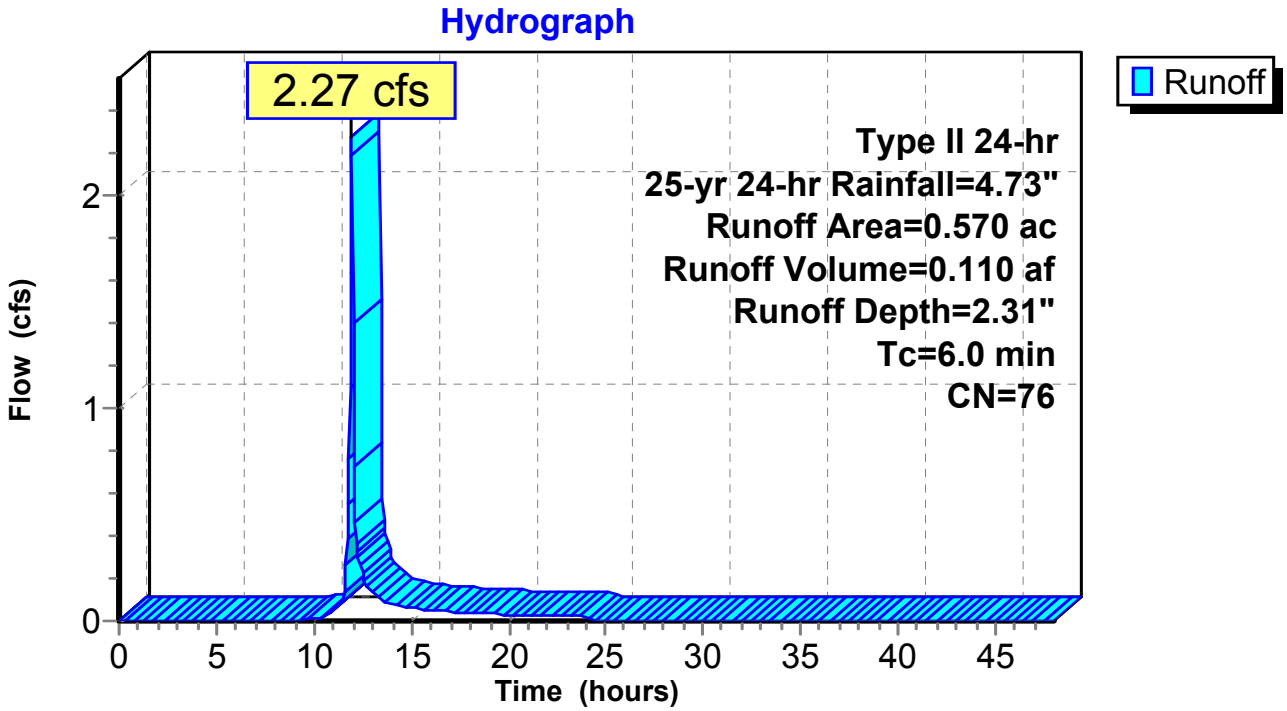
Runoff = 2.27 cfs @ 11.97 hrs, Volume= 0.110 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr 24-hr Rainfall=4.73"

	Area (ac)	CN	Description
*	0.570	76	
	0.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 147S: M+ (direct to pond)

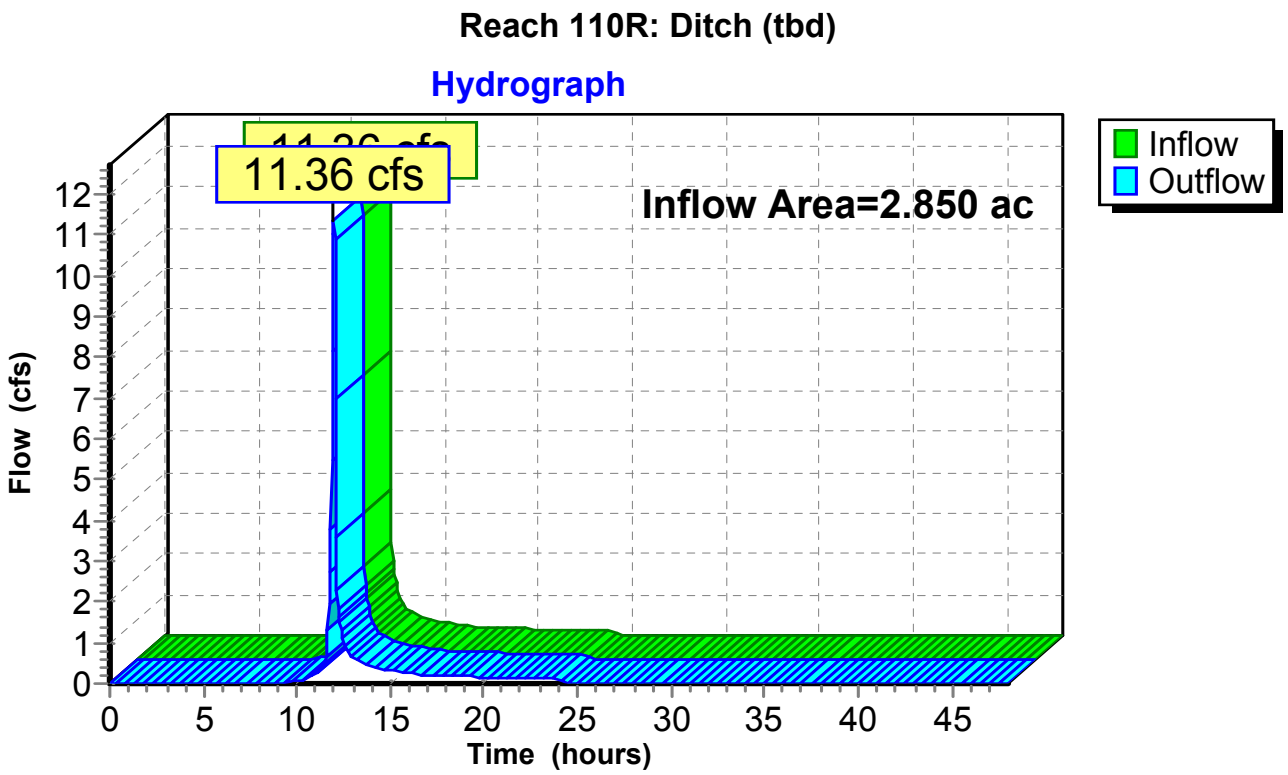


Summary for Reach 110R: Ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af
Outflow = 11.36 cfs @ 11.97 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



Summary for Reach 111R: B Downslope

[61] Hint: Exceeded Reach 112R outlet invert by 0.31' @ 12.00 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 17.26 cfs @ 11.98 hrs, Volume= 0.866 af
Outflow = 17.25 cfs @ 11.98 hrs, Volume= 0.867 af, Atten= 0%, Lag= 0.0 min

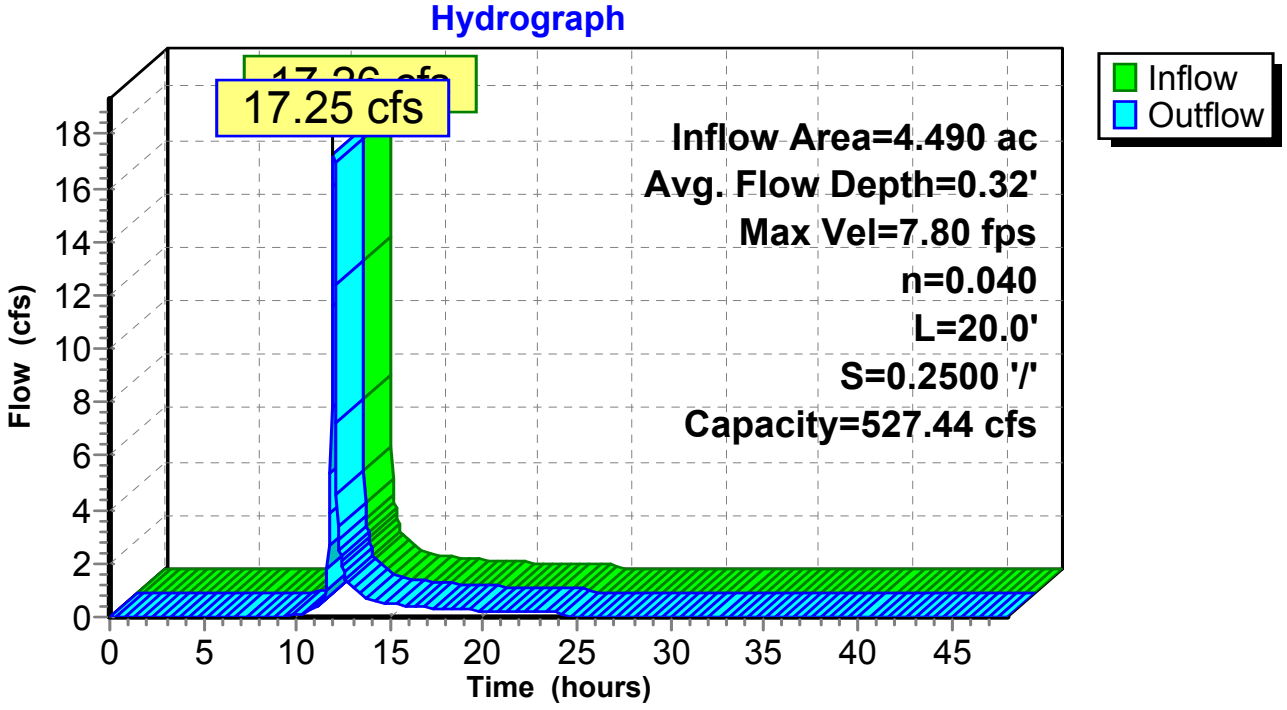
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 7.80 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 0.2 min

Peak Storage= 44 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 527.44 cfs

6.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 20.0' Slope= 0.2500 '/'
Inlet Invert= 1,192.00', Outlet Invert= 1,187.00'

‡

Reach 111R: B Downslope



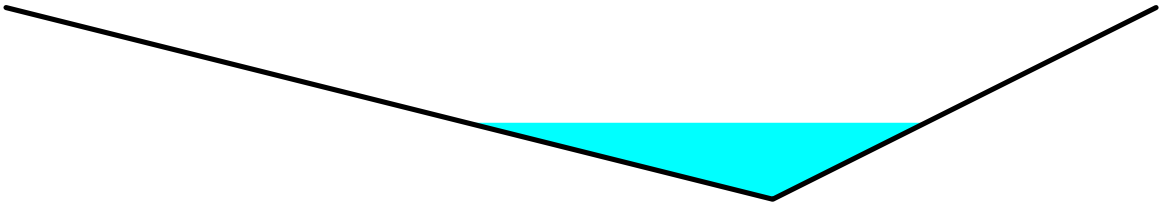
Summary for Reach 112R: B east swale

Inflow Area = 1.640 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 6.54 cfs @ 11.97 hrs, Volume= 0.316 af
Outflow = 6.04 cfs @ 12.01 hrs, Volume= 0.316 af, Atten= 8%, Lag= 1.9 min

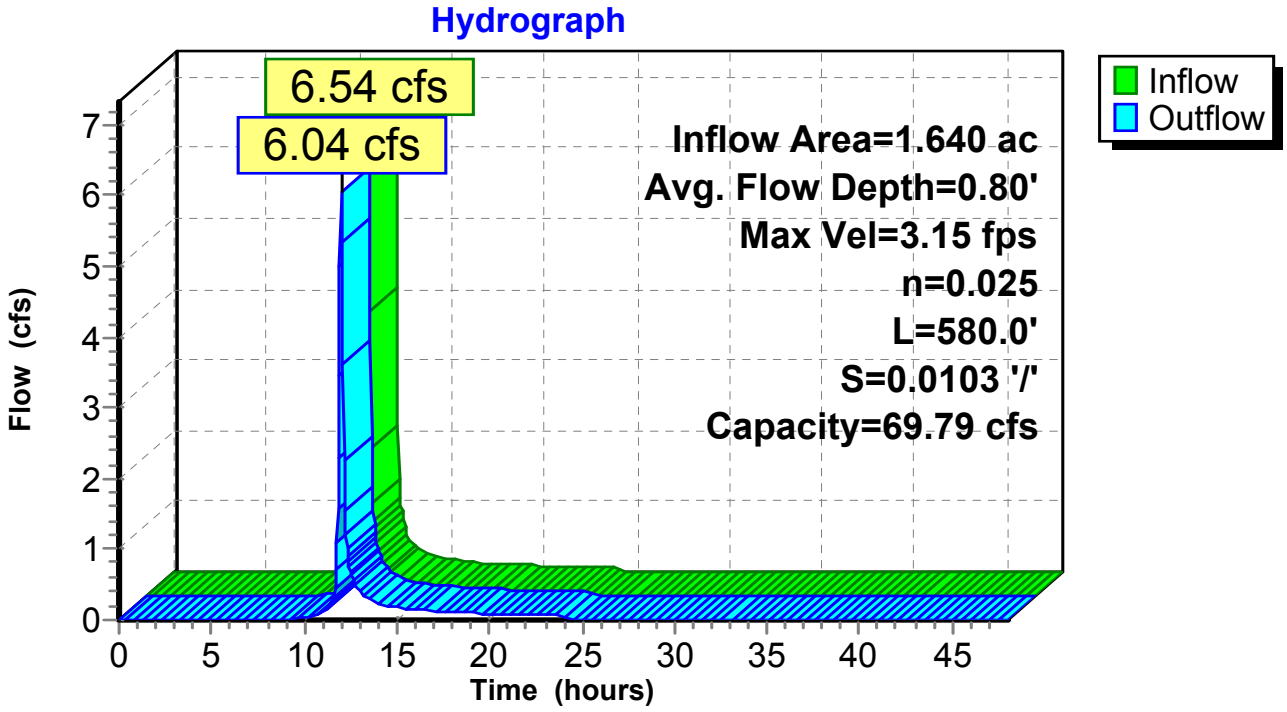
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.15 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 8.9 min

Peak Storage= 1,110 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.80'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 69.79 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 580.0' Slope= 0.0103 '/'
Inlet Invert= 1,198.00', Outlet Invert= 1,192.00'



Reach 112R: B east swale



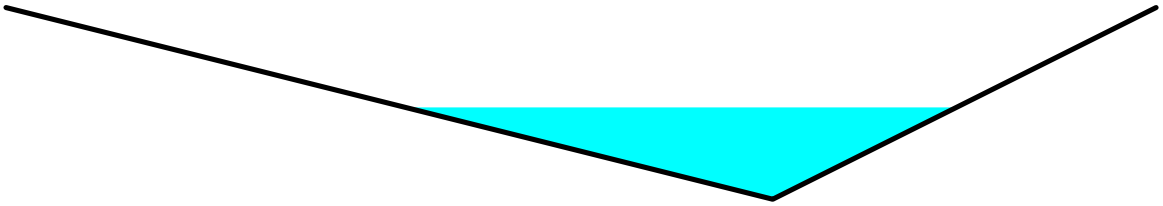
Summary for Reach 117R: G-upper east swale

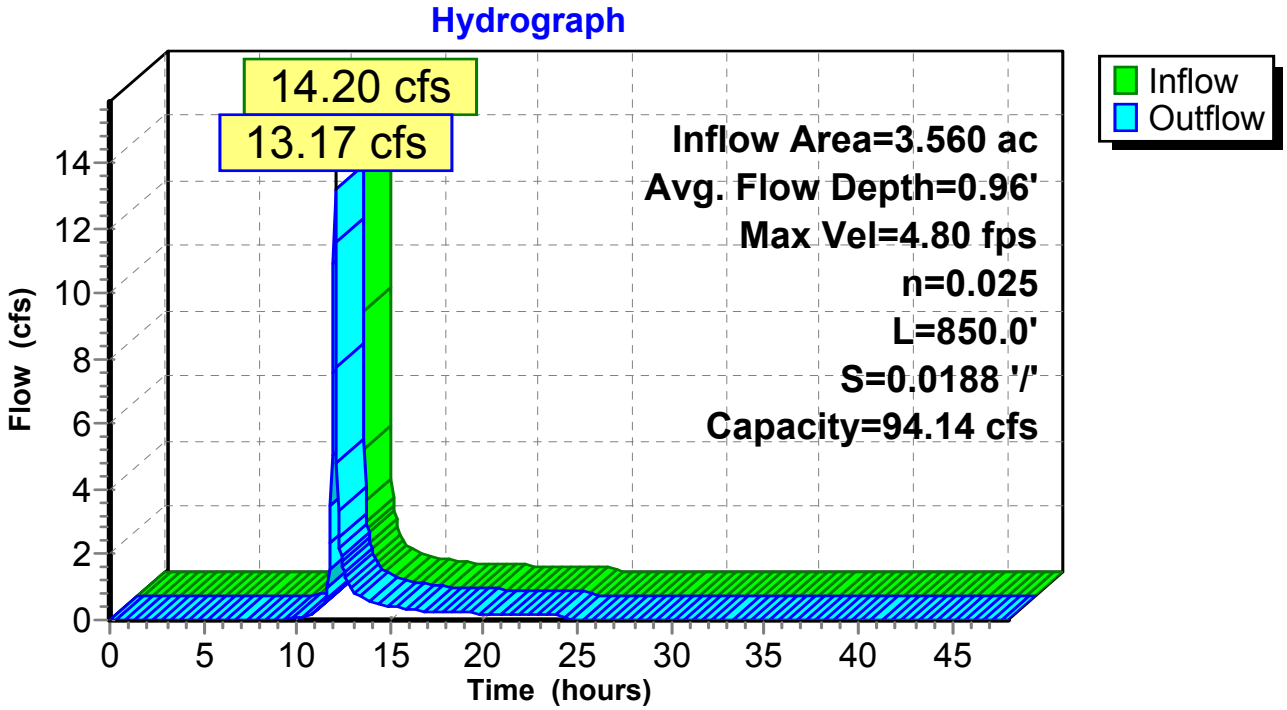
Inflow Area = 3.560 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 14.20 cfs @ 11.97 hrs, Volume= 0.687 af
Outflow = 13.17 cfs @ 12.00 hrs, Volume= 0.687 af, Atten= 7%, Lag= 1.9 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 8.8 min

Peak Storage= 2,334 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 94.14 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,206.00'





Summary for Reach 118R: G-upper downslope

[61] Hint: Exceeded Reach 117R outlet invert by 0.25' @ 12.00 hrs
[62] Hint: Exceeded Reach 119R OUTLET depth by 4.00' @ 24.65 hrs

Inflow Area = 4.090 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 15.19 cfs @ 12.00 hrs, Volume= 0.789 af
Outflow = 15.16 cfs @ 12.00 hrs, Volume= 0.789 af, Atten= 0%, Lag= 0.2 min

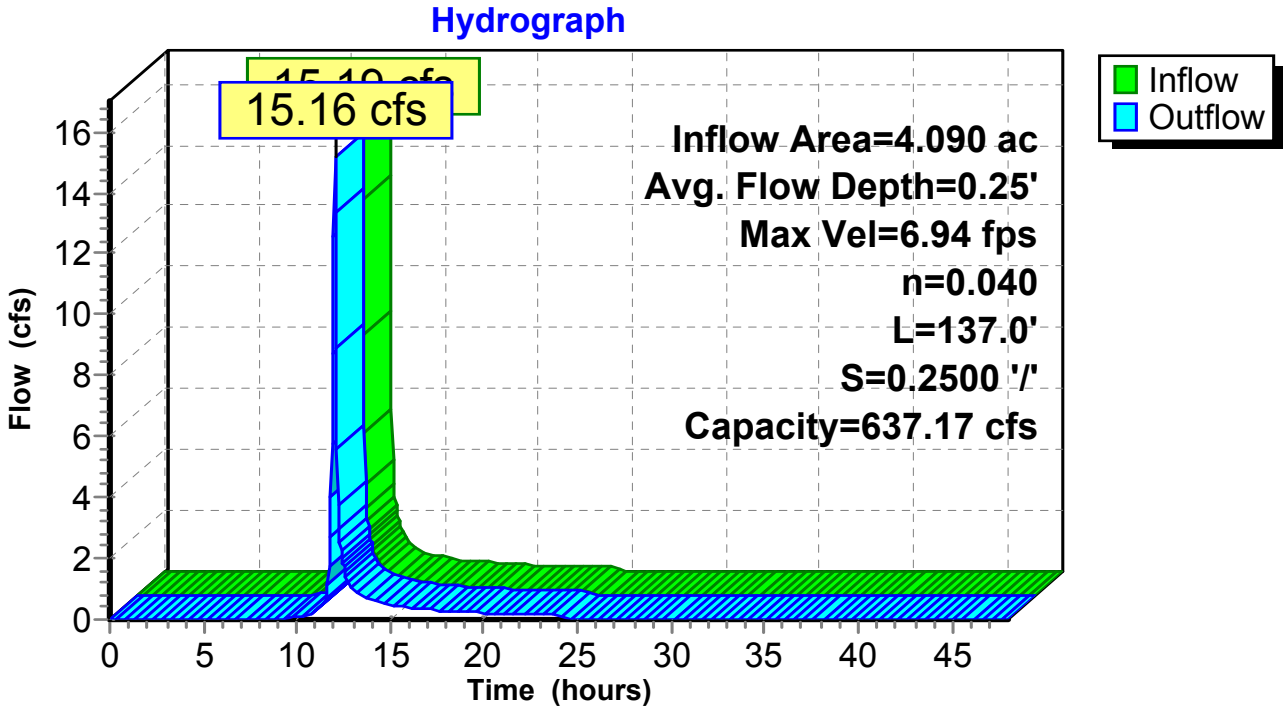
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.94 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 1.3 min

Peak Storage= 299 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 137.0' Slope= 0.2500 '/'
Inlet Invert= 1,206.00', Outlet Invert= 1,171.75'

‡

Reach 118R: G-upper downslope



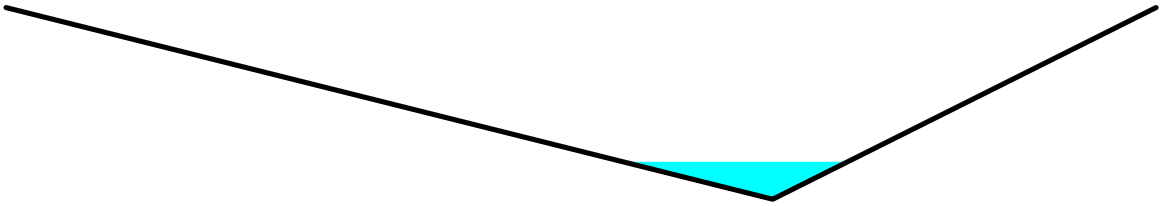
Summary for Reach 119R: G-upper west swale

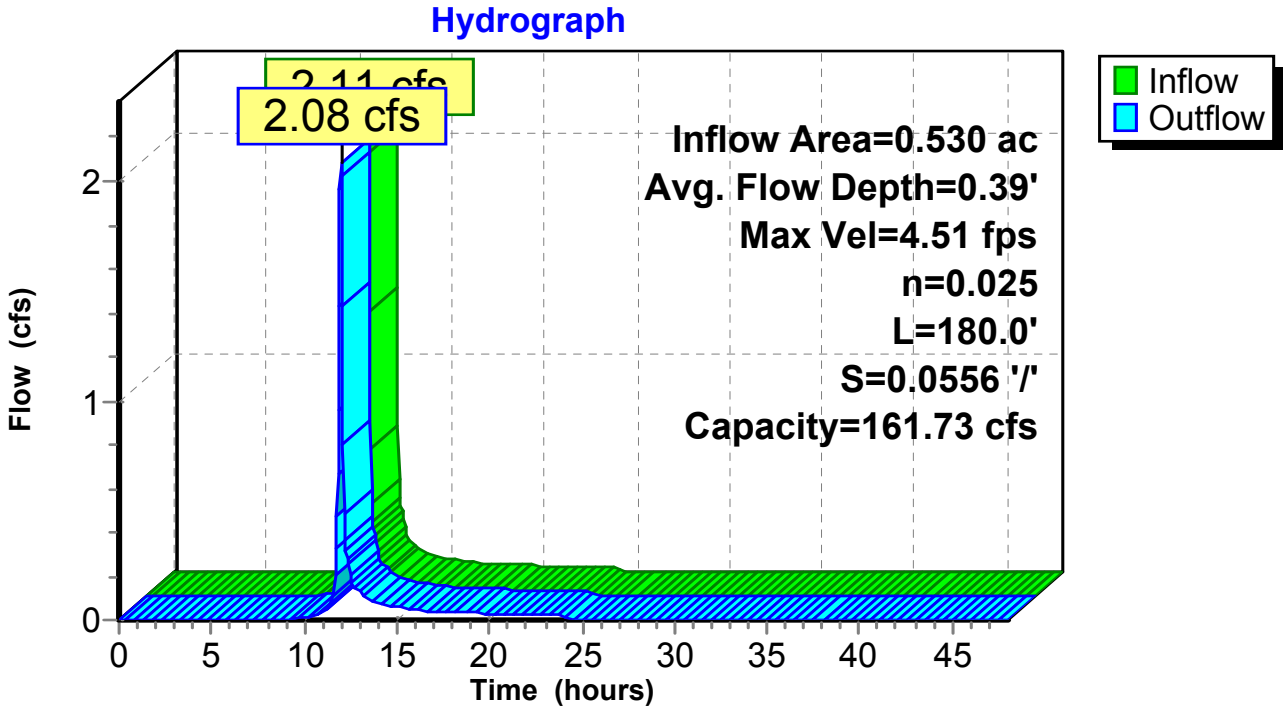
Inflow Area = 0.530 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 2.11 cfs @ 11.97 hrs, Volume= 0.102 af
Outflow = 2.08 cfs @ 11.98 hrs, Volume= 0.102 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 4.51 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 1.8 min

Peak Storage= 83 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 161.73 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 180.0' Slope= 0.0556 '/'
Inlet Invert= 1,212.00', Outlet Invert= 1,202.00'





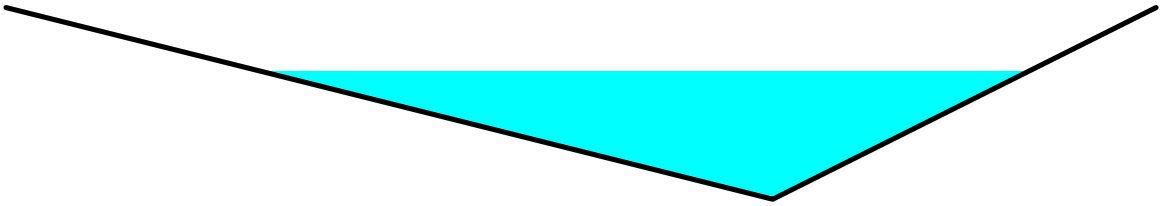
Summary for Reach 122R: G-middle east swale

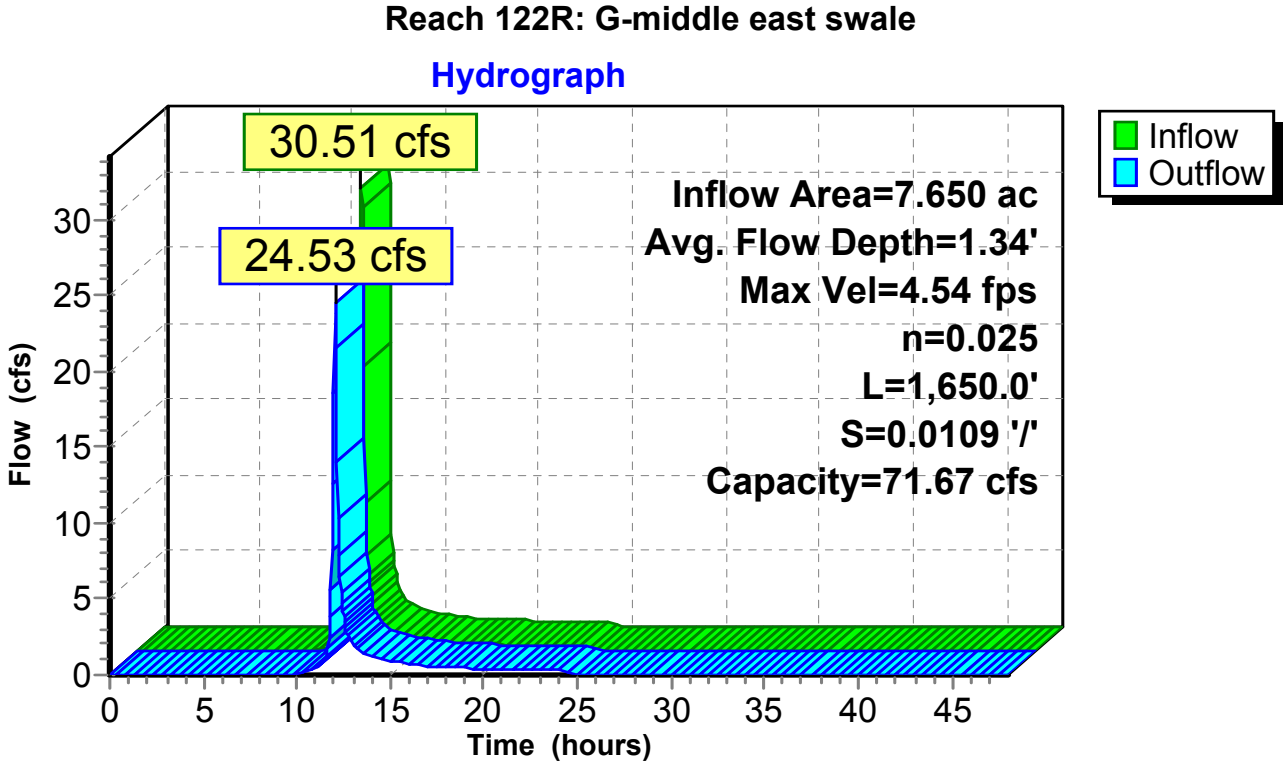
Inflow Area = 7.650 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 30.51 cfs @ 11.97 hrs, Volume= 1.476 af
Outflow = 24.53 cfs @ 12.03 hrs, Volume= 1.476 af, Atten= 20%, Lag= 3.2 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.54 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 20.6 min

Peak Storage= 8,864 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.34'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 71.67 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 1,650.0' Slope= 0.0109 '/'
Inlet Invert= 1,184.00', Outlet Invert= 1,166.00'





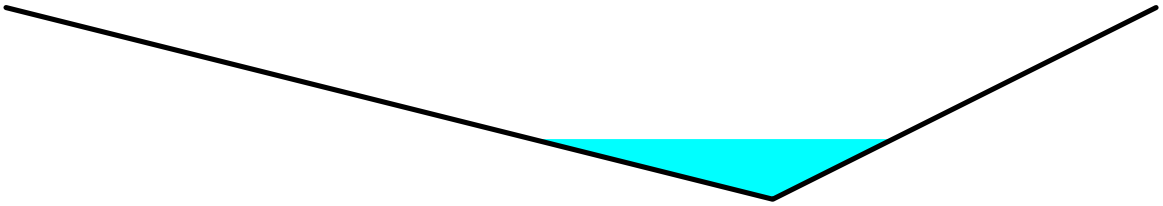
Summary for Reach 125R: G-lower west swale

Inflow Area = 0.920 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 3.67 cfs @ 11.97 hrs, Volume= 0.177 af
Outflow = 3.59 cfs @ 11.99 hrs, Volume= 0.177 af, Atten= 2%, Lag= 1.2 min

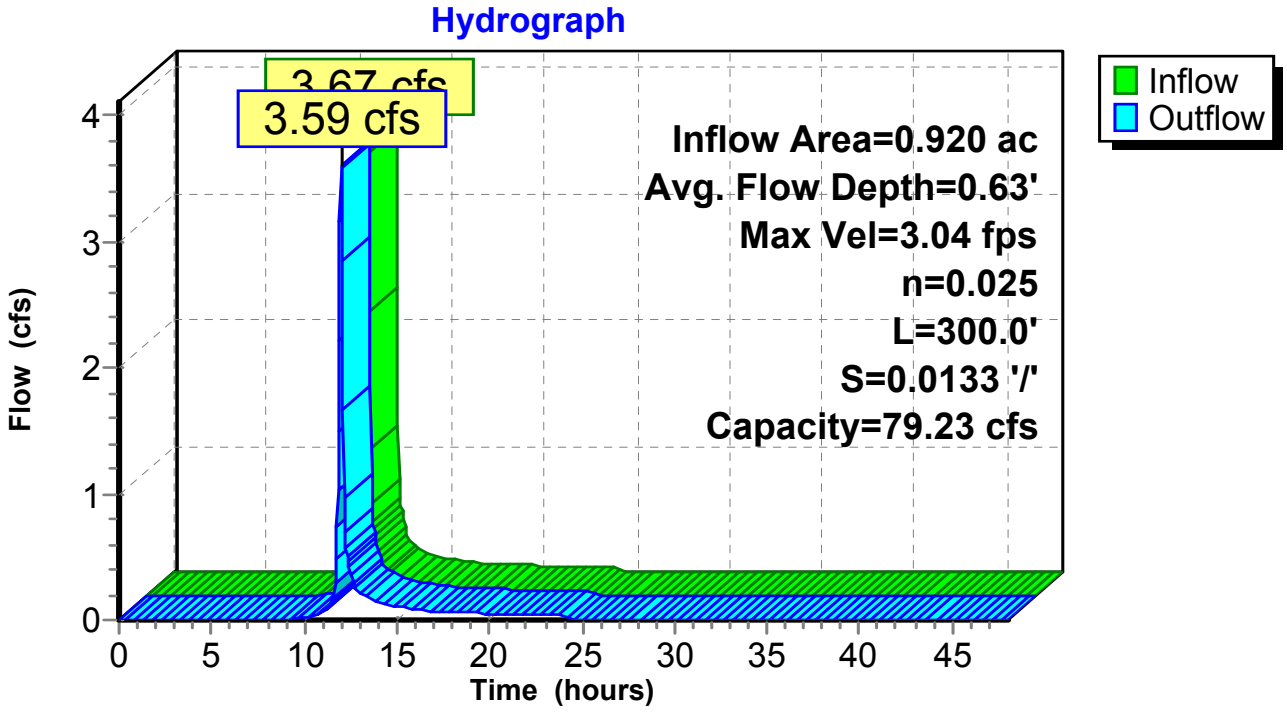
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.04 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 4.5 min

Peak Storage= 354 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 79.23 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 300.0' Slope= 0.0133 '/'
Inlet Invert= 1,174.00', Outlet Invert= 1,170.00'



Reach 125R: G-lower west swale



Summary for Reach 126R: G-lower downslope

[62] Hint: Exceeded Reach 118R OUTLET depth by 0.24' @ 12.00 hrs
[62] Hint: Exceeded Reach 122R OUTLET depth by 5.75' @ 0.00 hrs
[62] Hint: Exceeded Reach 125R OUTLET depth by 1.75' @ 26.00 hrs

Inflow Area = 13.910 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 47.55 cfs @ 12.01 hrs, Volume= 2.683 af
Outflow = 47.53 cfs @ 12.01 hrs, Volume= 2.683 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.32 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 0.4 min

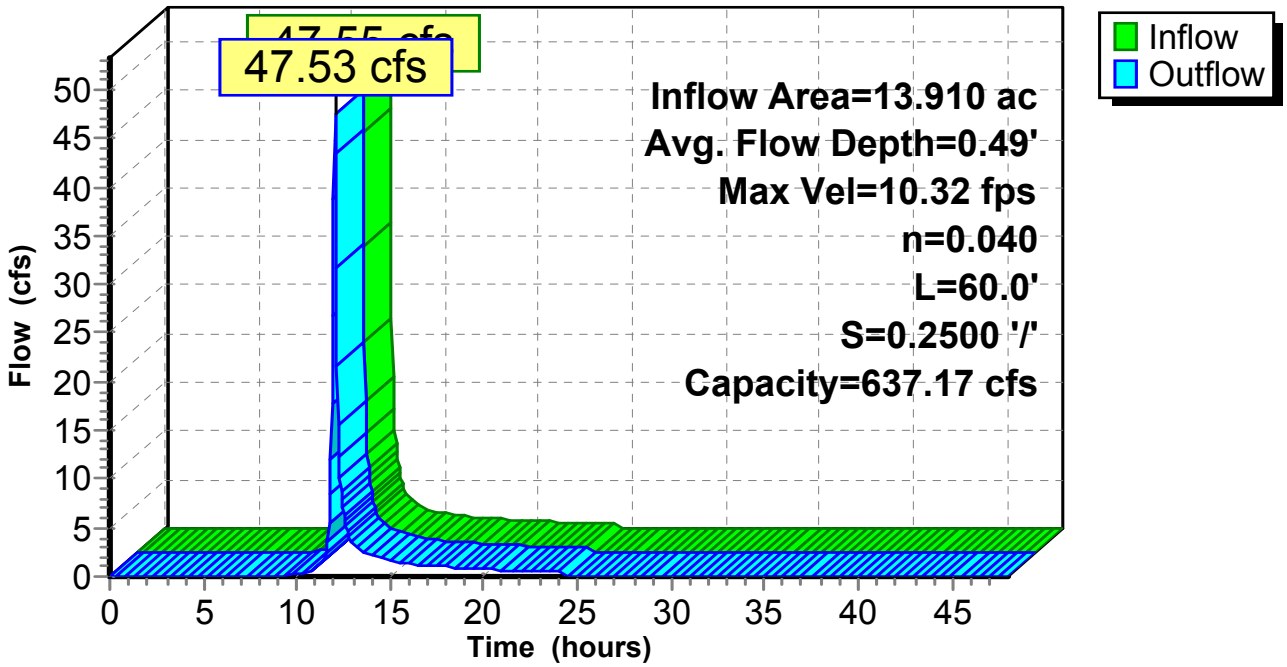
Peak Storage= 276 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 60.0' Slope= 0.2500 '/'
Inlet Invert= 1,171.75', Outlet Invert= 1,156.75'

‡

Reach 126R: G-lower downslope

Hydrograph



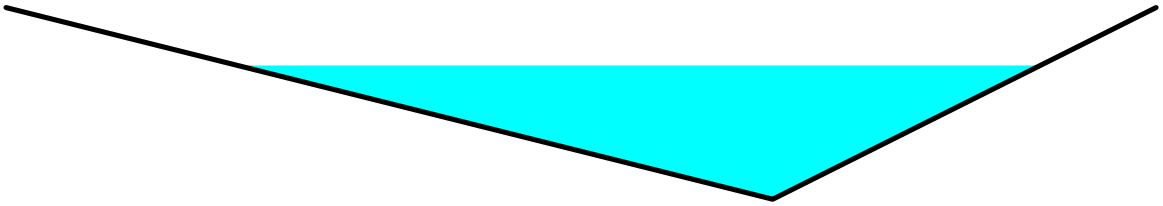
Summary for Reach 131R: M-east upper swale

Inflow Area = 9.990 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 39.84 cfs @ 11.97 hrs, Volume= 1.927 af
Outflow = 30.75 cfs @ 12.03 hrs, Volume= 1.927 af, Atten= 23%, Lag= 3.6 min

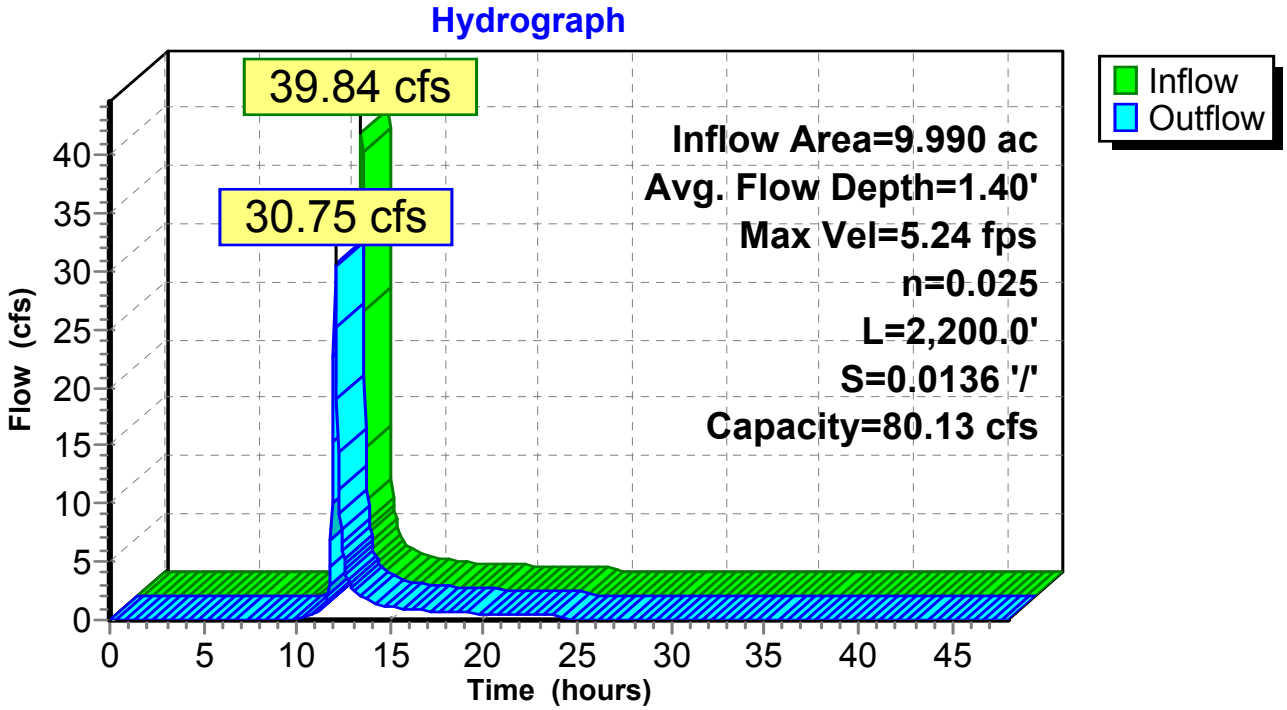
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.24 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 24.8 min

Peak Storage= 12,875 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.40'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 80.13 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 2,200.0' Slope= 0.0136 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,192.00'



Reach 131R: M-east upper swale



Summary for Reach 132R: M-upper downslope

[61] Hint: Exceeded Reach 134R outlet invert by 0.26' @ 12.00 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 16.64 cfs @ 12.00 hrs, Volume= 0.866 af
Outflow = 16.63 cfs @ 12.01 hrs, Volume= 0.866 af, Atten= 0%, Lag= 0.1 min

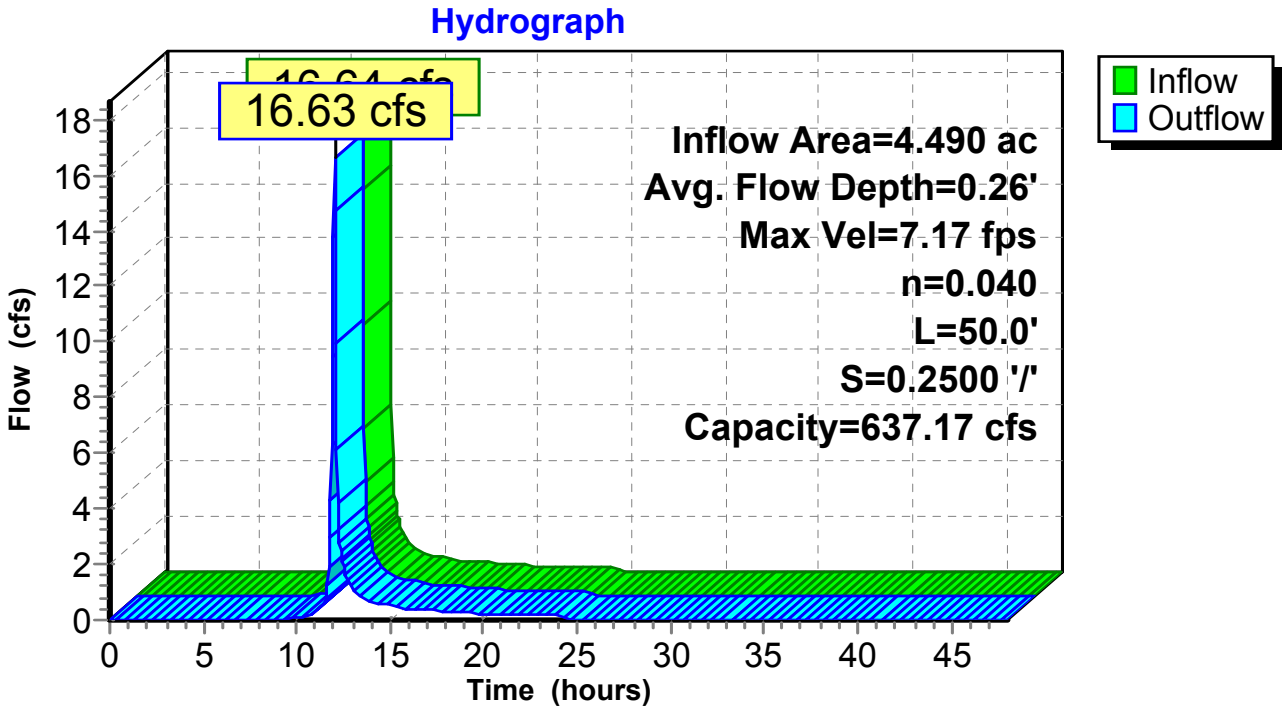
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.17 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 0.5 min

Peak Storage= 116 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 50.0' Slope= 0.2500 '/'
Inlet Invert= 1,204.50', Outlet Invert= 1,192.00'

‡

Reach 132R: M-upper downslope



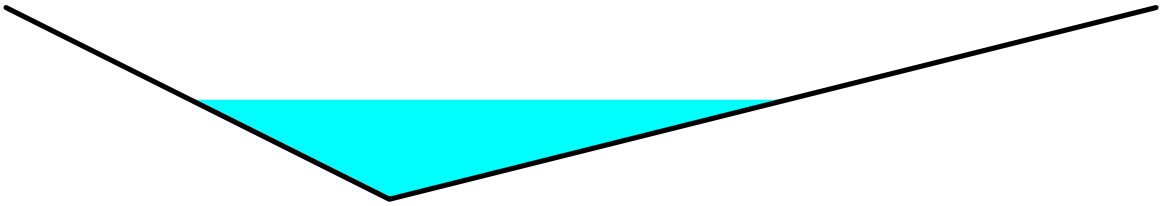
Summary for Reach 134R: M-west upper swale

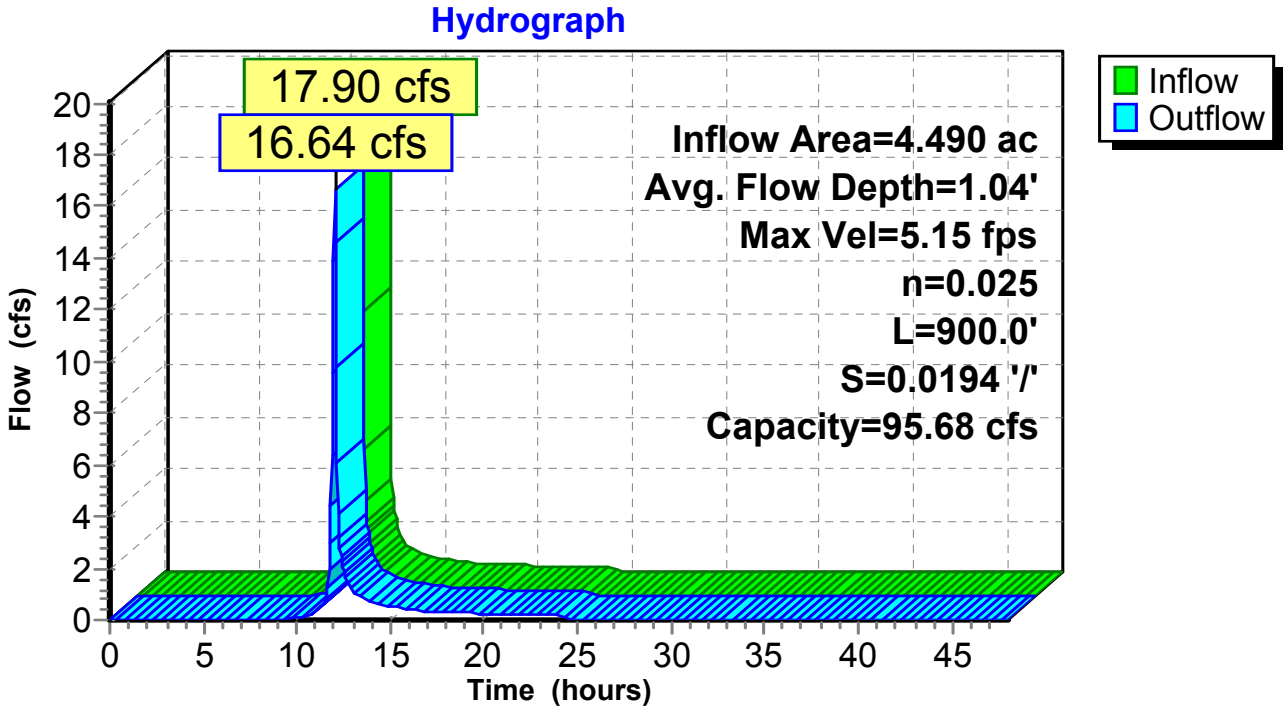
Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 17.90 cfs @ 11.97 hrs, Volume= 0.866 af
Outflow = 16.64 cfs @ 12.00 hrs, Volume= 0.866 af, Atten= 7%, Lag= 1.9 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.15 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 8.7 min

Peak Storage= 2,909 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 95.68 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 900.0' Slope= 0.0194 '/'
Inlet Invert= 1,222.00', Outlet Invert= 1,204.50'





Summary for Reach 135R: M-lower downslope

[61] Hint: Exceeded Reach 136R outlet invert by 0.59' @ 12.00 hrs
[62] Hint: Exceeded Reach 142R OUTLET depth by 0.11' @ 12.00 hrs
[61] Hint: Exceeded Reach 143R outlet invert by 0.59' @ 12.00 hrs

Inflow Area = 20.810 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 67.47 cfs @ 12.02 hrs, Volume= 4.014 af
Outflow = 67.44 cfs @ 12.02 hrs, Volume= 4.014 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 0.3 min

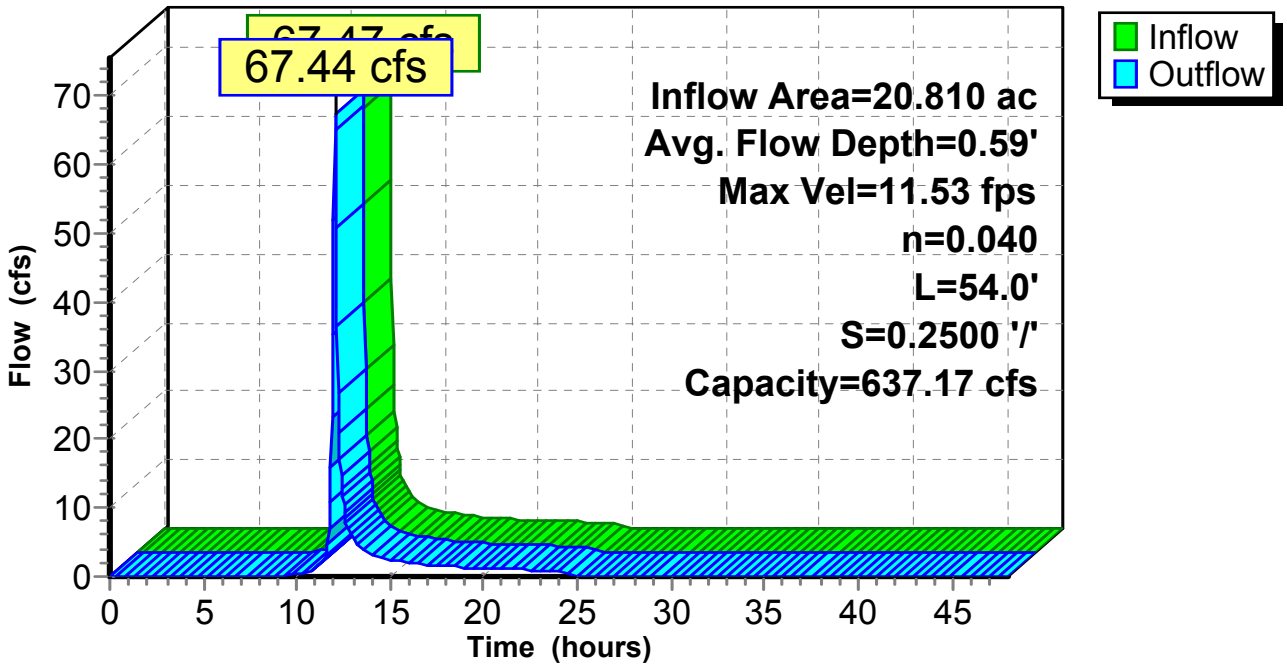
Peak Storage= 314 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 54.0' Slope= 0.2500 '/'
Inlet Invert= 1,170.00', Outlet Invert= 1,156.50'

‡

Reach 135R: M-lower downslope

Hydrograph



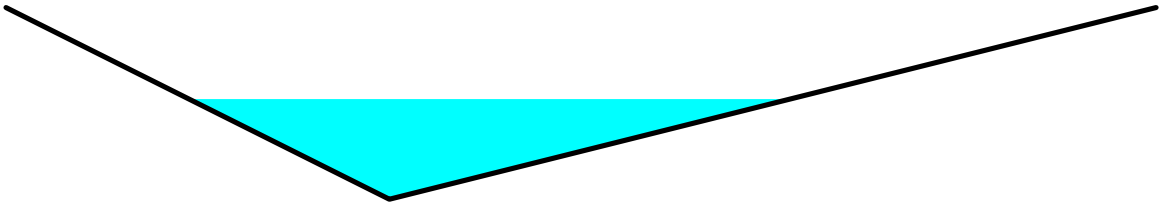
Summary for Reach 136R: M-west lower swale

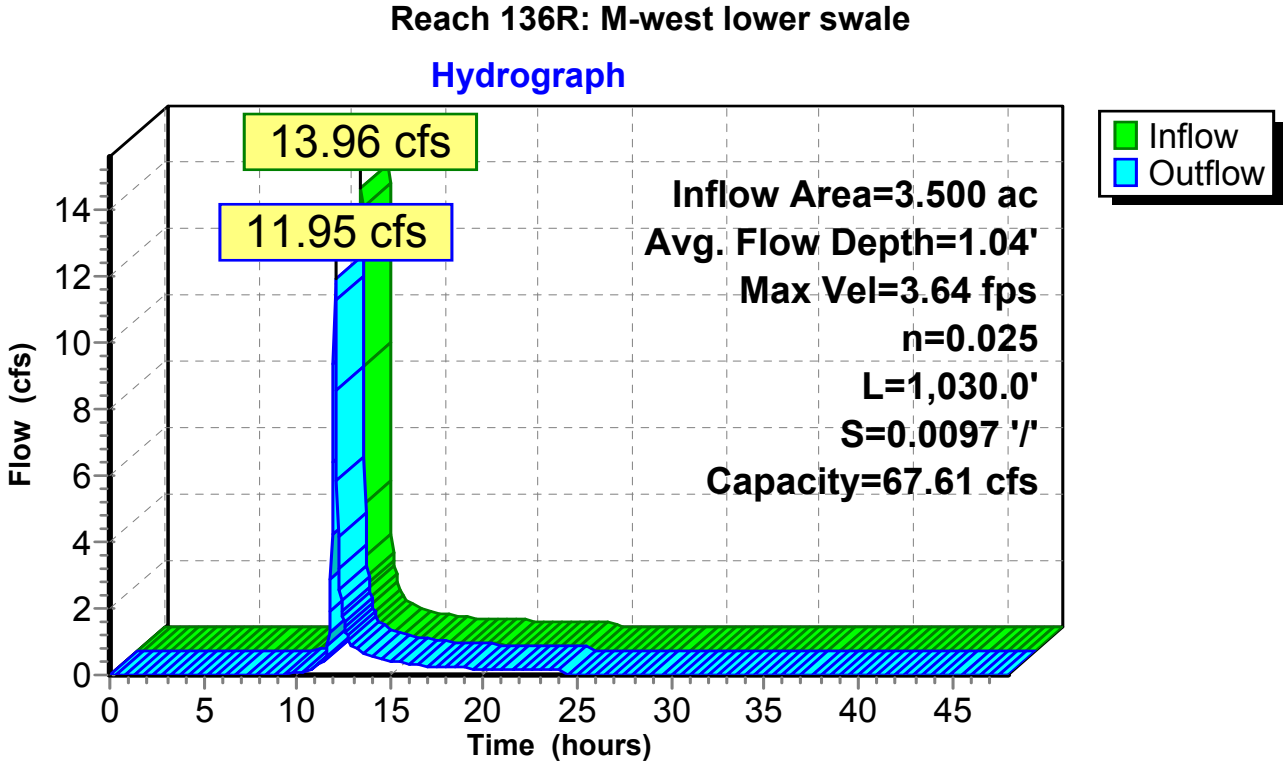
Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 13.96 cfs @ 11.97 hrs, Volume= 0.675 af
Outflow = 11.95 cfs @ 12.02 hrs, Volume= 0.675 af, Atten= 14%, Lag= 2.6 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 14.7 min

Peak Storage= 3,370 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.61 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 1,030.0' Slope= 0.0097 '/'
Inlet Invert= 1,180.00', Outlet Invert= 1,170.00'



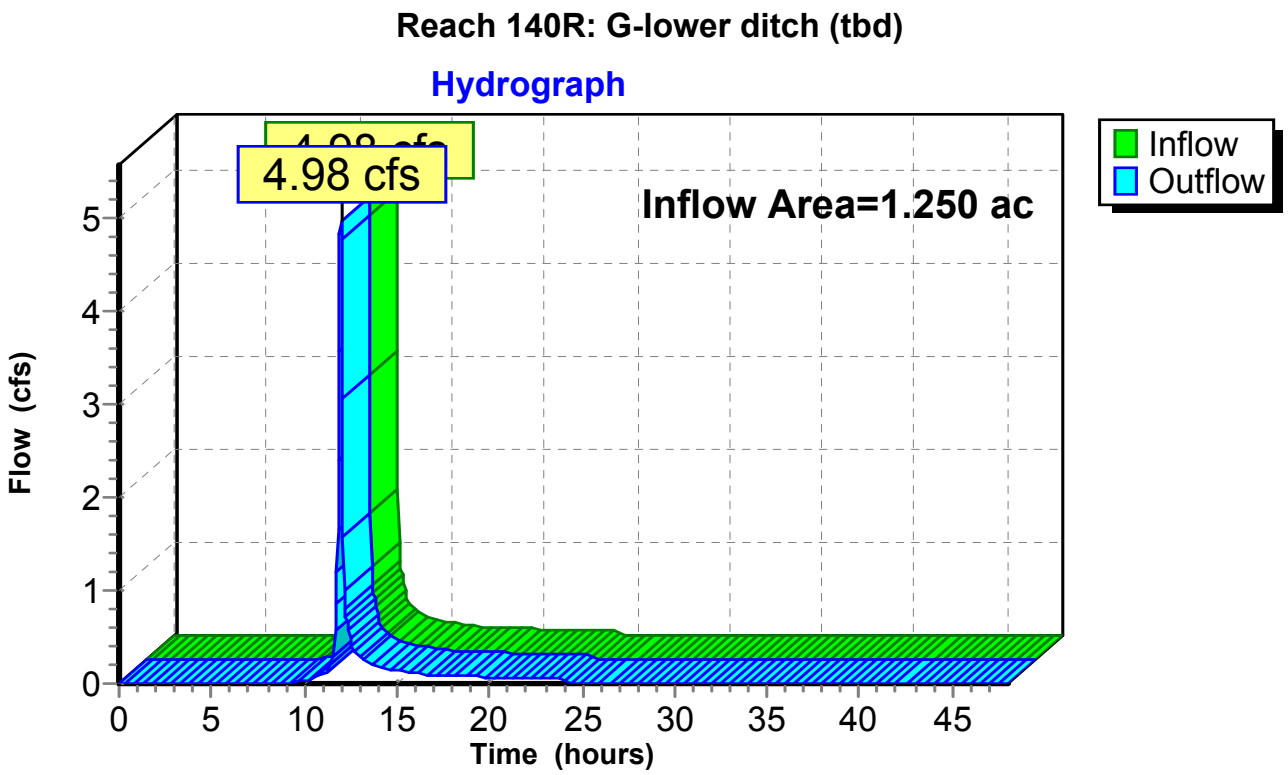


Summary for Reach 140R: G-lower ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.250 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af
Outflow = 4.98 cfs @ 11.97 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



Summary for Reach 142R: M-middle downslope

[61] Hint: Exceeded Reach 131R outlet invert by 0.48' @ 12.00 hrs
[62] Hint: Exceeded Reach 132R OUTLET depth by 0.23' @ 12.05 hrs

Inflow Area = 14.480 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 46.99 cfs @ 12.02 hrs, Volume= 2.793 af
Outflow = 46.96 cfs @ 12.02 hrs, Volume= 2.793 af, Atten= 0%, Lag= 0.1 min

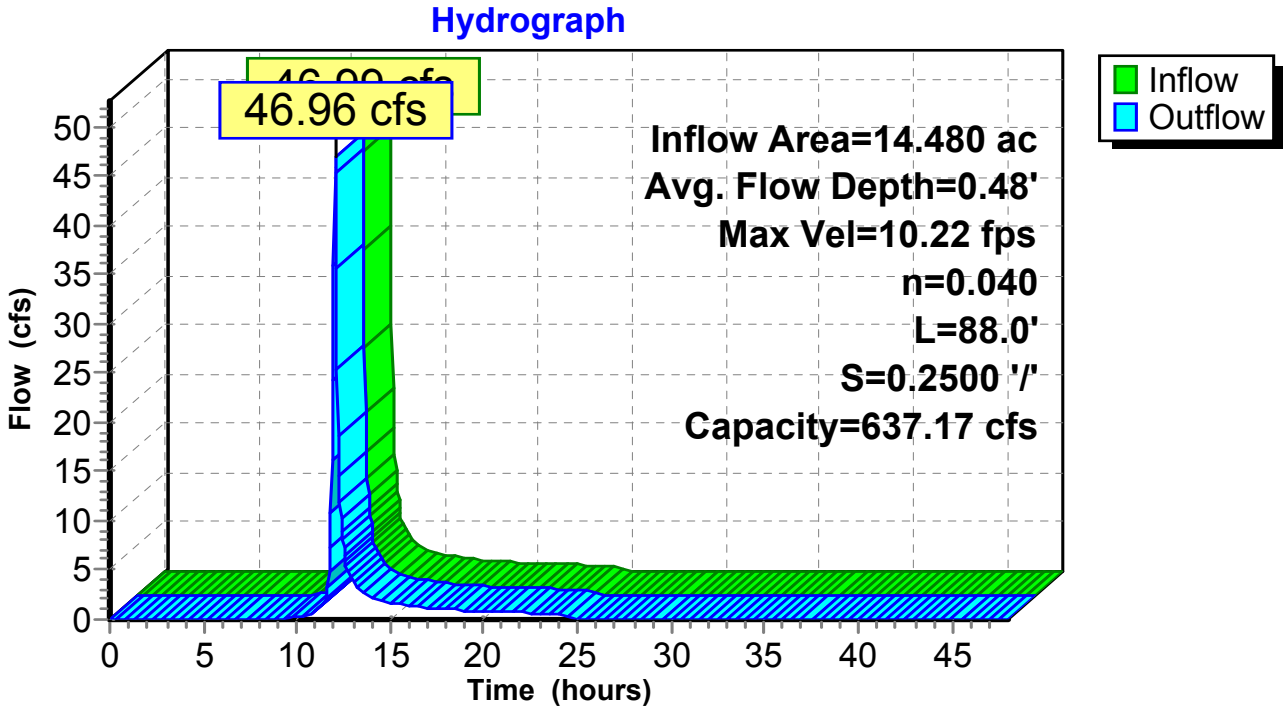
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.22 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.6 min

Peak Storage= 402 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 637.17 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 88.0' Slope= 0.2500 '/'
Inlet Invert= 1,192.00', Outlet Invert= 1,170.00'

‡

Reach 142R: M-middle downslope



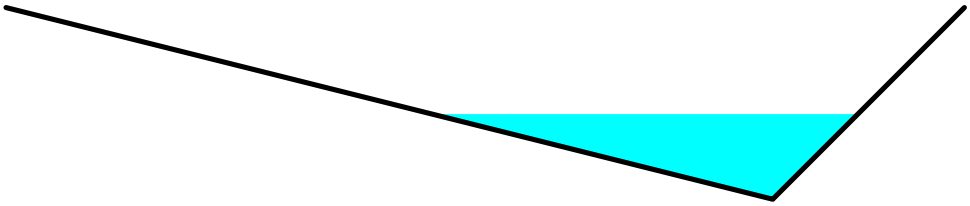
Summary for Reach 143R: M-east lower swale

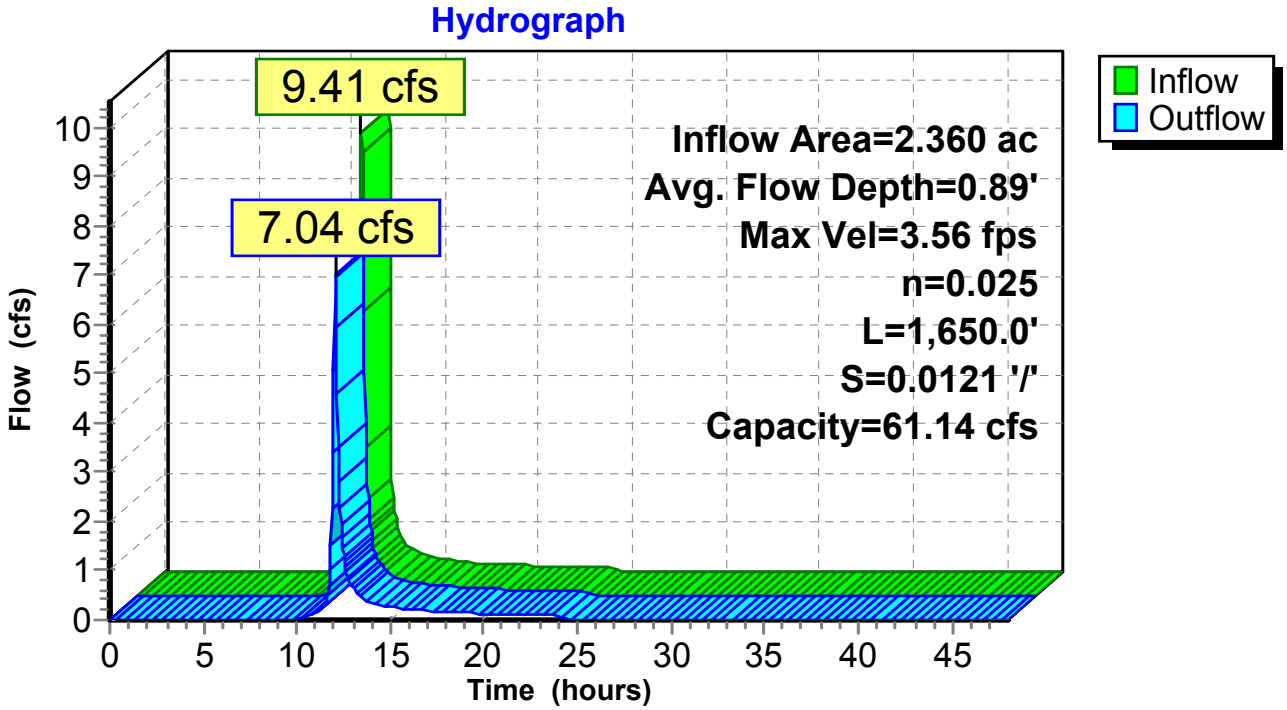
Inflow Area = 2.360 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 9.41 cfs @ 11.97 hrs, Volume= 0.455 af
Outflow = 7.04 cfs @ 12.04 hrs, Volume= 0.455 af, Atten= 25%, Lag= 3.8 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.56 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 1.11 fps, Avg. Travel Time= 24.8 min

Peak Storage= 3,262 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.89'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 61.14 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 1.0 '/' Top Width= 10.00'
Length= 1,650.0' Slope= 0.0121 '/'
Inlet Invert= 1,190.00', Outlet Invert= 1,170.00'



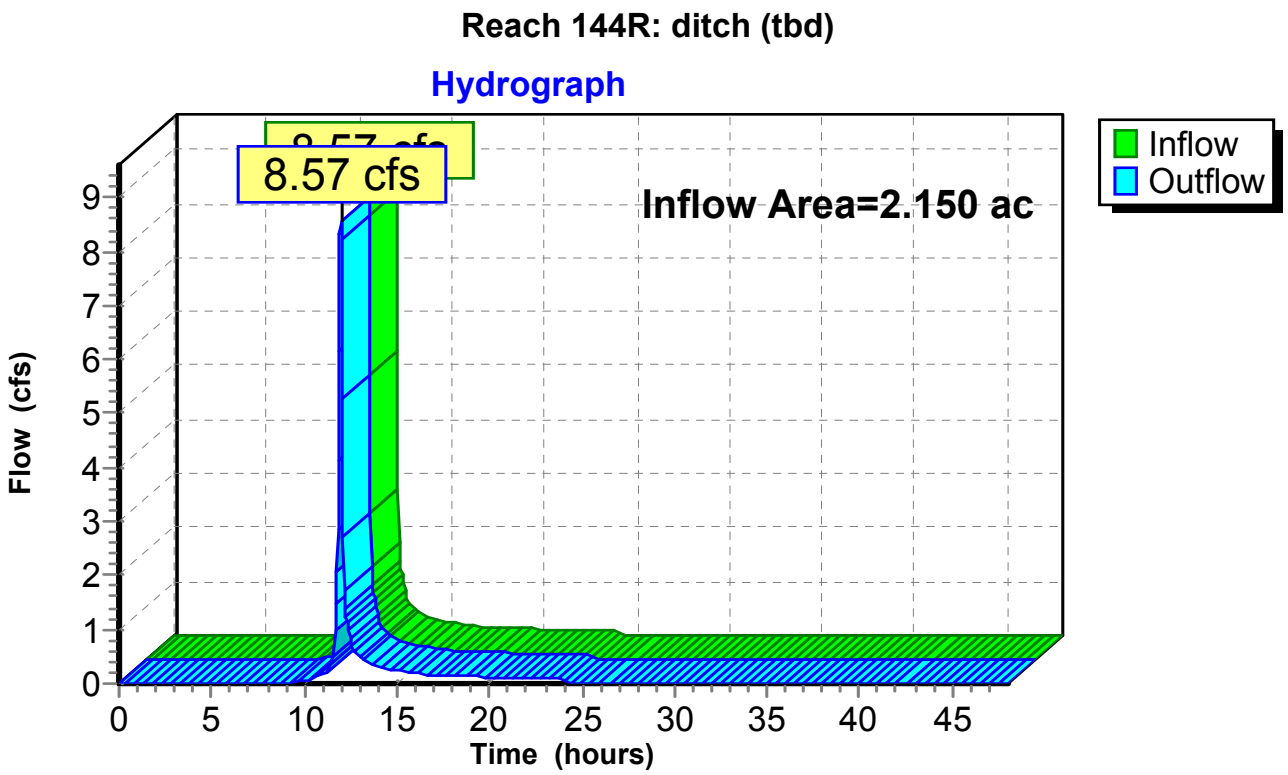


Summary for Reach 144R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.150 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af
Outflow = 8.57 cfs @ 11.97 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

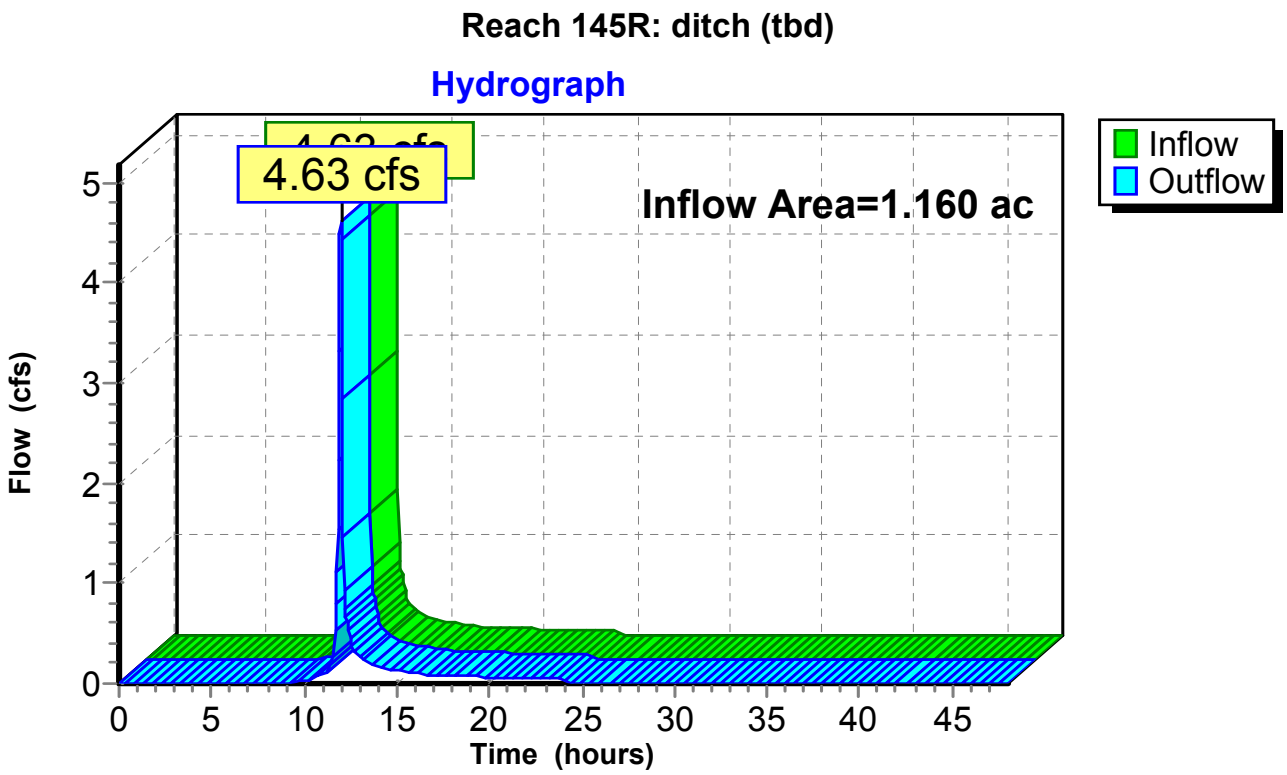


Summary for Reach 145R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.160 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af
Outflow = 4.63 cfs @ 11.97 hrs, Volume= 0.224 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

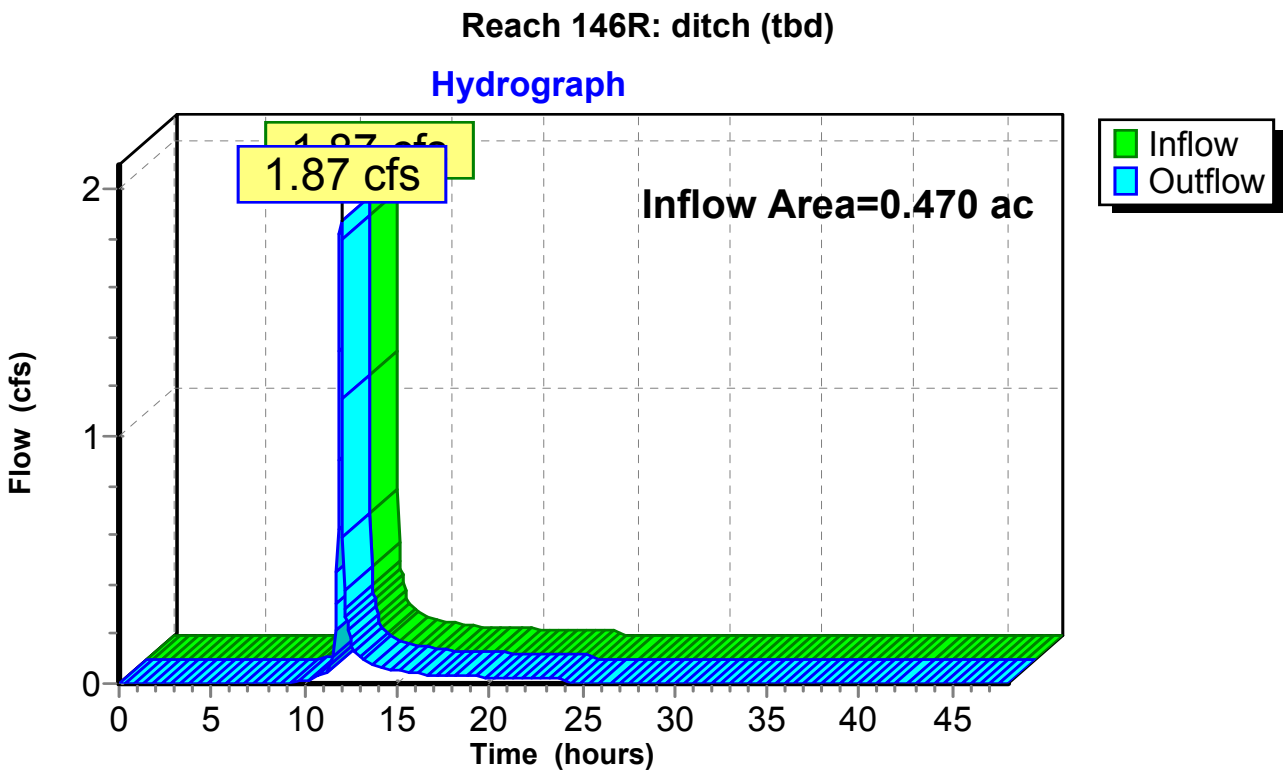


Summary for Reach 146R: ditch (tbd)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af
Outflow = 1.87 cfs @ 11.97 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs



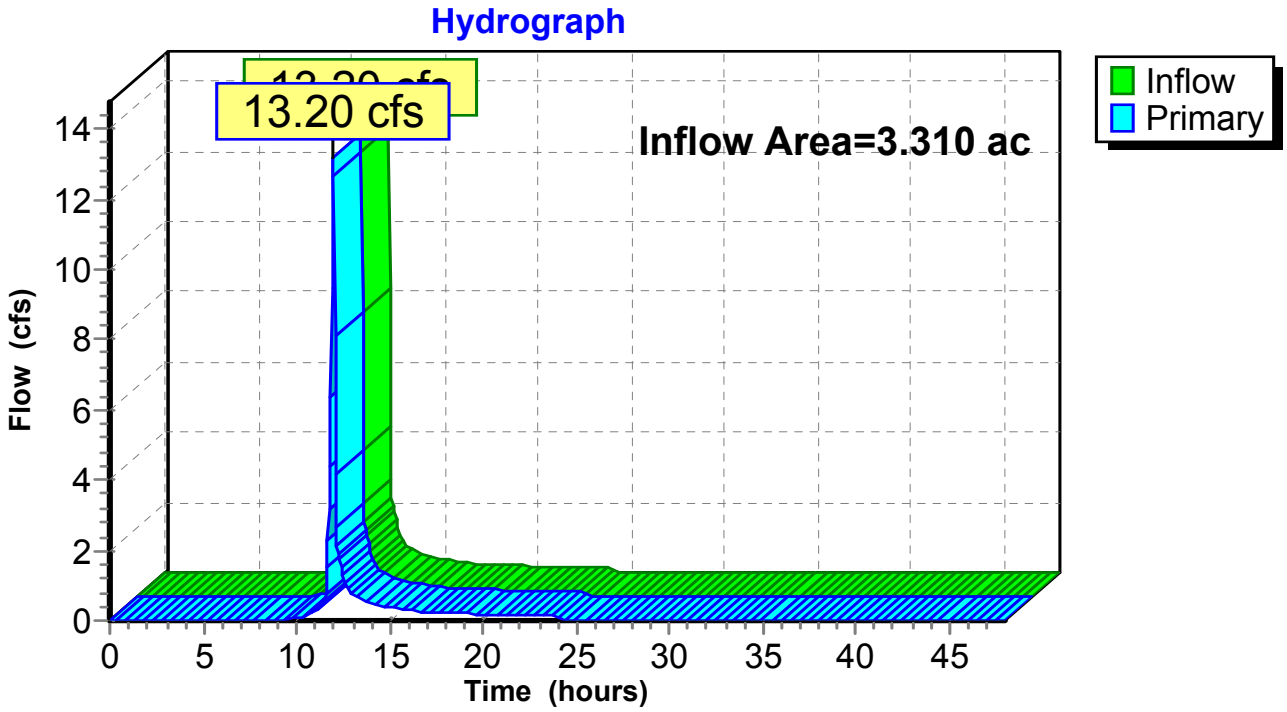
Summary for Pond 105P: NE Infiltration Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.310 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 13.20 cfs @ 11.97 hrs, Volume= 0.639 af
Primary = 13.20 cfs @ 11.97 hrs, Volume= 0.639 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2

Pond 105P: NE Infiltration Pond



Summary for Pond 108P: South Infiltration Pond

[62] Hint: Exceeded Reach 111R OUTLET depth by 1.17' @ 18.55 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 2.32" for 25-yr 24-hr event
Inflow = 17.25 cfs @ 11.98 hrs, Volume= 0.867 af
Outflow = 0.29 cfs @ 18.40 hrs, Volume= 0.732 af, Atten= 98%, Lag= 385.1 min
Discarded = 0.29 cfs @ 18.40 hrs, Volume= 0.732 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,188.20' @ 18.40 hrs Surf.Area= 0.243 ac Storage= 0.597 af

Plug-Flow detention time= 909.7 min calculated for 0.732 af (84% of inflow)
Center-of-Mass det. time= 838.1 min (1,671.9 - 833.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,184.00'	1.130 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

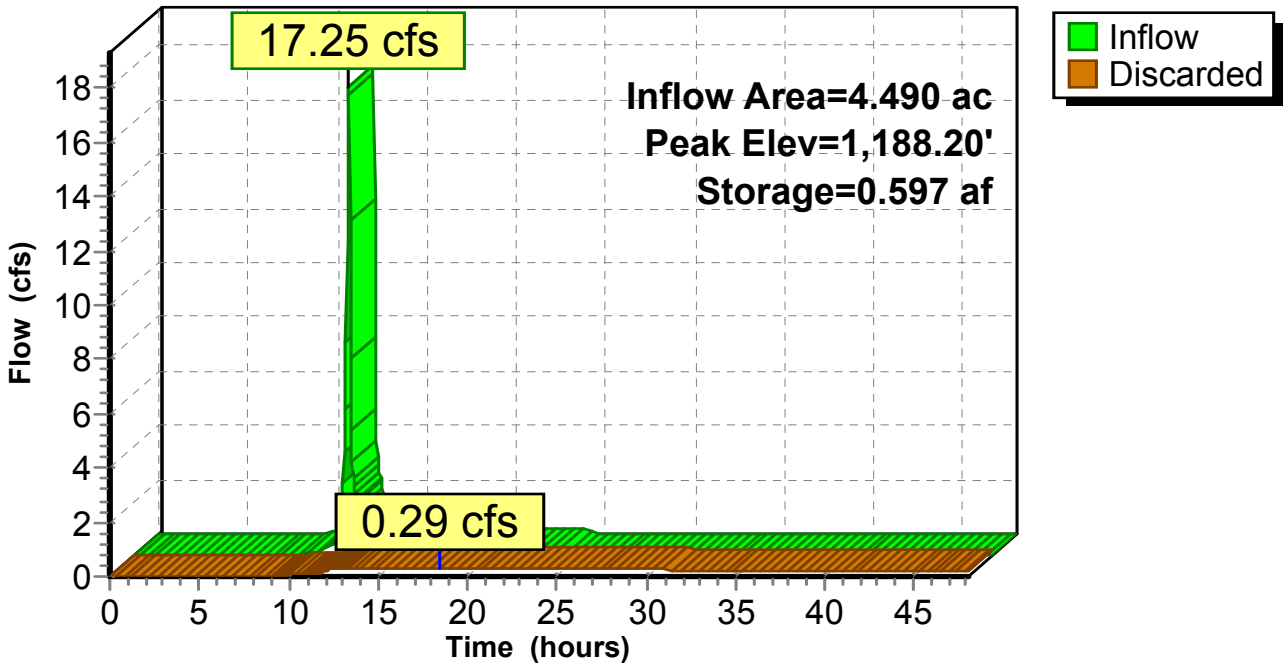
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,184.00	0.044	1,015.5	0.000	0.000	0.044
1,186.00	0.144	1,036.2	0.178	0.178	0.135
1,188.00	0.232	1,062.1	0.373	0.551	0.245
1,190.00	0.351	1,100.9	0.579	1.130	0.406

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,184.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 18.40 hrs HW=1,188.20' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Pond 108P: South Infiltration Pond

Hydrograph



Summary for Pond 129P: North infiltration pond

[62] Hint: Exceeded Reach 126R OUTLET depth by 0.22' @ 19.25 hrs

Inflow Area = 14.860 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 51.05 cfs @ 12.01 hrs, Volume= 2.867 af
Outflow = 0.90 cfs @ 19.01 hrs, Volume= 2.559 af, Atten= 98%, Lag= 420.3 min
Discarded = 0.90 cfs @ 19.01 hrs, Volume= 2.559 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,157.02' @ 19.01 hrs Surf.Area= 0.746 ac Storage= 1.957 af

Plug-Flow detention time= 937.0 min calculated for 2.556 af (89% of inflow)
Center-of-Mass det. time= 883.1 min (1,722.4 - 839.3)

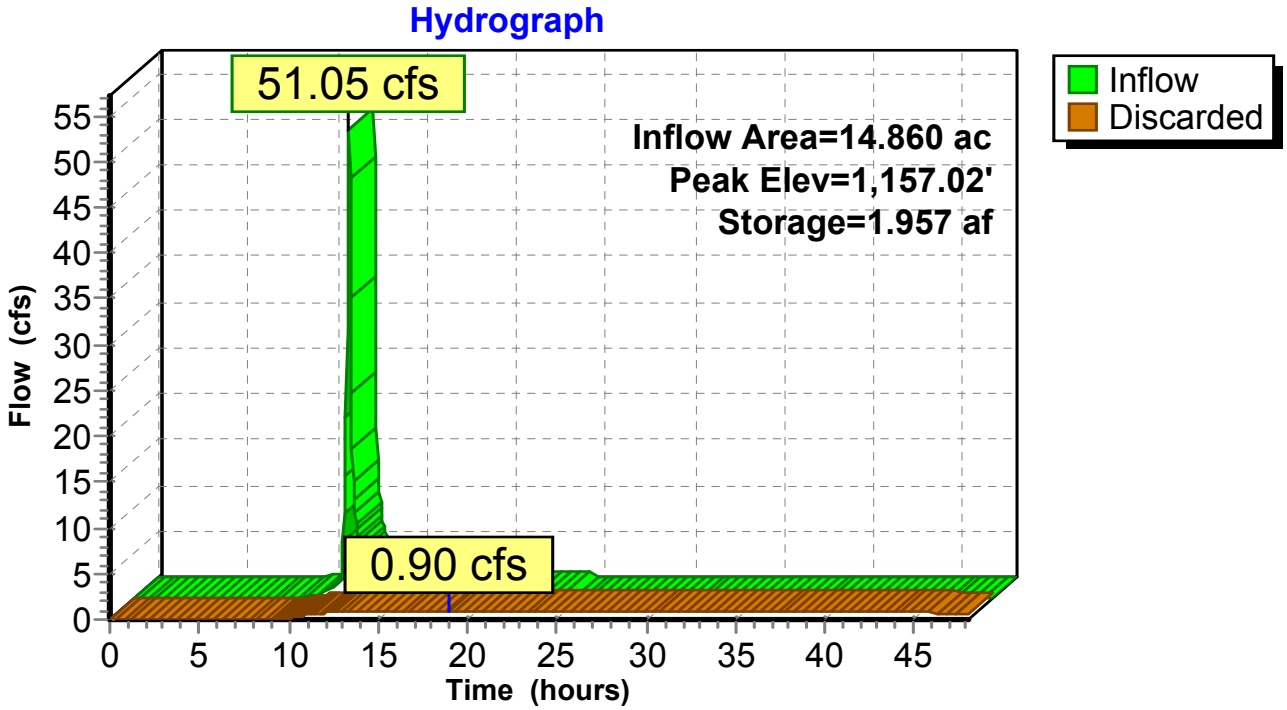
Volume	Invert	Avail.Storage	Storage Description
#1	1,154.00'	4.485 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,154.00	0.556	822.6	0.000	0.000	0.556
1,156.00	0.678	917.0	1.232	1.232	0.859
1,158.00	0.814	988.4	1.490	2.722	1.111
1,160.00	0.951	1,021.8	1.763	4.485	1.242

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,154.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.90 cfs @ 19.01 hrs HW=1,157.02' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.90 cfs)

Pond 129P: North infiltration pond



Summary for Pond 139P: SW Infiltration Pond

[62] Hint: Exceeded Reach 135R OUTLET depth by 1.15' @ 20.30 hrs

Inflow Area = 21.380 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-yr 24-hr event
Inflow = 69.39 cfs @ 12.02 hrs, Volume= 4.124 af
Outflow = 1.10 cfs @ 20.06 hrs, Volume= 3.191 af, Atten= 98%, Lag= 482.5 min
Discarded = 1.10 cfs @ 20.06 hrs, Volume= 3.191 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,157.70' @ 20.06 hrs Surf.Area= 0.912 ac Storage= 2.945 af

Plug-Flow detention time= 984.0 min calculated for 3.191 af (77% of inflow)
Center-of-Mass det. time= 891.4 min (1,733.5 - 842.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,154.00'	5.215 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

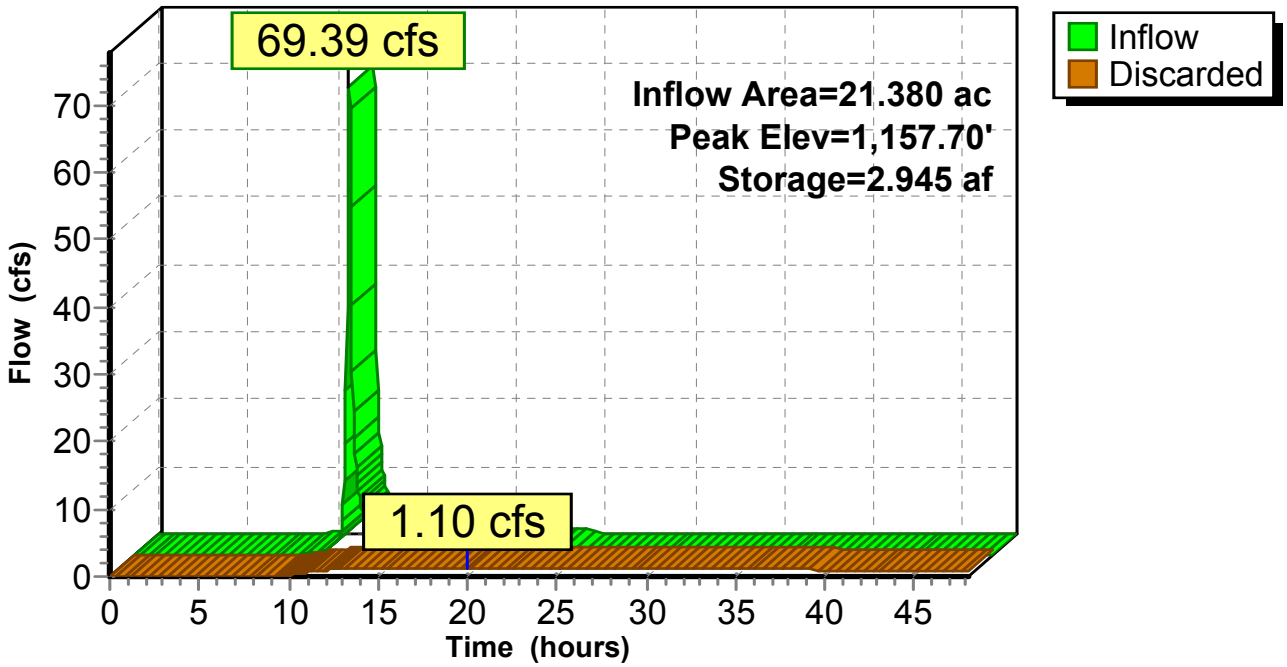
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
1,154.00	0.683	847.3	0.000	0.000	0.683
1,156.00	0.804	899.1	1.485	1.485	0.853
1,158.00	0.932	948.1	1.734	3.220	1.024
1,160.00	1.065	993.3	1.996	5.215	1.190

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,154.00'	**1.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.10 cfs @ 20.06 hrs HW=1,157.70' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.10 cfs)

Pond 139P: SW Infiltration Pond

Hydrograph



Appendix C

Criteria for Classification of Solid Waste Disposal Facilities and Practices

Part 257 Revision Introduction

PART 257—CRITERIA FOR CLASSIFICATION OF SOLID WASTE DISPOSAL FACILITIES AND PRACTICES

▲ 1. The authority citation for part 257 continues to read as follows:

Authority: 42 U.S.C. 6907(a)(3), 6912(a)(1), 6944(a); 33 U.S.C. 1345(d) and (e).

▲ 2. Section 257.1 is amended by:

a. Adding a sentence at the end of paragraph (a) introductory text;
b. Revising paragraphs (a)(1) and (2); and
c. Adding paragraph (c)(12).

The revisions and additions read as follows:

§ 257.1 Scope and purpose.

(a) Unless otherwise provided, the criteria in §§ 257.50 through 257.107 are adopted for determining which CCR landfills and CCR surface impoundments pose a reasonable probability of adverse effects on health or the environment under sections 1008(a)(3) and 4004(a) of the Act.

(b)

(1) Facilities failing to satisfy any of the criteria in §§ 257.1 through 257.4 or §§ 257.5 through 257.30 or §§ 257.50 through 257.107 are considered open

(2) Practices failing to satisfy any of the criteria in §§ 257.1 through 257.4 or §§ 257.5 through 257.30 or §§ 257.50 through 257.107 constitute open dumping, which is prohibited under section 4005 of the Act.

(c)

(12) Except as otherwise specifically provided in subpart D of this part, the criteria in subpart A of this part do not apply to CCR landfills, CCR surface impoundments, and lateral expansions of CCR units, as those terms are defined in subpart D of this part. Such units are instead subject to subpart D of this part.

▲ 3. Section 257.2 is amended by adding in alphabetical order definitions for ''CCR landfill'' and ''CCR surface impoundment'' to read as follows:

§ 257.2 Definitions.

CCR landfill means an area of land or an excavation that receives CCR and which is not a surface impoundment, an underground injection well, a salt dome CCR landfill also includes sand and gravel pits and quarries that receive CCR, CCR piles, and any practice that does not meet the definition of a beneficial use of CCR.

CCR surface impoundment means a natural topographic depression, man- made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR.

▲ 4. Part 257 is amended by:

a. Adding and reserving subpart C; and
b. Adding subpart D.

The additions read as follows:

Subpart C—[Reserved]

Part 257 Revision Introduction

Subpart D—Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments

General Provisions

257.50 Scope and purpose.
257.51 Effective date of this subpart.
257.52 Applicability of other regulations.
257.53 Definitions.

Location Restrictions

257.60 Placement above the uppermost aquifer.
257.61 Wetlands
257.62 Fault Areas
257.63 Seismic impact zones.
257.64 Unstable areas.

Design Criteria

257.70 Design criteria for new CCR landfills and any lateral expansion of a CCR landfill.
257.71 Liner design criteria for existing CCR surface impoundments.
257.72 Design criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment.
257.73 Structural integrity criteria for existing CCR surface impoundments.
257.74 Structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment.

Operating Criteria

257.80 Air criteria.
257.81 Run-on and run-off controls for CCR landfills.
257.82 Hydrologic and hydraulic capacity requirements for CCR surface impoundments.
257.83 Inspection requirements for CCR surface impoundments.
257.84 Inspection requirements for CCR landfills.

Groundwater Monitoring and Corrective Action Requirements

257.94 Detection monitoring program.
257.95 Assessment monitoring program.
257.96 Assessment of corrective measures.
257.97 Selection of remedy.
257.98 Implementation of the corrective action program.

Closure and Post-Closure Care

257.100 Inactive CCR surface impoundments.
257.101 Closure or retrofit of CCR units.
257.102 Criteria for conducting the closure or retrofit of CCR units.
257.103 Alternative closure requirements.
257.104 Post-closure care requirements.

Recordkeeping, Notification, and Posting of Information to the Internet

257.105 Recordkeeping requirements.
257.106 Notification requirements.
257.107 Publicly accessible internet site requirements.

▲ 5. Amend part 257 by adding ‘‘Appendix III to Part 257’’ and ‘‘Appendix IV to Part 257’’ to read as follows:

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name[1]
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids (TDS)

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name[1]
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Subpart D Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments
§ 257.50-52

§ 257.50 Scope and purpose.

(a) This subpart establishes minimum national criteria for purposes of determining which solid waste disposal facilities and solid waste management practices do not pose a reasonable probability of adverse effects on health or the environment under sections 1008(a)(3) and 4004(a) of the Resource Conservation and Recovery Act.

(b) This subpart applies to owners and operators of new and existing landfills and surface impoundments, including any lateral expansions of such units that dispose or otherwise engage in solid waste management of CCR generated from the combustion of coal at electric utilities and independent power producers. Unless otherwise provided in this subpart, these requirements also apply to disposal units located off-site of the electric utility or independent power producer. This subpart also applies to any practice that does not meet the definition of a beneficial use of CCR.

(c) This subpart also applies to inactive CCR surface impoundments at active electric utilities or independent power producers, regardless of the fuel currently used at the facility to produce electricity.

(d) This subpart does not apply to CCR landfills that have ceased receiving CCR prior to October 19, 2015.

(e) This subpart does not apply to electric utilities or independent power producers that have ceased producing electricity prior to October 19, 2015.

(f) This subpart does not apply to wastes, including fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated at facilities that are not part of an electric utility or independent power producer, such as manufacturing facilities, universities, and hospitals. This subpart also does not apply to fly ash, bottom ash, boiler slag, and flue gas desulfurization materials, generated primarily from the combustion of fuels (including other fossil fuels) other than coal, for the purpose of generating electricity unless the fuel burned consists of more than fifty percent (50%) coal on a total heat input or mass input basis, whichever results in the greater mass feed rate of coal.

(g) This subpart does not apply to practices that meet the definition of a beneficial use of CCR.

(h) This subpart does not apply to CCR placement at active or abandoned underground or surface coal mines.

(i) This subpart does not apply to municipal solid waste landfills that receive CCR.

§ 257.51 Effective date of this subpart.

The requirements of this subpart take effect on October 19, 2015.

§ 257.52 Applicability of other regulations.

(a) Compliance with the requirements of this subpart does not affect the need for the owner or operator of a CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit to comply with all other applicable federal, state, tribal, or local laws or other requirements.

(b) Any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit continues to be subject to the requirements in §§ 257.3–1, 257.3–2, and 257.3–3.

Subpart D
§ 257.53 Definitions

The following definitions apply to this subpart. Terms not defined in this section have the meaning given by RCRA.

Acre foot means the volume of one acre of surface area to a depth of one foot.

Active facility or active electric utilities or independent power producers means any facility subject to the requirements of this subpart that is in operation on October 14, 2015. An electric utility or independent power producer is in operation if it is generating electricity that is provided to electric power transmission systems or to electric power distribution systems on or after October 14, 2015. An off-site disposal facility is in operation if it is accepting or managing CCR on or after October 14, 2015.

Active life or in operation means the period of operation beginning with the initial placement of CCR in the CCR unit and ending at completion of closure activities in accordance with § 257.102.

Active portion means that part of the CCR unit that has received or is receiving CCR or non-CCR waste and that has not completed closure in accordance with § 257.102.

Aquifer means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

Area-capacity curves means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations.

Areas susceptible to mass movement means those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where, because of natural or human-induced events, the movement of earthen material at, beneath, or adjacent to the CCR unit results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, and rock fall.

Beneficial use of CCR means the CCR meet **all** of the following conditions:

(1) The CCR must provide a functional benefit;

(2) The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction;

(3) The use of the CCR must meet relevant product specifications, regulatory standards or design standards when available, and when such standards are not available, the CCR is not used in excess quantities; and

(4) When unencapsulated use of CCR involving placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCR, or that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.

Subpart D
§ 257.53 Definitions

Closed means placement of CCR in a CCR unit has ceased, and the owner or operator has completed closure of the CCR unit in accordance with § 257.102 and has initiated post-closure care in accordance with § 257.104.

Coal combustion residuals (CCR) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers.

CCR fugitive dust means solid airborne particulate matter that contains or is derived from CCR, emitted from any source other than a stack or chimney.

CCR landfill or landfill means an area of land or an excavation that receives CCR and which is not a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground or surface coal mine, or a cave. For purposes of this subpart, a CCR landfill also includes sand and gravel pits and quarries that receive CCR, CCR piles, and any practice that does not meet the definition of a beneficial use of CCR.

CCR pile or pile means any non- containerized accumulation of solid,non-flowing CCR that is placed on the land. CCR that is beneficially used off- site is not a CCR pile.

CCR surface impoundment or impoundment means a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR.

CCR unit means any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these units, based on the context of the paragraph(s) in which it is used. This term includes both new and existing units, unless otherwise specified.

Dike means an embankment, berm, or ridge of either natural or man-made materials used to prevent the movement of liquids, sludges, solids, or other materials.

Displacement means the relative movement of any two sides of a fault measured in any direction.

Disposal means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste as defined in section 1004(27) of the Resource Conservation and Recovery Act into or on any land or water so that such solid waste, or constituent thereof, may enter the environment or be emitted into the air or discharged into any waters, including groundwaters. For purposes of this subpart, disposal does not include the storage or the beneficial use of CCR.

Downstream toe means the junction of the downstream slope or face of the CCR surface impoundment with the ground surface.

Encapsulated beneficial use means a beneficial use of CCR that binds the CCR into a solid matrix that minimizes its mobilization into the surrounding environment.

Subpart D
§ 257.53 Definitions

Existing CCR landfill means a CCR landfill that receives CCR both before and after October 14, 2015, or for which construction commenced prior to October 14, 2015 and receives CCR on or after October 14, 2015. A CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous on-site, physical construction program had begun prior to October 14, 2015.

Existing CCR surface impoundment means a CCR surface impoundment that receives CCR both before and after October 14, 2015, or for which construction commenced prior to October 14, 2015 and receives CCR on or after October 14, 2015. A CCR surface impoundment has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous on-site, physical construction program had begun prior to October 14, 2015.

Facility means all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, disposing, or otherwise conducting solid waste management of CCR. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

Factor of safety (Safety factor) means the ratio of the forces tending to resist the failure of a structure to the forces tending to cause such failure as determined by accepted engineering practice.

Fault means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

Flood hydrograph means a graph showing, for a given point on a stream, the discharge, height, or other characteristic of a flood as a function of time.

Freeboard means the vertical distance between the lowest point on the crest of the impoundment dike and the surface of the waste contained therein.

Free liquids means liquids that readily separate from the solid portion of a waste under ambient temperature and pressure.

Groundwater means water below the land surface in a zone of saturation.

Hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications include high hazard potential CCR surface impoundment, significant hazard potential CCR surface impoundment, and low hazard potential CCR surface impoundment, which terms mean:

(1) High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

(2) Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis- operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

(3) Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Height means the vertical measurement from the downstream toe of the CCR surface impoundment at its lowest point to the lowest elevation of the crest of the CCR surface impoundment.

Holocene means the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch, at 11,700 years before present, to present.

Hydraulic conductivity means the rate at which water can move through a permeable medium (i.e., the coefficient of permeability).

Inactive CCR surface impoundment means a CCR surface impoundment that no longer receives CCR on or after October 14, 2015 and still contains both CCR and liquids on or after October 14, 2015.

Incised CCR surface impoundment means a CCR surface impoundment which is constructed by excavating entirely below the natural ground surface, holds an accumulation of CCR entirely below the adjacent natural ground surface, and does not consist of any constructed diked portion.

Indian country or Indian lands means:

(1) All land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and including rights-of-way running throughout the reservation;

(2) All dependent Indian communities
within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of the State; and

(3) All Indian allotments, the Indian
titles to which have not been extinguished, including rights of way running through the s ame.

Indian Tribe or Tribe means any Indian tribe, band, nation, or community recognized by the Secretary of the Interior and exercising substantial governmental duties and powers on Indian lands.

Inflow design flood means the flood hydrograph that is used in the design or modification of the CCR surface impoundments and its appurtenant works.

In operation means the same as active life.

Karst terrain means an area where karst topography, with its characteristic erosional surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terranes include, but are not limited to, dolines, collapse shafts (sinkholes), sinking streams, caves, seeps, large springs, and blind valleys.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill or existing CCR surface impoundment made after October 14, 2015.

Subpart D
§ 257.53 Definitions

Liquefaction factor of safety means the factor of safety (safety factor) determined using analysis under liquefaction conditions.

Lithified earth material means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.

Maximum horizontal acceleration in lithified earth material means the maximum expected horizontal acceleration at the ground surface as depicted on a seismic hazard map, with a 98% or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site- specific seismic risk assessment.

New CCR landfill means a CCR landfill or lateral expansion of a CCR landfill that first receives CCR or commences construction after October 14, 2015. A new CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous on-site, physical construction program had begun after October 14, 2015. Overfills are also considered new CCR landfills.

New CCR surface impoundment means a CCR surface impoundment or lateral expansion of an existing or new CCR surface impoundment that first receives CCR or commences construction after October 14, 2015. A new CCR surface impoundment has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous on-site, physical construction program had begun after October 14, 2015.

Operator means the person(s) responsible for the overall operation of a CCR unit.

Overfill means a new CCR landfill constructed over a closed CCR surface impoundment.

Owner means the person(s) who owns a CCR unit or part of a CCR unit.

Poor foundation conditions mean those areas where features exist which indicate that a natural or human- induced event may result in inadequate foundation support for the structural components of an existing or new CCR unit. For example, failure to maintain static and seismic factors of safety as required in §§ 257.73(e) and 257.74(e) would cause a poor foundation condition.

Probable maximum flood means the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the drainage basin.

Qualified person means a person or persons trained to recognize specific appearances of structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit by visual observation and, if applicable, to monitor instrumentation.

Subpart D
§ 257.53 Definitions

Qualified professional engineer means an individual who is licensed by a state as a Professional Engineer to practice one or more disciplines of engineering and who is qualified by education, technical knowledge and experience to make the specific technical certifications required under this subpart. Professional engineers making these certifications must be currently licensed in the state where the CCR unit(s) is located.

Recognized and generally accepted good engineering practices means engineering maintenance or operation activities based on established codes, widely accepted standards, published technical reports, or a practice widely recommended throughout the industry. Such practices generally detail approved ways to perform specific engineering, inspection, or mechanical integrity activities.

Retrofit means to remove all CCR and contaminated soils and sediments from the CCR surface impoundment, and to ensure the unit complies with the requirements in § 257.72

Representative sample means a sample of a universe or whole (e.g., waste pile, lagoon, and groundwater) which can be expected to exhibit the average properties of the universe or whole. See EPA publication SW–846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Chapter 9 (available at http:// www.epa.gov/epawaste/hazard/ testmethods/sw846/online/index.htm) for a discussion and examples of representative samples.

Run-off means any rainwater, leachate, or other liquid that drains over land from any part of a CCR landfill or lateral expansion of a CCR landfill.

Run-on means any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill or lateral expansion of a CCR landfill.

Sand and gravel pit or quarry means an excavation for the extraction of aggregate, minerals or metals. The term sand and gravel pit and/or quarry does not include subsurface or surface coal mines.

Seismic factor of safety means the factor of safety (safety factor) determined using analysis under earthquake conditions using the peak ground acceleration for a seismic event with a 2% probability of exceedance in 50 years, equivalent to a return period of approximately 2,500 years, based on the U.S. Geological Survey (USGS) seismic hazard maps for seismic events with this return period for the region where the CCR surface impoundment is located.

Seismic impact zone means an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years.

Slope protection means engineered or non-engineered measures installed on the upstream or downstream slope of the CCR surface impoundment to protect the slope against wave action or erosion, including but not limited to rock riprap, wooden pile, or concrete revetments, vegetated wave berms, concrete facing, gabions, geotextiles, or fascines.

Solid waste management or management means the systematic administration of the activities which provide for the collection, source separation, storage, transportation, processing, treatment, or disposal of solid waste.

Subpart D
§ 257.53 Definitions

State means any of the fifty States in addition to the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

State Director means the chief administrative officer of the lead state agency responsible for implementing the state program regulating disposal in CCR landfills, CCR surface impoundments, and all lateral expansions of a CCR unit.

Static factor of safety means the factor of safety (safety factor) determined using analysis under the long-term, maximum storage pool loading condition, the maximum surcharge pool loading condition, and under the end-of- construction loading condition.

Structural components mean liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.

Unstable area means a location that is susceptible to natural or human- induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.

Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Waste boundary means a vertical surface located at the hydraulically downgradient limit of the CCR unit. The vertical surface extends down into the uppermost aquifer.

Subpart D Location Restrictions

257.60 Placement above the uppermost aquifer

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in§ 257.105(e), the notification requirements specified in § 257.106(e), and the internet requirements specified in § 257.107(e).

Subpart D Location Restrictions

§ 257.61 Wetlands

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in § 232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.

(2) The construction and operation of the CCR unit will not cause or contribute to any of the following:
- (i) A violation of any applicable state or federal water quality standard;
- (ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act;
- (iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and
- (iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors:
- (i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit;
- (ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;
- (iii) The volume and chemical nature of the CCR;
- (iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR;
- (v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and
- (vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and

(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section.

Subpart D Location Restrictions

§ 257.61 Wetlands

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstrations required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstrations showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e).

Subpart D Location Restrictions

§ 257.62 Fault areas

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e).

Subpart D Location Restrictions

§ 257.63 Seismic impact zones

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e).

Subpart D Location Restrictions

§ 257.64 Unstable areas

(a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

(b) The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(c) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(d) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (d)(1) or (2) of this section.

(1) For an existing CCR landfill or existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment or existing CCR landfill who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (d)(1) of this section is subject to the requirements of § 257.101(b)(1) or (d)(1), respectively.

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements specified in § 257.107(e).

Subpart D Design Criteria

§ 257.70 Design criteria for new CCR landfills and any lateral expansion of a CCR landfill

(a)

(1) New CCR landfills and any lateral expansion of a CCR landfill must be designed, constructed, operated, and maintained with either a composite liner that meets the requirements of paragraph (b) of this section or an alternative composite liner that meets the requirements in paragraph (c) of this section, and a leachate collection and removal system that meets the requirements of paragraph (d) of this section.

(2) Prior to construction of an overfill the underlying surface impoundment must meet the requirements of § 257.102(d).

(b) A composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil geomembrane liner (GM), and the lower component consisting of at least a two- foot layer of compacted soil with a hydraulic conductivity of no more than $1x10^{-7}$ centimeters per second (cm/ sec). GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The composite liner must be:

(1) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(2) Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes;

(3) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and

(4) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

(c) If the owner or operator elects to install an alternative composite liner, all of the following requirements must be met:

(1) An alternative composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil GM, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than 1x10-7 cm/sec. GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. If the lower component of the alternative liner is compacted soil, the GM must be installed in direct and uniform contact with the compacted soil.

(2) The owner or operator must obtain certification from a qualified professional engineer that the liquid flow rate through the lower component of the alternative composite liner

is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1x10-7 cm/ sec. The hydraulic conductivity for the two feet of compacted soil used in the comparison shall be no greater than 1x10-7 cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods. The liquid flow rate comparison must be made using Equation 1 of this section, which is derived from Darcy's Law for gravity flow through porous media.

(Eq. 1) $$\frac{Q}{A} = q = k\left(\frac{h}{t} + 1\right)$$

Where,
Q = flow rate (cubic centimeters/second);
A = surface area of the liner (squared centimeters);
q = flow rate per unit area (cubic centimeters/ second/squared centimeter);
k = hydraulic conductivity of the liner (centimeters/second);
h = hydraulic head above the liner (centimeters); and
t = thickness of the liner (centimeters).

(3) The alternative composite liner must meet the requirements specified in paragraphs (b)(1) through (4) of this section.

(d) The leachate collection and removal system must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post-closure care period. The leachate collection and removal system must be:

(1) Designed and operated to maintain less than a 30-centimeter depth of leachate over the composite liner or alternative composite liner;

(2) Constructed of materials that are chemically resistant to the CCR and any non-CCR waste managed in the CCR unit and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the CCR unit; and

(3) Designed and operated to minimize clogging during the active life and post-closure care period.

(e) Prior to construction of the CCR landfill or any lateral expansion of a CCR landfill, the owner or operator must obtain a certification from a qualified professional engineer that the design of the composite liner (or, if applicable, alternative composite liner) and the leachate collection and removal system meets the requirements of this section.

Subpart D Design Criteria

§ 257.70 Design criteria for new CCR landfills and any lateral expansion of a CCR landfill

(f) Upon completion of construction of the CCR landfill or any lateral expansion of a CCR landfill, the owner or operator must obtain a certification from a qualified professional engineer that the composite liner (or, if applicable, alternative composite liner) and the leachate collection and removal system has been constructed in accordance with the requirements of this section.

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the Internet requirements specified in § 257.107(f).

Subpart D Design Criteria

§ 257.71 Liner design criteria for existing CCR surface impoundments

(a)

(1) No later than October 17, 2016, the owner or operator of an existing CCR surface impoundment must document whether or not such unit was constructed with any one of the following:

(i) A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no more than 1x10-7 cm/sec;
(ii) A composite liner that meets the requirements of § 257.70(b); or
(iii) An alternative composite liner that meets the requirements of § 257.70(c).

(2) The hydraulic conductivity of the compacted soil must be determined using recognized and generally accepted methods.

(3) An existing CCR surface impoundment is considered to be an existing unlined CCR surface impoundment if either:

(i) The owner or operator of the CCR unit determines that the CCR unit is not constructed with a liner that meets the requirements of paragraphs (a)(1)(i), (ii), or (iii) of this section; or
(ii) The owner or operator of the CCR unit fails to document whether the CCR unit was constructed with a liner that meets the requirements of paragraphs (a)(1)(i), (ii), or (iii) of this section.

(4) All existing unlined CCR surface impoundments are subject to the requirements of §257.101(a).

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer attesting that the documentation as to whether a CCR unit meets the requirements of paragraph (a) of this section is accurate.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the Internet requirements specified in § 257.107(f).

Subpart D Design Criteria

§ 257.72 Liner design criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment

(a) New CCR surface impoundments and lateral expansions of existing and new CCR surface impoundments must be designed, constructed, operated, and maintained with either a composite liner or an alternative composite liner that meets the requirements of § 257.70(b) or (c).

(b) Any liner specified in this section must be installed to cover all surrounding earth likely to be in contact with CCR. Dikes shall not be constructed on top of the composite liner.

(c) Prior to construction of the CCR surface impoundment or any lateral expansion of a CCR surface impoundment, the owner or operator must obtain certification from a qualified professional engineer that the design of the composite liner or, if applicable, the design of an alternative composite liner complies with the requirements of this section.

(d) Upon completion, the owner or operator must obtain certification from a qualified professional engineer that the composite liner or if applicable, the alternative composite liner has been constructed in accordance with the requirements of this section.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the Internet requirements specified in § 257.107(f).

Subpart D Design Criteria

§ 257.73 Structural integrity criteria for existing CCR surface impoundments

(a) The requirements of paragraphs (a)(1) through (4) of this section apply to all existing CCR surface impoundments, except for those existing CCR surface impoundments that are incised CCR units. If an incised CCR surface impoundment is subsequently modified (e.g., a dike is constructed) such that the CCR unit no longer meets the definition of an incised CCR unit, the CCR unit is subject to the requirements of paragraphs (a)(1) through (4) of this section.

(1) No later than, December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

(2) Periodic hazard potential classification assessments.

(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.

(3) Emergency Action Plan (EAP)

(i) Development of the plan. No later than April 17, 2017, the owner or operator of a CCR unit determined to be either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment under paragraph (a)(2) of this section must prepare and maintain a written EAP. At a minimum, the EAP must:

(A) Define the events or circumstances involving the CCR unit that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner;

(B) Define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving the CCR unit;

(C) Provide contact information of emergency responders;

(D) Include a map which delineates the downstream area which would be affected in the event of a CCR unit failure and a physical description of the CCR unit; and

(E) Include provisions for an annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders.

(ii) Amendment of the plan.

(A) The owner or operator of a CCR unit subject to the requirements of paragraph (a)(3)(i) of this section may amend the written EAP at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(f)(6). The owner or operator must amend the written EAP whenever there is a change in conditions that would substantially affect the EAP in effect.

(B) The written EAP must be evaluated, at a minimum, every five years to ensure the information required in paragraph (a)(3)(i) of this section is accurate. As necessary, the EAP must be updated and a revised EAP placed in the facility's operating record as required by § 257.105(f)(6).

(iii) Changes in hazard potential classification.

(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written EAP beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by § 257.105(f)(5).

(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.

(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.

(b) The requirements of paragraphs (c) through (e) of this section apply to an owner or operator of an existing CCR surface impoundment that either:

(1) Has a height of five feet or more and a storage volume of 20 acre-feet or more; or

(2) Has a height of 20 feet or more.

(c)

(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified in paragraphs (c)(1)(i) through (xi) of this section.

(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.
(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.
(iii) A statement of the purpose for which the CCR unit is being used.
(iv) The name and size in acres of the watershed within which the CCR unit is located.
(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.
(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

(2) Changes to the history of construction. If there is a significant change to any information compiled under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

(d) Periodic structural stability assessments.

(1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

(i) Stable foundations and abutments;

(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section.

(A) All spillways must be either:

(1) Of non-erodible construction and designed to carry sustained flows; or

(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and

(vii) For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

(e) Periodic safety factor assessments.

(1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv)of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions.

The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.

(f) Timeframes for periodic assessments

(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

(2) Use of a previously completed assessment(s) in lieu of the initial assessment(s). The owner or operator of the CCR unit may elect to use a previously completed assessment to serve as the initial assessment required by paragraphs (a)(2), (d), and (e) of this section provided that the previously completed assessment(s):

(i) Was completed no earlier than 42 months prior to October 17, 2016; and
(ii) Meets the applicable requirements of paragraphs (a)(2), (d), and (e) of this section.

(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. If the owner or operator elects to use a previously completed assessment(s) in lieu of the initial assessment as provided by paragraph (f)(2) of this section, the date of the report for the previously completed assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator may complete any required assessment prior to the required deadline provided the owner or operator places the completed assessment(s) into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent assessments is based on the date of completing the previous assessment. For purposes of this paragraph (f)(3), the owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of §257.101(b)(2).

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the internet requirements specified in § 257.107(f).

Subpart D Design Criteria

§ 257.74 Structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment

(a) The requirements of paragraphs (a)(1) through (4) of this section apply to all new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, except for those new CCR surface impoundments that are incised CCR units. If an incised CCR surface impoundment is subsequently modified (e.g., a dike is constructed) such that the CCR unit no longer meets the definition of an incised CCR unit, the CCR unit is subject to the requirements of paragraphs (a)(1) through (4) of this section.

(1) No later than the initial receipt of CCR, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

(2) Periodic hazard potential classification assessments.

(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.

(3) Emergency Action Plan (EAP)—(i) Development of the plan. Prior to the initial receipt of CCR in the CCR unit, the owner or operator of a CCR unit determined to be either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment under paragraph (a)(2) of this section must prepare and maintain a written EAP. At a minimum, the EAP must:

(A) Define the events or circumstances involving the CCR unit that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner;

(B) Define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving the CCR unit;

(C) Provide contact information of emergency responders;

(D) Include a map which delineates the downstream area which would be affected in the event of a CCR unit failure and a physical description of the CCR unit; and

(E) Include provisions for an annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders.

(ii) Amendment of the plan.

(A) The owner or operator of a CCR unit subject to the requirements of paragraph (a)(3)(i) of this section may amend the written EAP at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(f)(6). The owner or operator must amend the written EAP whenever there is a change in conditions that would substantially affect the EAP in effect.

(B) The written EAP must be evaluated, at a minimum, every five years to ensure the information required in paragraph (a)(3)(i) of this section is accurate. As necessary, the EAP must be updated and a revised EAP placed in the facility's operating record as required by § 257.105(f)(6).

(iii) Changes in hazard potential classification.

(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written EAP beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by § 257.105(f)(5).

(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.

(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

Subpart D Design Criteria

§ 257.74 Structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment

(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of six inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.

(b) The requirements of paragraphs (c) through (e) of this section apply to an owner or operator of a new CCR surface impoundment and any lateral expansion of a CCR surface impoundment that either:

(1) Has a height of five feet or more and a storage volume of 20 acre-feet or more; or
(2) Has a height of 20 feet or more.

(c)

(1) No later than the initial receipt of CCR in the CCR unit, the owner or operator unit must compile the design and construction plans for the CCR unit, which must include, to the extent feasible, the information specified in paragraphs (c)(1)(i) through (xi) of this section.

(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.
(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.
(iii) A statement of the purpose for which the CCR unit is being used.
(iv) The name and size in acres of the watershed within which the CCR unit is located.
(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.
(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the dates of construction of each successive stage of construction of the CCR unit.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

(2) Changes in the design and construction. If there is a significant change to any information compiled under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(13).

(d) Periodic structural stability assessments.

(1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

(i) Stable foundations and abutments;

(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section.

(A) All spillways must be either:
(1) Of non-erodible construction and designed to carry sustained flows; or
(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or
(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or
(3) 100-year flood for a low hazard potential CCR surface impoundment.

(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and

(vii) For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

Subpart D Design Criteria

§ 257.74 Structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment

(e) Periodic safety factor assessments.

(1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (v)of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the end-of-construction loading condition must equal or exceed 1.30. The assessment of this loading condition is only required for the initial safety factor assessment and is not required for subsequent assessments.

(ii) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(iii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iv) The calculated seismic factor of safety must equal or exceed 1.00.

(v) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.

(f) Timeframes for periodic assessments

(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section prior to the initial receipt of CCR in the unit. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

(2) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator may complete any required assessment prior to the required deadline provided the owner or operator places the completed assessment(s) into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent assessments is based on the date of completing the previous assessment. For purposes of this paragraph (f)(2), the owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

(3) Failure to document minimum safety factors during the initial assessment. Until the date an owner or operator of a CCR unit documents that the calculated factors of safety achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (v) of this section, the owner or operator is prohibited from placing CCR in such unit.

(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely periodic safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of § 257.101(c).

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the internet requirements specified in § 257.107(f).

Subpart D Operating Criteria
§ 257.80 Air criteria

(a) The owner or operator of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit must adopt measures that will effectively minimize CCR from becoming airborne at the facility, including CCR fugitive dust originating from CCR units, roads, and other CCR management and material handling activities.

(b) CCR fugitive dust control plan. The owner or operator of the CCR unit must prepare and operate in accordance with a CCR fugitive dust control plan as specified in paragraphs (b)(1) through (7) of this section. This requirement applies in addition to, not in place of, any applicable standards under the Occupational Safety and Health Act.

(1) The CCR fugitive dust control plan must identify and describe the CCR fugitive dust control measures the owner or operator will use to minimize CCR from becoming airborne at the facility. The owner or operator must select, and include in the CCR fugitive dust control plan, the CCR fugitive dust control measures that are most appropriate for site conditions, along with an explanation of how the measures selected are applicable and appropriate for site conditions. Examples of control measures that may be appropriate include: Locating CCR inside an enclosure or partial enclosure; operating a water spray or fogging system; reducing fall distances at material drop points; using wind barriers, compaction, or vegetative covers; establishing and enforcing reduced vehicle speed limits; paving and sweeping roads; covering trucks transporting CCR; reducing or halting operations during high wind events; or applying a daily cover.

(2) If the owner or operator operates a CCR landfill or any lateral expansion of a CCR landfill, the CCR fugitive dust control plan must include procedures to emplace CCR as conditioned CCR. Conditioned CCR means wetting CCR with water to a moisture content that will prevent wind dispersal, but will not result in free liquids. In lieu of water, CCR conditioning may be accomplished with an appropriate chemical dust suppression agent.

(3) The CCR fugitive dust control plan must include procedures to log citizen complaints received by the owner or operator involving CCR fugitive dust events at the facility.

(4) The CCR fugitive dust control plan must include a description of the procedures the owner or operator will follow to periodically assess the effectiveness of the control plan.

(5) The owner or operator of a CCR unit must prepare an initial CCR fugitive dust control plan for the facility no later than October 19, 2015, or by initial receipt of CCR in any CCR unit at the facility if the owner or operator becomes subject to this subpart after October 19, 2015. The owner or operator has completed the initial CCR fugitive dust control plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(1).

(6) Amendment of the plan. The owner or operator of a CCR unit subject to the requirements of this section may amend the written CCR fugitive dust control plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(1). The owner or operator must amend the written plan whenever there is a change in conditions that would substantially affect the written plan in effect, such as the construction and operation of a new CCR unit.

(7) The owner or operator must obtain a certification from a qualified professional engineer that the initial CCR fugitive dust control plan, or any subsequent amendment of it, meets the requirements of this section.

(c) Annual CCR fugitive dust control report. The owner or operator of a CCR unit must prepare an annual CCR fugitive dust control report that includes a description of the actions taken by the owner or operator to control CCR fugitive dust, a record of all citizen complaints, and a summary of any corrective measures taken. The initial annual report must be completed no later than 14 months after placing the initial CCR fugitive dust control plan in the facility's operating record. The deadline for completing a subsequent report is one year after the date of completing the previous report. For purposes of this paragraph (c), the owner or operator has completed the annual CCR fugitive dust control report when the plan has been placed in the facility's operating record as required by § 257.105(g)(2).

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Operating Criteria

§ 257.81 Run-on and run-off controls for CCR landfills

(a) The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:

(1) A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and

(2) A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

(b) Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under § 257.3–3.

(c) Run-on and run-off control system plan

(1) Content of the plan. The owner or operator must prepare initial and periodic run-on and run-off control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator has completed the initial run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(3).

(2) Amendment of the plan. The owner or operator may amend the written run-on and run-off control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(3). The owner or operator must amend the written run-on and run- off control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

(3) Timeframes for preparing the initial plan

(i) Existing CCR landfills. The owner or operator of the CCR unit must prepare the initial run-on and run- off control system plan no later than October 17, 2016.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must prepare the initial run-on and run-off control system plan no later than the date of initial receipt of CCR in the CCR unit.

(4) Frequency for revising the plan. The owner or operator of the CCR unit must prepare periodic run-on and run- off control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating recordwithin a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic run-on and run-off control

system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(3).

(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Operating Criteria

§ 257.82 Hydrologic and hydraulic capacity requirements for CCR surface impoundments

(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.

(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(3) The inflow design flood is:

(i) For a high hazard potential CCR surface impoundment, as determined under § 257.73(a)(2) or § 257.74(a)(2), the probable maximum flood;
(ii) For a significant hazard potential CCR surface impoundment, as determined under § 257.73(a)(2) or
§ 257.74(a)(2), the 1,000-year flood;
(iii) For a low hazard potential CCR surface impoundment, as determined under § 257.73(a)(2) or § 257.74(a)(2), the 100-year flood; or
(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under § 257.3–3.

(c) Inflow design flood control system plan

(1) Content of the plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(4).

(2) Amendment of the plan. The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

(3) Timeframes for preparing the initial plan

(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must prepare the initial inflow design flood control system plan no later than October 17, 2016.

(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator must prepare the initial inflow design flood control system plan no later than the date of initial receipt of CCR in the CCR unit.

(4) Frequency for revising the plan. The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed an inflow design flood control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(4).

(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Operating Criteria

§ 257.83 Inspection requirements for CCR surface impoundments

(a) Inspections by a qualified person.

(1) All CCR surface impoundments and any lateral expansion of a CCR surface impoundment must be examined by a qualified person as follows:

(i) At intervals not exceeding seven days, inspect for any appearances of actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit;

(ii) At intervals not exceeding seven days, inspect the discharge of all outlets of hydraulic structures which pass underneath the base of the surface impoundment or through the dike of the CCR unit for abnormal discoloration, flow or discharge of debris or sediment; and

(iii) At intervals not exceeding 30 days, monitor all CCR unit instrumentation.

(iv) The results of the inspection by a qualified person must be recorded in the facility's operating record as required by § 257.105(g)(5).

(2) Timeframes for inspections by a qualified person

(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section no later than October 19, 2015.

(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section upon initial receipt of CCR by the CCR unit.

(b) Annual inspections by a qualified professional engineer.

(1) If the existing or new CCR surface impoundment or any lateral expansion of the CCR surface impoundment is subject to the periodic structural stability assessment requirements under § 257.73(d) or § 257.74(d), the CCR unit must additionally be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. The inspection must, at a minimum, include:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., CCR unit design and construction information required by §§ 257.73(c)(1) and 257.74(c)(1), previous periodic structural stability assessments required under §§ 257.73(d) and 257.74(d), the results of inspections by a qualified person, and results of previous annual inspections);

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit and appurtenant structures; and

(iii) A visual inspection of any hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit for structural integrity and continued safe and reliable operation.

(2) Inspection report. The qualified professional engineer must prepare a report following each inspection that addresses the following:

(i) Any changes in geometry of the impounding structure since the previous annual inspection;
(ii) The location and type of existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection;
(iii) The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection;
(iv) The storage capacity of the impounding structure at the time of the inspection;
(v) The approximate volume of the impounded water and CCR at the time of the inspection;
(vi) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures; and
(vii) Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.

(3) Timeframes for conducting the initial inspection

(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.

(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator of the CCR unit must complete the initial annual inspection required by paragraphs (b)(1) and (2) of this section is completed no later than 14 months following the date of initial receipt of CCR in the CCR unit.

(4) Frequency of inspections.

(i) Except as provided for in paragraph (b)(4)(ii) of this section, the owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(6).

(ii) In any calendar year in which both the periodic inspection by a qualified professional engineer and the quinquennial (occurring every five years) structural stability assessment by a qualified professional engineer required by §§ 257.73(d) and 257.74(d) are required to be completed, the annual inspection is not required, provided the structural stability assessment is completed during the calendar year. If the annual inspection is not conducted in a year as provided by this paragraph (b)(4)(ii), the deadline for completing the next annual inspection is one year from the date of completing the quinquennial structural stability assessment.

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Operating Criteria
§ 257.84 Inspection requirements for CCR landfills

(a) Inspections by a qualified person.

(1) All CCR landfills and any lateral expansion of a CCR landfill must be examined by a qualified person as follows:

(i) At intervals not exceeding seven days, inspect for any appearances of actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit; and

(ii) The results of the inspection by a qualified person must be recorded in the facility's operating record as required by § 257.105(g)(8).

(2) Timeframes for inspections by a qualified person

(i) Existing CCR landfills. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section no later than October 19, 2015.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section upon initial receipt of CCR by the CCR unit.

(b) Annual inspections by a qualified professional engineer.

(1) Existing and new CCR landfills and any lateral expansion of a CCR landfill must be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. The inspection must, at a minimum, include:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., the results of inspections by a qualified person, and results of previous annual inspections); and

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

(2) Inspection report. The qualified professional engineer must prepare a report following each inspection that addresses the following:

(i) Any changes in geometry of the structure since the previous annual inspection;

(ii) The approximate volume of CCR contained in the unit at the time of the inspection;

(iii) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and

(iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.

(3) Timeframes for conducting the initial inspection

(i) Existing CCR landfills. The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator of the CCR unit must complete the initial annual inspection required by paragraphs (b)(1) and (2) of this section no later than 14 months following the date of initial receipt of CCR in the CCR unit.

(4) Frequency of inspections. The owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(9).

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Groundwater Monitoring and Corrective Action
§ 257.90 Applicability

(a) Except as provided for in § 257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §§ 257.90 through 257.98.

(b) Initial timeframes

(1) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2017, the owner or operator of the CCR unit must be in compliance with the following groundwater monitoring requirements:

(i) Install the groundwater monitoring system as required by § 257.91;
(ii) Develop the groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required by § 257.93;
(iii) Initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background and downgradient well as required by § 257.94(b); and
(iv) Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in appendix III of this part as required by § 257.94.

(2) New CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units. Prior to initial receipt of CCR by the CCR unit, the owner or operator must be in compliance with the groundwater monitoring requirements specified in paragraph (b)(1)(i) and (ii) of this section. In addition, the owner or operator of the CCR unit must initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background well as required by § 257.94(b).

(c) Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit as required by this subpart, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action throughout the active life and post-closure care period of the CCR unit.

(d) In the event of a release from a CCR unit, the owner or operator must immediately take all necessary measures to control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of contaminants into the environment. The owner or operator of the CCR unit must comply with all applicable requirements in §§ 257.96, 257.97, and 257.98.

(e) Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

(4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.91 Groundwater monitoring systems

(a) Performance standard. The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where:

(i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or

(ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and

(2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of:

(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and

(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain:

(1) A minimum of one upgradient and three downgradient monitoring wells; and

(2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

(d) The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit.

(1) The multiunit groundwater monitoring system must be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system specified in paragraphs (a) through (c) of this section for each CCR unit based on the following factors:

(i) Number, spacing, and orientation of each CCR unit;
(ii) Hydrogeologic setting;
(iii) Site history; and
(iv) Engineering design of the CCR unit.

(2) If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by § 257.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under § 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under § 257.101(a) to retrofit or close.

(e) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

(1) The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section.

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring program.

(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.92 [Reserved]

Groundwater Monitoring and Corrective Action
§ 257.93 Groundwater sampling and analysis requirements

(a) The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells required by § 257.91. The owner or operator of the CCR unit must develop a sampling and analysis program that includes procedures and techniques for:

(1) Sample collection;
(2) Sample preservation and shipment;
(3) Analytical procedures;
(4) Chain of custody control; and
(5) Quality assurance and quality control.

(b) The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. For purposes of §§ 257.90 through 257.98, the term constituent refers to both hazardous constituents and other monitoring parameters listed in either appendix III or IV of this part.

(c) Groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled. The owner or operator of the CCR unit must determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same CCR management area must be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.

(d) The owner or operator of the CCR unit must establish background groundwater quality in a hydraulically upgradient or background well(s) for each of the constituents required in the particular groundwater monitoring program that applies to the CCR unit as determined under § 257.94(a) or § 257.95(a). Background groundwater quality may be established at wells that are not located hydraulically upgradient from the CCR unit if it meets the requirements of § 257.91(a)(1).

(e) The number of samples collected when conducting detection monitoring and assessment monitoring (for both downgradient and background wells) must be consistent with the statistical procedures chosen under paragraph (f) of this section and the performance standards under paragraph (g) of this section. The sampling procedures shall be those specified under § 257.94(b) through (d) for detection monitoring, § 257.95(b) through (d) for assessment monitoring, and § 257.96(b) for corrective action.

(f) The owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of this section to be used in evaluating groundwater monitoring data for each specified constituent. The statistical test chosen shall be conducted separately for each constituent in each monitoring well.

(1) A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of paragraph (g) of this section.

(6) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.

(g) Any statistical method chosen under paragraph (f) of this section shall comply with the following performance standards, as appropriate, based on the statistical test method used:

(1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of constituents. Normal distributions of data values shall use parametric methods. Non-normal distributions shall use non-parametric methods. If the distribution of the constituents is shown by the owner or operator of the CCR unit to be inappropriate for a normal theory test, then the data must be transformed or a distribution-free (non-parametric) theory test must be used. If the distributions for the constituents differ, more than one statistical method may be needed.

(2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.

(3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. The parameter values shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(5) The statistical method must account for data below the limit of detection with one or more statistical procedures that shall at least as effective as any other approach in this section for evaluating groundwater data. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

(6) If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

(h) The owner or operator of the CCR unit must determine whether or not there is a statistically significant increase over background values for each constituent required in the particular groundwater monitoring program that applies to the CCR unit, as determined under § 257.94(a) or § 257.95(a).

(1) In determining whether a statistically significant increase has occurred, the owner or operator must compare the groundwater quality of each constituent at each monitoring well designated pursuant to § 257.91(a)(2) or (d)(1) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs (f) and (g) of this section.

(2) Within 90 days after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for any constituent at each monitoring well.

(i) The owner or operator must measure ‘‘total recoverable metals’’ concentrations in measuring groundwater quality. Measurement of total recoverable metals captures both the particulate fraction and dissolved fraction of metals in natural waters. Groundwater samples shall not be field- filtered prior to analysis.

(j) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.94 Detection monitoring program

(a) The owner or operator of a CCR unit must conduct detection monitoring at all groundwater monitoring wells consistent with this section. At a minimum, a detection monitoring program must include groundwater monitoring for all constituents listed in appendix III to this part.

(b) Except as provided in paragraph (d) of this section, the monitoring frequency for the constituents listed in appendix III to this part shall be at least semiannual during the active life of the CCR unit and the post-closure period. For existing CCR landfills and existing CCR surface impoundments, a minimum of eight independent samples from each background and downgradient well must be collected and analyzed for the constituents listed in appendix III and IV to this part no later than October 17, 2017. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, a minimum of eight independent samples for each background well must be collected and analyzed for the constituents listed in appendices III and IV to this part during the first six months of sampling.

(c) The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background and downgradient well.

(d) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix III to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (d)(1) and (2) of this section.

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:

(i) Lithology of the aquifer and unsaturated zone;
(ii) Hydraulic conductivity of the aquifer and unsaturated zone; and
(iii) Groundwater flow rates.

(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay establishment of an assessment monitoring program.

(3) The owner or operator must obtain a certification from a qualified professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Groundwater Monitoring and Corrective Action
§ 257.94 Detection monitoring program

(e) If the owner or operator of the CCR unit determines, pursuant to § 257.93(h) that there is a statistically significant increase over background levels for one or more of the constituents listed in appendix III to this part at any monitoring well at the waste boundary specified under § 257.91(a)(2), the owner or operator must:

(1) Except as provided for in paragraph (e)(2) of this section, within 90 days of detecting a statistically significant increase over background levels for any constituent, establish an assessment monitoring program meeting the requirements of § 257.95.

(2) The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(3) The owner or operator of a CCR unit must prepare a notification stating that an assessment monitoring program has been established. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(5).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.95 Assessment monitoring program

(a) Assessment monitoring is required whenever a statistically significant increase over background levels has been detected for one or more of the constituents listed in appendix III to this part.

(b) Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator of the CCR unit must sample and analyze the groundwater for all constituents listed in appendix IV to this part. The number of samples collected and analyzed for each well during each sampling event must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each well.

(c) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix IV to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (c)(1) and (2) of this section.

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:
  (i) Lithology of the aquifer and unsaturated zone;
  (ii) Hydraulic conductivity of the aquifer and unsaturated zone; and
  (iii) Groundwater flow rates.

(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay the initiation of any necessary remediation measures.

(3) The owner or operator must obtain a certification from a qualified professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(d) After obtaining the results from the initial and subsequent sampling events required in paragraph (b) of this section, the owner or operator must:

(1) Within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to the requirements of § 257.91, conduct analyses for all parameters in appendix III to this part and for those constituents in appendix IV to this part that are detected in response to paragraph (b) of this section, and record their concentrations in the facility operating record. The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background and downgradient well;

(2) Establish groundwater protection standards for all constituents detected pursuant to paragraph (b) or (d) of this section. The groundwater protection standards must be established in accordance with paragraph (h) of this section; and

(3) Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(e) If the concentrations of all constituents listed in appendices III and IV to this part are shown to be at or below background values, using the statistical procedures in § 257.93(g), for two consecutive sampling events, the owner or operator may return to detection monitoring of the CCR unit. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(7).

(f) If the concentrations of any constituent in Appendices III and IV to this part are above background values, but all concentrations are below the groundwater protection standard established under paragraph (h) of this section, using the statistical procedures in § 257.93(g), the owner or operator must continue assessment monitoring in accordance with this section.

(g) If one or more constituents in Appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under paragraph (h) of this section in any sampling event, the owner or operator must prepare a notification identifying the constituents in appendix IV to this part that have exceeded the groundwater protection standard. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(8). The owner or operator of the CCR unit also must:

(1) Characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected. The characterization must be sufficient to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the CCR unit pursuant to § 257.96. Characterization of the release includes the following minimum measures:

(i) Install additional monitoring wells necessary to define the contaminant plume(s);
(ii) Collect data on the nature and estimated quantity of material released including specific information on the constituents listed in appendix IV of this part and the levels at which they are present in the material released;
(iii) Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (d)(1) of this section; and
(iv) Sample all wells in accordance with paragraph (d)(1) of this section to characterize the nature and extent of the release.

(2) Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells in accordance with paragraph (g)(1) of this section. The owner or operator has completed the notifications when they are placed in the facility's operating record as required by § 257.105(h)(8).

(3) Within 90 days of finding that any of the constituents listed in appendix IV to this part have been detected at a statistically significant level exceeding the groundwater protection standards the owner or operator must either:

(i) Initiate an assessment of corrective measures as required by § 257.96; or

(ii) Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(4) If a successful demonstration has not been made at the end of the 90 day period provided by paragraph (g)(3)(ii) of this section, the owner or operator of the CCR unit must initiate the assessment of corrective measures requirements under § 257.96.

(5) If an assessment of corrective measures is required under § 257.96 by either paragraph (g)(3)(i) or (g)(4) of this section, and if the CCR unit is an existing unlined CCR surface impoundment as determined by § 257.71(a), then the CCR unit is subject to the closure requirements under § 257.101(a) to retrofit or close. In addition, the owner or operator must prepare a notification stating that an assessment of corrective measures has been initiated.

(h) The owner or operator of the CCR unit must establish a groundwater protection standard for each constituent in appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been established under §§ 141.62 and 141.66 of this title, the MCL for that constituent;

(2) For constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with § 257.91; or

(3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

(i) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.96 Assessment of corrective measures

(a) Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(b) The owner or operator of the CCR unit must continue to monitor groundwater in accordance with the assessment monitoring program as specified in § 257.95.

(c) The assessment under paragraph (a) of this section must include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

(d) The owner or operator must place the completed assessment of corrective measures in the facility's operating record. The assessment has been completed when it is placed in the facility's operating record as required by § 257.105(h)(10).

(e) The owner or operator must discuss the results of the corrective measures assessment at least 30 days prior to the selection of remedy, in a public meeting with interested and affected parties.

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.97 Selection of remedy

(a) Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator must, as soon as feasible, select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. This requirement applies to, not in place of, any applicable standards under the Occupational Safety and Health Act. The owner or operator must prepare a semiannual report describing the progress in selecting and designing the remedy. Upon selection of a remedy, the owner or operator must prepare a final report describing the selected remedy and how it meets the standards specified in paragraph (b) of this section. The owner or operator must obtain a certification from a qualified professional engineer that the remedy selected meets the requirements of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(12).

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment;

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;

(5) Comply with standards for management of wastes as specified in § 257.98(d).

(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;
(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;
(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;
(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;
(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;
(vii) Long-term reliability of the engineering and institutional controls; and
(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:
(i) The extent to which containment practices will reduce further releases; and
(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;
(ii) Expected operational reliability of the technologies;
(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;
(iv) Availability of necessary equipment and specialists; and
(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

(d) The owner or operator must specify as part of the selected remedy a schedule(s) for implementing and completing remedial activities. Such a schedule must require the completion of remedial activities within a reasonable period of time taking into consideration the factors set forth in paragraphs (d)(1) through (6) of this section. The owner or operator of the CCR unit must consider the following factors in determining the schedule of remedial activities:

(1) Extent and nature of contamination, as determined by the characterization required under § 257.95(g);

(2) Reasonable probabilities of remedial technologies in achieving compliance with the groundwater protection standards established under § 257.95(h) and other objectives of the remedy;

(3) Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;

(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

(5) Resource value of the aquifer including:
(i) Current and future uses;
(ii) Proximity and withdrawal rate of users;
(iii) Groundwater quantity and quality;

(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents;
(v) The hydrogeologic characteristic of the facility and surrounding land; and
(vi) The availability of alternative water supplies; and

(6) Other relevant factors.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

Groundwater Monitoring and Corrective Action
§ 257.98 Implementation of the corrective action program

(a) Within 90 days of selecting a remedy under § 257.97, the owner or operator must initiate remedial activities. Based on the schedule established under § 257.97(d) for implementation and completion of remedial activities the owner or operator must:

(1) Establish and implement a corrective action groundwater monitoring program that:

(i) At a minimum, meets the requirements of an assessment monitoring program under § 257.95;
(ii) Documents the effectiveness of the corrective action remedy; and
(iii) Demonstrates compliance with the groundwater protection standard pursuant to paragraph (c) of this section.

(2) Implement the corrective action remedy selected under § 257.97; and

(3) Take any interim measures necessary to reduce the contaminants leaching from the CCR unit, and/or potential exposures to human or ecological receptors. Interim measures must, to the greatest extent feasible, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to § 257.97. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:

(i) Time required to develop and implement a final remedy;
(ii) Actual or potential exposure of nearby populations or environmental receptors to any of the constituents listed in appendix IV of this part;
(iii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;
(iv) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;
(v) Weather conditions that may cause any of the constituents listed in appendix IV to this part to migrate or be released;
(vi) Potential for exposure to any of the constituents listed in appendix IV to this part as a result of an accident or failure of a container or handling system; and
(vii) Other situations that may pose threats to human health and the environment.

(b) If an owner or operator of the CCR unit, determines, at any time, that compliance with the requirements of § 257.97(b) is not being achieved through the remedy selected, the owner or operator must implement other methods or techniques that could feasibly achieve compliance with the requirements.

(c) Remedies selected pursuant to § 257.97 shall be considered complete when:

(1) The owner or operator of the CCR unit demonstrates compliance with the groundwater protection standards established under § 257.95(h) has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under § 257.91.

(2) Compliance with the groundwater protection standards established under § 257.95(h) has been achieved by demonstrating that concentrations of constituents listed in appendix IV to this part have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in § 257.93(f) and (g).

(3) All actions required to complete the remedy have been satisfied.

(d) All CCR that are managed pursuant to a remedy required under § 257.97, or an interim measure required under paragraph (a)(3) of this section, shall be managed in a manner that complies with all applicable RCRA requirements.

(e) Upon completion of the remedy, the owner or operator must prepare a notification stating that the remedy has been completed. The owner or operator must obtain a certification from a qualified professional engineer attesting that the remedy has been completed in compliance with the requirements of paragraph (c) of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(13).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

Closure and Post Closure Care
§ 257.100 Inactive CCR surface impoundments

(a) Except as provided by paragraph (b) of this section, inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments.

(b) An owner or operator of an inactive CCR surface impoundment that completes closure of such CCR unit, and meets all of the requirements of either paragraphs (b)(1) through (4) of this section or paragraph (b)(5) of this section no later than April 17, 2018, is exempt from all other requirements of this subpart.

(1) Closure by leaving CCR in place. If the owner or operator of the inactive CCR surface impoundment elects to close the CCR surface impoundment by leaving CCR in place, the owner or operator must ensure that, at a minimum, the CCR unit is closed in a manner that will:

(i) Control, minimize or eliminate, to the maximum extent feasible, post- closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;
(ii) Preclude the probability of future impoundment of water, sediment, or slurry;
(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system; and
(iv) Minimize the need for further maintenance of the CCR unit.

(2) The owner or operator of the inactive CCR surface impoundment must meet the requirements of paragraphs (b)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (b)(3) of this section.

(i) Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.
(ii) Remaining wastes must be stabilized sufficient to support the final cover system.

(3) The owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (b)(3)(i) of this section, or the requirements of an alternative final cover system specified in paragraph (b)(3)(ii) of this section.

(i) The final cover system must be designed and constructed to meet the criteria specified in paragraphs (b)(3)(i)(A) through (D) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ centimeters/second, whichever is less.
(B) The infiltration of liquids through the CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (b)(3)(ii)(A) through (C) of this section.

(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (b)(3)(i)(A) and (B) of this section.

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (b)(3)(i)(C) of this section.

(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(4) The owner or operator of the CCR surface impoundment must obtain a written certification from a qualified professional engineer stating that the design of the final cover system meets either the requirements of paragraphs (b)(3)(i) or (ii) of this section.

(5) Closure through removal of CCR. The owner or operator may alternatively elect to close an inactive CCR surface impoundment by removing and decontaminating all areas affected by releases from the CCR surface impoundment. CCR removal and decontamination of the CCR surface impoundment are complete when all CCR in the inactive CCR surface impoundment is removed, including the bottom liner of the CCR unit.

(6) The owner or operator of the CCR surface impoundment must obtain a written certification from a qualified professional engineer that closure of the CCR surface impoundment under either paragraphs (b)(1) through (4) or (b)(5) of this section is technically feasible within the timeframe in paragraph (b) of this section.

(7) If the owner or operator of the CCR surface impoundment fails to complete closure of the inactive CCR surface impoundment within the timeframe in paragraph (b) of this section, the CCR unit must comply with all of the requirements applicable to existing CCR surface impoundments under this subpart.

(c) Required notices and progress reports. An owner or operator of an inactive CCR surface impoundment that closes in accordance with paragraph (b) of this section must complete the notices and progress reports specified in paragraphs (c)(1) through (3) of this section.

(1) No later than December 17, 2015, the owner or operator must prepare and place in the facility's operating record a notification of intent to initiate closure of the CCR surface impoundment. The notification must state that the CCR surface impoundment is an inactive CCR surface impoundment closing under the requirements of paragraph (b) of this section. The notification must also include a narrative description of how the CCR surface impoundment will be closed, a schedule for completing closure activities, and the required certifications under paragraphs (b)(4) and (6) of this section, if applicable.

(2) The owner or operator must prepare periodic progress reports summarizing the progress of closure implementation, including a description of the actions completed to date, any problems encountered and a description of the actions taken to resolve the problems, and projected closure activities for the upcoming year. The annual progress reports must be completed according to the following schedule:

(i) The first annual progress report must be prepared no later than 13 months after completing the notification of intent to initiate closure required by paragraph (c)(1) of this section.
(ii) The second annual progress report must be prepared no later than 12 months after completing the first progress report required by paragraph (c)(2)(i) of this section.
(iii) The owner or operator has completed the progress reports specified in paragraph (c)(2) of this section when the reports are placed in the facility's operating record as required by § 257.105(i)(2).

(3) The owner or operator must prepare and place in the facility's operating record a notification of completion of closure of the CCR surface impoundment. The notification must be submitted within 60 days of completing closure of the CCR surface impoundment and must include a written certification from a qualified professional engineer stating that the CCR surface impoundment was closed in accordance with the requirements of either paragraph (b)(1) through (4) or (b)(5) of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(i), the notification requirements specified in § 257.106(i), and the internet requirements specified in § 257.107(i).

Closure and Post Closure Care
§ 257.101 Closure or retrofit of CCR units

(a) The owner or operator of an existing unlined CCR surface impoundment, as determined under § 257.71(a), is subject to the requirements of paragraph (a)(1) of this section.

(1) Except as provided by paragraph (a)(3) of this section, if at any time after October 19, 2015 an owner or operator of an existing unlined CCR surface impoundment determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under § 257.95(h) for such CCR unit, within six months of making such determination, the owner or operator of the existing unlined CCR surface impoundment must cease placing CCR and non-CCR waste streams into such CCR surface impoundment and either retrofit or close the CCR unit in accordance with the requirements of § 257.102.

(2) An owner or operator of an existing unlined CCR surface impoundment that closes in accordance with paragraph (a)(1) of this section must include a statement in the notification required under § 257.102(g) or (k)(5) that the CCR surface impoundment is closing or retrofitting under the requirements of paragraph (a)(1) of this section.

(3) The timeframe specified in paragraph (a)(1) of this section does not apply if the owner or operator complies with the alternative closure procedures specified in § 257.103.

(4) At any time after the initiation of closure under paragraph (a)(1) of this section, the owner or operator may cease closure activities and initiate a retrofit of the CCR unit in accordance with the requirements of § 257.102(k).

(b) The owner or operator of an existing CCR surface impoundment is subject to the requirements of paragraph (b)(1) of this section.

(1) Except as provided by paragraph (b)(4) of this section, within six months of determining that an existing CCR surface impoundment has not demonstrated compliance with any location standard specified in §§ 257.60(a), 257.61(a), 257.62(a), 257.63(a), and 257.64(a), the owner or operator of the CCR surface impoundment must cease placing CCR and non-CCR waste streams into such CCR unit and close the CCR unit in accordance with the requirements of § 257.102.

(2) Within six months of either failing to complete the initial or any subsequent periodic safety factor assessment required by § 257.73(e) by the deadlines specified in § 257.73(f)(1) through (3) or failing to document that the calculated factors of safety for the existing CCR surface impoundment achieve the minimum safety factors specified in § 257.73(e)(1)(i) through (iv), the owner or operator of the CCR surface impoundment must cease placing CCR and non-CCR waste streams into such CCR unit and close the CCR unit in accordance with the requirements of § 257.102.

(3) An owner or operator of an existing CCR surface impoundment that closes in accordance with paragraphs (b)(1) or (2) of this section must include a statement in the notification required under § 257.102(g) that the CCR surface impoundment is closing under the requirements of paragraphs (b)(1) or (2) of this section.

(4) The timeframe specified in paragraph (b)(1) of this section does not apply if the owner or operator complies with the alternative closure procedures specified in § 257.103.

(c) The owner or operator of a new CCR surface impoundment is subject to the requirements of paragraph (c)(1) of this section.

(1) Within six months of either failing to complete the initial or any subsequent periodic safety factor assessment required by § 257.74(e) by the deadlines specified in § 257.74(f)(1) through (3) or failing to document that the calculated factors of safety for the new CCR surface impoundment achieve the minimum safety factors specified in § 257.74(e)(1)(i) through (v), the owner or operator of the CCR surface impoundment must cease placing CCR and non-CCR wastestreams into such CCR unit and close the CCR unit in accordance with the requirements of § 257.102.

(2) An owner or operator of an new CCR surface impoundment that closes in accordance with paragraph (c)(1) of this section must include a statement in the notification required under § 257.102(g) that the CCR surface impoundment is closing under the requirements of paragraph (c)(1) of this section.

(d) The owner or operator of an existing CCR landfill is subject to the requirements of paragraph (d)(1) of this section.

(1) Except as provided by paragraph (d)(3) of this section, within six months of determining that an existing CCR landfill has not demonstrated compliance with the location restriction for unstable areas specified in § 257.64(a), the owner or operator of the CCR unit must cease placing CCR and non-CCR waste streams into such CCR landfill and close the CCR unit in accordance with the requirements of § 257.102.

(2) An owner or operator of an existing CCR landfill that closes in accordance with paragraph (d)(1) of this section must include a statement in the notification required under § 257.102(g) that the CCR landfill is closing under the requirements of paragraph (d)(1) of this section.

(3) The timeframe specified in paragraph (d)(1) of this section does not apply if the owner or operator complies with the alternative closure procedures specified in § 257.103.

Closure and Post Closure Care
§ 257.102 Criteria for conducting the closure or retrofit of CCR units

(a) Closure of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR unit, as described in paragraphs (b) through (j) of this section. Retrofit of a CCR surface impoundment must be completed in accordance with the requirements in paragraph (k) of this section.

(b) Written closure plan

(1) Content of the plan. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section.

(i) A narrative description of how the CCR unit will be closed in accordance with this section.

(ii) If closure of the CCR unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.

(iii) If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d)of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.

(iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.

(v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.

(vi) A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.

(2) Timeframes for preparing the initial written closure plan

(i) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2016, the owner or operator of the CCR unit must prepare an initial written closure plan consistent with the requirements specified in paragraph (b)(1) of this section.

(ii) New CCR landfills and new CCR surface impoundments, and any lateral expansion of a CCR unit. No later than the date of the initial receipt of CCR in the CCR unit, the owner or operator must prepare an initial written closure plan consistent with the requirements specified in paragraph (b)(1) of this section.

(iii) The owner or operator has completed the written closure plan when the plan, including the certification required by paragraph (b)(4) of this section, has been placed in the facility's operating record as required by § 257.105(i)(4).

(3) Amendment of a written closure plan.

(i) The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to paragraph (b)(1) of this section at any time.

(ii) The owner or operator must amend the written closure plan whenever:

(A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or

(B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.

(iii) The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.

(4) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this section.

(c) Closure by removal of CCR. An owner or operator may elect to close a CCR unit by removing and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to § 257.95(h) for constituents listed in appendix IV to this part.

(d) Closure performance standard when leaving CCR in place

(1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:

(i) Control, minimize or eliminate, to the maximum extent feasible, post- closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;

(ii) Preclude the probability of future impoundment of water, sediment, or slurry;

(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;

(iv) Minimize the need for further maintenance of the CCR unit; and

(v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

(2) Drainage and stabilization of CCR surface impoundments. The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of paragraphs (d)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (d)(3) of this section.

(i) Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.

(ii) Remaining wastes must be stabilized sufficient to support the final cover system.

(3) Final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.

(i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ cm/sec, whichever is less.

(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (f)(3)(ii)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.

(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.

(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(iii) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.

(e) Initiation of closure activities. Except as provided for in paragraph (e)(4) of this section and § 257.103, the owner or operator of a CCR unit must commence closure of the CCR unit no later than the applicable timeframes specified in either paragraph (e)(1) or (2) of this section.

(1) The owner or operator must commence closure of the CCR unit no later than 30 days after the date on which the CCR unit either:

(i) Receives the known final receipt of waste, either CCR or any non-CCR waste stream; or

(ii) Removes the known final volume of CCR from the CCR unit for the purpose of beneficial use of CCR.

(2)

(i) Except as provided by paragraph (e)(2)(ii) of this section, the owner or operator must commence closure of a CCR unit that has not received CCR or any non-CCR waste stream or is no longer removing CCR for the purpose of beneficial use within two years of the last receipt of waste or within two years of the last removal of CCR material for the purpose of beneficial use.

(ii) Notwithstanding paragraph (e)(2)(i) of this section, the owner or operator of the CCR unit may secure an additional two years to initiate closure of the idle unit provided the owner or operator provides written documentation that the CCR unit will continue to accept wastes or will start removing CCR for the purpose of beneficial use. The documentation must be supported by, at a minimum, the information specified in paragraphs (e)(2)(ii)(A) and (B) of this section. The owner or operator may obtain two-year extensions provided the owner or operator continues to be able to demonstrate that there is reasonable likelihood that the CCR unit will accept wastes in the foreseeable future or will remove CCR from the unit for the purpose of beneficial use. The owner or operator must place each completed demonstration, if more than one time extension is sought, in the facility's operating record as required by § 257.105(i)(5) prior to the end of any two-year period.

(A) Information documenting that the CCR unit has remaining storage or disposal capacity or that the CCR unit can have CCR removed for the purpose of beneficial use; and

(B) Information demonstrating that there is a reasonable likelihood that the CCR unit will resume receiving CCR or non-CCR waste streams in the foreseeable future or that CCR can be removed for the purpose of beneficial use. The narrative must include a best estimate as to when the CCR unit will resume receiving CCR or non-CCR waste streams. The situations listed in paragraphs (e)(2)(ii)(B)(1) through (4) of this section are examples of situations that would support a determination that the CCR unit will resume receiving CCR or non-CCR waste streams in the foreseeable future.

(1) Normal plant operations include periods during which the CCR unit does not receive CCR or non-CCR waste streams, such as the alternating use of two or more CCR units whereby at any point in time one CCR unit is receiving CCR while CCR is being removed from a second CCR unit after its dewatering.

(2) The CCR unit is dedicated to a coal-fired boiler unit that is temporarily idled (e.g., CCR is not being generated) and there is a reasonable likelihood that the coal-fired boiler will resume operations in the future.

(3)The CCR unit is dedicated to an operating coal-fired boiler (i.e., CCR is being generated); however, no CCR are being placed in the CCR unit because the CCR are being entirely diverted to beneficial uses, but there is a reasonable likelihood that the CCR unit will again be used in the foreseeable future.

(4) The CCR unit currently receives only non-CCR waste streams and those non-CCR waste streams are not generated for an extended period of time, but there is a reasonable likelihood that the CCR unit will again receive non-CCR waste streams in the future.

(iii) In order to obtain additional time extension(s) to initiate closure of a CCR unit beyond the two years provided by paragraph (e)(2)(i) of this section, the owner or operator of the CCR unit must include with the demonstration required by paragraph (e)(2)(ii) of this section the following statement signed by the owner or operator or an authorized representative:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(3) For purposes of this subpart, closure of the CCR unit has commenced if the owner or operator has ceased placing waste and completes any of the following actions or activities:

(i) Taken any steps necessary to implement the written closure plan required by paragraph (b) of this section;

(ii) Submitted a completed application for any required state or agency permit or permit modification; or

(iii) Taken any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR unit.

(4) The timeframes specified in paragraphs (e)(1) and (2) of this section do not apply to any of the following owners or operators:

(i) An owner or operator of an inactive CCR surface impoundment closing the CCR unit as required by § 257.100(b);

(ii) An owner or operator of an existing unlined CCR surface impoundment closing the CCR unit as required by § 257.101(a);

(iii) An owner or operator of an existing CCR surface impoundment closing the CCR unit as required by § 257.101(b);

(iv) An owner or operator of a new CCR surface impoundment closing the CCR unit as required by § 257.101(c); or

(v) An owner or operator of an existing CCR landfill closing the CCR unit as required by § 257.101(d).

(f) Completion of closure activities.

(1) Except as provided for in paragraph (f)(2) of this section, the owner or operator must complete closure of the CCR unit:

(i) For existing and new CCR landfills and any lateral expansion of a CCR landfill, within six months of commencing closure activities.

(ii) For existing and new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, within five years of commencing closure activities.

(2)

(i) Extensions of closure timeframes. The timeframes for completing closure of a CCR unit specified under paragraphs (f)(1) of this section may be extended if the owner or operator can demonstrate that it was not feasible to complete closure of the CCR unit within the required timeframes due to factors beyond the facility's control. If the owner or operator is seeking a time extension beyond the time specified in the written closure plan as required by paragraph (b)(1) of this section, the demonstration must include a narrative discussion providing the basis for additional time beyond that specified in the closure plan. The owner or operator must place each completed demonstration, if more than one time extension is sought, in the facility's operating record as required by § 257.105(i)(6) prior to the end of any two-year period. Factors that may support such a demonstration include:

(A) Complications stemming from the climate and weather, such as unusual amounts of precipitation or a significantly shortened construction season;

(B) Time required to dewater a surface impoundment due to the volume of CCR contained in the CCR unit or the characteristics of the CCR in the unit;

(C) The geology and terrain surrounding the CCR unit will affect the amount of material needed to close the CCR unit; or

(D) Time required or delays caused by the need to coordinate with and obtain necessary approvals and permits from a state or other agency.

(ii) Maximum time extensions.

(A) CCR surface impoundments of 40 acres or smaller may extend the time to complete closure by no longer than two years.

(B) CCR surface impoundments larger than 40 acres may extend the timeframe to complete closure of the CCR unit multiple times, in two-year increments. For each two-year extension sought, the owner or operator must substantiate the factual circumstances demonstrating the need for the extension. No more than a total of five two-year extensions may be obtained for any CCR surface impoundment.

(C) CCR landfills may extend the timeframe to complete closure of the CCR unit multiple times, in one-year increments. For each one-year extension sought, the owner or operator must substantiate the factual circumstances demonstrating the need for the extension. No more than a total of two one-year extensions may be obtained for any CCR landfill.

(iii) In order to obtain additional time extension(s) to complete closure of a CCR unit beyond the times provided by paragraph (f)(1) of this section, the owner or operator of the CCR unit must include with the demonstration required by paragraph (f)(2)(i) of this section the following statement signed by the owner or operator or an authorized representative:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(3) Upon completion, the owner or operator of the CCR unit must obtain a certification from a qualified professional engineer verifying that closure has been completed in accordance with the closure plan specified in paragraph (b) of this section and the requirements of this section.

(g) No later than the date the owner or operator initiates closure of a CCR unit, the owner or operator must prepare a notification of intent to close a CCR unit. The notification must include the certification by a qualified professional engineer for the design of the final cover system as required by § 257.102(d)(3)(iii), if applicable. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(7).

(h) Within 30 days of completion of closure of the CCR unit, the owner or operator must prepare a notification of closure of a CCR unit. The notification must include the certification by a qualified professional engineer as required by § 257.102(f)(3). The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(8).

(i) Deed notations.

(1) Except as provided by paragraph (i)(4) of this section, following closure of a CCR unit, the owner or operator must record a notation on the deed to the property, or some other instrument that is normally examined during title search.

(2) The notation on the deed must in perpetuity notify any potential purchaser of the property that:

(i) The land has been used as a CCR unit; and

(ii) Its use is restricted under the post- closure care requirements as provided by § 257.104(d)(1)(iii).

(3) Within 30 days of recording a notation on the deed to the property, the owner or operator must prepare a notification stating that the notation has been recorded. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(9).

(4) An owner or operator that closes a CCR unit in accordance with paragraph (c) of this section is not subject to the requirements of paragraphs (i)(1) through (3) of this section.

(j) The owner or operator of the CCR unit must comply with the closure recordkeeping requirements specified in § 257.105(i), the closure notification requirements specified in § 257.106(i), and the closure Internet requirements specified in § 257.107(i).

(k) Criteria to retrofit an existing CCR surface impoundment.

(1) To retrofit an existing CCR surface impoundment, the owner or operator must:
- (i) First remove all CCR, including any contaminated soils and sediments from the CCR unit; and
- (ii) Comply with the requirements in § 257.72.
- (iii) A CCR surface impoundment undergoing a retrofit remains subject to all other requirements of this subpart, including the requirement to conduct any necessary corrective action.

(2) Written retrofit plan
- (i) Content of the plan. The owner or operator must prepare a written retrofit plan that describes the steps necessary to retrofit the CCR unit consistent with recognized and generally accepted good engineering practices. The written retrofit plan must include, at a minimum, all of the following information:
  - (A) A narrative description of the specific measures that will be taken to retrofit the CCR unit in accordance with this section.
  - (B) A description of the procedures to remove all CCR and contaminated soils and sediments from the CCR unit.
  - (C) An estimate of the maximum amount of CCR that will be removed as part of the retrofit operation.
  - (D) An estimate of the largest area of the CCR unit that will be affected by the retrofit operation.
  - (E) A schedule for completing all activities necessary to satisfy the retrofit criteria in this section, including an estimate of the year in which retrofit activities of the CCR unit will be completed.

- (ii) Timeframes for preparing the initial written retrofit plan.
  - (A) No later than 60 days prior to date of initiating retrofit activities, the owner or operator must prepare an initial written retrofit plan consistent with the requirements specified in paragraph (k)(2) of this section. For purposes of this subpart, initiation of retrofit activities has commenced if the owner or operator has ceased placing waste in the unit and completes any of the following actions or activities:
    - (1) Taken any steps necessary to implement the written retrofit plan;
    - (2) Submitted a completed application for any required state or agency permit or permit modification; or

(3) Taken any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the retrofit of a CCR unit.

(B) The owner or operator has completed the written retrofit plan when the plan, including the certification required by paragraph (k)(2)(iv) of this section, has been placed in the facility's operating record as required by § 257.105(j)(1).

(iii) Amendment of a written retrofit plan.

(A) The owner or operator may amend the initial or any subsequent written retrofit plan at any time.

(B) The owner or operator must amend the written retrofit plan whenever:

(1) There is a change in the operation of the CCR unit that would substantially affect the written retrofit plan in effect; or

(2) Before or after retrofit activities have commenced, unanticipated events necessitate a revision of the written retrofit plan.

(C) The owner or operator must amend the retrofit plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the revision of an existing written retrofit plan. If a written retrofit plan is revised after retrofit activities have commenced for a CCR unit, the owner or operator must amend the current retrofit plan no later than 30 days following the triggering event.

(iv) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the activities outlined in the written retrofit plan, including any amendment of the plan, meet the requirements of this section.

(3) Deadline for completion of activities related to the retrofit of a CCR unit. Any CCR surface impoundment that is being retrofitted must complete all retrofit activities within the same time frames and procedures specified for the closure of a CCR surface impoundment in § 257.102(f) or, where applicable, § 257.103.

(4) Upon completion, the owner or operator must obtain a certification from a qualified professional engineer verifying that the retrofit activities have been completed in accordance with the retrofit plan specified in paragraph (k)(2) of this section and the requirements of this section.

(5) No later than the date the owner or operator initiates the retrofit of a CCR unit, the owner or operator must prepare a notification of intent to retrofit a CCR unit. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(j)(5).

(6) Within 30 days of completing the retrofit activities specified in paragraph (k)(1) of this section, the owner or operator must prepare a notification of completion of retrofit activities. The notification must include the certification by a qualified professional engineer as required by paragraph (k)(4) of this section. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(j)(6).

(7) At any time after the initiation of a CCR unit retrofit, the owner or operator may cease the retrofit and initiate closure of the CCR unit in accordance with the requirements of § 257.102.

(8) The owner or operator of the CCR unit must comply with the retrofit recordkeeping requirements specified in § 257.105(j), the retrofit notification requirements specified in § 257.106(j), and the retrofit Internet requirements specified in § 257.107(j).

Closure and Post Closure Care
§ 257.103 Alternative closure requirements

The owner or operator of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit that is subject to closure pursuant to § 257.101(a), (b)(1), or (d) may continue to receive CCR in the unit provided the owner or operator meets the requirements of either paragraph (a) or (b) of this section.

(a)

(1) No alternative CCR disposal capacity. Notwithstanding the provisions of § 257.101(a), (b)(1), or (d), a CCR unit may continue to receive CCR if the owner or operator of the CCR unit certifies that the CCR must continue to be managed in that CCR unit due to the absence of alternative disposal capacity both on-site and off-site of the facility. To qualify under this paragraph (a)(1), the owner or operator of the CCR unit must document that all of the following conditions have been met:

(i) No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification under this section;

(ii) The owner or operator has made, and continues to make, efforts to obtain additional capacity. Qualification under this subsection lasts only as long as no alternative capacity is available. Once alternative capacity is identified, the owner or operator must arrange to use such capacity as soon as feasible;

(iii) The owner or operator must remain in compliance with all other requirements of this subpart, including the requirement to conduct any necessary corrective action; and

(iv) The owner or operator must prepare an annual progress report documenting the continued lack of alternative capacity and the progress towards the development of alternative CCR disposal capacity.

(2) Once alternative capacity is available, the CCR unit must cease receiving CCR and initiate closure following the timeframes in § 257.102(e) and (f).

(3) If no alternative capacity is identified within five years after the initial certification, the CCR unit must cease receiving CCR and close in accordance with the timeframes in § 257.102(e) and (f).

(b)

(1) Permanent cessation of a coal- fired boiler(s) by a date certain. Notwithstanding the provisions of § 257.101(a), (b)(1), and (d), a CCR unit may continue to receive CCR if the owner or operator certifies that the facility will cease operation of the coal- fired boilers within the timeframes specified in paragraphs (b)(2) through (4) of this section, but in the interim period (prior to closure of the coal-fired boiler), the facility must continue to use the CCR unit due to the absence of alternative disposal capacity both on- site and off-site of the facility. To qualify under this paragraph (b)(1), the owner or operator of the CCR unit must document that all of the following conditions have been met:

(i) No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification under this section.

(ii) The owner or operator must remain in compliance with all other requirements of this subpart, including the requirement to conduct any necessary corrective action; and

(iii) The owner or operator must prepare an annual progress report documenting the continued lack of alternative capacity and the progress towards the closure of the coal-fired boiler.

(2) For a CCR surface impoundment that is 40 acres or smaller, the coal-fired boiler must cease operation and the CCR surface impoundment must have completed closure no later than October 17, 2023.

(3) For a CCR surface impoundment that is larger than 40 acres, the coal- fired boiler must cease operation, and the CCR surface impoundment must complete closure no later than October 17, 2028.

(4) For a CCR landfill, the coal-fired boiler must cease operation, and the CCR landfill must complete closure no later than April 19, 2021.

(c) Required notices and progress reports. An owner or operator of a CCR unit that closes in accordance with paragraphs (a) or (b) of this section must complete the notices and progress reports specified in paragraphs (c)(1) through (3) of this section.

(1) Within six months of becoming subject to closure pursuant to § 257.101(a), (b)(1), or (d), the owner or operator must prepare and place in the facility's operating record a notification of intent to comply with the alternative closure requirements of this section. The notification must describe why the CCR unit qualifies for the alternative closure provisions under either paragraph (a) or (b) of this section, in addition to providing the documentation and certifications required by paragraph (a) or (b) of this section.

(2) The owner or operator must prepare the periodic progress reports required by paragraphs (a)(1)(iv) or (b)(1)(iii), in addition to describing any problems encountered and a description of the actions taken to resolve the problems. The annual progress reports must be completed according to the following schedule:

(i) The first annual progress report must be prepared no later than 13 months after completing the notification of intent to comply with the alternative closure requirements required by paragraph (c)(1) of this section.

(ii) The second annual progress report must be prepared no later than 12 months after completing the first annual progress report. Additional annual progress reports must be prepared within 12 months of completing the previous annual progress report.

(iii) The owner or operator has completed the progress reports specified in paragraph (c)(2) of this section when the reports are placed in the facility's operating record as required by § 257.105(i)(10).

(3) An owner or operator of a CCR unit must also prepare the notification of intent to close a CCR unit as required by § 257.102(g).

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(i), the notification requirements specified in § 257.106(i), and the Internet requirements specified in § 257.107(i).

Closure and Post Closure Care

§ 257.104 Post-closure care requirements.

(a) Applicability.

(1) Except as provided by either paragraph (a)(2) or (3) of this section, § 257.104 applies to the owners or operators of CCR landfills, CCR surface impoundments, and all lateral expansions of CCR units that are subject to the closure criteria under § 257.102.

(2) An owner or operator of a CCR unit that elects to close a CCR unit by removing CCR as provided by § 257.102(c) is not subject to the post- closure care criteria under this section.

(3) An owner or operator of an inactive CCR surface impoundment that elects to close a CCR unit pursuant to the requirements under § 257.100(b) is not subject to the post-closure care criteria under this section.

(b) Post-closure care maintenance requirements. Following closure of the CCR unit, the owner or operator must conduct post-closure care for the CCR unit, which must consist of at least the following:

(1) Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(2) If the CCR unit is subject to the design criteria under § 257.70, maintaining the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of § 257.70; and

(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§ 257.90 through 257.98.

(c) Post-closure care period.

(1) Except as provided by paragraph (c)(2) of this section, the owner or operator of the CCR unit must conduct post-closure care for 30 years.

(2) If at the end of the post-closure care period the owner or operator of the CCR unit is operating under assessment monitoring in accordance with § 257.95, the owner or operator must continue to conduct post-closure care until the owner or operator returns to detection monitoring in accordance with § 257.95.

Closure and Post Closure Care
§ 257.104 Post-closure care requirements.

(d) Written post-closure plan

(1) Content of the plan. The owner or operator of a CCR unit must prepare a written post-closure plan that includes, at a minimum, the information specified in paragraphs (d)(1)(i) through (iii) of this section.

(i) A description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed;

(ii) The name, address, telephone number, and email address of the person or office to contact about the facility during the post-closure care period; and

(iii) A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart. Any other disturbance is allowed if the owner or operator of the CCR unit demonstrates that disturbance of the final cover, liner, or other component of the containment system, including any removal of CCR, will not increase the potential threat to human health or the environment. The demonstration must be certified by a qualified professional engineer, and notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible Internet site.

(2) Deadline to prepare the initial written post-closure plan

(i) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2016, the owner or operator of the CCR unit must prepare an initial written post-closure plan consistent with the requirements specified in paragraph (d)(1) of this section.

(ii) New CCR landfills, new CCR surface impoundments, and any lateral expansion of a CCR unit. No later than the date of the initial receipt of CCR in the CCR unit, the owner or operator must prepare an initial written post- closure plan consistent with the requirements specified in paragraph (d)(1) of this section.

(iii) The owner or operator has completed the written post-closure plan when the plan, including the certification required by paragraph (d)(4) of this section, has been placed in the facility's operating record as required by § 257.105(i)(4).

(3) Amendment of a written post- closure plan.

(i) The owner or operator may amend the initial or any subsequent written post-closure plan developed pursuant to paragraph (d)(1) of this section at any time.

(ii) The owner or operator must amend the written closure plan whenever:

(A) There is a change in the operation of the CCR unit that would substantially affect the written post-closure plan in effect; or

(B) After post-closure activities have commenced, unanticipated events necessitate a revision of the written post-closure plan.

(iii) The owner or operator must amend the written post-closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written post-closure plan. If a written post-closure plan is revised after post-closure activities have commenced for a CCR unit, the owner or operator must amend the written post-closure plan no later than 30 days following the triggering event.

(4) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written post-closure plan meets the requirements of this section.

(e) Notification of completion of post- closure care period. No later than 60 days following the completion of the post-closure care period, the owner or operator of the CCR unit must prepare a notification verifying that post-closure care has been completed. The notification must include the certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the closure plan specified in paragraph (d) of this section and the requirements of this section. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(13).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(i), the notification requirements specified in § 257.106(i), and the Internet requirements specified in § 257.107(i).

Recordkeeping, Notification, and Posting of Information to the Internet
§ 257.105 Recordkeeping requirements

(a) Each owner or operator of a CCR unit subject to the requirements of this subpart must maintain files of all information required by this section in a written operating record at their facility.

(b) Unless specified otherwise, each file must be retained for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study.

(c) An owner or operator of more than one CCR unit subject to the provisions of this subpart may comply with the requirements of this section in one recordkeeping system provided the system identifies each file by the name of each CCR unit. The files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

(d) The owner or operator of a CCR unit must submit to the State Director and/or appropriate Tribal authority any demonstration or documentation required by this subpart, if requested, when such information is not otherwise available on the owner or operator's publicly accessible Internet site.

(e) Location restrictions. The owner or operator of a CCR unit subject to this subpart must place the demonstrations documenting whether or not the CCR unit is in compliance with the requirements under §§ 257.60(a), 257.61(a), 257.62(a), 257.63(a), and 257.64(a), as it becomes available, in the facility's operating record.

(f) Design criteria. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

(1) The design and construction certifications as required by § 257.70(e) and (f).

(2) The documentation of liner type as required by § 257.71(a).

(3) The design and construction certifications as required by § 257.72(c) and (d).

(4) Documentation prepared by the owner or operator stating that the permanent identification marker was installed as required by §§ 257.73(a)(1) and 257.74(a)(1).

(5) The initial and periodic hazard potential classification assessments as required by §§ 257.73(a)(2) and 257.74(a)(2).

(6) The emergency action plan (EAP), and any amendment of the EAP, as required by §§ 257.73(a)(3) and 257.74(a)(3), except that only the most recent EAP must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.

(7) Documentation prepared by the owner or operator recording the annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders as required by § 257.73(a)(3)(i)(E) and 257.74(a)(3)(i)(E).

(8) Documentation prepared by the owner or operator recording all activations of the emergency action plan as required by §§ 257.73(a)(3)(v) and 257.74(a)(3)(v).

(9) The history of construction, and any revisions of it, as required by § 257.73(c), except that these files must be maintained until the CCR unit completes closure of the unit in accordance with § 257.102.

(10) The initial and periodic structural stability assessments as required by §§ 257.73(d) and 257.74(d).

(11) Documentation detailing the corrective measures taken to remedy the deficiency or release as required by §§ 257.73(d)(2) and 257.74(d)(2).

(12) The initial and periodic safety factor assessments as required by §§ 257.73(e) and 257.74(e).

(13) The design and construction plans, and any revisions of it, as required by § 257.74(c), except that these files must be maintained until the CCR unit completes closure of the unit in accordance with § 257.102.

(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

(1) The CCR fugitive dust control plan, and any subsequent amendment of the plan, required by § 257.80(b), except that only the most recent control plan must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.

(2) The annual CCR fugitive dust control report required by § 257.80(c).

(3) The initial and periodic run-on and run-off control system plans as required by § 257.81(c).

(4) The initial and periodic inflow design flood control system plan as required by § 257.82(c).

(5) Documentation recording the results of each inspection and instrumentation monitoring by a qualified person as required by § 257.83(a).

(6) The periodic inspection report as required by § 257.83(b)(2).

(7) Documentation detailing the corrective measures taken to remedy the deficiency or release as required by §§ 257.83(b)(5) and 257.84(b)(5).

(8) Documentation recording the results of the weekly inspection by a qualified person as required by § 257.84(a).

(9) The periodic inspection report as required by § 257.84(b)(2).

(h) Groundwater monitoring and corrective action. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

(1) The annual groundwater monitoring and corrective action report as required by § 257.90(e).

(2) Documentation of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices as required by § 257.91(e)(1).

(3) The groundwater monitoring system certification as required by § 257.91(f).

(4) The selection of a statistical method certification as required by § 257.93(f)(6).

(5) Within 30 days of establishing an assessment monitoring program, the notification as required by § 257.94(e)(3).

(6) The results of appendices III and IV to this part constituent concentrations as required by § 257.95(d)(1).

(7) Within 30 days of returning to a detection monitoring program, the notification as required by § 257.95(e).

(8) Within 30 days of detecting one or more constituents in appendix IV to this part at statistically significant levels above the groundwater protection standard, the notifications as required by § 257.95(g).

(9) Within 30 days of initiating the assessment of corrective measures requirements, the notification as required by § 257.95(g)(5).

(10) The completed assessment of corrective measures as required by § 257.96(d).

(11) Documentation prepared by the owner or operator recording the public meeting for the corrective measures assessment as required by § 257.96(e).

(12) The semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report as required by § 257.97(a), except that the selection of remedy report must be maintained until the remedy has been completed.

(13) Within 30 days of completing the remedy, the notification as required by § 257.98(e).

Recordkeeping, Notification, and Posting of Information to the Internet
§ 257.105 Recordkeeping requirements

(i) Closure and post-closure care. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

(1) The notification of intent to initiate closure of the CCR unit as required by § 257.100(c)(1).

(2) The annual progress reports of closure implementation as required by § 257.100(c)(2)(i) and (ii).

(3) The notification of closure completion as required by § 257.100(c)(3).

(4) The written closure plan, and any amendment of the plan, as required by § 257.102(b), except that only the most recent closure plan must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.

(5) The written demonstration(s), including the certification required by § 257.102(e)(2)(iii), for a time extension for initiating closure as required by § 257.102(e)(2)(ii).

(6) The written demonstration(s), including the certification required by § 257.102(f)(2)(iii), for a time extension for completing closure as required by § 257.102(f)(2)(i).

(7) The notification of intent to close a CCR unit as required by § 257.102(g).

(8) The notification of completion of closure of a CCR unit as required by § 257.102(h).

(9) The notification recording a notation on the deed as required by § 257.102(i).

(10) The notification of intent to comply with the alternative closure requirements as required by § 257.103(c)(1).

(11) The annual progress reports under the alternative closure requirements as required by § 257.103(c)(2).

(12) The written post-closure plan, and any amendment of the plan, as required by § 257.104(d), except that only the most recent closure plan must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.

(13) The notification of completion of post-closure care period as required by § 257.104(e).

Recordkeeping, Notification, and Posting of Information to the Internet
§ 257.105 Recordkeeping requirements

(j) Retrofit criteria. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record:

(1) The written retrofit plan, and any amendment of the plan, as required by § 257.102(k)(2), except that only the most recent retrofit plan must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.

(2) The notification of intent that the retrofit activities will proceed in accordance with the alternative procedures in § 257.103.

(3) The annual progress reports required under the alternative requirements as required by § 257.103.

(4) The written demonstration(s), including the certification in § 257.102(f)(2)(iii), for a time extension for completing retrofit activities as required by § 257.102(k)(3).

(5) The notification of intent to initiate retrofit of a CCR unit as required by § 257.102(k)(5).

(6) The notification of completion of retrofit activities as required by § 257.102(k)(6).

Recordkeeping, Notification, and Posting of Information to the Internet
§ 257.106 Notification requirements

(a) The notifications required under paragraphs (e) through (i) of this section must be sent to the relevant State Director and/or appropriate Tribal authority before the close of business on the day the notification is required to be completed. For purposes of this section, before the close of business means the notification must be postmarked or sent by electronic mail (email). If a notification deadline falls on a weekend or federal holiday, the notification deadline is automatically extended to the next business day.

(b) If any CCR unit is located in its entirety within Indian Country, the notifications of this section must be sent to the appropriate Tribal authority. If any CCR unit is located in part within Indian Country, the notifications of this section must be sent both to the appropriate State Director and Tribal authority.

(c) Notifications may be combined as long as the deadline requirement for each notification is met.

(d) Unless otherwise required in this section, the notifications specified in this section must be sent to the State Director and/or appropriate Tribal authority within 30 days of placing in the operating record the information required by § 257.105.

(e) Location restrictions. The owner or operator of a CCR unit subject to the requirements of this subpart must notify the State Director and/or appropriate Tribal authority that each demonstration specified under § 257.105(e) has been placed in the operating record and on the owner or operator's publicly accessible internet site.

(f) Design criteria. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must:

(1) Within 60 days of commencing construction of a new CCR unit, provide notification of the availability of the design certification specified under § 257.105(f)(1) or (3). If the owner or operator of the CCR unit elects to install an alternative composite liner, the owner or operator must also submit to the State Director and/or appropriate Tribal authority a copy of the alternative composite liner design.

(2) No later than the date of initial receipt of CCR by a new CCR unit, provide notification of the availability of the construction certification specified under § 257.105(f)(1) or (3).

(3) Provide notification of the availability of the documentation of liner type specified under § 257.105(f)(2).

(4) Provide notification of the availability of the initial and periodic hazard potential classification assessments specified under § 257.105(f)(5).

(5) Provide notification of the availability of emergency action plan (EAP), and any revisions of the EAP, specified under § 257.105(f)(6).

(6) Provide notification of the availability of documentation prepared by the owner or operator recording the annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders specified under § 257.105(f)(7).

(7) Provide notification of documentation prepared by the owner or operator recording all activations of the emergency action plan specified under § 257.105(f)(8).

(8) Provide notification of the availability of the history of construction, and any revision of it, specified under § 257.105(f)(9).

(9) Provide notification of the availability of the initial and periodic structural stability assessments specified under § 257.105(f)(10).

(10) Provide notification of the availability of the documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(f)(11).

(11) Provide notification of the availability of the initial and periodic safety factor assessments specified under § 257.105(f)(12).

(12) Provide notification of the availability of the design and construction plans, and any revision of them, specified under § 257.105(f)(13).

(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must:

(1) Provide notification of the availability of the CCR fugitive dust control plan, or any subsequent amendment of the plan, specified under § 257.105(g)(1).

(2) Provide notification of the availability of the annual CCR fugitive dust control report specified under § 257.105(g)(2).

(3) Provide notification of the availability of the initial and periodic run-on and run-off control system plans specified under § 257.105(g)(3).

(4) Provide notification of the availability of the initial and periodic inflow design flood control system plans specified under § 257.105(g)(4).

(5) Provide notification of the availability of the periodic inspection reports specified under § 257.105(g)(6).

(6) Provide notification of the availability of the documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(g)(7).

(7) Provide notification of the availability of the periodic inspection reports specified under § 257.105(g)(9).

(h) Groundwater monitoring and corrective action. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must:

(1) Provide notification of the availability of the annual groundwater monitoring and corrective action report specified under § 257.105(h)(1).

(2) Provide notification of the availability of the groundwater monitoring system certification specified under § 257.105(h)(3).

(3) Provide notification of the availability of the selection of a statistical method certification specified under § 257.105(h)(4).

(4) Provide notification that an assessment monitoring programs has been established specified under § 257.105(h)(5).

(5) Provide notification that the CCR unit is returning to a detection monitoring program specified under § 257.105(h)(7).

(6) Provide notification that one or more constituents in appendix IV to this part have been detected at statistically significant levels above the groundwater protection standard and the notifications to land owners specified under § 257.105(h)(8).

(7) Provide notification that an assessment of corrective measures has been initiated specified under § 257.105(h)(9).

(8) Provide notification of the availability of assessment of corrective measures specified under § 257.105(h)(10).

(9) Provide notification of the availability of the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report specified under § 257.105(h)(12).

(10) Provide notification of the completion of the remedy specified under § 257.105(h)(13).

(i) Closure and post-closure care. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible Internet site. The owner or operator must:

(1) Provide notification of the intent to initiate closure of the CCR unit specified under § 257.105(i)(1).

(2) Provide notification of the availability of the annual progress reports of closure implementation specified under § 257.105(i)(2).

(3) Provide notification of closure completion specified under § 257.105(i)(3).

(4) Provide notification of the availability of the written closure plan, and any amendment of the plan, specified under § 257.105(i)(4).

(5) Provide notification of the availability of the demonstration(s) for a time extension for initiating closure specified under § 257.105(i)(5).

(6) Provide notification of the availability of the demonstration(s) for a time extension for completing closure specified under § 257.105(i)(6).

(7) Provide notification of intent to close a CCR unit specified under § 257.105(i)(7).

(8) Provide notification of completion of closure of a CCR unit specified under § 257.105(i)(8).

(9) Provide notification of the deed notation as required by § 257.105(i)(9).

(10) Provide notification of intent to comply with the alternative closure requirements specified under § 257.105(i)(10).

(11) The annual progress reports under the alternative closure requirements as required by § 257.105(i)(11).

(12) Provide notification of the availability of the written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).

(13) Provide notification of completion of post-closure care specified under § 257.105(i)(13).

(j) Retrofit criteria. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible Internet site. The owner or operator must:

(1) Provide notification of the availability of the written retrofit plan, and any amendment of the plan, specified under § 257.105(j)(1).

(2) Provide notification of intent to comply with the alternative retrofit requirements specified under § 257.105(j)(2).

(3) The annual progress reports under the alternative retrofit requirements as required by § 257.105(j)(3).

(4) Provide notification of the availability of the demonstration(s) for a time extension for completing retrofit activities specified under § 257.105(j)(4).

(5) Provide notification of intent to initiate retrofit of a CCR unit specified under § 257.105(j)(5).

(6) Provide notification of completion of retrofit activities specified under § 257.105(j)(6).

Recordkeeping, Notification, and Posting of Information to the Internet
§ 257.107 Publicly Accessible Internet Site Requirements

(a) Each owner or operator of a CCR unit subject to the requirements of this subpart must maintain a publicly accessible Internet site (CCR Web site) containing the information specified in this section. The owner or operator's Web site must be titled ''CCR Rule Compliance Data and Information.''

(b) An owner or operator of more than one CCR unit subject to the provisions of this subpart may comply with the requirements of this section by using the same Internet site for multiple CCR units provided the CCR Web site clearly delineates information by the name or identification number of each unit.

(c) Unless otherwise required in this section, the information required to be posted to the CCR Web site must be made available to the public for at least five years following the date on which the information was first posted to the CCR Web site.

(d) Unless otherwise required in this section, the information must be posted to the CCR Web site within 30 days of placing the pertinent information required by § 257.105 in the operating record.

(e) Location restrictions. The owner or operator of a CCR unit subject to this subpart must place each demonstration specified under § 257.105(e) on the owner or operator's CCR Web site.

(f) Design criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) Within 60 days of commencing construction of a new unit, the design certification specified under § 257.105(f)(1) or (3).

(2) No later than the date of initial receipt of CCR by a new CCR unit, the construction certification specified under § 257.105(f)(1) or (3).

(3) The documentation of liner type specified under § 257.105(f)(2).

(4) The initial and periodic hazard potential classification assessments specified under § 257.105(f)(5).

(5) The emergency action plan (EAP) specified under § 257.105(f)(6), except that only the most recent EAP must be maintained on the CCR Web site irrespective of the time requirement specified in paragraph (c) of this section.

(6) Documentation prepared by the owner or operator recording the annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders specified under § 257.105(f)(7).

(7) Documentation prepared by the owner or operator recording any activation of the emergency action plan specified under § 257.105(f)(8).

(8) The history of construction, and any revisions of it, specified under § 257.105(f)(9).

(9) The initial and periodic structural stability assessments specified under § 257.105(f)(10).

(10) The documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(f)(11).

(11) The initial and periodic safety factor assessments specified under § 257.105(f)(12).

(12) The design and construction plans, and any revisions of them, specified under § 257.105(f)(13).

(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The CCR fugitive dust control plan, or any subsequent amendment of the plan, specified under § 257.105(g)(1) except that only the most recent plan must be maintained on the CCR Web site irrespective of the time requirement specified in paragraph (c) of this section.

(2) The annual CCR fugitive dust control report specified under § 257.105(g)(2).

(3) The initial and periodic run-on and run-off control system plans specified under § 257.105(g)(3).

(4) The initial and periodic inflow design flood control system plans specified under § 257.105(g)(4).

(5) The periodic inspection reports

(6) The documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(g)(7).

(7) The periodic inspection reports specified under § 257.105(g)(9).

(h) Groundwater monitoring and corrective action. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The annual groundwater monitoring and corrective action report specified under § 257.105(h)(1).

(2) The groundwater monitoring system certification specified under § 257.105(h)(3).

(3) The selection of a statistical method certification specified under § 257.105(h)(4).

(4) The notification that an assessment monitoring programs has been established specified under § 257.105(h)(5).

(5) The notification that the CCR unit is returning to a detection monitoring program specified under § 257.105(h)(7).

(6) The notification that one or more constituents in Appendix IV to this part have been detected at statistically significant levels above the groundwater protection standard and the notifications to land owners specified under § 257.105(h)(8).

(7) The notification that an assessment of corrective measures has been initiated specified under § 257.105(h)(9).The assessment of corrective measures specified under § 257.105(h)(10).

(8) The assessment of corrective measures specified under § 257.105(h)(10).

(9) The semiannual reports describing the progress in selecting and designing remedy and the selection of remedy report specified under § 257.105(h)(12), except that the selection of the remedy report must be maintained until the remedy has been completed.

(10) The notification that the remedy has been completed specified under § 257.105(h)(13).

(i) Closure and post-closure care. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The notification of intent to initiate closure of the CCR unit specified under §257.105(i)(1).

(2) The annual progress reports of closure implementation specified under § 257.105(i)(2).

(3) The notification of closure completion specified under § 257.105(i)(3).

(4) The written closure plan, and any amendment of the plan, specified under § 257.105(i)(4).

(5) Demonstration(s) for a time extension for initiating closure specified under § 257.105(i)(5).

(6) The demonstration(s) for a time extension for completing closure specified under § 257.105(i)(6).

(7) The notification of intent to close a CCR unit specified under § 257.105(i)(7).

(8) The notification of completion of closure of a CCR unit specified under § 257.105(i)(8).

(9) The notification recording a notation on the deed as required by § 257.105(i)(9).

(10) The notification of intent to comply with the alternative closure requirements as required by § 257.105(i)(10).

(11) The annual progress reports under the alternative closure requirements as required by § 257.105(i)(11).

(12) The written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).

(13) The notification of completion of post-closure care specified under § 257.105(i)(13).

(j) Retrofit criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The written retrofit plan, and any amendment of the plan, specified under § 257.105(j)(1).

(2) The notification of intent to comply with the alternative retrofit requirements as required by § 257.105(j)(2).

(3) The annual progress reports under the alternative retrofit requirements as required by § 257.105(j)(3).

(4) The demonstration(s) for a time extension for completing retrofit activities specified under § 257.105(j)(4).

(5) The notification of intent to retrofit a CCR unit specified under § 257.105(j)(5).

(6) The notification of completion of retrofit activities specified under § 257.105(j)(6).

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