SOUTH CAROLINA ELECTRIC & GAS

SCANA®
POWER FOR LIVING

RUN-ON & RUN-OFF CONTROL PLANS

FOR THE

WILLIAMS STATION CLASS THREE LANDFILL

BERKELEY COUNTY, SOUTH CAROLINA

JULY 2016

SOUTH CAROLINA
GARRETT AND MOORE, INC
No. C3371
CERTIFICATE OF AUTHORIZATION

GARRETT & MOORE
Engineering for the Power and Waste Industries

SOUTH CAROLINA
REGISTERED PROFESSIONAL ENGINEER
22411
J. STEFAN BRAY

1 OVERVIEW

The EPA Administrator, Gina McCarthy, signed the Disposal of Coal Combustion Residuals from Electric Utilities final rule on December 19, 2014, and it was published in the Federal Register (FR) on April 17, 2015. The regulations provide a comprehensive set of requirements for the safe disposal of coal combustion residuals (CCRs), commonly known as coal ash, from coal-fired power plants. The rule will be administered as part of the Resource Conservation and Recovery Act [RCRA, 42 United States Code (U.S.C.) §6901 et seq.], using the Subtitle D approach.

South Carolina Electric & Gas (SCE&G) is subject to the CCR Rule. Based on SCE&G's review of the rule, the **Class Three Landfill at SCE&G Williams Station** has been determined to be an existing CCR landfill subject to the CCR rule requirements.

2 PURPOSE

The purpose of this report is to document that the Williams Station Class Three Landfill run-on and run-off controls meet the requirements of CCR rule §257.81 – *Run-on and Run-off Controls for CCR Landfills.*

3 APPLICABLE REGULATIONS

CCR rule §257.81 - *Run-on and Run-off Controls for CCR Landfills* states the following:

> (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:
>
> > (I) 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
> >
> > (II) 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.

4 LANDFILL DESCRIPTION

Williams Station is coal-fired electric generation plant electric generation plant located in Bushy Park, Berkeley County, South Carolina. The Class Three Landfill associated with Williams Station is located on SC 9 approximately 5 miles east of the intersection of Highway 52 and SC 9.

Within the boundary of the Williams Station landfill property, SCE&G owns and operates Phase 1, consisting of Cell 1 through Cell 4, of the Class Three Landfill. The Phase 1 disposal unit was constructed in accordance with the construction permit (permit LF3-00001) issued from the South Carolina Department of Health and Environmental Control (DHEC) on September 30, 2008. The Phase 1 disposal unit was placed into operation in accordance with an operation approval issued by DHEC on June 23, 2010. The receiving Wastewater Pond was constructed in accordance with construction permit number 19188-IW issued on May 2, 2008, with approval to put into operation issued on June 10, 2010.

The ultimate development of the Class Three landfill is comprised of 12 landfill cells, planned for development in multiple phases. Phase 1 and all future phases of the Class Three landfill have been designed to control run-on and run-off from the 24-hour, 25-year storm.

5 Run-on Control Plan

§ 257.81 (a)(I) requires 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.

Sheet 2 from the solid waste permit to construct drawings (Attachment 1) illustrates the ultimate development of the Williams Station Class Three Landfill. Grades shown on Sheet 2 represent landfill subgrade.

As constructed, the active Phase 1 Class Three Landfill is elevated between 6-feet and 14-feet relative to existing natural topography (see Attachment 2). Future phases of landfill development are elevated between 6-feet and 20-feet relative to existing natural topography (as reflected in Sheet 2 in Attachment 1). Stormwater runoff from upgradient of the landfill is collected and conveyed around the landfill perimeter embankment by a series of natural and manmade swales and channels preventing run-on to the active landfill. Additionally, a ditch is located immediately adjacent to the landfill cells along the crest of the landfill perimeter embankment. This ditch collects runoff from along the crest (roadway) of the landfill embankment and conveys it away from the landfill to receiving management facilities.

Finally, a perimeter ditch is located along the inside perimeter of the landfill cells. In the unforeseeable event that run-on into the CCR unit could occur, the interior perimeter ditches would collect the water, where it would be commingled with run-off from the active are and routed to the wastewater pond. Permanent perimeter ditch performance is demonstrated in Section 5.

Given the combination of the landfill's built-up construction, existing drainage features and perimeter ditches, run-on will not occur onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm.

5 Run-off Control Plan

§ 257.81 (a)(II) requires 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.

Run-off from the currently active portion of the landfill and all future phases of development is managed by perimeter ditches. Perimeter ditch details are shown on Sheet 8 of the solid waste permit to construction drawings (Attachment 3). Perimeter ditches discharge to an adjacent downgradient lined wastewater pond. The perimeter ditches and wastewater pond are designed to manage the volume resulting from the 24-hour, 25-year storm. Relevant engineering calculations for the stormwater management system are included as Attachment 4 and summarized as follows:

Perimeter Ditches

Maximum Design Flow:	392 cfs
Maximum Design Capacity:	440 cfs

Wastewater Pond

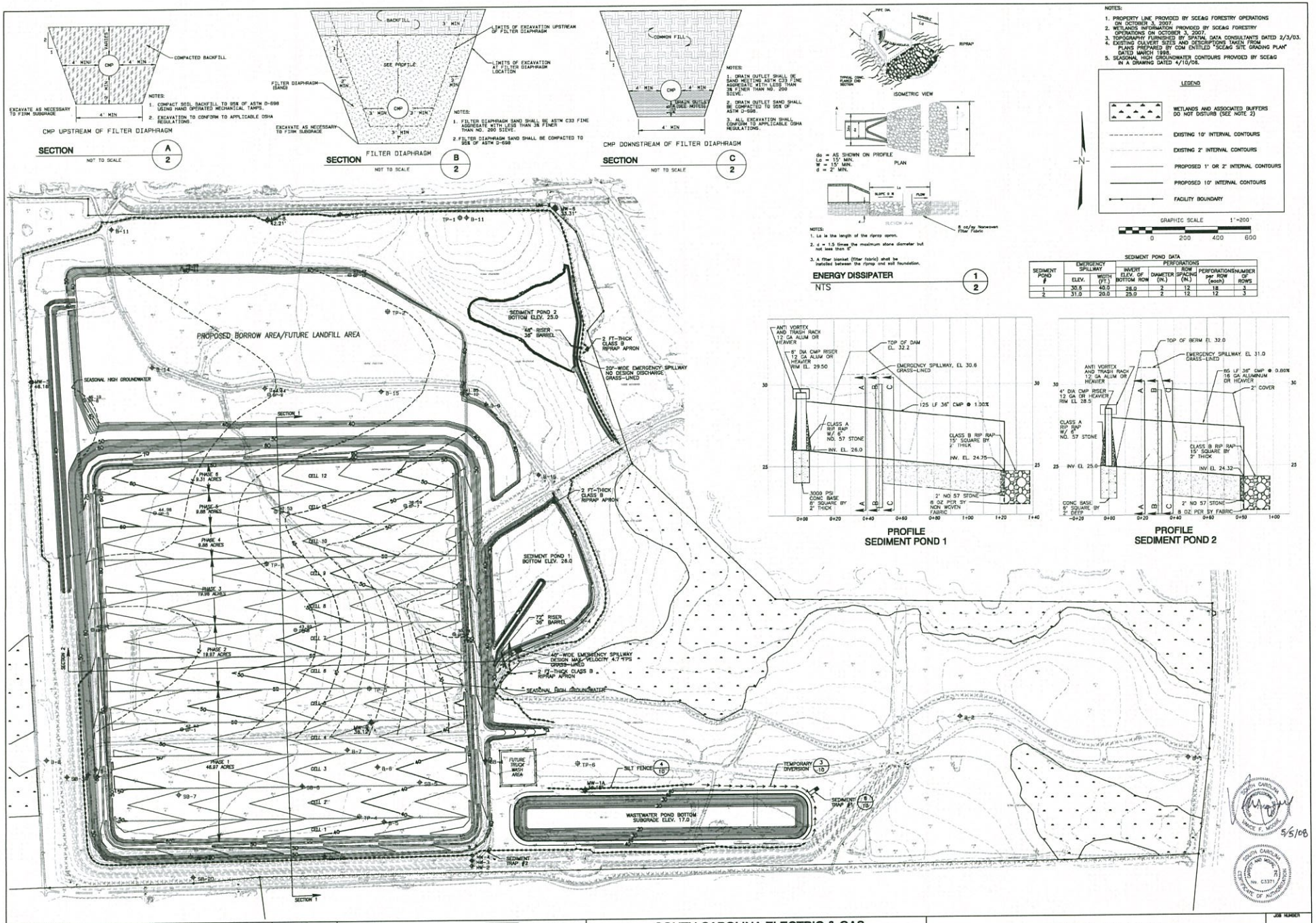
Berm Crest Elevation:	38.0 ft
24-hour, 25-year water surface elevation:	34.22 ft
Freeboard:	3.78 ft

As indicated above, the perimeter ditches and the downstream receiving wastewater pond exceed the required capacity requirements to collect and control the water volume resulting from a 24-hour, 25-year storm.

6 CONCLUSION

The existing Phase 1 Class Three Landfill and all future phases of Class Three Landfill Development meet the requirements of **§ 257.81(a)**. As demonstrated above, 1) run-on to the active disposal unit is prevented by elevation of the landfill grades relative to existing topography, and 2) the stormwater management system consisting of perimeter ditches and wastewater ponds is designed to collect and control the volume resulting from a 24-hour, 25-year storm.

ATTACHMENT 1



DATE: APRIL 24, 2007	REVISION	DATE
DESIGNED BY: GARRETT & MOORE	1)	
DRAWN BY: GARRETT & MOORE	2)	
CHECKED BY:	3)	
APPROVED BY:	4)	

GARRETT & MOORE, INC.
Engineering Services for the Power and Waste Industries

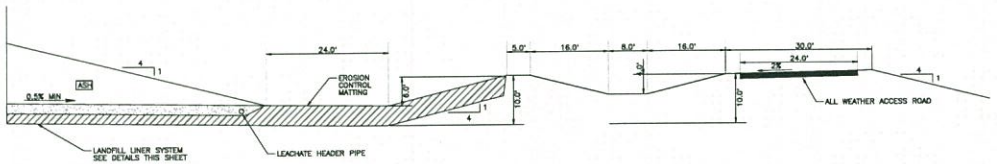
SOUTH CAROLINA ELECTRIC & GAS
HIGHWAY 52 INDUSTRIAL SOLID WASTE LANDFILL

SUBGRADE PLAN

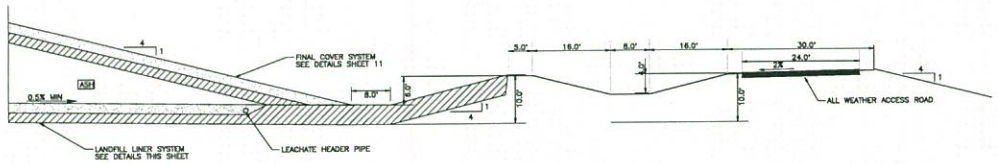
JOB NUMBER

SHEET 2

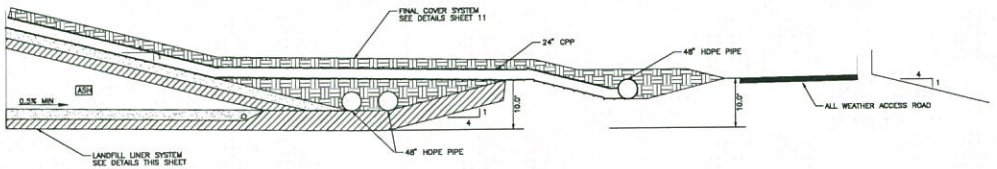
ATTACHMENT 2



OPERATIONS PHASE

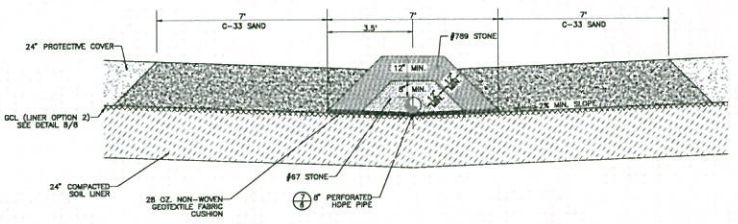


FINAL CLOSURE PHASE

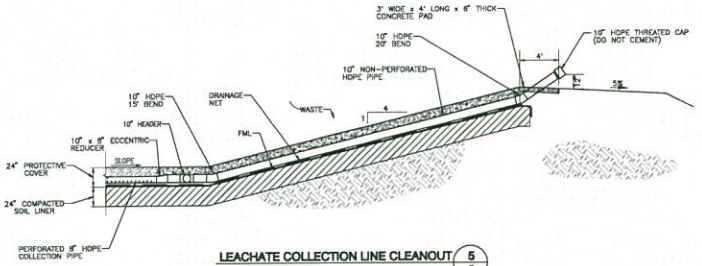


FINAL CLOSURE WITH STORMWATER SEGREGATION PHASE

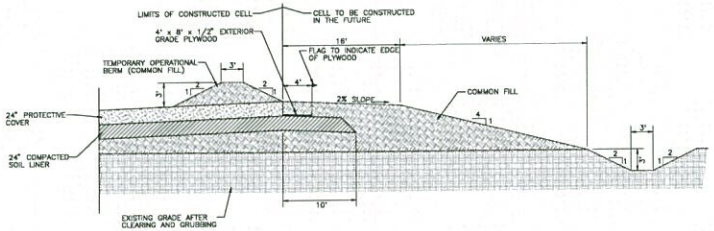
LANDFILL PERIMETER BERM DETAIL 1/8
N.T.S.



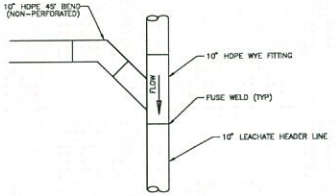
LEACHATE COLLECTION PIPE 4/8
N.T.S.



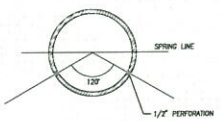
LEACHATE COLLECTION LINE CLEANOUT 5/8
N.T.S.



INTERIM ANCHOR BERM DETAIL 2/8
N.T.S.

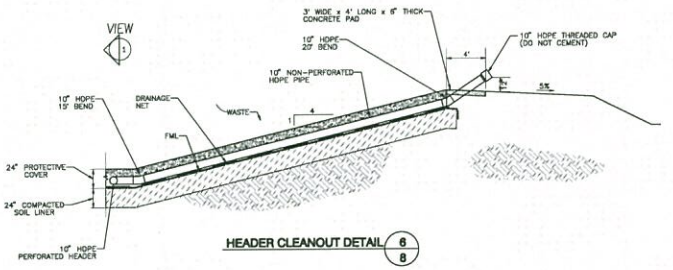


PLAN

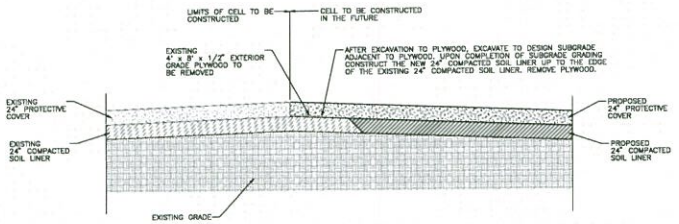


SECTION

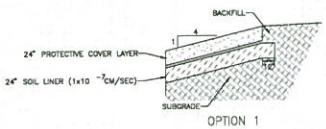
PERFORATED LEACHATE COLLECTION PIPE 7/8
N.T.S.



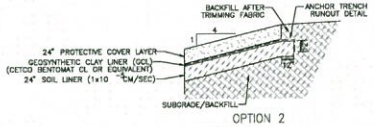
HEADER CLEANOUT DETAIL 6/8



FUTURE TIE-IN AT INTERIM ANCHOR BERM DETAIL 3/8
N.T.S.



OPTION 1



OPTION 2

NOTES:
1. THE DETAIL REPRESENTS FINAL ANCHOR TRENCH CONSTRUCTION. FABRIC MAY BE INITIALLY INSTALLED WITH MORE THAN ONE FOOT FABRIC IN THE ANCHOR TRENCH AND TRIMMED PRIOR TO BACKFILLING ANCHOR TRENCH. THIS WILL PERMIT FABRIC TO SHRINK AND SWELL PRIOR TO BACKFILLING ANCHOR TRENCH.
2. IMMEDIATELY PRIOR TO BACKFILLING ANCHOR TRENCH, CUT FABRIC/LINER TO FINAL ANCHOR LENGTH.

LANDFILL LINER SYSTEMS OPTIONS 8/8

DATE: APRIL 24, 2007	REVISION	DATE
DESIGNED BY: GARRETT & MOORE	1)	
DRAWN BY: GARRETT & MOORE	2)	
CHECKED BY:	3)	
APPROVED BY:	4)	

GARRETT & MOORE, INC.
Engineering Services for the Power and Waste Industries

SOUTH CAROLINA ELECTRIC & GAS
HIGHWAY 52 INDUSTRIAL SOLID WASTE LANDFILL

DETAILS

JOB NUMBER

SHEET 8

ATTACHMENT 3

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

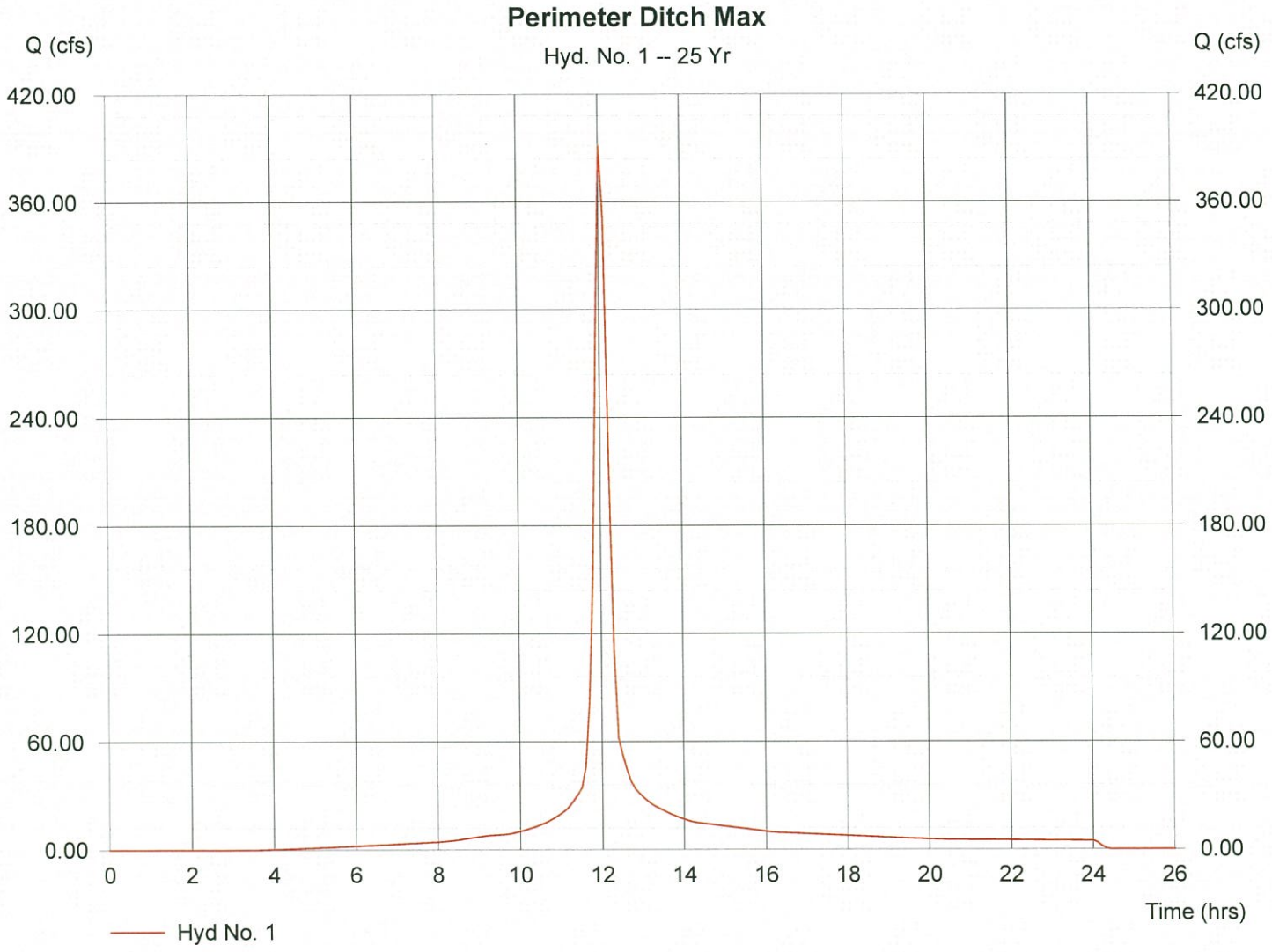
Tuesday, Jul 12 2016, 1:3 PM

Hyd. No. 1

Perimeter Ditch Max

Hydrograph type	= SCS Runoff	Peak discharge	= 391.37 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Drainage area	= 61.000 ac	Curve number	= 87
Basin Slope	= 5.0 %	Hydraulic length	= 4451 ft
Tc method	= KIRPICH	Time of conc. (Tc)	= 15.93 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,238,003 cuft



Project Name: SCE&G Highway 52 ISWLF
Channel Section: Perimeter Channel #1
Performed By: Garrett Date: April 24, 2007

A. Discharge,Q, using Manning Equation with assigned maximum depth of flow, y.

	Input Data	
max depth of flow (ft), y:	3.75	(set max. depth of flow from storm)
longitudinal slope (ft/ft), S:	0.005	
bottom width (ft), b:	8	
channel side slope (m:1):	4	

TEMPORARY LINING: Bare channel with North American Green Blanket, C125/C150BN.
roughness coefficient, *n*: 0.025
max. shear stress (psf), Td: 2.25

Temporary lining flow capacity, Q (cfs) = 616.17

PERMANENT LINING: Tall Fescue
max. velocity of lining (ft/s): 5.5
retardance class for lining: D (from table 8.05c)
VR (max velocity x R): 12.2 (including one retardance class increase)
Manning's *n*: 0.035 (rough channel with grass)

Permanent lining flow capacity, Q (cfs) = 440.12 CONTROLS

Channel design controlled by permanent lining flow capacity.

A, area (sf)	P, wetted perimeter (ft)	R, hydraulic radius (ft)	S, slope (ft/ft)	Q, flow (cfs)	V, velocity (ft/s)
86.25	38.92	2.22	0.005	440.12	5.10

B. Normal Depth and Shear Stress using Normal-Depth Procedure (known Q)

Discharge (cfs), Q:	418.00	(design max. Q of controlling lining system, from above)
longitudinal slope (ft/ft), S:	0.005	
bottom width (ft), b:	8	
channel side slope (m:1):	4	

	Input	
TEMPORARY LINING:	Bare channel with North American Green Blanket, C125/C150BN.	
roughness coefficient, *n*:	0.025	
max. shear stress (psf), Td:	2.25	Iterate y to make Zav = Zreg

Temp. Lined Channel:	y-var. (ft)	A (ft)	P (ft)	R (ft)	Zav	Zreq	V (ft/s)	Td (psf)
	3.18	65.8896	34.22	1.93	101.97	99.18	6.34	0.99

OK

PERMANENT LINING: Tall Fescue
max. velocity of lining (ft/s): 5.5
retardance class for lining: D (table 8.05a)
VR (max velocity x R): 12.2 (including one retardance class increase)
Manning's *n*: 0.035 (rough channel with grass)

Flow capacity controlling lining: permanent

Perm. Lined Channel:	y-var. (ft)	A (ft)	P (ft)	R (ft)	Zav	Zreq	V (ft/s)	Td (psf)
	3.691	84.021924	38.44	2.19	141.52	138.86	4.97	1.15

Referenced Tables and Figures from *North Carolina Erosion and Sediment Control Planning and Design Manual (1988).* V OK

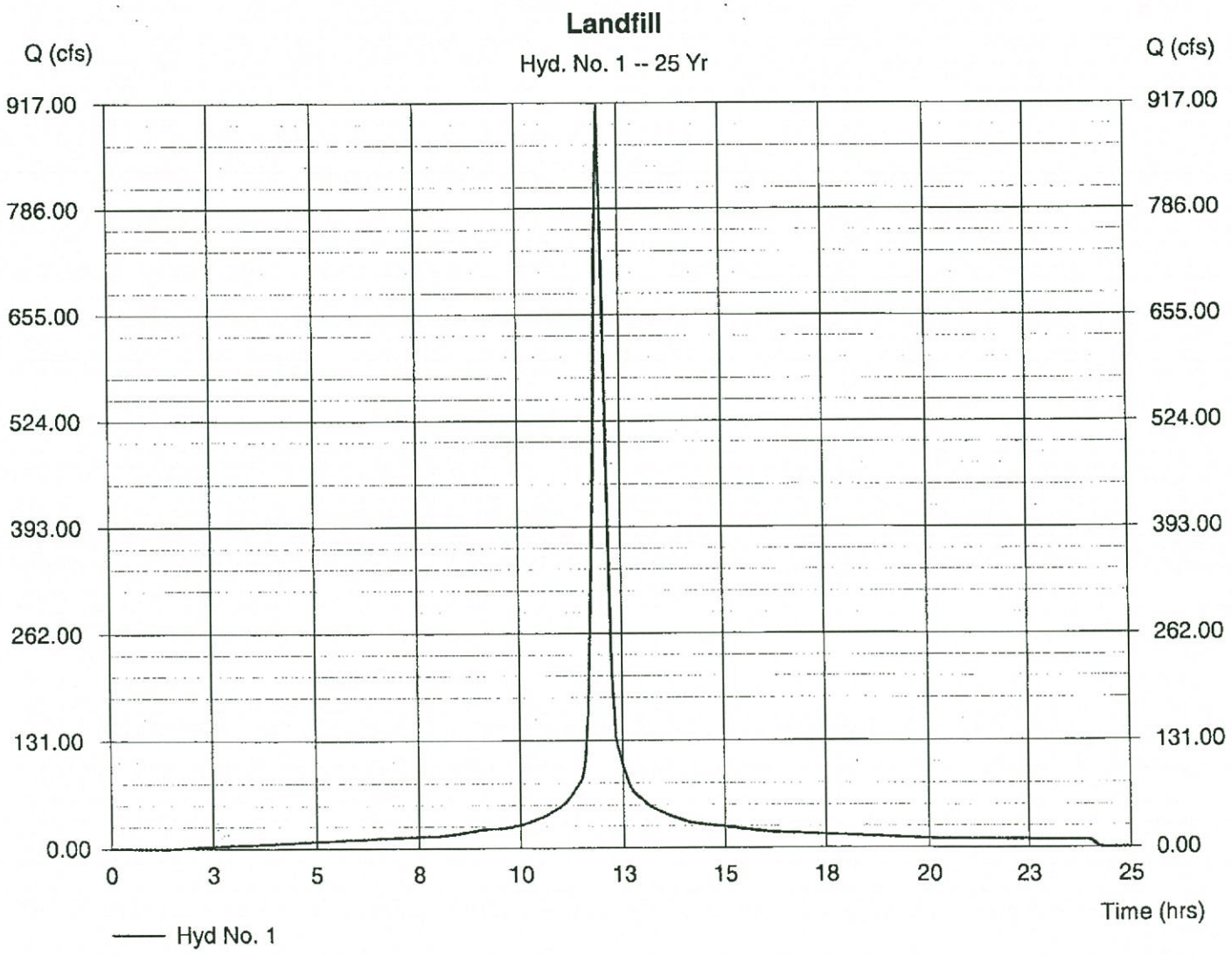
Hydrograph Plot

Hyd. No. 1

Landfill

Hydrograph type	= SCS Runoff	Peak discharge	= 913.54 cfs
Storm frequency	= 25 yrs	Time interval	= 5 min
Drainage area	= 117.000 ac	Curve number	= 95
Basin Slope	= 25.0 %	Hydraulic length	= 4300 ft
Tc method	= LAG	Time of conc. (Tc)	= 11.40 min
Total precip.	= 7.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,756,619 cuft



Hydrograph Plot

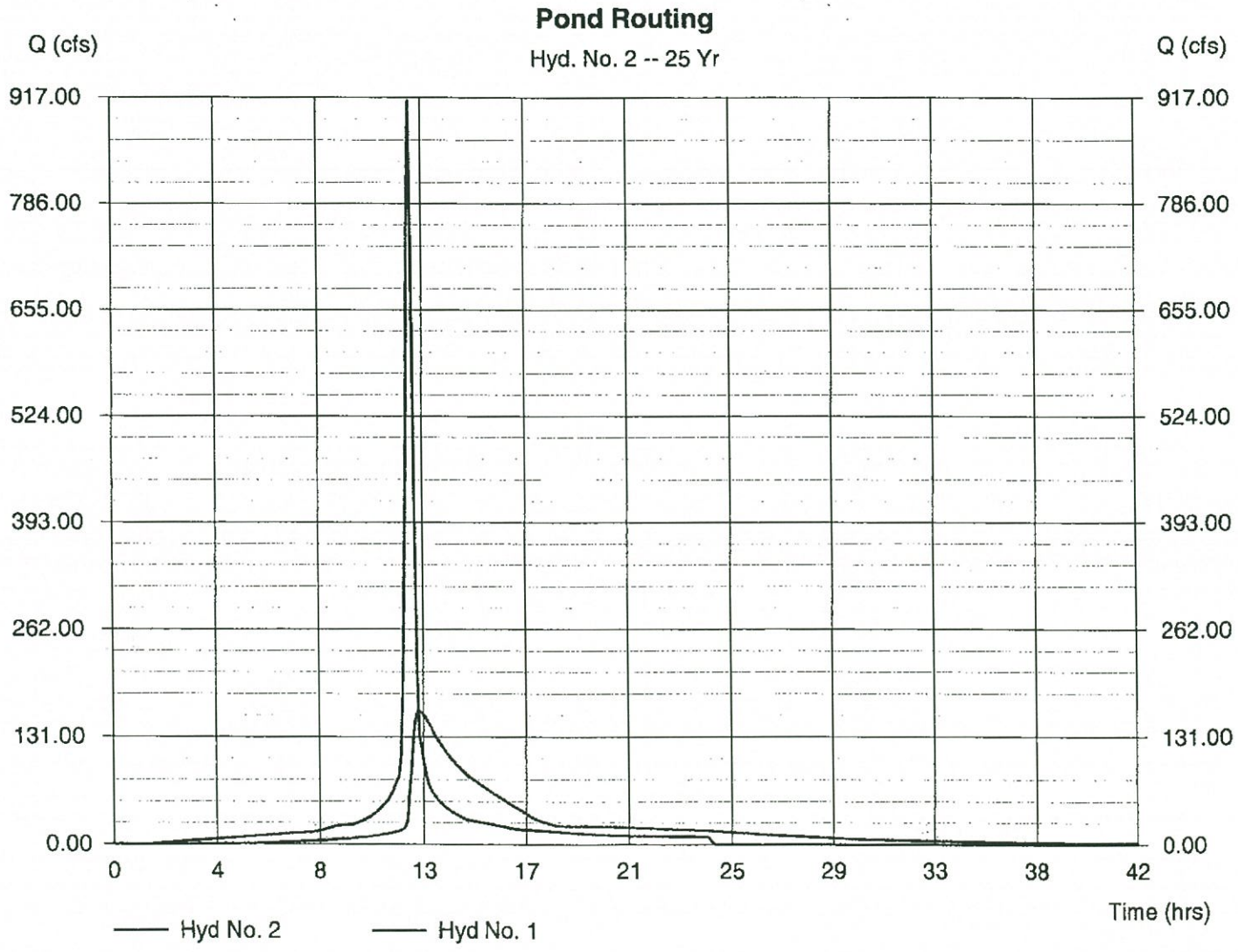
Hydraflow Hydrographs by Intelisolve — Tuesday, May 1 2007, 9:52 AM

Hyd. No. 2

Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 162.81 cfs
Storm frequency	= 25 yrs	Time interval	= 5 min
Inflow hyd. No.	= 1	Max. Elevation	= 34.22 ft
Reservoir name	= New Pond1	Max. Storage	= 1,486,053 cuft

Storage Indication method used. — Hydrograph Volume = 2,756,556 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, May 1 2007, 9:52 AM

Pond No. 1 - New Pond1

Pond Data

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

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	30.00	319,625	0	0
2.00	32.00	349,300	668,925	668,925
4.00	34.00	379,357	728,657	1,397,582
6.00	36.00	409,826	789,183	2,186,765
8.00	38.00	440,688	850,514	3,037,279

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 4	0	0	0
Invert El. (ft)	= 30.00	0.00	0.00	0.00
Length (ft)	= 8.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 33.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

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