

US EPA ARCHIVE DOCUMENT

September 15, 2011

Mr. William Skalitzky
Alliant Energy
4902 N. Biltmore Lane
Madison, WI 53718

154.016.001

Re: Main Ash Ponds and Emergency Ash Ponds Hydraulic / Hydrology Review
M. L. Kapp Generating Station – Clinton, IA

Mr. Skalitzky;

Aether db, reports our findings from the Ash Pond Hydraulic / Hydrology review performed for the M. L. Kapp Generating Station. Alliant Energy requested that Aether DBS review the January 2011 “M. L. Kapp Pond Examination Program, Pond Examination Report” prepared by Sargent & Lundy, LLC (S&L). Aether DBS has determined that S&L made several general assumptions in the determination of the freeboard capacity for the Main Ash Pond / Discharge Pond and the Emergency Pond. This letter report is intended to refine the S&L hydraulic analysis and more closely determine the actual freeboard during a SCS Type II, 24-hour, 100-year storm event for both ash pond systems. The refined analyses are based on information provided by the M.L. Kapp Generating Station personnel, information obtained from the S&L report, and historical information.

Background

The M. L. Kapp Generating Station is a single unit 218 megawatt fossil-fueled electric generating plant commissioned in 1967. As described by S&L and shown in Figure 1, the Main Ash Pond is located approximately one third of a mile northwest of the generating plant. The Main Ash Pond was construction in 1995 along with a secondary Discharge Pond within the original Ash Settling Basin.

The Emergency Ash Pond is located adjacent to the generating plant to the north east (plant north) as shown in Figure 2 of the S&L report. The original Emergency Pond layout was modified in 2000 to expand the coal storage area. The current configuration includes a dike that separates the pond into a northern section and a southern section.

During routine operation, ash is pumped to the Main Ash Pond. In an emergency or unusual operating condition the flow can be directed to the Emergency Ash Pond. For example, the ash flow is directed to the Emergency Ash Pond while ash is being removed from the Main Ash Pond. Water is removed from both the Discharge Pond and the Northern portion of the Emergency Pond via identical pumps houses.

Both pump houses were designed to house three 550 GPM pumps but Aether DBS understands that both pump houses currently contain two operational 550 GPM pumps. The Main Ash Pond pump house is shown in Attachment A; “Ash Settling Basin Plan”, S&L drawing B-320 (1965 – 1995). The Emergency Ash Pond pump house is shown in Attachment B; “Settling Basin and Ash Line Support – Plan”, S&L drawing B-322 (1966 – 1995).

Drainage

The Main Ash Pond and its Discharge Pond were built within the original 28 acre Ash Settling Basin. Most of the area within the original Ash Settling Basin, 18 acres, flows into the Discharge Pond as shown in Attachment 3 of S&L Calc. No. MLK-C-001. The Main Ash Pond berm was built approximately ten feet above the surrounding original Ash Settling Basin berm such that the Main Ash Pond receives essentially no surface runoff (ignoring any drainage from the top of the surrounding berm). An 18” diameter round corrugated metal stand pipe drains the Main Ash Pond to the Discharge Pond. (S&L report page 11, photograph P-22, of Appendix A) Since the approximately 2.5 acre Main Ash Pond does not receive a significant amount of runoff, its water surface cannot possibly rise more than the full design storm precipitation amount (6.25 inches).

The approximately 1.5 acre Emergency Ash Pond accepts runoff from the generating plant area (13 acres) including the Coal Pile Area (7 acres) as shown in Attachment 3 of S&L Calc. No. MLK-C-002. Storm water runoff and process water enter the southern section of the pond and are pumped from the pump house near the northwest corner of the northern section of the pond. The north and south sections (cells) of the Emergency Ash Pond are connected by a 24-inch steel pipe (culvert).

Hydrology and Hydraulics

The procedures of FEMA¹ suggest that the embankments rate as low risk dams and the ash ponds are listed as non-hazardous by the USEPA. Therefore, a 100-year, SCS Type 2, 24-hour storm is the appropriate design storm. For Clinton, Iowa the design storm totals 6.25 inches of precipitation².

Hydraflow by Intelisolve³ was used to generate and route the storm hydrograph for the Main Ash / Discharge Ponds and the Emergency Ash Pond. Pond volumes, drainage areas and runoff curve numbers were obtained from the S&L report with the exception of the Coal Storage Area runoff curve number as discussed below.

¹ Federal Emergency Management Agency, “Federal Guidelines for Dam Safety”, May 2005

² United States Department of Commerce, Rainfall Frequency Analysis of the United States,

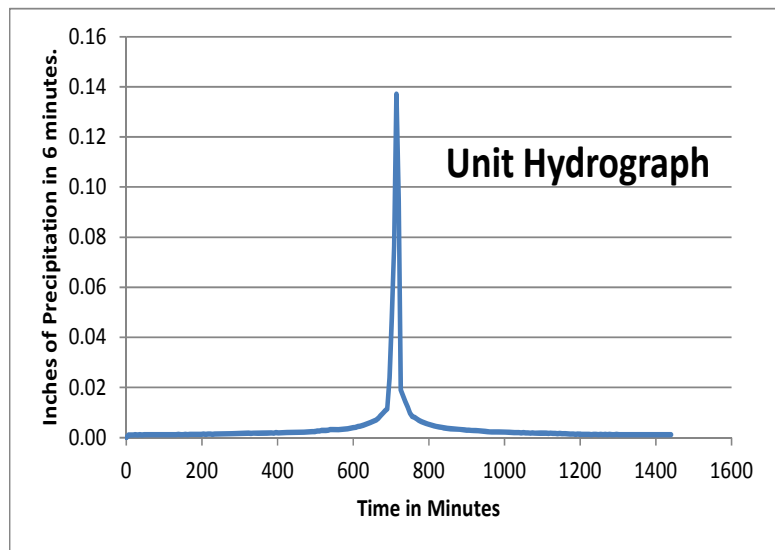
³ Intelisolve. Pond Routing Software Hydraflow, 2002

Main Ash / Discharge Ponds

Aether DBS has extended the S&L hydrology / hydraulic analysis of the original ash pond basin to include storm routing through both the Main Ash Pond and the Discharge Pond. The Main Ash Pond is approximately 2.5 acres in size and only rainfall falling directly on the pond was routed through the Main Ash Pond to the Discharge Pond. All of the ground surface storm water runoff was assumed to drain directly into the discharge pond (without any delay due to reservoir routing in the Main Ash Pond). The weighted Curve Number for the water shed was adjusted from 90.15 to 88.6 based on the reduced pond area because the HydraFlow model considers the Main Ash Pond separately.

The two 550 GPM (1.2 CFS) pumps are modeled to turn on sequentially at water elevations of 585.5 feet and 586.0 feet based on M. L. Kapp Generating Station Personnel⁴ supplied information. The design storm is assumed to start with the existing water level in the discharge pond at the first trigger level of 585.5 feet. (Once the first pump triggers at 585.5 feet it will not actually turn off until the water level has been lowered to 583.0 feet. This 2.5 foot lower pump turn-off setting will increase the actual available storage volume by the time that the peak storm flow arrives. The fixed stage discharge curve specified for HydraFlow is based on turn-on triggers and conservatively ignores the lower shut-off setting.)

Two extreme base flow cases were modeled; no base flow (in-other-words, storm water only) and with the full ash transport flow rate of 1.2 CFS (based on metered flow rates). The addition of a third 550 GPM pump (triggering on at 586.5 feet) was also considered for both base flow cases. However, the maximum water surface elevation with three pumps is not reduced much from the two pump model results as shown in the following table because of the nature of the SCS Type II 24-hour unit hydrograph with its slow then rapid runoff rise to the peak runoff.



The HydraFlow model output for the Main Ash Pond with no base flow is included as Attachment C. The HydraFlow model output for the Main Ash Pond with 1.2 CFS base flow is

⁴ Correspondence with Mr. John Watts, Maintenance Manager, M. L. Kapp Station sent August 31, 2011.

included as Attachment D. The base flow is modeled by reducing the stage – discharge curve / pumping capacity.

Maximum Water Surface Elevation

	Two Pumps	With Additional Pump
No Base Flow	587.55	587.37
1.2 CFS Base Flow	588.12	587.77

The S&L analysis did not consider reservoir routing which dampens the flow and gives the pumps time to reduce the maximum water level elevation. Hence S&L calculated a very conservative maximum water elevation of 588.66 feet.

To calculate the Discharge Pond’s freeboard, the calculated maximum water level is compared to the low point elevation measured on the northeast berm of the original Ash Settling Basin by Hinkle Engineering & Surveying LLC, 11/2/2010; Attachment E. With the maximum surface water elevation from the HydraFlow results, this model predicts 1.5 feet of freeboard (1.49 = 589.04 - 587.55 feet) when the base flow is zero and almost one foot with the 1.2 CFS base flow (0.92 = 589.04 - 588.12).

Emergency Ash Pond

HydraFlow was used to model the Emergency Ash Pond ignoring the dike separating the south inlet section from the northern outlet section. In other words, the two sections were assumed to be well connected hydraulically as shown by the S&L PondPack model. The two pond sections are connected by a 24-inch diameter steel pipe culvert resulting in a maximum 0.2 foot water level difference between the pond sections.) The only significant difference in the HydraFlow storm water runoff model versus the corresponding S&L PondPack model is with the curve number assigned to the 7 acre Coal Storage Area. S&L states on page 4 of Calc. No MLK-C-002 that “The runoff curve number for the coal pile is taken as 85 for this calculation”. Aether DBS believes that this assumption is overly conservative based on published laboratory tests⁵. The laboratory test results are reported for both new coal and “sealed” coal that has been weathered. Multiple coal runoff slopes were tested resulting in an average runoff curve number of 46 for new coal and 56 for weathered coal. The higher, more conservative value of 56 was specified for the HydraFlow input even though much of the coal must be new since it is replenished every year.

There are also significant differences regarding pump house modeling based on information recently obtained from Alliant. Aether DBS understands that only two pumps in the pump house

⁵ "Hydrology of stockpiled industrial coal exposed to rainfall" by K.J.Curran, I.G.Droppo and K.N.Irvine in Hydrological Processes, Vol. 16, pages 2781-2790 (2002)

are operational and that they are staged to turn on at elevations of 584.0 and 584.5 feet⁶ (versus staged elevations of 586.0, 586.5 and 587.0 model by S&L). The base flow was modeled by reducing the pump capacity 1.2 CFS (550 GPM) based on measured effluent flow rates supplied by Alliant⁷. The design storm is assumed to start with the existing water elevation in the discharge pond at the first trigger level of 584.0 feet. (Once the first pump triggers at 584.0 feet it will not actually turn off until the water level has been lowered to 582.0 feet. This lower pump turn-off setting is conservatively ignored.)

Since the Coal Storage Area, 7 acres, is a major fraction of the total drainage area, 13 acres, the reduced runoff curve number has a significant impact on the calculated maximum water rise. Consequently the S&L / PondPack model predicted a maximum water surface elevation rise of 2.9 feet (588.4 – 585.5 feet) whereas the Aether DBS / HydraFlow model predicts a maximum water surface elevation rise of 2.27 feet (586.27 – 584.0 feet) despite modeling just two 550 GPM pumps draining the pond instead of three. The calculated maximum water surface elevation is also significantly lower than the S&L PondPack model because the pumps are set to trigger-on at a two feet lower elevation. The HydraFlow output is included as Attachment F.

HydraFlow was also executed with the addition of a theoretical third pump that triggers at elevation 585.0 feet. With a third 550 GPM pump in place, the maximum water level elevation in the Emergency Pond is 585.96 feet. The maximum water level is not reduced much (0.31 feet) from the two pump model because of the nature of the SCS Type II 24-hour unit hydrograph with its slow then rapid runoff rise to the peak runoff.

To calculate the Emergency Pond's freeboard, the maximum water level elevation is compared to the minimum surrounding surface elevation, 588.5 feet measured by Hinkle Engineering & Surveying (Attachment 2, Calc. No. MLK-C-002). With the maximum surface water elevation from the HydraFlow results, the model predicts well over 1.5 feet of freeboard; 2.23 feet (= 588.5 – 586.27 feet).

Conclusion

M. L. Kapp Generating Station Personnel⁸ reported that the site received seven inches of rainfall over a three day period last July including almost four inches falling in a single day and there were no adverse impacts on either of the ash pond systems. This recent event indicates that the ash ponds can handle large storm flows similar to the design storm.

The Main Ash Pond / Discharge Pond can handle a 100-year 24-hour storm without overtopping the original Ash Settling Basin berm. The predicted minimum freeboard of 1.5 feet with no base flow (in-other-words, assuming that the emergency pond is receiving all of the base / production

⁶ Correspondence with Mr. John Watts, Maintenance Manager, M. L. Kapp Station sent August 31, 2011.

⁷ Correspondence with Mr. Kurt Hubbard of Alliant sent August 31, 2011.

⁸ Correspondence with Mr. Kurt Hubbard of Alliant sent August 31, 2011.

flow) is adequate for the short duration. With the base flow consuming the capacity of one of the two pumps, the minimum freeboard becomes 0.9 feet.

The Emergency Ash Pond can handle a 100-year 24-hour storm without overtopping. The predicted minimum freeboard for the Emergency Ash Pond is 2.23 feet with storm and the full base flow of 1.2 CFS


Recommendations

In order to achieve 1.5 feet of freeboard within the Main Ash Pond / Discharge Pond any of the following three options may be implemented:

- The pump trigger-on settings can be lowered by at least 0.6 feet;
- Enlarging the Discharge Pond storage capacity; or,
- Diverting all production related flows to the emergency pond during large storm events.

Please let us know if you have any questions.

Respectfully Submitted,



Thomas C. Wells, P.E.

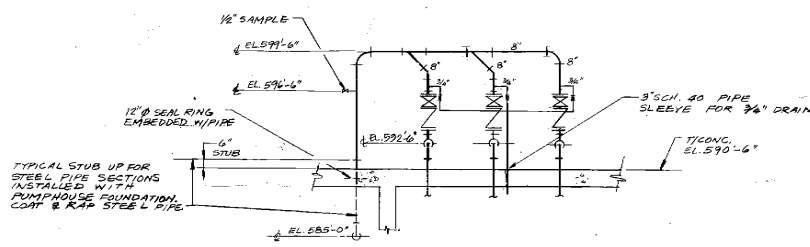
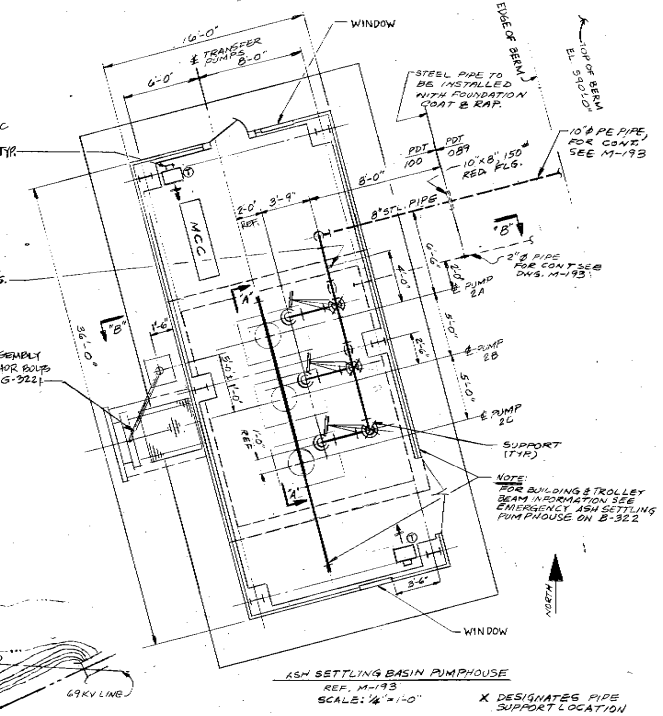
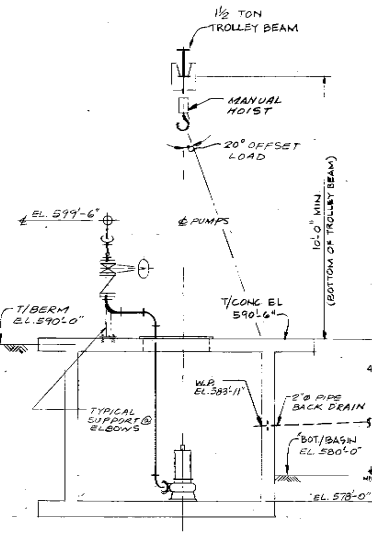
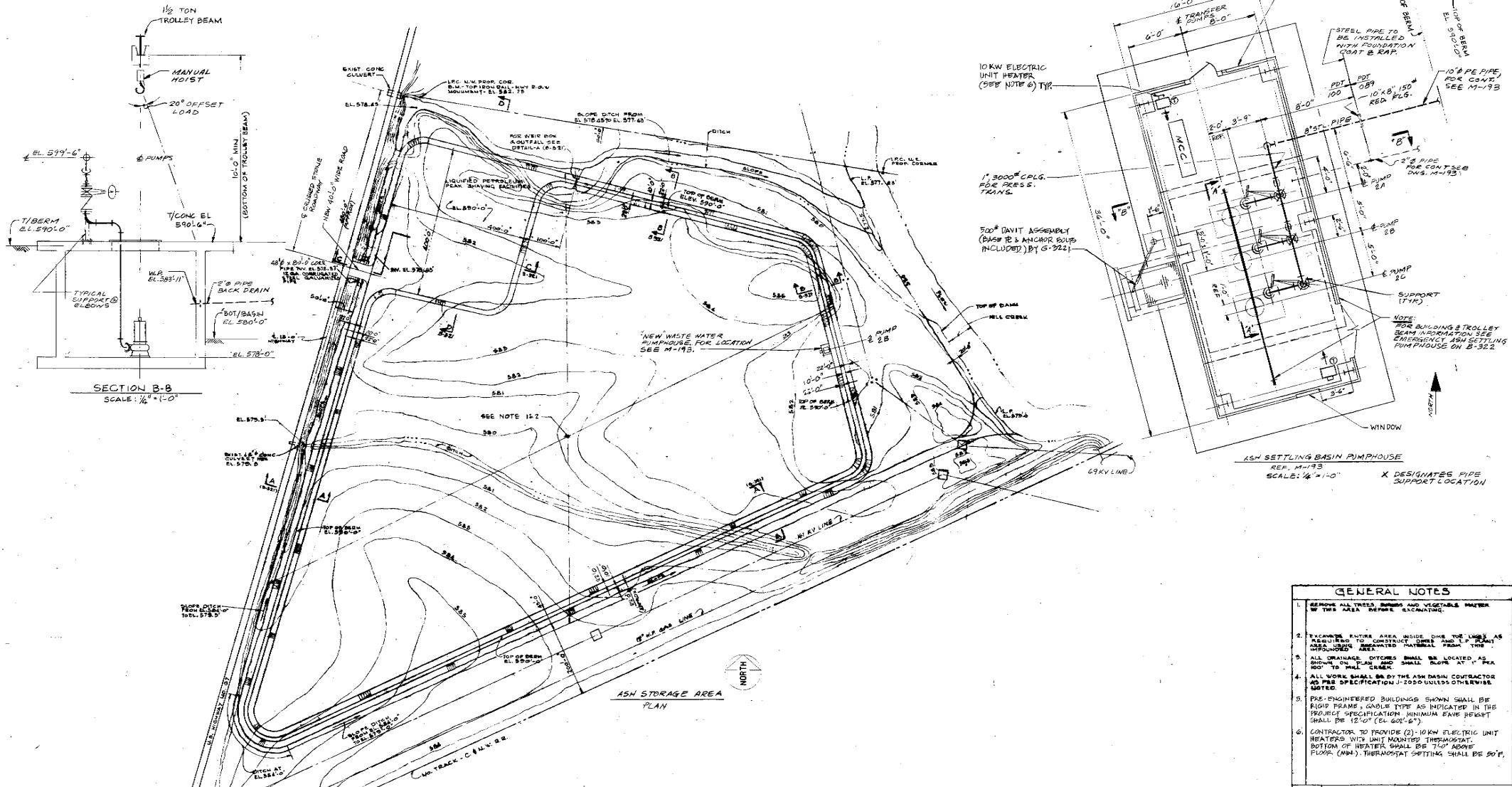


Mark W. Loerop, P.E.

Attachment A

**Ash Settling Basin Plan
M. L. Kapp Power Station
Interstate Power Co.
Clinton, Iowa**

**Sargent & Lundy Engineers
Drawing No. B-320 (1965 with 1995 As Builts)**



- GENERAL NOTES**
- REMOVE ALL TREES, SHRUBS AND VEGETABLE MATTER IN THIS AREA BEFORE EXCAVATING.
 - EXCAVATE ENTIRE AREA INSIDE DIME THE LINES AS REQUIRED TO INSTALL 12" R.P. BRANT AREA. LOOSE EXCAVATED MATERIAL FROM THIS CONTRACTOR TO BE REMOVED FROM THE SITE.
 - ALL ORANGE DITCHES SHALL BE LOCATED AS SHOWN ON THIS PLAN. SMALL DITCH AT 1" FROM 100' TO MILL CREEK.
 - ALL WORK SHALL BE BY THE ASH BASIN CONTRACTOR AND THE SPECIFICATION. JOB UNLESS OTHERWISE NOTED.
 - PRE-ENGINEERED BUILDINGS SHOWN SHALL BE RIGID FRAME - GABLE TYPE AS INDICATED IN THE PROJECT SPECIFICATION. MINIMUM EAVE HEIGHT SHALL BE 12'-0" (EL. 601'-6").
 - CONTRACTOR TO PROVIDE (2) 10 KW ELECTRIC UNIT HEATERS WITH UNIT MOUNTED THERMOSTAT. BOTTOM OF HEATER SHALL BE 7'-0" ABOVE FLOOR (FIN). THERMOSTAT SETTING SHALL BE 90°F.

DWG. NO. REF. DRAWINGS
B-30 ASH SETTLING BASIN SECTIONS AND DETAILS



ASH SETTLING BASIN PLAN
M.L. KAPP POWER STATION
INTERSTATE POWER CO.
CLINTON, IOWA

DRAWING RELEASE RECORD

REV.	DATE RELEASED	PURPOSE	PREPARED BY	APPROVED BY	PLN.
D	09-08-95	INCORPORATED AS BURL'S	<i>[Signature]</i>	<i>[Signature]</i>	
C	09-26-94	FOR CONSTRUCTION SPEC. G-3221	<i>[Signature]</i>	<i>[Signature]</i>	

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	09/08/95

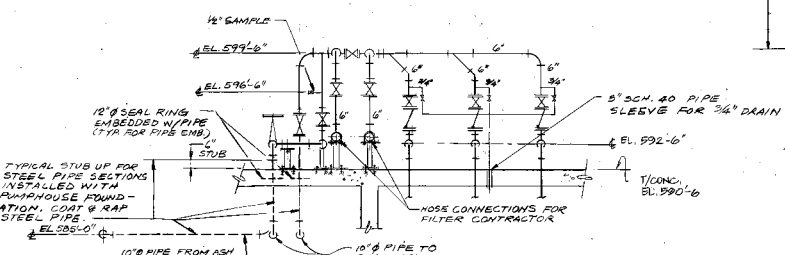
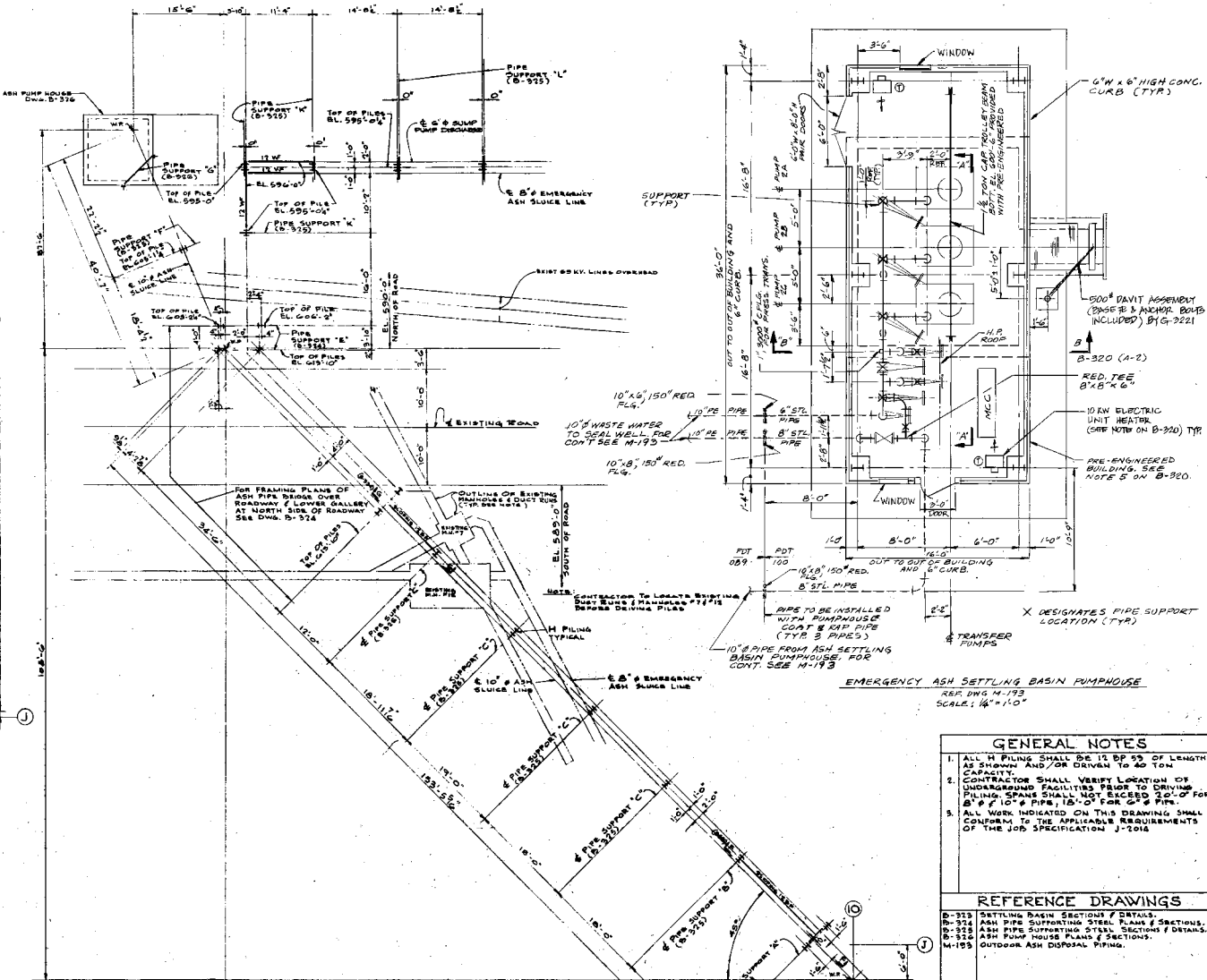
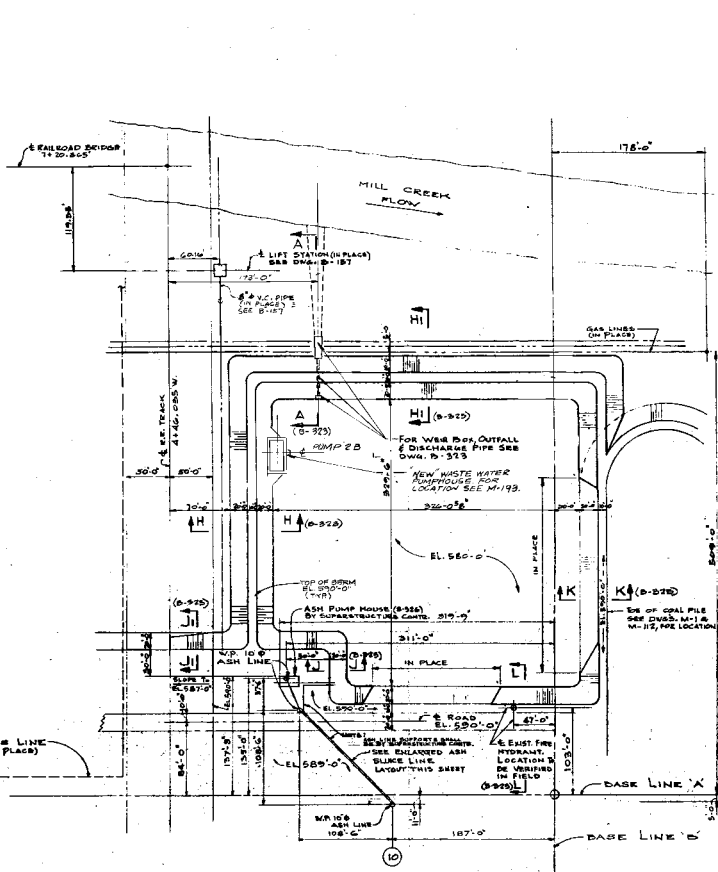
SCALE: 1" = 100'
DRAWN BY: *[Signature]* 11-16-95
CHECKED BY: *[Signature]* 12-1-95
ENGINEER: *[Signature]* 12-26-95
DATE: 12/26/95
JOB NO. 108 NO. 108 NO. 108 NO.
5547 5717/24

SARGENT & LUNDY ENGINEERS
CHICAGO 3, ILLINOIS
DRAWING NO. **B-320**

Attachment B

**Settling Basin and Ash Line Support - Plan
Beaver Channel Station
Interstate Power Co.
Clinton, Iowa**

**Sargent & Lundy Engineers
Drawing No. B-322 (1966 with 1995 As Builts)**

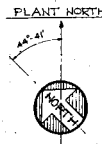


- GENERAL NOTES**
1. ALL H PILING SHALL BE 12" DP 55 OF LENGTH AS SHOWN AND/OR DRIVEN TO 40 TON CAPACITY.
 2. CONTRACTOR SHALL VERIFY LOCATION OF UNDERGROUND FACILITIES PRIOR TO DRIVING PILING. SPANS SHALL NOT EXCEED 20'-0" FOR 8" & 10" & PILES 18'-0" FOR 12" & PILES.
 3. ALL WORK INDICATED ON THIS DRAWING SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF THE JOB SPECIFICATION J-2014.

- REFERENCE DRAWINGS**
- B-323 SETTLING BASIN SECTIONS & DETAILS.
 - B-324 ASH PIPE SUPPORTING STEEL PLANS & SECTIONS.
 - B-325 ASH PUMP HOUSE PLANS & SECTIONS.
 - M-159 OUTDOOR ASH DISPOSAL PILING.



REV.	DATE	RELEASED	PREPARED	REVIEWED	APPROVED
B	09-26-94	FOR CONST. SPEC. G-322	E.R.P.	J. Proctor	J. Proctor
C	09-08-95	INCORPORATED AS BUILTS			



SETTLING BASIN AND ASH LINE SUPPORT - PLAN
BEAVER CHANNEL STATION
INTERSTATE POWER CO.
CLINTON, IOWA

SCALE: 1/8"=1'-0" AS NOTED

DESIGNED BY: J.C.C. (J.C.C.)

CHECKED BY: J.C.C. (J.C.C.)

DATE: 12-21-94

PROJECT NO.: 112-3-6

JOB NO.: 347 (2/11-94)

SARGENT & LUNDY
ENGINEERS
CHICAGO & ILLINOIS

DRAWING NO. **B-322**

Attachment C

**Main Ash Pond / Discharge Pond
Hydrological and Hydraulics Model**

Storm Water Influent Only (No Production Water Influent)

Program HydraFlow output by Aether DBS, September 2011

**Hydrograph 1
SCS Runoff to
Discharge Pond**



**Hydrograph 2
Main Ash Pond
Rainfall**



**Hydrograph 3
Main Ash Pond
Routing**



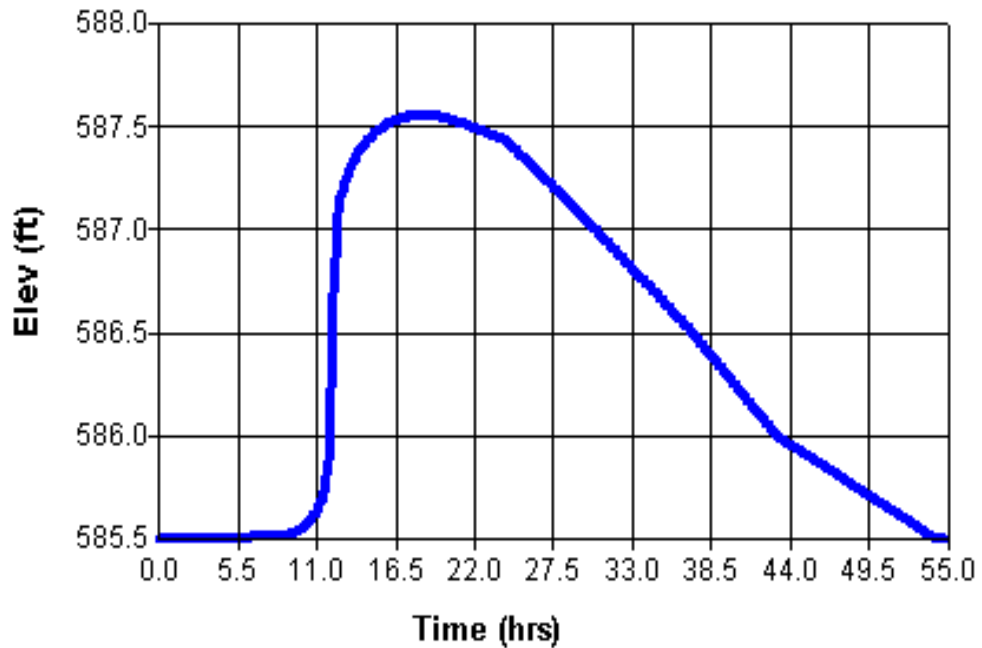
**Hydrograph 4
Combined Flows
Into Discharge
Pond**



**Hydrograph 5
Discharge Pond
Routing**



5 - Reservoir - 100 Yr - Max. El. = 587.55 ft



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (acft)	Hydrograph description
1	SCS Runoff	68.70	6	726	6.524	---	-----	-----	100 Year Storm
2	Manual	21.80	6	714	1.313	---	-----	-----	Main Ash Pond Rainfall
3	Reservoir	2.12	6	738	1.313	2	557.28	0.711	Main Ash Pond Routing
4	Combine	70.78	6	726	7.837	1, 3	-----	-----	Storm Runoff & Main Ash Pond Outflow
5	Reservoir	2.39	6	1110	7.837	4	587.55	9.170	Discharge Pond Routing

Hydrograph Report

Hyd. No. 1

100 Year Storm

Hydrograph type	= SCS Runoff	Peak discharge	= 68.70 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 15.87 ac	Curve number	= 88.6
Basin Slope	= 0.7 %	Hydraulic length	= 750 ft
Tc method	= LAG	Time of conc. (Tc)	= 22.4 min
Total precip.	= 6.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6.524 acft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
7.00 0.70	24.00 1.08
7.50 0.83	
8.00 0.96	
8.50 1.18	...End
9.00 1.55	
9.50 1.85	
10.00 2.18	
10.50 2.95	
11.00 4.21	
11.50 6.71	
12.00 56.63	
12.50 26.95	
13.00 7.56	
13.50 5.35	
14.00 4.15	
14.50 3.43	
15.00 3.09	
15.50 2.76	
16.00 2.42	
16.50 2.17	
17.00 2.05	
17.50 1.93	
18.00 1.81	
18.50 1.69	
19.00 1.57	
19.50 1.45	
20.00 1.33	
20.50 1.25	
21.00 1.22	
21.50 1.20	
22.00 1.18	
22.50 1.15	
23.00 1.13	
23.50 1.10	

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Hydrograph Report

Hyd. No. 2

Main Ash Pond Rainfall

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 21.80 cfs
Time interval = 6 min

Hydrograph Volume = 1.313 acft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
3.40 0.22	
3.90 0.22	
4.40 0.24	...End
4.90 0.25	
5.40 0.27	
5.90 0.29	
6.40 0.30	
6.90 0.32	
7.40 0.33	
7.90 0.35	
8.40 0.41	
8.90 0.48	
9.40 0.51	
9.90 0.60	
10.40 0.76	
10.90 1.05	
11.40 1.69	
11.90 21.80 <<	
12.40 1.94	
12.90 1.08	
13.40 0.83	
13.90 0.64	
14.40 0.54	
14.90 0.49	
15.40 0.43	
15.90 0.38	
16.40 0.35	
16.90 0.33	
17.40 0.30	
17.90 0.30	
18.40 0.27	
18.90 0.25	
19.40 0.24	
19.90 0.22	

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Hydrograph Report

Hyd. No. 3

Main Ash Pond Routing

Hydrograph type = Reservoir
 Storm frequency = 100 yrs
 Inflow hyd. No. = 2
 Max. Elevation = 557.28 ft

Peak discharge = 2.12 cfs
 Time interval = 6 min
 Reservoir name = Main Ash Pond
 Max. Storage = 0.711 acft

Storage Indication method used.

Outflow hydrograph volume = 1.313 acft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1.00	0.17	557.00	----	----	----	----	0.02	----	----	----	----	0.02
1.50	0.17	557.01	----	----	----	----	0.03	----	----	----	----	0.03
2.00	0.19	557.01	----	----	----	----	0.04	----	----	----	----	0.04
2.50	0.19	557.01	----	----	----	----	0.05	----	----	----	----	0.05
3.00	0.21	557.01	----	----	----	----	0.06	----	----	----	----	0.06
3.50	0.21	557.02	----	----	----	----	0.07	----	----	----	----	0.07
4.00	0.22	557.02	----	----	----	----	0.08	----	----	----	----	0.08
4.50	0.24	557.02	----	----	----	----	0.09	----	----	----	----	0.09
5.00	0.25	557.02	----	----	----	----	0.11	----	----	----	----	0.11
5.50	0.25	557.03	----	----	----	----	0.12	----	----	----	----	0.12
6.00	0.29	557.03	----	----	----	----	0.13	----	----	----	----	0.13
6.50	0.29	557.03	----	----	----	----	0.14	----	----	----	----	0.14
7.00	0.32	557.03	----	----	----	----	0.15	----	----	----	----	0.15
7.50	0.33	557.04	----	----	----	----	0.16	----	----	----	----	0.16
8.00	0.35	557.04	----	----	----	----	0.18	----	----	----	----	0.18
8.50	0.41	557.04	----	----	----	----	0.19	----	----	----	----	0.19
9.00	0.51	557.05	----	----	----	----	0.21	----	----	----	----	0.21
9.50	0.51	557.05	----	----	----	----	0.23	----	----	----	----	0.23
10.00	0.62	557.06	----	----	----	----	0.25	----	----	----	----	0.25
10.50	0.81	557.06	----	----	----	----	0.29	----	----	----	----	0.29
11.00	1.11	557.07	----	----	----	----	0.33	----	----	----	----	0.33
11.50	1.83	557.09	----	----	----	----	0.41	----	----	----	----	0.41
12.00	15.12	557.25	----	----	----	----	1.84	----	----	----	----	1.84
12.50	1.56	557.28	----	----	----	----	2.11	----	----	----	----	2.11
13.00	1.02	557.27	----	----	----	----	1.97	----	----	----	----	1.97
13.50	0.76	557.25	----	----	----	----	1.80	----	----	----	----	1.80
14.00	0.60	557.23	----	----	----	----	1.62	----	----	----	----	1.62
14.50	0.54	557.22	----	----	----	----	1.45	----	----	----	----	1.45
15.00	0.48	557.20	----	----	----	----	1.30	----	----	----	----	1.30
15.50	0.43	557.19	----	----	----	----	1.19	----	----	----	----	1.19
16.00	0.37	557.18	----	----	----	----	1.09	----	----	----	----	1.09
16.50	0.35	557.17	----	----	----	----	1.00	----	----	----	----	1.00
17.00	0.33	557.16	----	----	----	----	0.92	----	----	----	----	0.92
17.50	0.32	557.15	----	----	----	----	0.84	----	----	----	----	0.84
18.00	0.29	557.14	----	----	----	----	0.77	----	----	----	----	0.77
18.50	0.27	557.13	----	----	----	----	0.71	----	----	----	----	0.71
19.00	0.24	557.13	----	----	----	----	0.65	----	----	----	----	0.65
19.50	0.22	557.12	----	----	----	----	0.60	----	----	----	----	0.60

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US EPA ARCHIVE DOCUMENT

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
20.00	0.21	557.11	----	----	----	----	0.55	----	----	----	----	0.55
20.50	0.19	557.11	----	----	----	----	0.51	----	----	----	----	0.51
21.00	0.19	557.10	----	----	----	----	0.47	----	----	----	----	0.47
21.50	0.19	557.10	----	----	----	----	0.44	----	----	----	----	0.44
22.00	0.19	557.10	----	----	----	----	0.42	----	----	----	----	0.42
22.50	0.17	557.09	----	----	----	----	0.41	----	----	----	----	0.41
23.00	0.17	557.09	----	----	----	----	0.39	----	----	----	----	0.39
23.50	0.17	557.08	----	----	----	----	0.38	----	----	----	----	0.38
24.00	0.17	557.08	----	----	----	----	0.36	----	----	----	----	0.36
24.50	0.00	557.08	----	----	----	----	0.34	----	----	----	----	0.34
25.00	0.00	557.07	----	----	----	----	0.31	----	----	----	----	0.31
25.50	0.00	557.07	----	----	----	----	0.29	----	----	----	----	0.29
26.00	0.00	557.06	----	----	----	----	0.27	----	----	----	----	0.27
26.50	0.00	557.06	----	----	----	----	0.25	----	----	----	----	0.25
27.00	0.00	557.05	----	----	----	----	0.23	----	----	----	----	0.23
27.50	0.00	557.05	----	----	----	----	0.22	----	----	----	----	0.22
28.00	0.00	557.05	----	----	----	----	0.20	----	----	----	----	0.20
28.50	0.00	557.04	----	----	----	----	0.19	----	----	----	----	0.19
29.00	0.00	557.04	----	----	----	----	0.18	----	----	----	----	0.18
29.50	0.00	557.04	----	----	----	----	0.16	----	----	----	----	0.16
30.00	0.00	557.03	----	----	----	----	0.15	----	----	----	----	0.15
30.50	0.00	557.03	----	----	----	----	0.14	----	----	----	----	0.14
31.00	0.00	557.03	----	----	----	----	0.13	----	----	----	----	0.13
31.50	0.00	557.03	----	----	----	----	0.12	----	----	----	----	0.12
32.00	0.00	557.03	----	----	----	----	0.11	----	----	----	----	0.11
32.50	0.00	557.02	----	----	----	----	0.11	----	----	----	----	0.11
33.00	0.00	557.02	----	----	----	----	0.10	----	----	----	----	0.10
33.50	0.00	557.02	----	----	----	----	0.09	----	----	----	----	0.09
34.00	0.00	557.02	----	----	----	----	0.08	----	----	----	----	0.08
34.50	0.00	557.02	----	----	----	----	0.08	----	----	----	----	0.08
35.00	0.00	557.02	----	----	----	----	0.07	----	----	----	----	0.07
35.50	0.00	557.02	----	----	----	----	0.07	----	----	----	----	0.07
36.00	0.00	557.01	----	----	----	----	0.06	----	----	----	----	0.06
36.50	0.00	557.01	----	----	----	----	0.06	----	----	----	----	0.06
37.00	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
37.50	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
38.00	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
38.50	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
39.00	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
39.50	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
40.00	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
40.50	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
41.00	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
41.50	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
42.00	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
42.50	0.00	557.01	----	----	----	----	0.02	----	----	----	----	0.02
43.00	0.00	557.01	----	----	----	----	0.02	----	----	----	----	0.02

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US EPA ARCHIVE DOCUMENT

Reservoir Report

Reservoir No. 1 - Main Ash Pond

Hydraflow Hydrographs by Intelisolve

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 (acft)	Total storage (acft)
0.00	557.00	109,926	0.000	0.000
1.00	558.00	109,926	2.524	2.524

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 4.70	0.00	0.00	0.00
Crest El. ft	= 557.00	0.00	0.00	0.00
Weir Coeff.	= 3.00	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	557.00	---	---	---	---	0.00	---	---	---	---	0.00
1.00	2.524	558.00	---	---	---	---	14.10	---	---	---	---	14.10

US EPA ARCHIVE DOCUMENT

Hydrograph Report

Hyd. No. 4

Storm Runoff & Main Ash Pond Outflow

Hydrograph type = Combine
Storm frequency = 100 yrs
Inflow hyds. = 1, 3

Peak discharge = 70.78 cfs
Time interval = 6 min

Hydrograph Volume = 7.837 acft

Hydrograph Discharge Table

Time (hrs)	Hyd. 1 + (cfs)	Hyd. 3 = (cfs)	Outflow (cfs)
6.50	0.57	0.14	0.71
7.00	0.70	0.15	0.85
7.50	0.83	0.16	0.99
8.00	0.96	0.18	1.14
8.50	1.18	0.19	1.37
9.00	1.55	0.21	1.76
9.50	1.85	0.23	2.08
10.00	2.18	0.25	2.43
10.50	2.95	0.29	3.23
11.00	4.21	0.33	4.54
11.50	6.71	0.41	7.13
12.00	56.63	1.84	58.47
12.50	26.95	2.11	29.05
13.00	7.56	1.97	9.53
13.50	5.35	1.80	7.15
14.00	4.15	1.62	5.77
14.50	3.43	1.45	4.89
15.00	3.09	1.30	4.39
15.50	2.76	1.19	3.94
16.00	2.42	1.09	3.51
16.50	2.17	1.00	3.17
17.00	2.05	0.92	2.96
17.50	1.93	0.84	2.77
18.00	1.81	0.77	2.58
18.50	1.69	0.71	2.40
19.00	1.57	0.65	2.23
19.50	1.45	0.60	2.05
20.00	1.33	0.55	1.89
20.50	1.25	0.51	1.76
21.00	1.22	0.47	1.70
21.50	1.20	0.44	1.64
22.00	1.18	0.42	1.60
22.50	1.15	0.41	1.56
23.00	1.13	0.39	1.52
23.50	1.10	0.38	1.48
24.00	1.08	0.36	1.44

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US EPA ARCHIVE DOCUMENT

Hydrograph Report

Hyd. No. 5

Discharge Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 2.39 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 4	Reservoir name	= Discharge Pond
Max. Elevation	= 587.55 ft	Max. Storage	= 9.170 acft

Storage Indication method used.

Outflow hydrograph volume = 7.837 acft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1.50	0.03	585.50	----	----	----	----	----	----	----	----	----	0.03
2.00	0.04	585.50	----	----	----	----	----	----	----	----	----	0.04
2.50	0.05	585.50	----	----	----	----	----	----	----	----	----	0.05
3.00	0.06	585.50	----	----	----	----	----	----	----	----	----	0.06
3.50	0.07	585.50	----	----	----	----	----	----	----	----	----	0.07
4.00	0.12	585.50	----	----	----	----	----	----	----	----	----	0.10
4.50	0.22	585.50	----	----	----	----	----	----	----	----	----	0.18
5.00	0.33	585.50	----	----	----	----	----	----	----	----	----	0.28
5.50	0.45	585.50	----	----	----	----	----	----	----	----	----	0.40
6.00	0.58	585.50	----	----	----	----	----	----	----	----	----	0.52
6.50	0.71	585.51	----	----	----	----	----	----	----	----	----	0.65
7.00	0.85	585.51	----	----	----	----	----	----	----	----	----	0.79
7.50	0.99	585.51	----	----	----	----	----	----	----	----	----	0.93
8.00	1.14	585.51	----	----	----	----	----	----	----	----	----	1.08
8.50	1.37	585.51	----	----	----	----	----	----	----	----	----	1.19
9.00	1.76	585.52	----	----	----	----	----	----	----	----	----	1.19
9.50	2.08	585.53	----	----	----	----	----	----	----	----	----	1.19
10.00	2.43	585.55	----	----	----	----	----	----	----	----	----	1.19
10.50	3.23	585.58	----	----	----	----	----	----	----	----	----	1.19
11.00	4.54	585.63	----	----	----	----	----	----	----	----	----	1.19
11.50	7.13	585.72	----	----	----	----	----	----	----	----	----	1.19
12.00	58.47	586.12	----	----	----	----	----	----	----	----	----	2.37
12.50	29.05	587.03	----	----	----	----	----	----	----	----	----	2.39
13.00	9.53	587.22	----	----	----	----	----	----	----	----	----	2.39
13.50	7.15	587.32	----	----	----	----	----	----	----	----	----	2.39
14.00	5.77	587.38	----	----	----	----	----	----	----	----	----	2.39
14.50	4.89	587.43	----	----	----	----	----	----	----	----	----	2.39
15.00	4.39	587.46	----	----	----	----	----	----	----	----	----	2.39
15.50	3.94	587.49	----	----	----	----	----	----	----	----	----	2.39
16.00	3.51	587.51	----	----	----	----	----	----	----	----	----	2.39
16.50	3.17	587.53	----	----	----	----	----	----	----	----	----	2.39
17.00	2.96	587.54	----	----	----	----	----	----	----	----	----	2.39
17.50	2.77	587.55	----	----	----	----	----	----	----	----	----	2.39
18.00	2.58	587.55	----	----	----	----	----	----	----	----	----	2.39
18.50	2.40	587.55 <<	----	----	----	----	----	----	----	----	----	2.39 <<
19.00	2.23	587.55	----	----	----	----	----	----	----	----	----	2.39
19.50	2.05	587.55	----	----	----	----	----	----	----	----	----	2.39
20.00	1.89	587.54	----	----	----	----	----	----	----	----	----	2.39

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US EPA ARCHIVE DOCUMENT

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
20.50	1.76	587.53	----	----	----	----	----	----	----	----	----	2.39
21.00	1.70	587.52	----	----	----	----	----	----	----	----	----	2.39
21.50	1.64	587.51	----	----	----	----	----	----	----	----	----	2.39
22.00	1.60	587.50	----	----	----	----	----	----	----	----	----	2.39
22.50	1.56	587.48	----	----	----	----	----	----	----	----	----	2.39
23.00	1.52	587.47	----	----	----	----	----	----	----	----	----	2.39
23.50	1.48	587.46	----	----	----	----	----	----	----	----	----	2.39
24.00	1.44	587.44	----	----	----	----	----	----	----	----	----	2.39
24.50	0.50	587.42	----	----	----	----	----	----	----	----	----	2.39
25.00	0.31	587.39	----	----	----	----	----	----	----	----	----	2.39
25.50	0.29	587.35	----	----	----	----	----	----	----	----	----	2.39
26.00	0.27	587.32	----	----	----	----	----	----	----	----	----	2.39
26.50	0.25	587.28	----	----	----	----	----	----	----	----	----	2.39
27.00	0.23	587.25	----	----	----	----	----	----	----	----	----	2.39
27.50	0.22	587.21	----	----	----	----	----	----	----	----	----	2.39
28.00	0.20	587.18	----	----	----	----	----	----	----	----	----	2.39
28.50	0.19	587.14	----	----	----	----	----	----	----	----	----	2.39
29.00	0.18	587.11	----	----	----	----	----	----	----	----	----	2.39
29.50	0.16	587.07	----	----	----	----	----	----	----	----	----	2.39
30.00	0.15	587.04	----	----	----	----	----	----	----	----	----	2.39
30.50	0.14	587.00	----	----	----	----	----	----	----	----	----	2.39
31.00	0.13	586.97	----	----	----	----	----	----	----	----	----	2.39
31.50	0.12	586.93	----	----	----	----	----	----	----	----	----	2.39
32.00	0.11	586.89	----	----	----	----	----	----	----	----	----	2.39
32.50	0.11	586.86	----	----	----	----	----	----	----	----	----	2.39
33.00	0.10	586.82	----	----	----	----	----	----	----	----	----	2.39
33.50	0.09	586.78	----	----	----	----	----	----	----	----	----	2.39
34.00	0.08	586.75	----	----	----	----	----	----	----	----	----	2.39
34.50	0.08	586.71	----	----	----	----	----	----	----	----	----	2.39
35.00	0.07	586.67	----	----	----	----	----	----	----	----	----	2.39
35.50	0.07	586.63	----	----	----	----	----	----	----	----	----	2.39
36.00	0.06	586.60	----	----	----	----	----	----	----	----	----	2.39
36.50	0.06	586.56	----	----	----	----	----	----	----	----	----	2.39
37.00	0.05	586.52	----	----	----	----	----	----	----	----	----	2.39
37.50	0.05	586.48	----	----	----	----	----	----	----	----	----	2.38
38.00	0.05	586.44	----	----	----	----	----	----	----	----	----	2.38
38.50	0.04	586.40	----	----	----	----	----	----	----	----	----	2.38
39.00	0.04	586.35	----	----	----	----	----	----	----	----	----	2.38
39.50	0.04	586.31	----	----	----	----	----	----	----	----	----	2.38
40.00	0.04	586.27	----	----	----	----	----	----	----	----	----	2.38
40.50	0.03	586.23	----	----	----	----	----	----	----	----	----	2.37
41.00	0.03	586.18	----	----	----	----	----	----	----	----	----	2.37
41.50	0.03	586.14	----	----	----	----	----	----	----	----	----	2.37
42.00	0.03	586.10	----	----	----	----	----	----	----	----	----	2.37
42.50	0.02	586.06	----	----	----	----	----	----	----	----	----	2.37
43.00	0.02	586.01	----	----	----	----	----	----	----	----	----	2.37
43.50	0.02	585.99	----	----	----	----	----	----	----	----	----	1.20
44.00	0.02	585.96	----	----	----	----	----	----	----	----	----	1.20
44.50	0.02	585.94	----	----	----	----	----	----	----	----	----	1.20
45.00	0.02	585.92	----	----	----	----	----	----	----	----	----	1.20
45.50	0.02	585.90	----	----	----	----	----	----	----	----	----	1.20

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US EPA ARCHIVE DOCUMENT

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
46.00	0.01	585.87	----	----	----	----	----	----	----	----	----	1.20
46.50	0.01	585.85	----	----	----	----	----	----	----	----	----	1.20
47.00	0.01	585.83	----	----	----	----	----	----	----	----	----	1.20
47.50	0.01	585.81	----	----	----	----	----	----	----	----	----	1.20
48.00	0.01	585.78	----	----	----	----	----	----	----	----	----	1.20
48.50	0.01	585.76	----	----	----	----	----	----	----	----	----	1.20
49.00	0.01	585.74	----	----	----	----	----	----	----	----	----	1.19
49.50	0.01	585.72	----	----	----	----	----	----	----	----	----	1.19
50.00	0.01	585.69	----	----	----	----	----	----	----	----	----	1.19
50.50	0.01	585.67	----	----	----	----	----	----	----	----	----	1.19
51.00	0.01	585.65	----	----	----	----	----	----	----	----	----	1.19
51.50	0.01	585.63	----	----	----	----	----	----	----	----	----	1.19
52.00	0.01	585.60	----	----	----	----	----	----	----	----	----	1.19
52.50	0.01	585.58	----	----	----	----	----	----	----	----	----	1.19
53.00	0.01	585.56	----	----	----	----	----	----	----	----	----	1.19
53.50	0.00	585.54	----	----	----	----	----	----	----	----	----	1.19
54.00	0.00	585.51	----	----	----	----	----	----	----	----	----	1.19
54.50	0.00	585.50	----	----	----	----	----	----	----	----	----	0.16

...End

Reservoir Report

Reservoir No. 2 - Discharge Pond

Hydraflow Hydrographs by Intelisolve

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 (acft)	Total storage (acft)
0.00	583.50	92,347	0.000	0.000
2.00	585.50	92,347	4.240	4.240
2.01	585.51	92,347	0.021	4.261
2.50	586.00	96,765	1.064	5.325
2.51	586.01	96,765	0.022	5.347
3.00	586.50	101,184	1.113	6.460
3.01	586.51	101,184	0.023	6.484
5.50	589.00	123,275	6.415	12.899

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	583.50	---	---	---	---	---	---	---	---	---	0.00
2.00	4.240	585.50	---	---	---	---	---	---	---	---	---	0.00
2.01	4.261	585.51	---	---	---	---	---	---	---	---	---	1.19
2.50	5.325	586.00	---	---	---	---	---	---	---	---	---	1.20
2.51	5.347	586.01	---	---	---	---	---	---	---	---	---	2.37
3.00	6.460	586.50	---	---	---	---	---	---	---	---	---	2.38
3.01	6.484	586.51	---	---	---	---	---	---	---	---	---	2.39
5.50	12.899	589.00	---	---	---	---	---	---	---	---	---	2.40

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Attachment D

**Main Ash Pond / Discharge Pond
Hydrological and Hydraulics Model**

Storm Water And All Production Water Influent

Program HydraFlow output by Aether DBS, September 2011

**Hydrograph 1
SCS Runoff to
Discharge Pond**



**Hydrograph 2
Main Ash Pond
Rainfall**



**Hydrograph 3
Main Ash Pond
Routing**



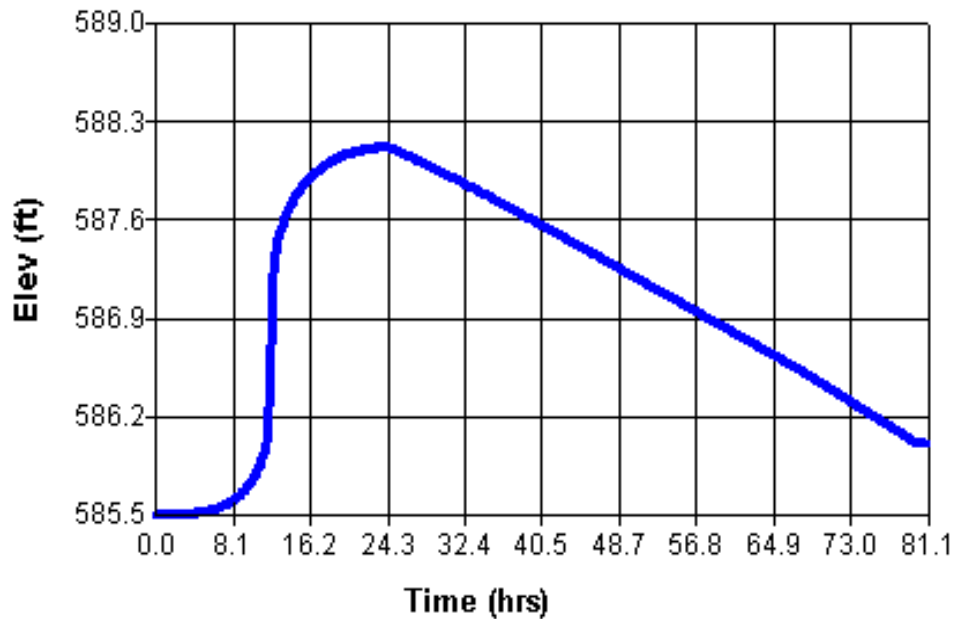
**Hydrograph 4
Combined Flows
Into Discharge
Pond**



**Hydrograph 5
Discharge Pond
Routing**



5 - Reservoir - 100 Yr - Max. El. = 588.12 ft



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (acft)	Hydrograph description
1	SCS Runoff	68.70	6	726	6.524	---	-----	-----	100 Year Storm
2	Manual	21.80	6	714	1.313	---	-----	-----	Main Ash Pond Rainfall
3	Reservoir	2.12	6	738	1.313	2	557.28	0.711	Main Ash Pond Routing
4	Combine	70.78	6	726	7.837	1, 3	-----	-----	Storm Runoff & Main Ash Pond Outflow
5	Reservoir	1.20	6	1452	6.752	4	588.12	10.626	Discharge Pond Routing

Hydrograph Report

Hyd. No. 1

100 Year Storm

Hydrograph type	= SCS Runoff	Peak discharge	= 68.70 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 15.87 ac	Curve number	= 88.6
Basin Slope	= 0.7 %	Hydraulic length	= 750 ft
Tc method	= LAG	Time of conc. (Tc)	= 22.4 min
Total precip.	= 6.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6.524 acft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
7.00 0.70	24.00 1.08
7.50 0.83	
8.00 0.96	
8.50 1.18	...End
9.00 1.55	
9.50 1.85	
10.00 2.18	
10.50 2.95	
11.00 4.21	
11.50 6.71	
12.00 56.63	
12.50 26.95	
13.00 7.56	
13.50 5.35	
14.00 4.15	
14.50 3.43	
15.00 3.09	
15.50 2.76	
16.00 2.42	
16.50 2.17	
17.00 2.05	
17.50 1.93	
18.00 1.81	
18.50 1.69	
19.00 1.57	
19.50 1.45	
20.00 1.33	
20.50 1.25	
21.00 1.22	
21.50 1.20	
22.00 1.18	
22.50 1.15	
23.00 1.13	
23.50 1.10	

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Hydrograph Report

Hyd. No. 2

Main Ash Pond Rainfall

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 21.80 cfs
Time interval = 6 min

Hydrograph Volume = 1.313 acft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
3.40 0.22	
3.90 0.22	
4.40 0.24	...End
4.90 0.25	
5.40 0.27	
5.90 0.29	
6.40 0.30	
6.90 0.32	
7.40 0.33	
7.90 0.35	
8.40 0.41	
8.90 0.48	
9.40 0.51	
9.90 0.60	
10.40 0.76	
10.90 1.05	
11.40 1.69	
11.90 21.80 <<	
12.40 1.94	
12.90 1.08	
13.40 0.83	
13.90 0.64	
14.40 0.54	
14.90 0.49	
15.40 0.43	
15.90 0.38	
16.40 0.35	
16.90 0.33	
17.40 0.30	
17.90 0.30	
18.40 0.27	
18.90 0.25	
19.40 0.24	
19.90 0.22	

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Hydrograph Report

Hyd. No. 3

Main Ash Pond Routing

Hydrograph type = Reservoir
 Storm frequency = 100 yrs
 Inflow hyd. No. = 2
 Max. Elevation = 557.28 ft

Peak discharge = 2.12 cfs
 Time interval = 6 min
 Reservoir name = Main Ash Pond
 Max. Storage = 0.711 acft

Storage Indication method used.

Outflow hydrograph volume = 1.313 acft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1.00	0.17	557.00	----	----	----	----	0.02	----	----	----	----	0.02
1.50	0.17	557.01	----	----	----	----	0.03	----	----	----	----	0.03
2.00	0.19	557.01	----	----	----	----	0.04	----	----	----	----	0.04
2.50	0.19	557.01	----	----	----	----	0.05	----	----	----	----	0.05
3.00	0.21	557.01	----	----	----	----	0.06	----	----	----	----	0.06
3.50	0.21	557.02	----	----	----	----	0.07	----	----	----	----	0.07
4.00	0.22	557.02	----	----	----	----	0.08	----	----	----	----	0.08
4.50	0.24	557.02	----	----	----	----	0.09	----	----	----	----	0.09
5.00	0.25	557.02	----	----	----	----	0.11	----	----	----	----	0.11
5.50	0.25	557.03	----	----	----	----	0.12	----	----	----	----	0.12
6.00	0.29	557.03	----	----	----	----	0.13	----	----	----	----	0.13
6.50	0.29	557.03	----	----	----	----	0.14	----	----	----	----	0.14
7.00	0.32	557.03	----	----	----	----	0.15	----	----	----	----	0.15
7.50	0.33	557.04	----	----	----	----	0.16	----	----	----	----	0.16
8.00	0.35	557.04	----	----	----	----	0.18	----	----	----	----	0.18
8.50	0.41	557.04	----	----	----	----	0.19	----	----	----	----	0.19
9.00	0.51	557.05	----	----	----	----	0.21	----	----	----	----	0.21
9.50	0.51	557.05	----	----	----	----	0.23	----	----	----	----	0.23
10.00	0.62	557.06	----	----	----	----	0.25	----	----	----	----	0.25
10.50	0.81	557.06	----	----	----	----	0.29	----	----	----	----	0.29
11.00	1.11	557.07	----	----	----	----	0.33	----	----	----	----	0.33
11.50	1.83	557.09	----	----	----	----	0.41	----	----	----	----	0.41
12.00	15.12	557.25	----	----	----	----	1.84	----	----	----	----	1.84
12.50	1.56	557.28	----	----	----	----	2.11	----	----	----	----	2.11
13.00	1.02	557.27	----	----	----	----	1.97	----	----	----	----	1.97
13.50	0.76	557.25	----	----	----	----	1.80	----	----	----	----	1.80
14.00	0.60	557.23	----	----	----	----	1.62	----	----	----	----	1.62
14.50	0.54	557.22	----	----	----	----	1.45	----	----	----	----	1.45
15.00	0.48	557.20	----	----	----	----	1.30	----	----	----	----	1.30
15.50	0.43	557.19	----	----	----	----	1.19	----	----	----	----	1.19
16.00	0.37	557.18	----	----	----	----	1.09	----	----	----	----	1.09
16.50	0.35	557.17	----	----	----	----	1.00	----	----	----	----	1.00
17.00	0.33	557.16	----	----	----	----	0.92	----	----	----	----	0.92
17.50	0.32	557.15	----	----	----	----	0.84	----	----	----	----	0.84
18.00	0.29	557.14	----	----	----	----	0.77	----	----	----	----	0.77
18.50	0.27	557.13	----	----	----	----	0.71	----	----	----	----	0.71
19.00	0.24	557.13	----	----	----	----	0.65	----	----	----	----	0.65
19.50	0.22	557.12	----	----	----	----	0.60	----	----	----	----	0.60

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
20.00	0.21	557.11	----	----	----	----	0.55	----	----	----	----	0.55
20.50	0.19	557.11	----	----	----	----	0.51	----	----	----	----	0.51
21.00	0.19	557.10	----	----	----	----	0.47	----	----	----	----	0.47
21.50	0.19	557.10	----	----	----	----	0.44	----	----	----	----	0.44
22.00	0.19	557.10	----	----	----	----	0.42	----	----	----	----	0.42
22.50	0.17	557.09	----	----	----	----	0.41	----	----	----	----	0.41
23.00	0.17	557.09	----	----	----	----	0.39	----	----	----	----	0.39
23.50	0.17	557.08	----	----	----	----	0.38	----	----	----	----	0.38
24.00	0.17	557.08	----	----	----	----	0.36	----	----	----	----	0.36
24.50	0.00	557.08	----	----	----	----	0.34	----	----	----	----	0.34
25.00	0.00	557.07	----	----	----	----	0.31	----	----	----	----	0.31
25.50	0.00	557.07	----	----	----	----	0.29	----	----	----	----	0.29
26.00	0.00	557.06	----	----	----	----	0.27	----	----	----	----	0.27
26.50	0.00	557.06	----	----	----	----	0.25	----	----	----	----	0.25
27.00	0.00	557.05	----	----	----	----	0.23	----	----	----	----	0.23
27.50	0.00	557.05	----	----	----	----	0.22	----	----	----	----	0.22
28.00	0.00	557.05	----	----	----	----	0.20	----	----	----	----	0.20
28.50	0.00	557.04	----	----	----	----	0.19	----	----	----	----	0.19
29.00	0.00	557.04	----	----	----	----	0.18	----	----	----	----	0.18
29.50	0.00	557.04	----	----	----	----	0.16	----	----	----	----	0.16
30.00	0.00	557.03	----	----	----	----	0.15	----	----	----	----	0.15
30.50	0.00	557.03	----	----	----	----	0.14	----	----	----	----	0.14
31.00	0.00	557.03	----	----	----	----	0.13	----	----	----	----	0.13
31.50	0.00	557.03	----	----	----	----	0.12	----	----	----	----	0.12
32.00	0.00	557.03	----	----	----	----	0.11	----	----	----	----	0.11
32.50	0.00	557.02	----	----	----	----	0.11	----	----	----	----	0.11
33.00	0.00	557.02	----	----	----	----	0.10	----	----	----	----	0.10
33.50	0.00	557.02	----	----	----	----	0.09	----	----	----	----	0.09
34.00	0.00	557.02	----	----	----	----	0.08	----	----	----	----	0.08
34.50	0.00	557.02	----	----	----	----	0.08	----	----	----	----	0.08
35.00	0.00	557.02	----	----	----	----	0.07	----	----	----	----	0.07
35.50	0.00	557.02	----	----	----	----	0.07	----	----	----	----	0.07
36.00	0.00	557.01	----	----	----	----	0.06	----	----	----	----	0.06
36.50	0.00	557.01	----	----	----	----	0.06	----	----	----	----	0.06
37.00	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
37.50	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
38.00	0.00	557.01	----	----	----	----	0.05	----	----	----	----	0.05
38.50	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
39.00	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
39.50	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
40.00	0.00	557.01	----	----	----	----	0.04	----	----	----	----	0.04
40.50	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
41.00	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
41.50	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
42.00	0.00	557.01	----	----	----	----	0.03	----	----	----	----	0.03
42.50	0.00	557.01	----	----	----	----	0.02	----	----	----	----	0.02
43.00	0.00	557.01	----	----	----	----	0.02	----	----	----	----	0.02

...End

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Reservoir Report

Reservoir No. 1 - Main Ash Pond

Hydraflow Hydrographs by Intelisolve

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 (acft)	Total storage (acft)
0.00	557.00	109,926	0.000	0.000
1.00	558.00	109,926	2.524	2.524

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 4.70	0.00	0.00	0.00
Crest El. ft	= 557.00	0.00	0.00	0.00
Weir Coeff.	= 3.00	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	557.00	---	---	---	---	0.00	---	---	---	---	0.00
1.00	2.524	558.00	---	---	---	---	14.10	---	---	---	---	14.10

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Hydrograph Report

Hyd. No. 4

Storm Runoff & Main Ash Pond Outflow

Hydrograph type = Combine
Storm frequency = 100 yrs
Inflow hyds. = 1, 3

Peak discharge = 70.78 cfs
Time interval = 6 min

Hydrograph Volume = 7.837 acft

Hydrograph Discharge Table

Time (hrs)	Hyd. 1 + (cfs)	Hyd. 3 = (cfs)	Outflow (cfs)
6.50	0.57	0.14	0.71
7.00	0.70	0.15	0.85
7.50	0.83	0.16	0.99
8.00	0.96	0.18	1.14
8.50	1.18	0.19	1.37
9.00	1.55	0.21	1.76
9.50	1.85	0.23	2.08
10.00	2.18	0.25	2.43
10.50	2.95	0.29	3.23
11.00	4.21	0.33	4.54
11.50	6.71	0.41	7.13
12.00	56.63	1.84	58.47
12.50	26.95	2.11	29.05
13.00	7.56	1.97	9.53
13.50	5.35	1.80	7.15
14.00	4.15	1.62	5.77
14.50	3.43	1.45	4.89
15.00	3.09	1.30	4.39
15.50	2.76	1.19	3.94
16.00	2.42	1.09	3.51
16.50	2.17	1.00	3.17
17.00	2.05	0.92	2.96
17.50	1.93	0.84	2.77
18.00	1.81	0.77	2.58
18.50	1.69	0.71	2.40
19.00	1.57	0.65	2.23
19.50	1.45	0.60	2.05
20.00	1.33	0.55	1.89
20.50	1.25	0.51	1.76
21.00	1.22	0.47	1.70
21.50	1.20	0.44	1.64
22.00	1.18	0.42	1.60
22.50	1.15	0.41	1.56
23.00	1.13	0.39	1.52
23.50	1.10	0.38	1.48
24.00	1.08	0.36	1.44

...End

Hydrograph Report

Hyd. No. 5

Discharge Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 1.20 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 4	Reservoir name	= Discharge Pond
Max. Elevation	= 588.12 ft	Max. Storage	= 10.626 acft

Storage Indication method used.

Outflow hydrograph volume = 6.752 acft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
12.00	58.47	586.37	----	----	----	----	----	----	----	----	----	1.18
12.50	29.05	587.26	----	----	----	----	----	----	----	----	----	1.19
13.00	9.53	587.48	----	----	----	----	----	----	----	----	----	1.19
13.50	7.15	587.59	----	----	----	----	----	----	----	----	----	1.19
14.00	5.77	587.67	----	----	----	----	----	----	----	----	----	1.19
14.50	4.89	587.74	----	----	----	----	----	----	----	----	----	1.19
15.00	4.39	587.79	----	----	----	----	----	----	----	----	----	1.20
15.50	3.94	587.84	----	----	----	----	----	----	----	----	----	1.20
16.00	3.51	587.88	----	----	----	----	----	----	----	----	----	1.20
16.50	3.17	587.92	----	----	----	----	----	----	----	----	----	1.20
17.00	2.96	587.95	----	----	----	----	----	----	----	----	----	1.20
17.50	2.77	587.97	----	----	----	----	----	----	----	----	----	1.20
18.00	2.58	588.00	----	----	----	----	----	----	----	----	----	1.20
18.50	2.40	588.02	----	----	----	----	----	----	----	----	----	1.20
19.00	2.23	588.04	----	----	----	----	----	----	----	----	----	1.20
19.50	2.05	588.05	----	----	----	----	----	----	----	----	----	1.20
20.00	1.89	588.06	----	----	----	----	----	----	----	----	----	1.20
20.50	1.76	588.07	----	----	----	----	----	----	----	----	----	1.20
21.00	1.70	588.08	----	----	----	----	----	----	----	----	----	1.20
21.50	1.64	588.09	----	----	----	----	----	----	----	----	----	1.20
22.00	1.60	588.10	----	----	----	----	----	----	----	----	----	1.20
22.50	1.56	588.10	----	----	----	----	----	----	----	----	----	1.20
23.00	1.52	588.11	----	----	----	----	----	----	----	----	----	1.20
23.50	1.48	588.11	----	----	----	----	----	----	----	----	----	1.20
24.00	1.44	588.12	----	----	----	----	----	----	----	----	----	1.20
24.50	0.50	588.11	----	----	----	----	----	----	----	----	----	1.20
25.00	0.31	588.10	----	----	----	----	----	----	----	----	----	1.20
25.50	0.29	588.09	----	----	----	----	----	----	----	----	----	1.20
26.00	0.27	588.07	----	----	----	----	----	----	----	----	----	1.20
26.50	0.25	588.06	----	----	----	----	----	----	----	----	----	1.20
27.00	0.23	588.04	----	----	----	----	----	----	----	----	----	1.20
27.50	0.22	588.03	----	----	----	----	----	----	----	----	----	1.20
28.00	0.20	588.01	----	----	----	----	----	----	----	----	----	1.20
28.50	0.19	587.99	----	----	----	----	----	----	----	----	----	1.20
29.00	0.18	587.98	----	----	----	----	----	----	----	----	----	1.20
29.50	0.16	587.96	----	----	----	----	----	----	----	----	----	1.20
30.00	0.15	587.94	----	----	----	----	----	----	----	----	----	1.20
30.50	0.14	587.93	----	----	----	----	----	----	----	----	----	1.20

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
31.00	0.13	587.91	----	----	----	----	----	----	----	----	----	1.20
31.50	0.12	587.89	----	----	----	----	----	----	----	----	----	1.20
32.00	0.11	587.88	----	----	----	----	----	----	----	----	----	1.20
32.50	0.11	587.86	----	----	----	----	----	----	----	----	----	1.20
33.00	0.10	587.84	----	----	----	----	----	----	----	----	----	1.20
33.50	0.09	587.82	----	----	----	----	----	----	----	----	----	1.20
34.00	0.08	587.81	----	----	----	----	----	----	----	----	----	1.20
34.50	0.08	587.79	----	----	----	----	----	----	----	----	----	1.20
35.00	0.07	587.77	----	----	----	----	----	----	----	----	----	1.20
35.50	0.07	587.75	----	----	----	----	----	----	----	----	----	1.19
36.00	0.06	587.73	----	----	----	----	----	----	----	----	----	1.19
36.50	0.06	587.72	----	----	----	----	----	----	----	----	----	1.19
37.00	0.05	587.70	----	----	----	----	----	----	----	----	----	1.19
37.50	0.05	587.68	----	----	----	----	----	----	----	----	----	1.19
38.00	0.05	587.66	----	----	----	----	----	----	----	----	----	1.19
38.50	0.04	587.64	----	----	----	----	----	----	----	----	----	1.19
39.00	0.04	587.62	----	----	----	----	----	----	----	----	----	1.19
39.50	0.04	587.61	----	----	----	----	----	----	----	----	----	1.19
40.00	0.04	587.59	----	----	----	----	----	----	----	----	----	1.19
40.50	0.03	587.57	----	----	----	----	----	----	----	----	----	1.19
41.00	0.03	587.55	----	----	----	----	----	----	----	----	----	1.19
41.50	0.03	587.53	----	----	----	----	----	----	----	----	----	1.19
42.00	0.03	587.51	----	----	----	----	----	----	----	----	----	1.19
42.50	0.02	587.49	----	----	----	----	----	----	----	----	----	1.19
43.00	0.02	587.47	----	----	----	----	----	----	----	----	----	1.19
43.50	0.02	587.46	----	----	----	----	----	----	----	----	----	1.19
44.00	0.02	587.44	----	----	----	----	----	----	----	----	----	1.19
44.50	0.02	587.42	----	----	----	----	----	----	----	----	----	1.19
45.00	0.02	587.40	----	----	----	----	----	----	----	----	----	1.19
45.50	0.02	587.38	----	----	----	----	----	----	----	----	----	1.19
46.00	0.01	587.36	----	----	----	----	----	----	----	----	----	1.19
46.50	0.01	587.34	----	----	----	----	----	----	----	----	----	1.19
47.00	0.01	587.32	----	----	----	----	----	----	----	----	----	1.19
47.50	0.01	587.30	----	----	----	----	----	----	----	----	----	1.19
48.00	0.01	587.29	----	----	----	----	----	----	----	----	----	1.19
48.50	0.01	587.27	----	----	----	----	----	----	----	----	----	1.19
49.00	0.01	587.25	----	----	----	----	----	----	----	----	----	1.19
49.50	0.01	587.23	----	----	----	----	----	----	----	----	----	1.19
50.00	0.01	587.21	----	----	----	----	----	----	----	----	----	1.19
50.50	0.01	587.19	----	----	----	----	----	----	----	----	----	1.19
51.00	0.01	587.17	----	----	----	----	----	----	----	----	----	1.19
51.50	0.01	587.15	----	----	----	----	----	----	----	----	----	1.19
52.00	0.01	587.13	----	----	----	----	----	----	----	----	----	1.19
52.50	0.01	587.11	----	----	----	----	----	----	----	----	----	1.19
53.00	0.01	587.10	----	----	----	----	----	----	----	----	----	1.19
53.50	0.00	587.08	----	----	----	----	----	----	----	----	----	1.19
54.00	0.00	587.06	----	----	----	----	----	----	----	----	----	1.19
54.50	0.00	587.04	----	----	----	----	----	----	----	----	----	1.19
55.00	0.00	587.02	----	----	----	----	----	----	----	----	----	1.19
55.50	0.00	587.00	----	----	----	----	----	----	----	----	----	1.19
56.00	0.00	586.98	----	----	----	----	----	----	----	----	----	1.19

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
56.50	0.00	586.96	----	----	----	----	----	----	----	----	----	1.19
57.00	0.00	586.94	----	----	----	----	----	----	----	----	----	1.19
57.50	0.00	586.92	----	----	----	----	----	----	----	----	----	1.19
58.00	0.00	586.91	----	----	----	----	----	----	----	----	----	1.19
58.50	0.00	586.89	----	----	----	----	----	----	----	----	----	1.19
59.00	0.00	586.87	----	----	----	----	----	----	----	----	----	1.19
59.50	0.00	586.85	----	----	----	----	----	----	----	----	----	1.19
60.00	0.00	586.83	----	----	----	----	----	----	----	----	----	1.19
60.50	0.00	586.81	----	----	----	----	----	----	----	----	----	1.19
61.00	0.00	586.79	----	----	----	----	----	----	----	----	----	1.19
61.50	0.00	586.77	----	----	----	----	----	----	----	----	----	1.19
62.00	0.00	586.75	----	----	----	----	----	----	----	----	----	1.19
62.50	0.00	586.73	----	----	----	----	----	----	----	----	----	1.19
63.00	0.00	586.71	----	----	----	----	----	----	----	----	----	1.19
63.50	0.00	586.70	----	----	----	----	----	----	----	----	----	1.19
64.00	0.00	586.68	----	----	----	----	----	----	----	----	----	1.19
64.50	0.00	586.66	----	----	----	----	----	----	----	----	----	1.19
65.00	0.00	586.64	----	----	----	----	----	----	----	----	----	1.19
65.50	0.00	586.62	----	----	----	----	----	----	----	----	----	1.19
66.00	0.00	586.60	----	----	----	----	----	----	----	----	----	1.19
66.50	0.00	586.58	----	----	----	----	----	----	----	----	----	1.19
67.00	0.00	586.56	----	----	----	----	----	----	----	----	----	1.19
67.50	0.00	586.54	----	----	----	----	----	----	----	----	----	1.19
68.00	0.00	586.52	----	----	----	----	----	----	----	----	----	1.19
68.50	0.00	586.50	----	----	----	----	----	----	----	----	----	1.18
69.00	0.00	586.48	----	----	----	----	----	----	----	----	----	1.18
69.50	0.00	586.46	----	----	----	----	----	----	----	----	----	1.18
70.00	0.00	586.44	----	----	----	----	----	----	----	----	----	1.18
70.50	0.00	586.42	----	----	----	----	----	----	----	----	----	1.18
71.00	0.00	586.40	----	----	----	----	----	----	----	----	----	1.18
71.50	0.00	586.38	----	----	----	----	----	----	----	----	----	1.18
72.00	0.00	586.35	----	----	----	----	----	----	----	----	----	1.18
72.50	0.00	586.33	----	----	----	----	----	----	----	----	----	1.18
73.00	0.00	586.31	----	----	----	----	----	----	----	----	----	1.18
73.50	0.00	586.29	----	----	----	----	----	----	----	----	----	1.18
74.00	0.00	586.27	----	----	----	----	----	----	----	----	----	1.18
74.50	0.00	586.25	----	----	----	----	----	----	----	----	----	1.17
75.00	0.00	586.23	----	----	----	----	----	----	----	----	----	1.17
75.50	0.00	586.20	----	----	----	----	----	----	----	----	----	1.17
76.00	0.00	586.18	----	----	----	----	----	----	----	----	----	1.17
76.50	0.00	586.16	----	----	----	----	----	----	----	----	----	1.17
77.00	0.00	586.14	----	----	----	----	----	----	----	----	----	1.17
77.50	0.00	586.12	----	----	----	----	----	----	----	----	----	1.17
78.00	0.00	586.10	----	----	----	----	----	----	----	----	----	1.17
78.50	0.00	586.08	----	----	----	----	----	----	----	----	----	1.17
79.00	0.00	586.05	----	----	----	----	----	----	----	----	----	1.17
79.50	0.00	586.03	----	----	----	----	----	----	----	----	----	1.17
80.00	0.00	586.01	----	----	----	----	----	----	----	----	----	1.17
80.50	0.00	586.00	----	----	----	----	----	----	----	----	----	0.17
81.00	0.00	586.00	----	----	----	----	----	----	----	----	----	0.02

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US EPA ARCHIVE DOCUMENT

Reservoir Report

Reservoir No. 2 - Discharge Pond

Hydraflow Hydrographs by Intelisolve

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 (acft)	Total storage (acft)
0.00	583.50	92,347	0.000	0.000
2.00	585.50	92,347	4.240	4.240
2.01	585.51	92,347	0.021	4.261
2.50	586.00	96,765	1.064	5.325
2.51	586.01	96,765	0.022	5.347
3.00	586.50	101,184	1.113	6.460
3.01	586.51	101,184	0.023	6.484
5.50	589.00	123,275	6.415	12.899

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	583.50	---	---	---	---	---	---	---	---	---	0.00
2.00	4.240	585.50	---	---	---	---	---	---	---	---	---	0.00
2.01	4.261	585.51	---	---	---	---	---	---	---	---	---	0.00
2.50	5.325	586.00	---	---	---	---	---	---	---	---	---	0.00
2.51	5.347	586.01	---	---	---	---	---	---	---	---	---	1.17
3.00	6.460	586.50	---	---	---	---	---	---	---	---	---	1.18
3.01	6.484	586.51	---	---	---	---	---	---	---	---	---	1.19
5.50	12.899	589.00	---	---	---	---	---	---	---	---	---	1.20

US EPA ARCHIVE DOCUMENT

Attachment E

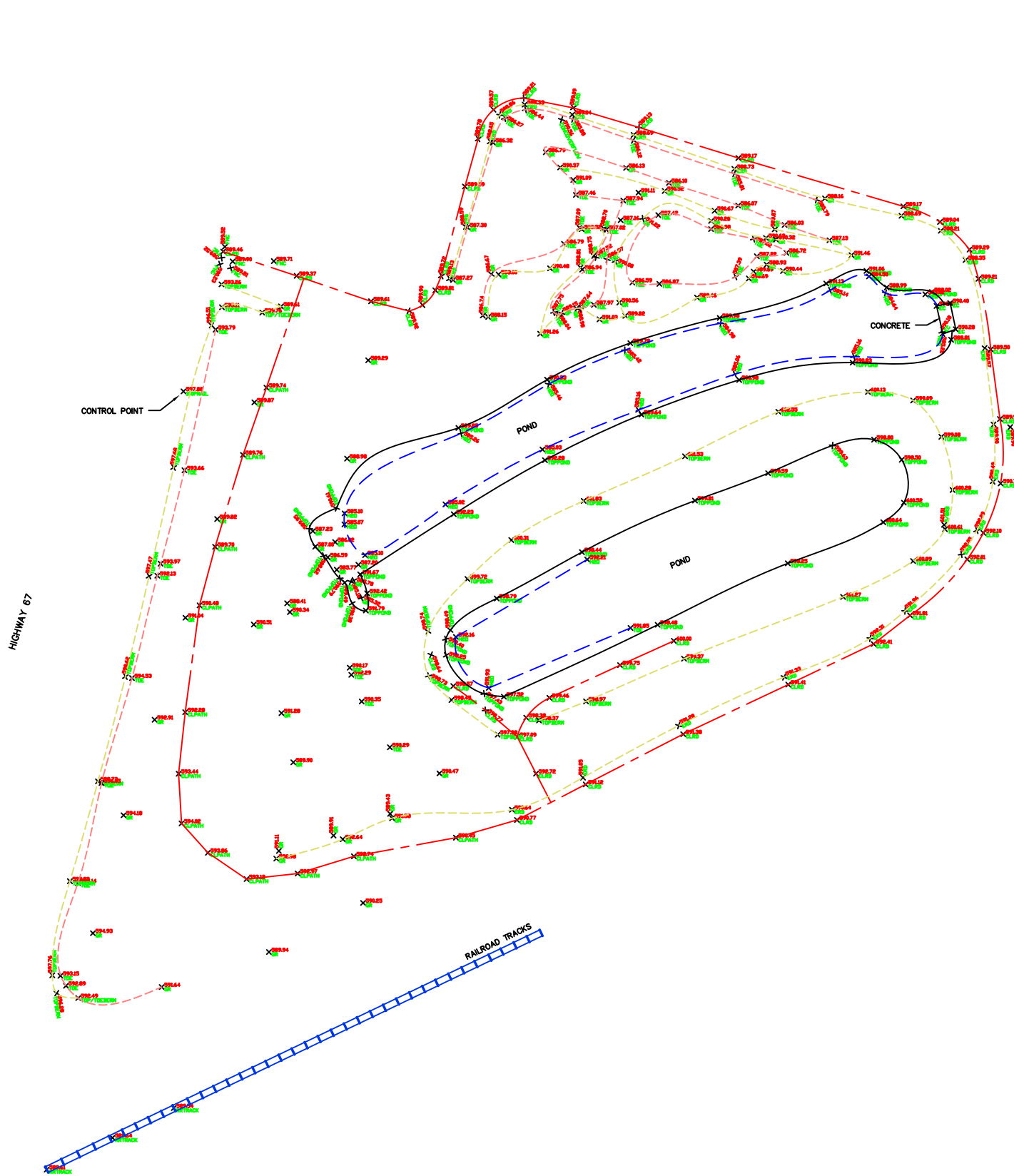
**Elevation Plan
Alliant Energy Settlement Ponds
Clinton, Iowa**

**Hinkle Engineering & Surveying LLC
Sheet 1 of 1 - 11/2/2010**

ALLIANT ELEVATION PLAN

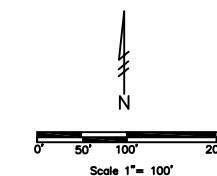
HIGHWAY 67 CLINTON, IOWA

FOR: ALLIANT ENERGY
2001 BEAVER CHANNEL PARKWAY
CLINTON, IA. 52732



LEGEND:

- × 589.24 GR EXISTING GROUND SHOT NEXT TO FENCE LINE WITH ELEVATION
- × 589.80 TOPPOND EXISTING TOP OF POND SHOT WITH ELEVATION
- × 589.61 DOCK EXISTING DOCK SHOT WITH ELEVATION
- × 589.61 CLRD EXISTING CENTERLINE OF DRIVEWAY SHOT WITH ELEVATION
- × 589.61 TOE EXISTING TOE OF SLOPE SHOT WITH ELEVATION
- × 589.61 TOP BERM EXISTING TOP OF BERM SHOT WITH ELEVATION
- × 589.27 5/8" BRB 5/8" REBAR SHOT WITH ELEVATION
- × 588.80 H2O EXISTING SHOT ON WATER WITH ELEVATION
- × 589.75 ERD EXISTING SHOT ON EDGE OF ROAD WITH ELEVATION
- × 589.61 100P/NAIL CONTROL POINT SHOT WITH ELEVATION
- × 589.61 FNC EXISTING SHOT NEXT TO FENCE WITH ELEVATION
- × 589.61 RRTRACK EXISTING SHOT ON RAILROAD TRACKS WITH ELEVATION
- × 589.61 CLPATH EXISTING SHOT ON PATH WITH ELEVATION
- × 589.61 CLPATH EXISTING SHOT ON CONCRETE WITH ELEVATION



HINKLE ENGINEERING & SURVEYING L.L.C.
2100 CAMANCHE AVENUE
CLINTON, IA 52732
PHONE = (563) 243-4027
FAX = (563) 243-4029

REV.	DESCRIPTION	BY	DATE
JOB NAME: ALLIANT ENERGY SETTLEMENT PONDS LOCATION: CLINTON, IA		DRAWN BY:	CHECK BY: DMH
		SCALE: 1" = 100'	
		DATE: 11/2/10	
DESCRIPTION: ELEVATION PLAN		JOB NUMBER: 10-0884	SHEET: 1 OF 1

Attachment F

Emergency Ash Pond Hydrological and Hydraulics Model

Program HydraFlow output by Aether DBS, September 2011

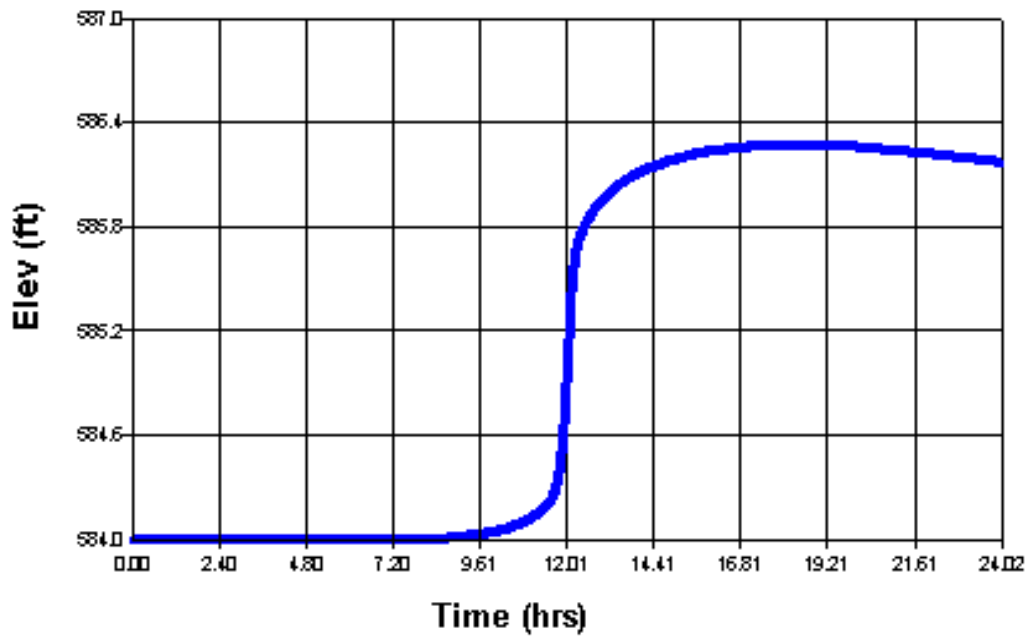


Hydrograph 1 - SCS Runoff



Hydrograph 2 - Reservoir

2 - Reservoir - 100 Yr - Max. El. = 586.27 ft



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (acft)	Hydrograph description
1	SCS Runoff	57.93	1	723	3.778	---	-----	-----	100 Year Storm
2	Reservoir	1.19	1	1109	1.195	1	586.27	4.805	Combined Ponds

Hydrograph Report

Hyd. No. 1

100 Year Storm

Hydrograph type	= SCS Runoff	Peak discharge	= 57.93 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 13.00 ac	Curve number	= 74.6
Basin Slope	= 0.0 %	Hydraulic length	= 100 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.6 min
Total precip.	= 6.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3.778 acft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
9.95 0.59	15.62 1.85	21.28 0.88
10.12 0.68	15.78 1.77	21.45 0.87
10.28 0.80	15.95 1.70	21.62 0.87
10.45 0.95	16.12 1.62	21.78 0.86
10.62 1.11	16.28 1.57	21.95 0.86
10.78 1.32	16.45 1.54	22.12 0.85
10.95 1.58	16.62 1.51	22.28 0.84
11.12 1.81	16.78 1.49	22.45 0.84
11.28 2.30	16.95 1.46	22.62 0.83
11.45 3.04	17.12 1.43	22.78 0.83
11.62 4.67	17.28 1.40	22.95 0.82
11.78 14.21	17.45 1.38	23.12 0.82
11.95 43.56	17.62 1.35	23.28 0.81
12.12 51.15	17.78 1.32	23.45 0.81
12.28 19.83	17.95 1.29	23.62 0.80
12.45 9.17	18.12 1.27	23.78 0.79
12.62 6.91	18.28 1.24	23.95 0.79
12.78 5.50	18.45 1.21	
12.95 4.84	18.62 1.18	
13.12 4.31	18.78 1.15	...End
13.28 3.90	18.95 1.13	
13.45 3.58	19.12 1.10	
13.62 3.29	19.28 1.07	
13.78 3.03	19.45 1.04	
13.95 2.81	19.62 1.01	
14.12 2.60	19.78 0.98	
14.28 2.46	19.95 0.95	
14.45 2.38	20.12 0.93	
14.62 2.31	20.28 0.91	
14.78 2.23	20.45 0.90	
14.95 2.16	20.62 0.90	
15.12 2.08	20.78 0.89	
15.28 2.00	20.95 0.89	
15.45 1.93	21.12 0.88	

US EPA ARCHIVE DOCUMENT

Hydrograph Report

Hyd. No. 2

Combined Ponds

Hydrograph type = Reservoir
 Storm frequency = 100 yrs
 Inflow hyd. No. = 1
 Max. Elevation = 586.27 ft

Peak discharge = 1.19 cfs
 Time interval = 1 min
 Reservoir name = Combined Ponds
 Max. Storage = 4.805 acft

Storage Indication method used.

Outflow hydrograph volume = 1.195 acft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
12.00	53.74	584.87	----	----	----	----	----	----	----	----	----	1.18
12.17	41.17	585.44	----	----	----	----	----	----	----	----	----	1.19
12.33	13.69	585.71	----	----	----	----	----	----	----	----	----	1.19
12.50	8.47	585.80	----	----	----	----	----	----	----	----	----	1.19
12.67	6.36	585.87	----	----	----	----	----	----	----	----	----	1.19
12.83	5.26	585.92	----	----	----	----	----	----	----	----	----	1.19
13.00	4.68	585.96	----	----	----	----	----	----	----	----	----	1.19
13.17	4.17	585.99	----	----	----	----	----	----	----	----	----	1.19
13.33	3.80	586.02	----	----	----	----	----	----	----	----	----	1.19
13.50	3.49	586.05	----	----	----	----	----	----	----	----	----	1.19
13.67	3.21	586.07	----	----	----	----	----	----	----	----	----	1.19
13.83	2.97	586.09	----	----	----	----	----	----	----	----	----	1.19
14.00	2.75	586.11	----	----	----	----	----	----	----	----	----	1.19
14.17	2.55	586.13	----	----	----	----	----	----	----	----	----	1.19
14.33	2.43	586.14	----	----	----	----	----	----	----	----	----	1.19
14.50	2.36	586.15	----	----	----	----	----	----	----	----	----	1.19
14.67	2.28	586.16	----	----	----	----	----	----	----	----	----	1.19
14.83	2.21	586.18	----	----	----	----	----	----	----	----	----	1.19
15.00	2.13	586.19	----	----	----	----	----	----	----	----	----	1.19
15.17	2.06	586.20	----	----	----	----	----	----	----	----	----	1.19
15.33	1.98	586.20	----	----	----	----	----	----	----	----	----	1.19
15.50	1.91	586.21	----	----	----	----	----	----	----	----	----	1.19
15.67	1.83	586.22	----	----	----	----	----	----	----	----	----	1.19
15.83	1.75	586.23	----	----	----	----	----	----	----	----	----	1.19
16.00	1.67	586.23	----	----	----	----	----	----	----	----	----	1.19
16.17	1.60	586.24	----	----	----	----	----	----	----	----	----	1.19
16.33	1.56	586.24	----	----	----	----	----	----	----	----	----	1.19
16.50	1.53	586.24	----	----	----	----	----	----	----	----	----	1.19
16.67	1.51	586.25	----	----	----	----	----	----	----	----	----	1.19
16.83	1.48	586.25	----	----	----	----	----	----	----	----	----	1.19
17.00	1.45	586.25	----	----	----	----	----	----	----	----	----	1.19
17.17	1.42	586.26	----	----	----	----	----	----	----	----	----	1.19
17.33	1.40	586.26	----	----	----	----	----	----	----	----	----	1.19
17.50	1.37	586.26	----	----	----	----	----	----	----	----	----	1.19
17.67	1.34	586.26	----	----	----	----	----	----	----	----	----	1.19
17.83	1.31	586.26	----	----	----	----	----	----	----	----	----	1.19
18.00	1.29	586.27	----	----	----	----	----	----	----	----	----	1.19
18.17	1.26	586.27	----	----	----	----	----	----	----	----	----	1.19

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
18.33	1.23	586.27	----	----	----	----	----	----	----	----	----	1.19
18.50	1.20	586.27 <<	----	----	----	----	----	----	----	----	----	1.19 <<
18.67	1.17	586.27	----	----	----	----	----	----	----	----	----	1.19
18.83	1.15	586.27	----	----	----	----	----	----	----	----	----	1.19
19.00	1.12	586.27	----	----	----	----	----	----	----	----	----	1.19
19.17	1.09	586.27	----	----	----	----	----	----	----	----	----	1.19
19.33	1.06	586.26	----	----	----	----	----	----	----	----	----	1.19
19.50	1.03	586.26	----	----	----	----	----	----	----	----	----	1.19
19.67	1.00	586.26	----	----	----	----	----	----	----	----	----	1.19
19.83	0.97	586.26	----	----	----	----	----	----	----	----	----	1.19
20.00	0.95	586.26	----	----	----	----	----	----	----	----	----	1.19
20.17	0.92	586.25	----	----	----	----	----	----	----	----	----	1.19
20.33	0.91	586.25	----	----	----	----	----	----	----	----	----	1.19
20.50	0.90	586.25	----	----	----	----	----	----	----	----	----	1.19
20.67	0.90	586.24	----	----	----	----	----	----	----	----	----	1.19
20.83	0.89	586.24	----	----	----	----	----	----	----	----	----	1.19
21.00	0.89	586.24	----	----	----	----	----	----	----	----	----	1.19
21.17	0.88	586.23	----	----	----	----	----	----	----	----	----	1.19
21.33	0.88	586.23	----	----	----	----	----	----	----	----	----	1.19
21.50	0.87	586.23	----	----	----	----	----	----	----	----	----	1.19
21.67	0.86	586.22	----	----	----	----	----	----	----	----	----	1.19
21.83	0.86	586.22	----	----	----	----	----	----	----	----	----	1.19
22.00	0.85	586.22	----	----	----	----	----	----	----	----	----	1.19
22.17	0.85	586.21	----	----	----	----	----	----	----	----	----	1.19
22.33	0.84	586.21	----	----	----	----	----	----	----	----	----	1.19
22.50	0.84	586.21	----	----	----	----	----	----	----	----	----	1.19
22.67	0.83	586.20	----	----	----	----	----	----	----	----	----	1.19
22.83	0.83	586.20	----	----	----	----	----	----	----	----	----	1.19
23.00	0.82	586.19	----	----	----	----	----	----	----	----	----	1.19
23.17	0.82	586.19	----	----	----	----	----	----	----	----	----	1.19
23.33	0.81	586.19	----	----	----	----	----	----	----	----	----	1.19
23.50	0.80	586.18	----	----	----	----	----	----	----	----	----	1.19
23.67	0.80	586.18	----	----	----	----	----	----	----	----	----	1.19
23.83	0.79	586.17	----	----	----	----	----	----	----	----	----	1.19
24.00	0.00	586.17	----	----	----	----	----	----	----	----	----	1.19

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Reservoir Report

Reservoir No. 2 - Combined Ponds

Hydraflow Hydrographs by Intelisolve

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 (acft)	Total storage (acft)
0.00	582.00	45,641	0.000	0.000
2.00	584.00	45,641	2.096	2.096
2.01	584.01	45,641	0.010	2.106
2.50	584.50	47,100	0.522	2.628
2.51	584.51	47,100	0.011	2.638
3.00	585.00	48,559	0.538	3.176
3.01	585.01	48,559	0.011	3.188
8.00	590.00	63,552	6.421	9.609

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	582.00	---	---	---	---	---	---	---	---	---	0.00
2.00	2.096	584.00	---	---	---	---	---	---	---	---	---	0.00
2.01	2.106	584.01	---	---	---	---	---	---	---	---	---	0.00
2.50	2.628	584.50	---	---	---	---	---	---	---	---	---	0.00
2.51	2.638	584.51	---	---	---	---	---	---	---	---	---	1.17
3.00	3.176	585.00	---	---	---	---	---	---	---	---	---	1.18
3.01	3.188	585.01	---	---	---	---	---	---	---	---	---	1.19
8.00	9.609	590.00	---	---	---	---	---	---	---	---	---	1.20

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