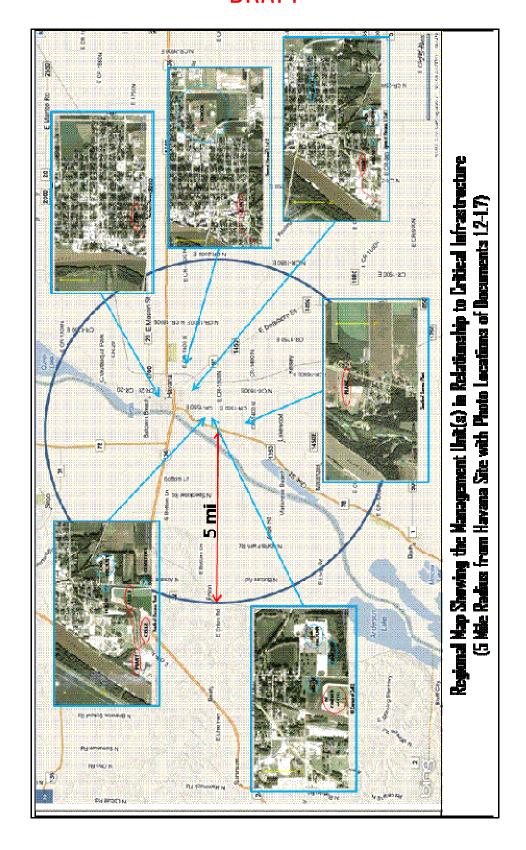
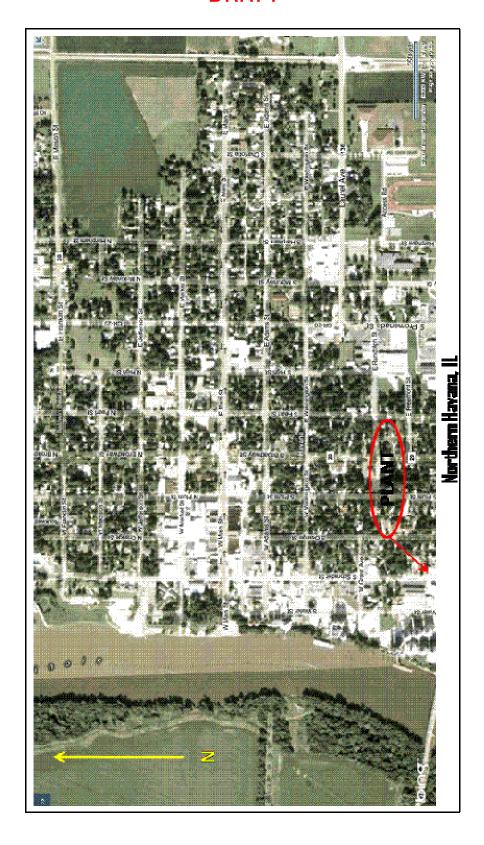
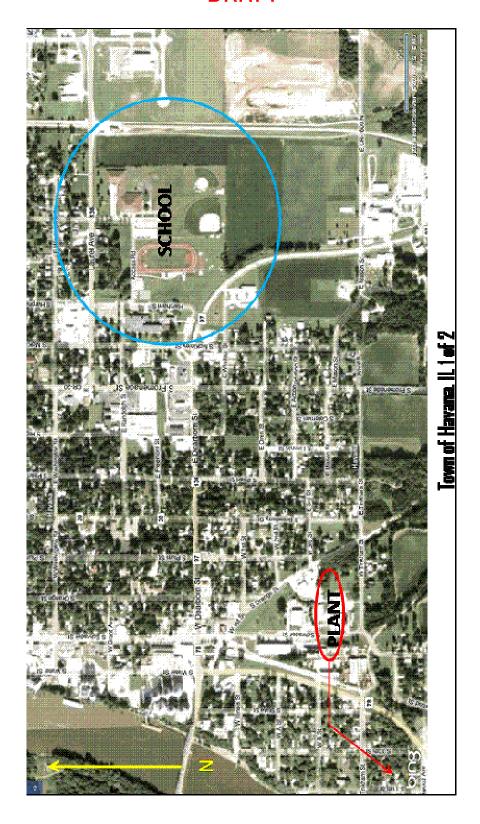
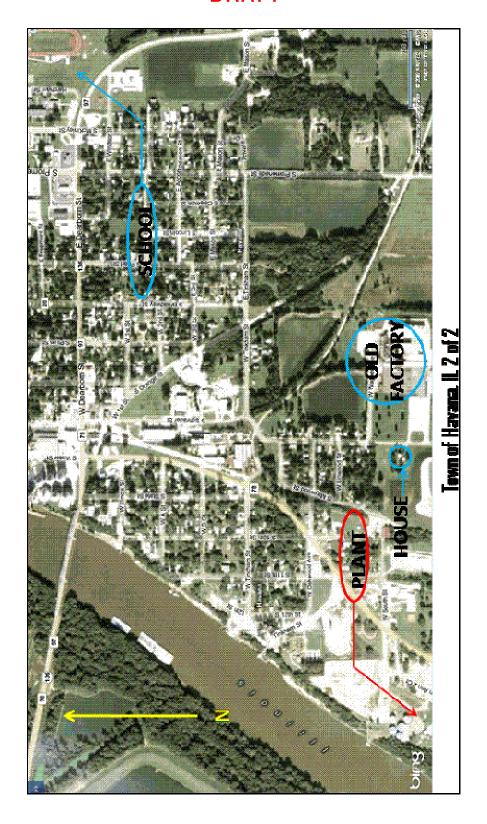
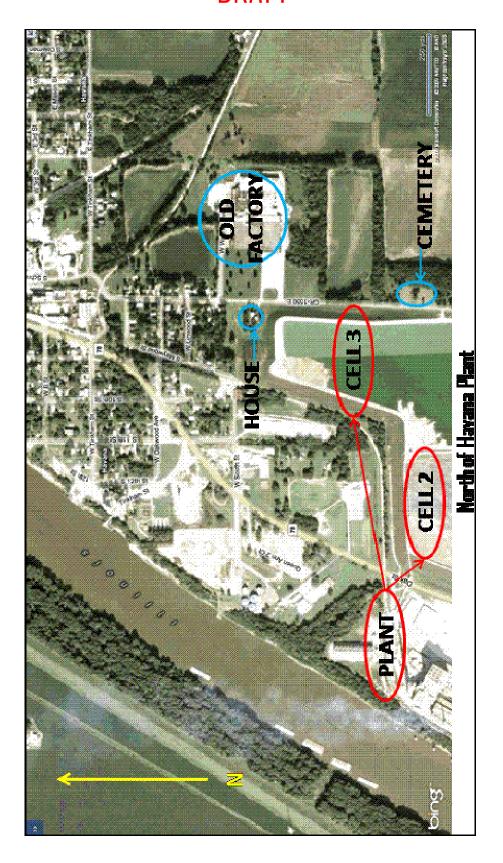
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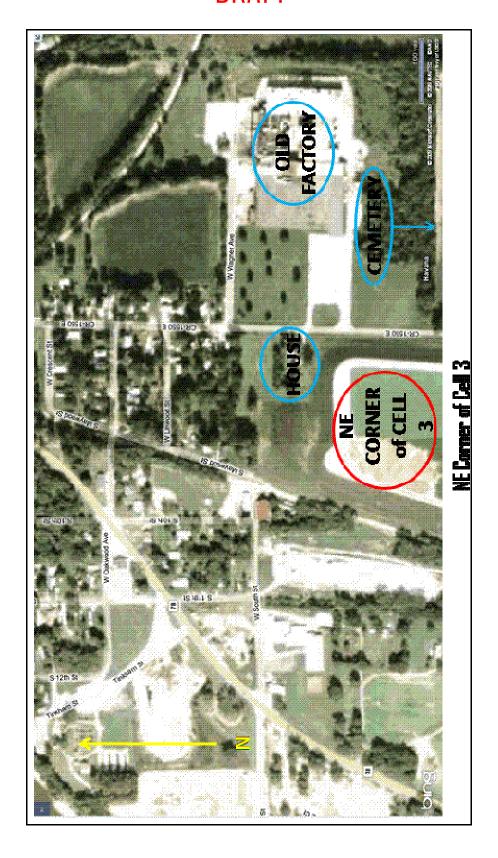


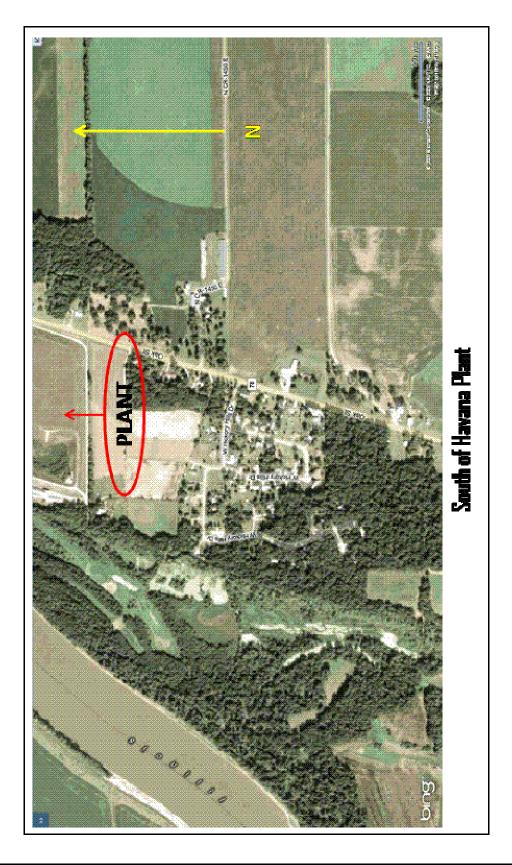


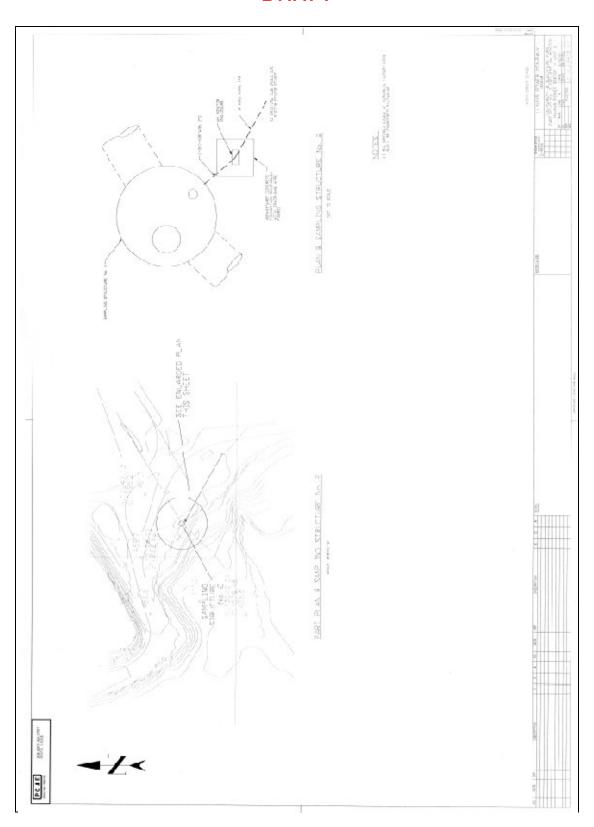


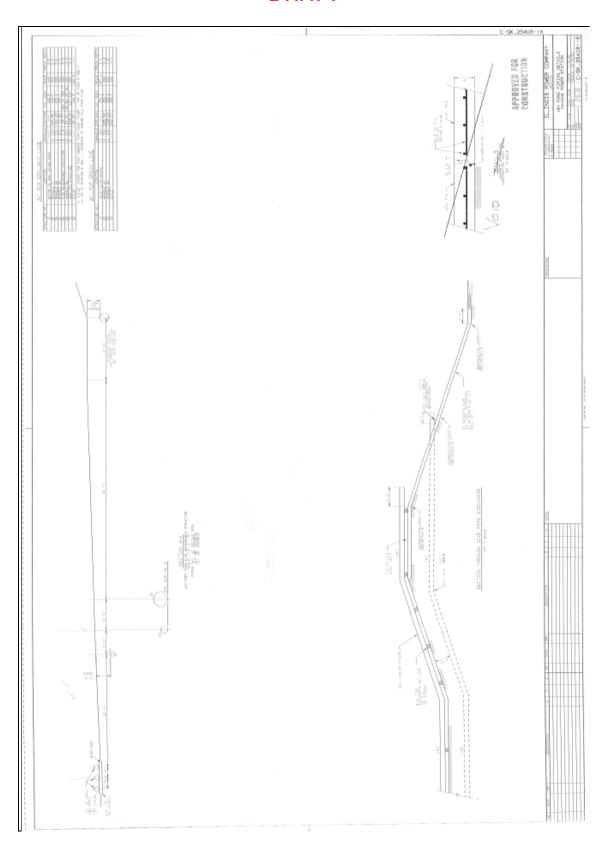


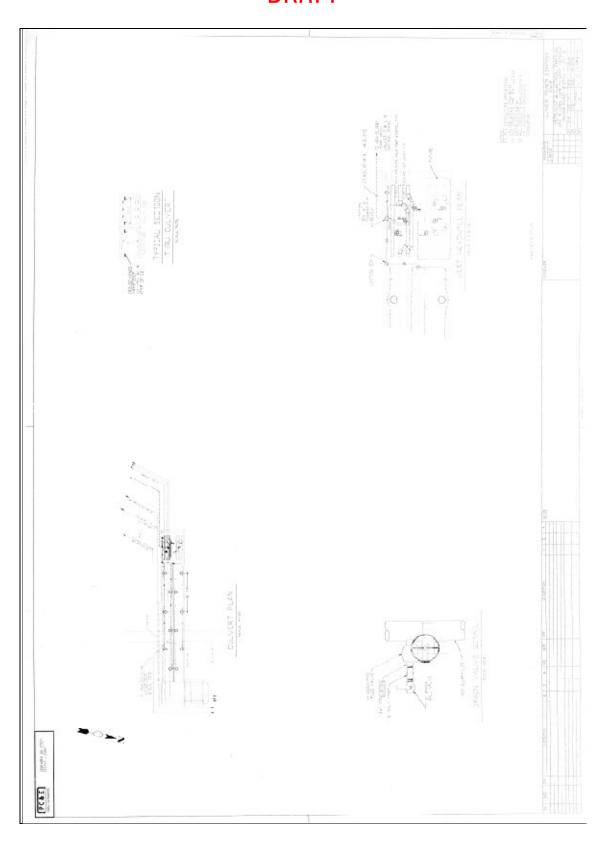


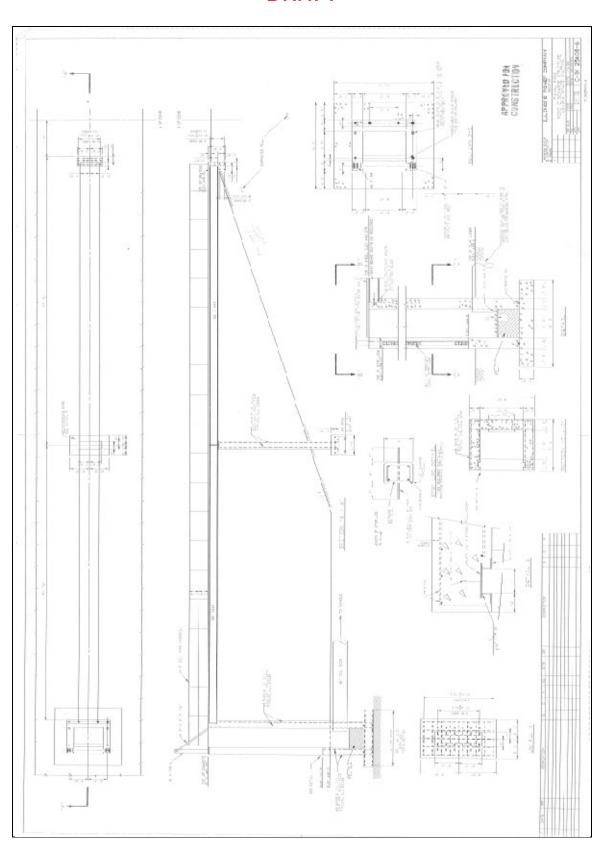


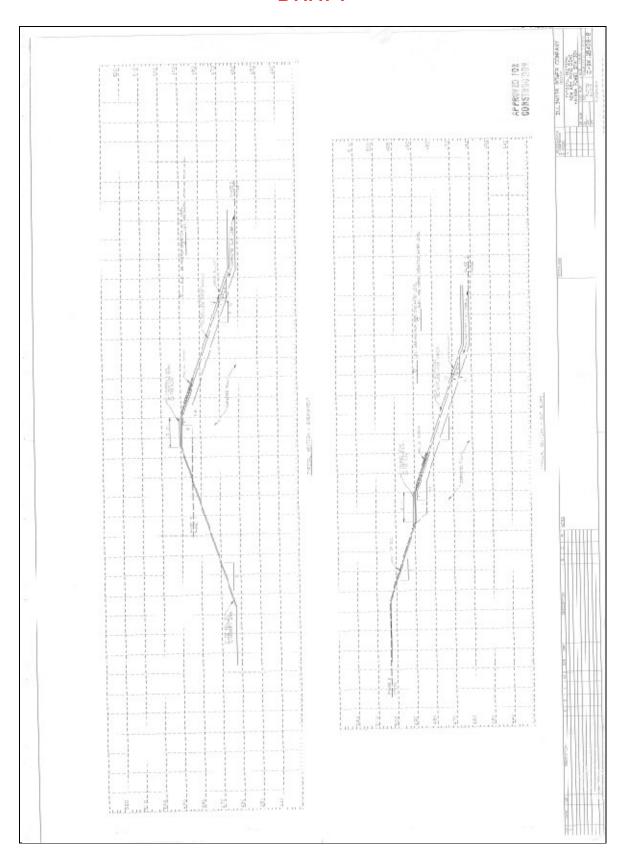


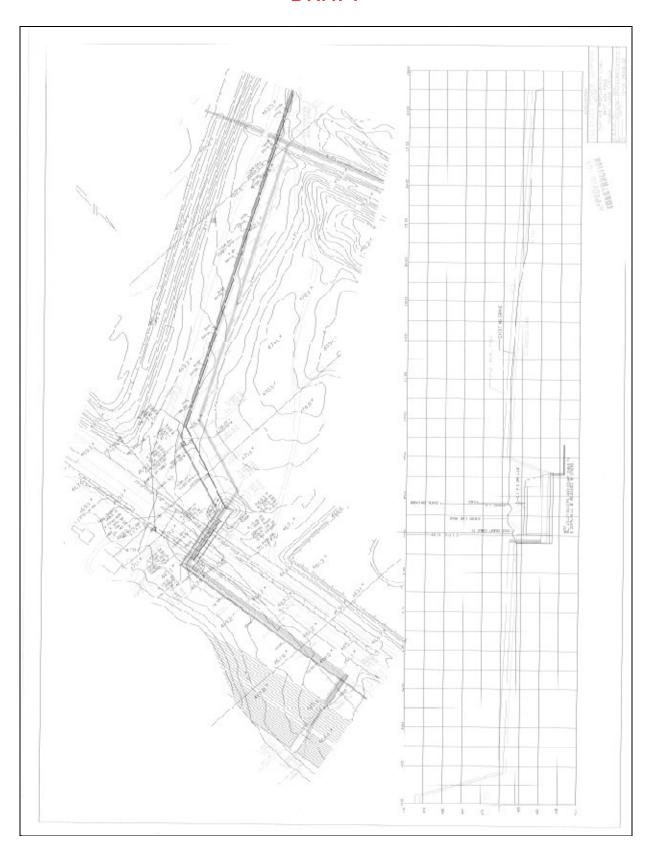




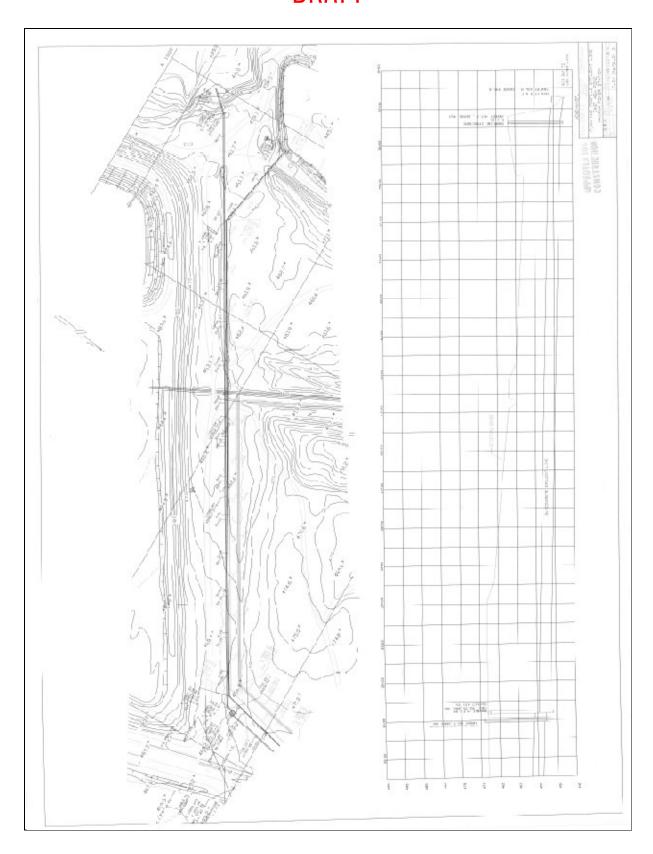




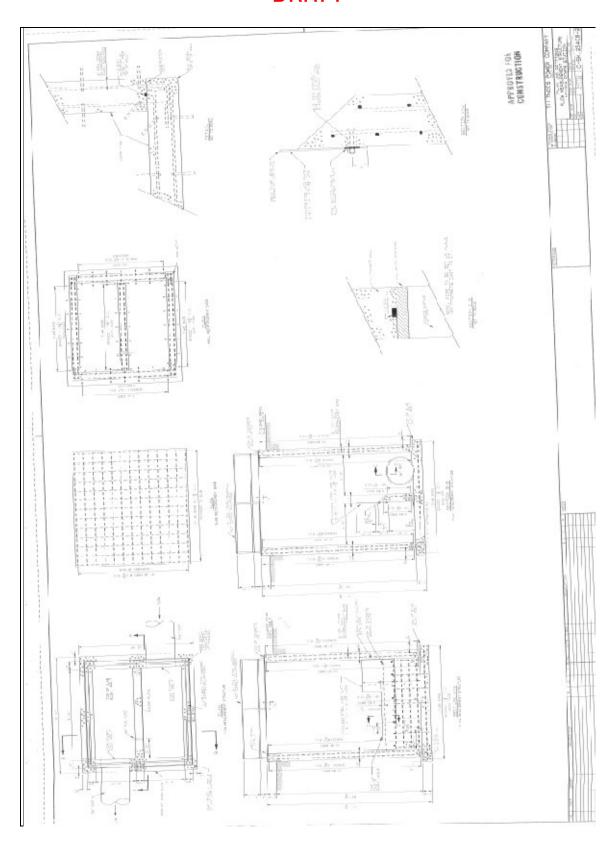


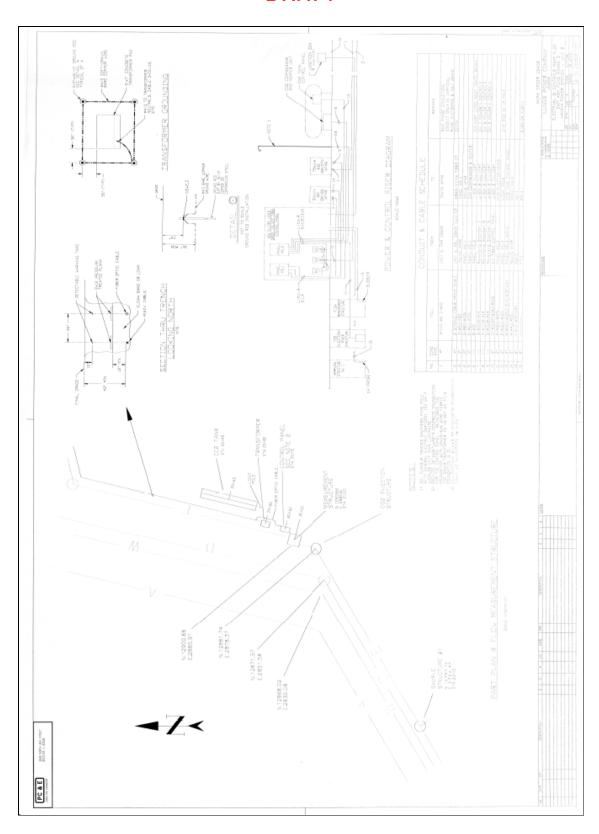


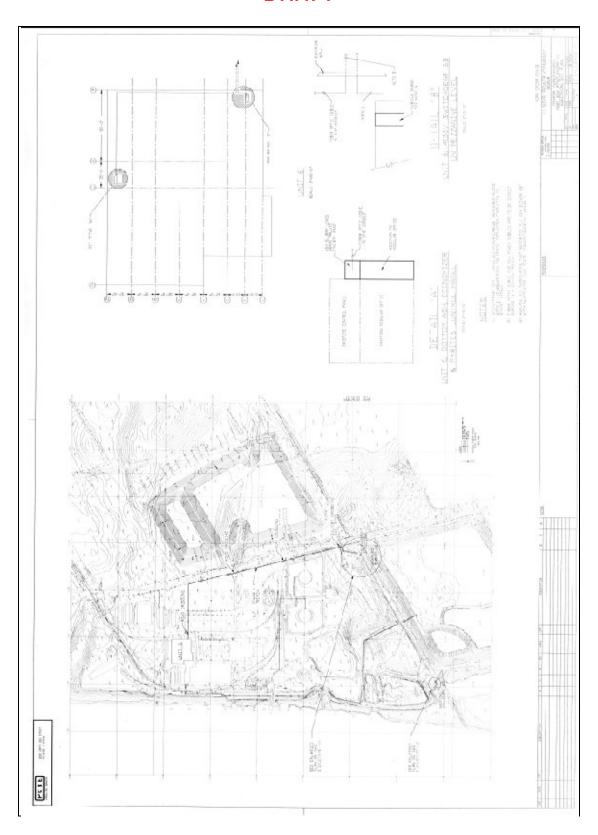


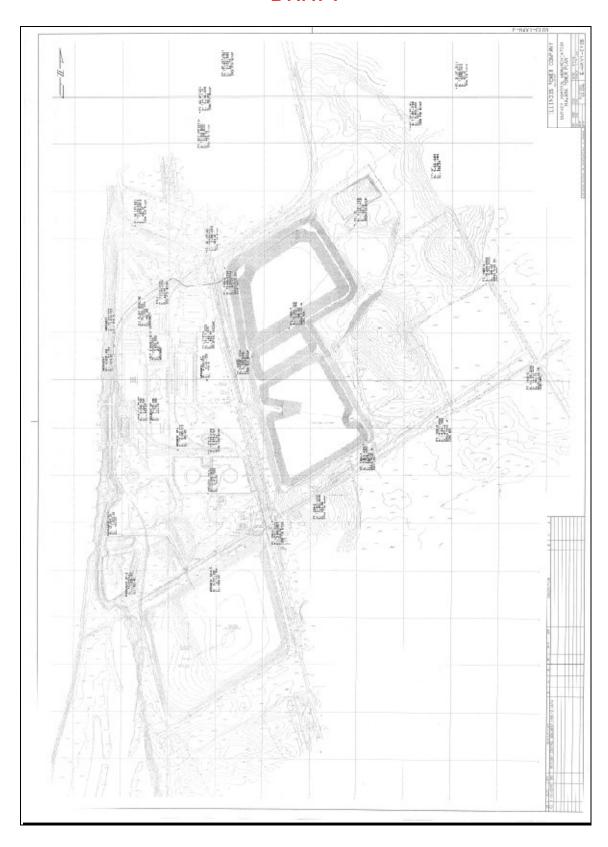


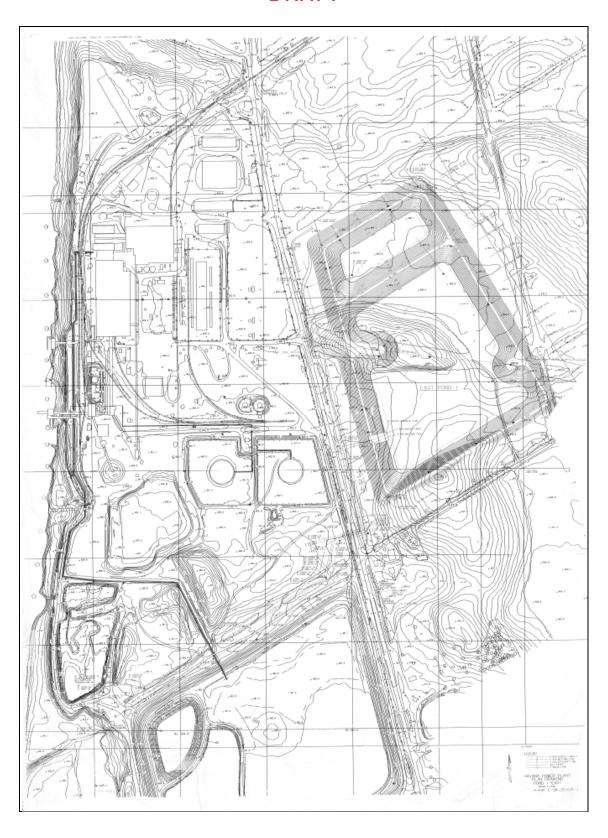


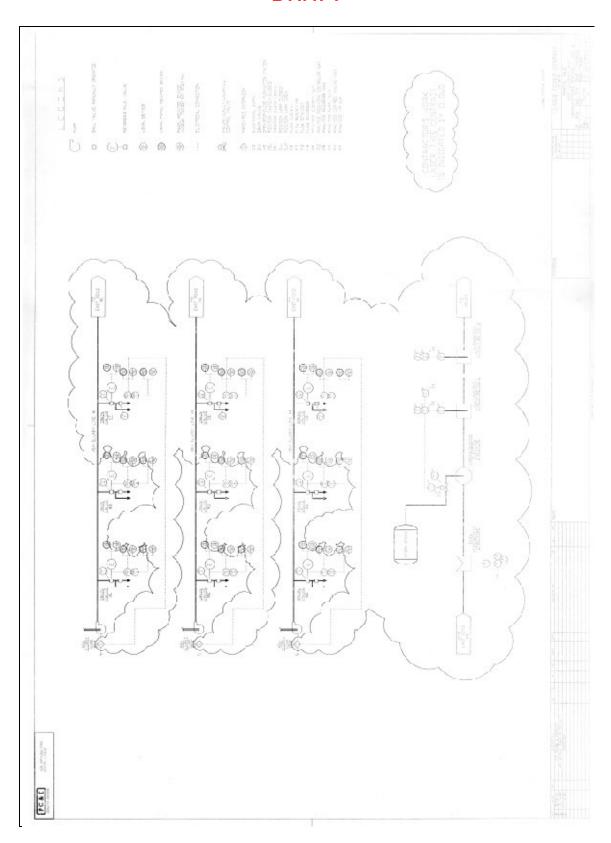














### **Dynegy Midwest Generation, Inc.**

Havana Power Station Havana, Illinois

**East Ash Pond System** 

**IDNR Dam Safety Program** 

Permit No. DS2002185

Dam ID No. IL50483

Operations and Maintenance Plan

**November 2008** 

# Havana Power Station East Ash Pond System Class 1 Dam Operations and Maintenance Plan

#### 1.0 General

The following operation and maintenance procedures are provided to maintain the structural integrity of the east ash pond system (cells 1, 2, 3, and the final polishing pond - cell 4). Cells 1 and 2, and the final polishing pond of this system are classified as Small Class 1 dams by the Illinois Department of Natural Resources, Office of Water Resources (IDNR\_OWR). Cell 3 is classified as an Intermediate Class 1 dam.

Cells 1, 2, and 3 are the primary ash deposition cells of the system. The fourth cell is the final effluent polishing pond. Cells 1, 2, and 3 are not hydraulically connected.

Water elevations in cell 4 will be slightly lower than in cells 1, 2, or 3. The normal pool elevation of primary cells 1 and 2 of this system is 486 feet above msl. Cell 1 is currently used only for the deposition of bottom ash and there is minimal free standing water in the pond. Cell 2 was taken out of service after cell 3 was constructed and placed into service (2003).

The normal pool elevation of cell no. 3 is 492 feet above msl. The <u>emergency</u> spillway crest in cell 3 is at approximate elevation 494 feet above msl. This emergency spillway consists of a concrete overflow channel which would discharge to the final effluent polishing pond.

#### 2.0 Operation

#### 2.1 Normal Operation and Surveillance

Ash disposal facility operation will be controlled by limiting discharges from the station to cells 1, 2, or 3 and by varying water surface elevations at the final effluent polishing pond (cell 4) discharge structure.

#### (a) Ash Pond Monitoring

An <u>Ash Pond Log</u> shall be used to establish and maintain pond history. All inspections and maintenance activities shall be recorded. Responsibility for maintaining this log shall be designated by the Station Manager.

#### (b) Daily Surveillance

The water surface elevation of each cell of the ash pond system shall be observed and recorded daily in the <u>Ash Pond Log</u>. A staff gauge is installed in each cell of the system and these gauges shall be maintained such that they accurately indicate water level elevations in each cell.

#### (c) Weekly Surveillance and Inspection

Weekly inspections of the perimeter berms around cells 1, 2, 3, and 4 shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the <u>Ash Pond Log</u> and maintenance activities shall be initiated, if required.

#### 2.2 Emergency Action Plan

During and immediately following unusual storm and flood events, inspection of the cells and their appurtenances shall be carried out and recorded at least once each day.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 487 feet or 492.7 feet in cell 3, inspection of the cells and their appurtenances shall be carried out and recorded at least once every 12 hours.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 488 feet or 494 feet in cell 3, a downstream flood <u>watch</u> will be disseminated and discharges from the station to the ash pond system will be suspended. Inspection of the cells and their appurtenances shall be carried out and recorded at least once every four hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489 feet or 495 feet in cell 3, a flood <u>warning</u> will be disseminated and downstream residents that could experience first floor flooding shall be evacuated. Inspection of the ponds and their appurtenances shall be carried out and recorded at least once every two hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489.25 feet or 495.25 feet in cell 3, all residents within the breach wave area shall be evacuated. Inspection of the ponds and their appurtenances shall be performed and recorded continuously. Residents will not be permitted to return to the breach wave area until the event concludes, the water surface in the cells fall to normal pool levels, and complete inspection of the cells and their appurtenances indicate pond operation to be safe.

Any unusual condition discovered during major storm events or routine inspection which may constitute an emergency shall be communicated as follows:

- Notice of any type of emergency involving the berms or outfall shall be made to the Shift Leader on duty.
- The shift leader on duty shall then notify the Station Manager (A.K. Millis; pager and home tel. nos. 309-297-0105; 309-692-8228; kirk\_millis @dynegy.com) or in his absence the Production Manager (B.W. Veech; pager and home telephone nos. 309-303-5678 and 815-664-2608, respectively; e-mail address: byron\_veech @dynegy.com). One of these shall then notify the following city, county, state, and federal regulatory authorities:

	Illinois ESDA, 24-hour service 1	-800-782-7860
*	IDNR OWR, Dam Safety Section	217-782-3863
*	IDOT, District 6	217-782-7301
*	Mason County Sheriff	309-543-2231
*	Havana Police Department	309-543-3321
	DMG, Director of Construction	
	DMG, Operations and Environmental Compliance(OEC	
		618-206-5934 (office)
		618-288-5659 (home)
		618-401-5060 (cellular)

#### 2.3 <u>Dewatering</u>

The Station Manager or the Production Manager shall be responsible for determining how repairs shall be accomplished and whether dewatering of the ash pond cells is necessary. Dewatering shall be accomplished by (a) manually removing the concrete stop logs from cell 4 of the ash pond system and (b) pumping of water from cell 1, or cell 2, or cell 3 to cell 4.

If water from cell 1, cell 2, or cell 3 must be <u>rapidly</u> drained to cell 4, the <u>internal</u> berm between cell 1 and cell 4, or between cell 2 and cell 4, or between cell 3 and cell 4 should be breached, but in a controlled manner. Only portions of a berm should be removed to maintain equalized water levels in cell 4. Breaching should be constantly manned and monitored by station personnel until water levels are equalized. Heavy equipment should be kept available so that, if excessive erosion of a berm begins to occur, berm materials can be replaced.

#### 3.0 Maintenance

#### 3.1. <u>Semiannual Inspections</u>

Semiannual inspections shall be conducted during optimal conditions at approximately six-month intervals to determine the general condition of the berms and discharge structure. Degradation of riprap, berm erosion, tree growth, animal burrows, and berm seepage shall be monitored during these inspections.

#### 3.2 Vegetation

Berms shall be maintained to protect the structural integrity of the ash ponds. Damaged and barren areas shall be repaired as soon as appropriate with topsoil, limed, fertilized, and seeded with appropriate vegetation. Refer to Appendix A for a repair design suggestion.

Trees and shrubs observed during semiannual inspections shall be cut and removed from the berms. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a 3-inch diameter. Low-growing vegetation that will not interfere with inspections shall be planted and maintained. Grass on the slopes of the berms should not be allowed to grow greater than 12 inches in height.

### 3.3. <u>Intermediate Standpipe Structures, Final Discharge Structure, and Effluent Piping</u>

Intermediate standpipe structures (which allow water to flow from cell to cell) shall be inspected semiannually for significant corrosion, scaling, etc. Structures significantly corroded shall be promptly repaired or replaced. Substantial deposits of scale shall be removed.

The final discharge structure shall be inspected semiannually for significant corrosion and for spalling and cracking of the concrete beams present in the structure. Any defects discovered shall be promptly repaired.

Effluent piping shall be inspected semiannually for excessive corrosion or scaling. Pipe which is significantly corroded shall be promptly replaced. Substantial scale deposits shall be removed. Effluent piping channels shall be inspected semiannual for seepage (infiltration) and corrosion. Excessive infiltration and corrosion shall be repaired.

Erosion of berms around the discharge structure or intermediate standpipe structures be promptly corrected by revetment with riprap or another erosion control method. Refer to Appendix A for a repair design suggestion.

#### 3.4. Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

#### 3.5 Restriction of Unauthorized Vehicles and Personnel

Berm approaches shall be posted with signs and the entire site enclosed by security fencing to prevent unauthorized travel on the roadways and slopes.

#### 3.6. Annual Inspection

An annual inspection shall be made by a licensed Professional Engineer. This inspection shall follow IDNR's "Guidelines and Forms for Inspection of Illinois Dams", and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with the recommendations of the consulting engineer and as outlined above. Copies of the engineer's report along with the corrective action taken shall be reported to the IDNR. An annual statement on forms furnished by the IDNR certifying compliance with the above maintenance plan shall be submitted to the IDNR.

### **Havana Station IDNR O&M Plan**



#### ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 – (217) 782-3397 James R. Thompson Center, 100 West Randolph, Suite 11-300, Chicago, IL 60601 – (312) 814-6026

DOUGLAS P. SCOTT, DIRECTOR

May 22, 2009

Mr. Rick Diericx Senior Director, Operations Environmental Compliance Dynegy Midwest Region Operations 604 Pierce Boulevard O'Fallon, Illinois 62269

Dear Mr. Diericx:

This letter is in response to Dynegy's "2008 Closure Work Plan Annual Report" (Annual Report) and cover letter for the Havana South Ash Pond System, received by the Illinois Environmental Protection Agency (Illinois EPA) on October 6, 2008.

In the cover letter, Dynegy requests that the Illinois EPA give written approval for the discontinuation of all Groundwater monitoring at the South Ash Pond site and provide a declaration of closure. Such action will cause the groundwater management zone (GMZ) established June 1996, in accordance with consent decree 89-CH-5, to expire.

Pursuant to 35 IAC 620.250(c):

A groundwater management zone expires upon the Agency's receipt of appropriate documentation which confirms the completion of the action taken pursuant to subsection (a) and which confirms the attainment of applicable standards as set forth in Subpart D.

The Annual Report provides data indicating that during the most recent five years of monitoring, four monitoring wells Well 04, Well 15, Well 23 and Well 25 have had boron and/or manganese concentrations higher than the Class I numerical groundwater standard. No other monitoring wells have exceeded the Class I numerical groundwater standards (35 IAC 620.410) during that time period.

Based on the data provided, Well 23 is within the outer most edge (620.240(f)(1)) of the closed impoundment. The applicable groundwater standard is Class IV groundwater. The Class IV groundwater standards are equal to existing concentrations (i.e. constituent concentrations must not increase). The monitoring data provided indicates that both boron and manganese concentrations show a decreasing trend in Well 23. Therefore, Well 23 appears to be in compliance with the applicable standards of 35 IAC 620.

ROCKFORD - 4302 North Main Street, Rockford, IL 61103 - (815) 987-7760

ELGIN - 595 South State, Elgin, IL 60123 - (847) 608-3131

DESPRINGFIELD - 4500 S. Sixth Street Rd., Springfield, IL 62706 - (217) 786-6892

MARION - 2309 W. Main St., Suite 116, Marion, IL 62959 - (618) 993-7200

DESPLAINES - 9511 W. Harrison St., Des Plaines, IL 60016 - (847) 294-4000

PECNIA - 5415 N. University St., Peoria, IL 61614 - (309) 693-5463

CHAMPAICN - 2125 South First Street, Champaign, IL 61820 - (217) 278-5800

COLUNSVILE - 2009 Mall Street, Collinsville, IL 62234 - (618) 346-5120

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While Well 25 is within 25 feet of the edge of the closed impoundment, available data indicates that the well is screened more than 15 feet below the base of the impoundment, and is therefore monitoring Class I groundwater. Wells 04 and 15 are down gradient and are also monitoring Class I groundwater. During the most recent five years of monitoring all three of these wells have had manganese concentrations higher than the Class I numerical groundwater standard.

Pursuant to 35 IAC 620.410(a)

Inorganic Chemical Constituents

Except due to natural causes or as provided in Section 620.450, concentrations of the following chemical constituents must not be exceeded in Class I groundwater:

Based on a review of the monitoring data provided and the conclusions of the 2002 EPRI report, the concentrations of manganese in these three wells appear to be due to natural aquifer conditions. Under these circumstances, Wells 04, 15 and 25 are in compliance with the applicable standards of 35 IAC 620.450(a)(4)(A), and no reporting pursuant to 35 IAC 620.450(a)(5) is required.

Based on the Illinois EPA's review and interpretation of the data submitted by Dynegy, the requirements of 35 IAC 620.250(c) have been satisfied. Therefore, the Havana South Ash Pond GMZ shall expire as of the date of this letter. The Havana South Ash Pond is considered to be closed and no further monitoring or reporting is required pursuant to the GMZ.

I trust this responds to your needs. If you have further questions or concerns please contact Lynn Dunaway of my staff or me at (217) 785-4787.

Sincerely,

William E. Buscher, P.G.

Supervisor, Hydogeology and Compliance Unit

Groundwater Section

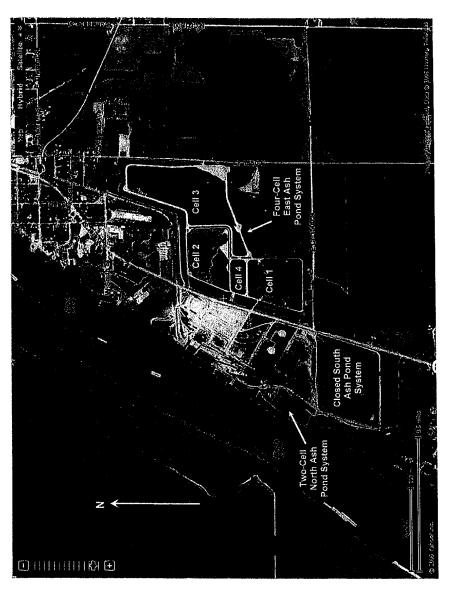
Division of Public Water Supplies

William 9. Pasches

Bureau of Water

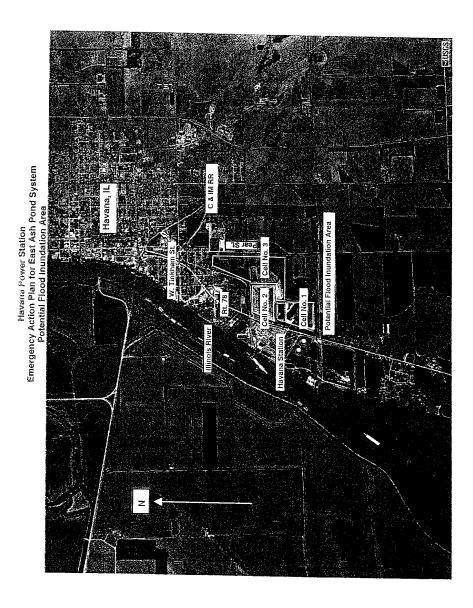
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Connie Tonsor, DLC Mike Garretson, CAS Lynn Dunaway Groundwater File



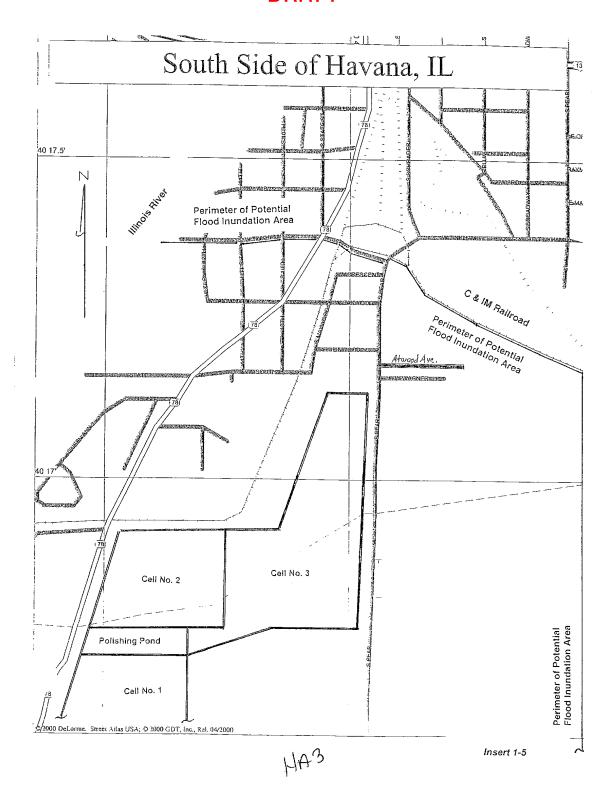
Havana Station Ash Pond Systems

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CC: Al Keller, BOW Permits

Connie Tonsor, DLC Mike Garretson, CAS Lynn Dunaway Groundwater File

HAS



**Design Calculations and Commentary** Submitted for a Dam Safety Construction Permit

> **Dynegy-Illinois Power** Havana Power Plant East Ash Pond #3

January 2002



Aavid M. Laskins 1/14/02 license expires 11/30/03

HAL

Design Calculations and Commentary Submitted for a Dam Safety Construction Permit

> Dynegy- Illinois Power Havana Power Plant East Ash Pond #3

January 2002

HAM

Design Calculations and Commentary Submitted for a Dam Safety Construction Permit

> Dynegy- Illinois Power Havana Power Plant East Ash Pond #3

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Wave Runup / Freeboard

Hydrology and Hydraulics

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Seepage

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Slope Stability Analysis

Soil Reports

Auxiliary Spillway Analysis

Maps

Introduction to Engineering Calcs. Havana Power Station East Ash Pond #3B September 14, 2001

This manual contains the engineering calculations for the #3B cell of the Havana Power Plant East Ash Pond system. This facility is owned and operated by Illinois Power Company of Decatur, Illinois, a subsidiary of Dynegy, Corp. Its construction will be very similar to the initial ponds of the east ash pond system built in 1992/93 under permit number 20748 and the pond system built in 1998/99 under permit number. The most significant change in construction between the #3B cell and the initial ponds will be the relative size of the new pond, with a storage volume over 2.2 million cubic yards.

The liner for cell #3B will consist of one foot of compacted glacial till clay brought in from off site covered with a 45-mil polypropylene geomembrane. The membrane is essentially impervious to water. The clay layer is to provide additional protection against seepage in the event of pinholes or seaming defects in the membrane. The ponds built in 1992/93 have a three-foot clay liner without a geomembrane.

The maximum toe to crest height for the cell #3B embankment is 34 feet.

Cell #3B will receive no stormwater runoff except for rain that falls directly on the cell or the top of the embankment. All plant waste streams currently going to cell #2 will be redirected to the new cell. These result in a maximum of 11.9-cfs flow into the pond. In an emergency, plant flows can be shut off in a relatively short time.

Outflow from cell #3B will go to the existing polishing pond. From there, the existing outlet works will carry the water to a backwater area of the Illinois River. The only new piping work is the standpipe in cell #3B that directs the outflow to the polishing pond.

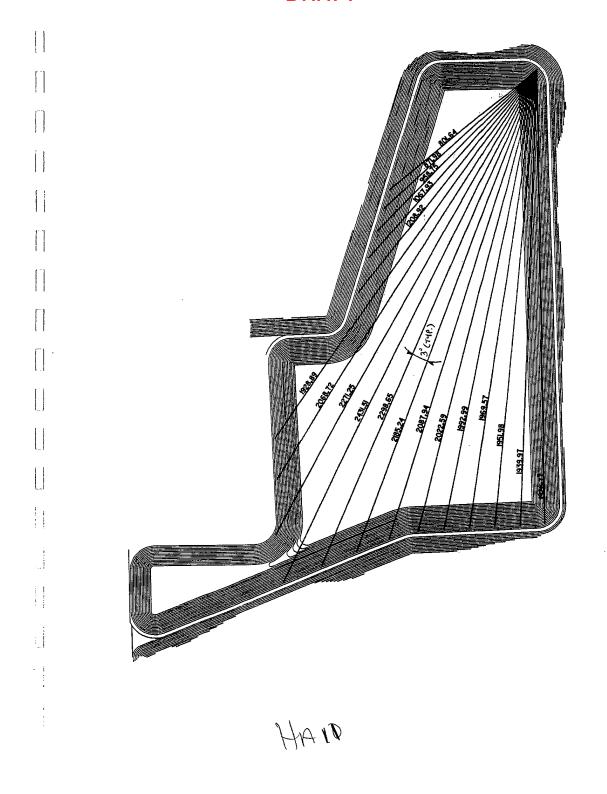
The accompanying project plans show the construction details for the new cell. The embankment will be constructed of the on-site soils compacted to no less than 95% of the Standard Proctor density. The clay liner will also be compacted to not less than 95% of Standard Proctor density. A competent inspector, who has experience in this type of work, will observe all construction. The inspector will be hired by the Owner and will be completely independent of the construction contractor. Furthermore, the Illinois Power Engineering Department will closely follow the project from start to finish.

These calculations are intended for submittal to the Illinois Department of Natural Resources, Office of Water Resources for a construction permit. They have been prepared in accordance with the following Office of Water Resources publications:

- 1. Rules for Construction and Maintenance of Dams
- 2. Procedural Guidelines for Preparation of Technical Data to be Included for Permits for Construction and Maintenance of Dams

The table of contents lists the scope of these calculations. They cover hydrology, hydraulics and geotechnical concerns. There are no components of this dam that require structural calculations.

The greatest risk to life and property in the event of a dam breach of the pond system is on State Highway 78 immediately west of cell #2, the power plant adjacent to the highway and the rural township road immediately east of cell #3B and the houses adjacent to the road. The main channel of the Illinois River is approximately ½ mile west of cell #3B. The risk to life and property along the Illinois River caused by a breach of cell #3B is very small.



#### Havana East Ash Pond #3B

#### Fetch Lengths for Wave Runup Analysis

Angle (degrees)	Length (ft.)	Length (mile)	cosine alpha	Length*cos. (mi.)
				ŀ
18	1928.89	0.365	0.951	0.347
15	2068.72	0.392	0.966	0.378
12	2271.25	0.430	0.978	0.421
9	2431.51	0.461	0.988	0.455
6	2298.65	0.435	0.995	0.433
3	2185.24	0.414	0.999	0.413
0	2087.94	0.395	1.000	0.395
3	2022.59	0.383	0.999	0.383
6	1992.99	0.377	0.995	0.375
9	1969.57	0.373	0.988	0.368
12	1951.98	0.370	0.978	0.362
15	1939.97	0.367	0.966	0.355
18	1928.77	0.365	0.951	0.347

Summations:

12.753

5.034

Feff. =

5.034/12.753 =

0.395 miles

61 AH

and relation

	Suk	ject: Wave Runup and Freeboard calculation for Pond #3B
	l.	Purpose:
		Calculate the maximum wave runup and freeboard required in Pond #3B of Havana East Ash Pond.
	II.	Assumptions, inputs and references:
		References:  1.) "Wave Runup and Wind Setup on Reservoir Embankments", U.S. Army Corps of Engineers, Office of the Chief of Engineers, ETL 1110-2-221, November 1976.
		2.) "Wave Characteristics, Wave Runup and Wind Setup Computational Model" program manual by B.R. Bodine, Corps of Engineers Southwestern Division, January 1986.  2. **Transport***  The Additional Model of Program and Tolder of Program and To
		<ul> <li>3.) Calculations done for Havana East ash pond #2</li> <li>4.) 100-yr, 24 hr. rainfall from Frequency Distributions of Heavy Rainstorms in Illinois, Illinois State Water Survey, 1989</li> </ul>
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11/02/01 Designer JHK Project No. Havana Project Subject: Wave Runup and Freeboard calculation for Pond #3B Methodology 111. Using the methodology outlined in Ref. 1 & 2, calculate the wave runup from the normal water elevation at 492' and check against the freeboard provided of 4' between top of dam at elevation 496' and water elevation of 492'. IV. Analysis and Results: Top of dam elevation= 496' Normal water elevation= 492' Pond bottom elevation= 455' Pond depth at toe of slope (elev. 492' - elev. 458') = 34' Embankment Slope of 3:1 Volume at elev. 492' = 1,993,412 cu. Yd = 53,822,129 cu. Ft. Area at elev. 492' = 1,928,963 sq. ft. 1-min. = 65 mph Max. overland winds: 1-hr. = 43 mph 2-hr. wind estimated at 96% of 1-hr. wind 2-hr. = 0.96\*43 = 41.3 mph . Maximum fetch = 0.395 mi. (See Excel Spreadsheet output) From fig. 11 of Ref. 1: 6-min. dur. - 58 mph 8-min. dur. - 28 mph 10-min. dur. - 17 mph From Ref.2: Using a  $U_{\rm p}$ = 65 mph design wind and  $F_{\rm eff.}$  = 0.395 mi.,  $U_A = 0.589(U_D)^{1.23}$  $=0.589(65)^{1.23}$ = 100 mph

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Subject: Wave Runup and Freeboard calculation for Pond #3B
     H_0 = 0.0301(U_A)F^{1/2}
         = 0.0301(100)0.395^{1/2}
         = 1.89'
      \mathsf{T} = 0.559[(\mathsf{U}_\mathsf{A})\mathsf{F}]^{1/3}
       = 0.559[(100)0.395]^{1/3}
        = 1.90 sec.
      L_0 = 5.12x(T^2) where L_0 = wave length
         = 5.12(1.90)^2
         = 18.56'
      L<sub>1</sub>/2 = 9.28' < avg. pond depth, therefore waves are not affected by bottom
      R_s = (H_0 \sin \theta)[(5.95 \tan \theta) + 1.5][0.123L_0/H_0]^a
      where a= (1.58-2.35 \tan \theta + 0.092 \cot \theta - 0.26)(H_0/d_s) and d_s = depth of water at toe of slope
                = [1.58-2.35(1/3) +0.092(3) -0.26](1.89/34')
                = 0.0452
      and \theta= embankment slope and tan \theta = 1/3
      R_s = (1.89' \sin 18.43')[(5.95/3) +1.5](0.123x18.56'/1.89')^{0.0452}
          = 2.10^{\circ}
      R_m = 1.517R_s
          = 3.18'
      Wind setup
       S = U^2F_u/1440D, where U= wind speed (mph), F_u = 2x(fetch distance) and D= avg. depth
       S = 68^{2}(2)(0.395)/1440x34' = 0.075'
       Maximum elevation = 3.18'+0.075'+ 492.68' (max. stage elev. from Havana1.out output)
                             = 495.93' ~ 496' (Acceptable, since location is only at one point with wind
                                                blowing in most critical direction and with maximum wind and
                                                stage elev.)
                         Wave Runup and Freeboard acceptable.
```



Hydrologic Analysis/ Spillway Analysis Havana Power Station East Ash Pond #3B November 7, 2001 JHK

The pond system meets the following two design criteria:

- 1. For the main spillway, a 100-yr., 24-hr. storm plus maximum plant flow must be safely routed through the pond system. This equals a 7-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).
- For the emergency spillway, a storm equal to one-half the PMP storm plus maximum plant flow must be safely routed through the pond system. One half the PMP equals a 16-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).

For the pond system, the main spillway and emergency spillway are the same. Standpipes in ponds 1, 2 and 3B, discharge into pond 3. A stoplog structure in pond 3 discharges into an underground 36-inch RCCP that carries the water to the Illinois River. With the exception of the standpipe in the proposed pond 3B, all the outlet structures are existing.

As part of the construction of the new pond, a secondary emergency spillway will be added between ponds 3B and 3. This spillway will be a concrete-lined overflow spillway. It would receive flow only if the 36-inch pipe between ponds 3B and existing pond 3 should become blocked.

From the HEC-1 computer program, the following results were obtained. The HEC-1 runs were run using both the maximum pipe discharge capacity and the pipe discharge capacity based on weir equation. For the ½ PMP storm, the stoplog discharge capacity was based on the weir with end contractions equation. The maximum pond elevations for the 100-yr. storm are below the maximum pond level, as established by wave run-up and setup calculations. It is assumed that wave action will be limited during a ½ PMP storm.

Pond	½ the PMP storm max. elevation (feet)	max. discharge (cfs)
1	486.92	23
2	486.57	35
3B	493.17	40
3	486.79	93
Pond	100-yr., 24-hour storm max. elevation (feet)	max. discharge (cfs)
1	486.41	8
2	486.21	19
3B	492.68	18
3	485.63	42
	VLA 180	

#### References used:

- Frequency Distributions of Heavy Rainstorms in Illinois, Illinois State Water Survey, 1989.
- 2. Effects of Basin Rainfall Estimates on Dam Safety Design in Illinois, Illinois State Water Survey, Surface Water Division, 1981.

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#### Stage-Storage Relationship- Pond 1 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
486.00	0.00	20.93
486.50	10.53	21.17
487.00	21.17	21.42
487.50	31.94	21.66
488.00	42.84	21.91
488.50	53.85	22.15
489.00	64.98	22.39
489.50	76.24	22.64
490.00	87.62	22.88

Normal pool elevation:

486'

Area at normal elevation:

20.93 acres = 911,818 sq. ft.

Max. pool elevation:

Nor

490'

Area at max. elevation:

22.88 acres = 996,705 sq. ft.

Stage-Discharge Relationship- Pond 1 at Havana Power Station

Weir Equation	Input
Q = CLH^1.5	D= dia. of standpipe = 30"
L= PI*D	H= head increment
C- 2 22	

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	486.00	0.00	0.00	
	486.50	0.50	9.25	
	487.00	1.00	26.15	
pipe flow begins	487.50	1.50	48.05	
	488.00	2.00	73.97	
	488.50	2.50	103.38	
	489.00	3.00	135.90	
	489.50	3.50	171.25	
	490.00	4.00	209.23	

Normal pool elevation: 486'

Area at normal elevation:

20.93 acres = 911,818 sq. ft.

Max. pool elevation:

490'

Area at max. elevation:

22.88 acres = 996,705 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.0' head of water. This is conservative for pipe evaluation.

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#### Stage-Discharge Relationship- Pond 2 at Havana Power Station

 Weir Equation
 Input

 Q = CLH^1.5
 D= dia. of standpipe = 36"

 L= PI\*D
 H= head increment

 C= 3.33
 H= head increment

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	485.50	0.00	0.00	
	486.00	0.50	11.10	
	486.50	1.00	31.38	
pipe flow begins	487.00	1.50	57.66	
	487.50	2.00	88.77	
	488.00	2.50	124.06	
	488.50	3.00	163,08	
	489.00	3.50	205.50	
	489.50	4.00	251.08	
	490.00	4.50	299.59	

Normal pool elevation:

486'

Area at normal elevation:

19.4 acres = 845,135 sq. ft.

Max. pool elevation:

490'

Area at max. elevation:

20.48 acres = 891,891 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.

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#### Stage-Storage Relationship- Pond 2 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)	
486.00	0.00	19.40	
486.50	9.73	19.54	
487.00	19.54	19.67	
487.50	29.40	19.80	
488.00	39.34	19.94	
488.50	49.34	20.07	
489.00	59.41	20.21	
489.50	69.55	20.34	
490.00	79 75	20.48	

Normal pool elevation:

486'

Area at normal elevation:

19.40 acres = 845,135 sq. ft.

Max. pool elevation:

490

Area at max. elevation;

20.48 acres = 891,891 sq. ft.

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Stage-Discharge Relationship- Pond 3B at Havana Power Station

Q = CLH^1.5 L= PI\*D C= 3.33

D= dia. of standpipe = 36" H= head increment

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	492.00 492.50	0.00 0.50	0.00 11.10	
pipe flow begins	493.00 493.50 494.00	1.00 1.50 2.00	31.38 57.66 88.77	
	494.50 495.00 495.50 496.00	2.50 3.00 3.50 4.00	124.06 163.08 205.50 251.08	

Normal pool elevation:

492'

Area at normal elevation:

44.28 acres = 1,928,963 sq. ft.

Max. pool elevation:

496'

Area at max. elevation:

46.28 acres = 2,016,020 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.

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#### Stage-Storage Relationship- Pond 3B at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)	
492.00	0.00	44.28	
492.50	22.20	44.53	
493.00	44.53	44.78	
493.50	66.98	45.03	
494.00	89.56	45.28	
494.50	112.26	45.53	
495.00	135.09	45.78	
495.50	158.04	46.03	
496 00	181 12	46 28	

Normal pool elevation:

492'

Area at normal elevation:

44.28 acres = 1,928,963 sq. ft.

Max. pool elevation:

496'

Area at max. elevation:

46.28 acres = 2,016,020 sq. ft.



#### Stage-Discharge Relationship- Polishing Pond 3 at Havana

#### Weir Equation

Q = 3.33\*L\*H^1.5 L= Weir length= 6'

 $Q1 = 3.33*(L-0.2*H)*H^1.5$ 

Weir length adjusted to account for end contractions

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Elevation (ft)	Head (ft)	Q (cfs)	)   Od (efe)
	7,104,4 (71)	G (C/S)	Q1 (cfs)
484.00	0.00	0.00	0.00
484.50	0.50	7.06	6.95
485.00	1.00	19.98	19.31
485.50	1.50	36.71	34.87
486.00	2.00	56.51	52.74
486.50	2.50	78.98	72.40
487.00	3.00	103.82	93.44
487.50	3.50	130.83	115.56
488.00	4.00	159.84	138.53
488.50	4.50	190.73	162.12
489.00	5.00	223.38	186.15
489.50	5.50	257.71	210.47
490.00	6.00	293.64	234.92

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#### Stage-Storage Relationship- Pond 3 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
•		
484.50	0.00	4.70
485.00	2.36	4.76
485.50	4.76	4.82
486.00	7.18	4.88
486.50	9.64	4.94
487.00	12.12	5.00
487.50	14.63	5.05
488.00	17.17	5.11
488.50	19.75	5.17
489.00	22.35	5.23
489.50	24.98	5.29
490.00	27.64	5.35

Normal pool elevation:

484.5'

Area at normal elevation:

4.70 acres = 204,790 sq. ft.

Max. pool elevation:

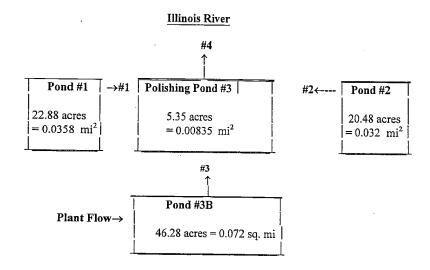
490'

Area at max. elevation:

5.35 acres = 232,886 sq. ft.

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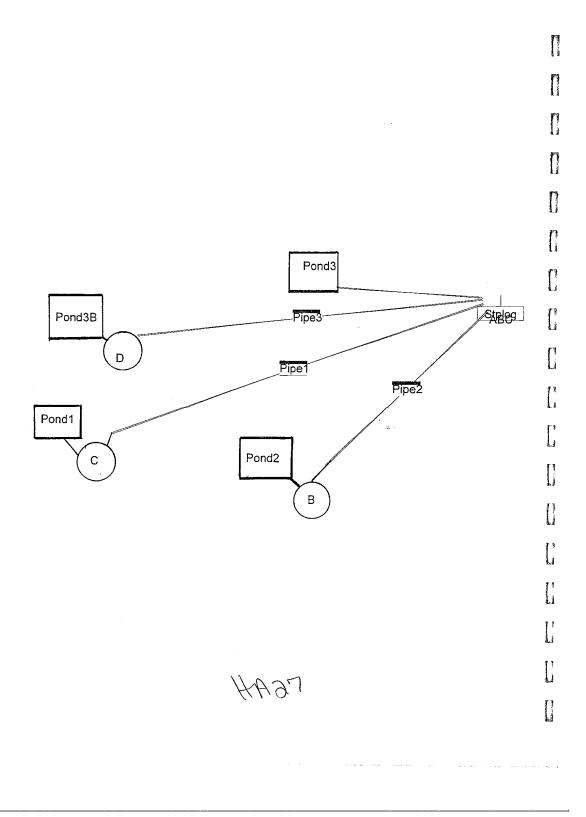
#### **Principal Outlet Design**



- #1- 30" standpipe discharging into bottom of Polishing Pond
- #2- 36"φ pipe between Pond #2 and Polishing Pond
- #3- 36" standpipe between Pond #3B and Polishing Pond
- #4- 6' wide stop log structure and 36" φ RCCP to Illinois River

For 24-hr. events, plant flow = 11.9 cfs (7.70 MGD)

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# **US EPA ARCHIVE DOCUMENT**

**************************************	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	13), HECIGS, HECIDB, AND HECIKW. USED WITH THE 1973-STYLE INDUT STRUCTURE. SEP 81. THIS IS THE FORTEAN77 VERSION NO AMET INFILTRATION	PAGE 1			0.0073 0.0083 0.0094 0.0185 0.0196 0.0208 0.0307 0.0319 0.0332 0.0482 0.0452 0.0466 0.0583 0.0598 0.0614 0.0747 0.0764 0.0782
***  havanal.out  *  *  *  *  *  *  *  *  *  *  *  *  *	X XXXXXX XXXXXXX X X X X X X X X X X X	S PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HECIGS, HEC1DB, AND HECIKW. DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTY DEFINITION OF "AASKEN ON RAI-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRANTY VERSION OPTIONS: DAMBREAK OUTEOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:HRITE STAGE FREQUENCY, READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION	HEC-1 INPUT		0 0 1 22 N94 0	0.002 0.0031 0.0041 0.0051 0.0052 0.0127 0.0138 0.015 0.0161 0.0173 0.0244 0.0257 0.0265 0.0281 0.0281 0.0294 0.0371 0.0384 0.0598 0.0411 0.0425 0.0508 0.0553 0.0568 0.0652 0.0568 0.0712 0.073 Pade 1.
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# **US EPA ARCHIVE DOCUMENT**

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SCS LOSS RATE  SCS LOSS RATE  SCS LOSS RATE  TLAG  SCS DIMENSIONLESS UNITGRAPH  TLAG  STATU  SCS DIMENSIONLESS UNITGRAPH  TLAG  SCS DIMENSIONLESS UNITGRAPH  ****	SCS LOSS RATE  SCS LOSS RATE  TIAG  SCS DIMENSIONLESS UNITGRAPH  TLAG  CO 0.00 0.15 LAG  ***  CO 0.00 0.15 LAG  ***  CO 0.00 0.10 0.10 0.10 0.10 0.10 0.10 0.1	SCS LOSS RATE  STATL  CAVIDE  SCS DIMENSIONLESS UNITGRAPH  TLAG  TLAG  COO 0.00  COO 0	SCS LOSS RATE STRILL ST	SCS LOSS RATE STRTL CRINBR 100.00 PERCENT IMPERVIOUS AREA SCS DIMENSIONLESS UNITGRAPH TLAG CLUB CLUB CLUB CLUB CLUB CLUB CLUB CLUB	SCS LOSS RATE  STATL  CAVIDER  SCS DIMENSIONLESS UNITGRAPH  TLAG  C. 10	SCS LOSS RATE  STRIL  CRUBS INDICESS UNITGRAPH  SCS DIMENSIONLESS UNITGRAPH  TLAG  STATA  SCS LAGS  SCS LAGS  SCS LAGS  STATA  SCS LAGS	SCS DIMENSIONLESS UNITGRAPH  0.00  0	SCS LOSS RATE  STRIL  CVNJBR  TIMP  TO 00 00 00 00 00 00 00 00 00 00 00 00 00
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0.14 0.19 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01	0.14 0.19 0.03 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01
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0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	SCS LOSS RATE  SCS LOSS RATE  SCS DIMENSIONLESS UNITGRAPH  SCS DIMENSIONLE	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	CONTRACTOR	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
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0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	SCS LOSS RATE  SCS DIMENSIONLESS UNITGRAPH  0.000	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
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INCREMENTAL PRECIPITATION PATTERN  0.00  0	INCREMENTAL PRECIPITATION PATTERN  0.00  0	INCREMENTAL FRECIPITATION PATTERN   0.00	INCREMENTAL PRECIPITATION PATTERN  0.00  0	INCREMENTAL PRECIPITATION PATTERN  0.00  0	INCREMENTAL FRECIPITATION PATTERN   0.00	INCREMENTAL PRECIPITATION PATTERN  0.00  0	INCREMENTAL PRECIPITATION PATTERN   0.00	INCREMENTAL PRECIPITATION PATTERN  0.00  0
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NUCREMENTAL FRECIPITATION PATTERN	INCREMENTAL FRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	NUCREMENTAL FRECIPITATION PATTERN   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00   0.00	PI INCREMENTAL FRECIPITATION PATTERN  0.00	INCREMENTAL FRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	NUCREMENTAL FRECIPITATION PATTERN   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00   0.00	INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	INCREMENTAL FRECIPITATION PATTERN  0.00  0	NUCREMENTAL PRECIPITATION PATTERN   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00 BASIN TOTAL PRECIPITATION   1.00   0.00
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NCEMEMENTAL PRECIPITATION   PATTERN   O.00	NCEMEMENTAL PRECIPITATION   PATTERN   O.00	PH INCREMENTAL PRECIPITATION  PI 1 NUCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PI INCREMENTAL PRECIPITATION  PI 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	INCEMENTAL FRECIPITATION  INCEMENTAL FRECIPITATION  O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	STORM  INCREMENTAL PRECIPITATION  O.00  O.	STORM INCREMENTAL PRECIPITATION  10.00  0.	STORM  INCREMENTAL FRECIPITATION  INCREMENTAL FRECIPITATION  0.00	STORM INCREMENTAL PRECIPITATION  10.00  0.
INCREMENTAL FRECIPITATION DATA  STORM  7.00 BASIN TOTAL PRECIPITATION  1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	INCREMENTAL PRECIPITATION DATA  STORM  7.00 BASIN TOTAL PRECIPITATION  1.00 Co.00 0.00 0.00 0.00 0.00 0.00 0.00	PH STOCKH 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PB STORM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL FRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	INCREMENTAL PRECIPITATION DATA  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL FRECIPITATION PATTERN  0.00	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
NUCREMENTAL PRECIPITATION   PATTERN	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PE STORM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PH STORM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	NUCREMENTAL PRECIPITATION   PATTERN	STORM 7.00 BASIN TOTAL PRECIPITATION  NOTEMBRITAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL FRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	NUCREMENTAL PRECIPITATION   PATTERN	STORM 7.00 BASIN TOTAL PRECIPITATION  NOTEMBRITAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
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NUCREMENTAL PRECIPITATION DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	NCTEMENTAL PRECIPITATION DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  0.00	PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	NCTEMENTALION DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	NCREMENTAL PRECIPITATION DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	NUMBERSON DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	NCTEMENTALION DATA   STORM   7.00 BASIN TOTAL PRECIPITATION	NCREMENTAL PRECIPITATION   PATERN   1000   PASIN TOTAL PRECIPITATION   1000   0.00
STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCEMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  NOTEMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	STORM	STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	NUMBER   PRECIPITATION DATA   STORM   T.00 BASIN TOTAL PRECIPITATION	STORM 7.00 BASIN TOTAL PRECIPITATION  NOTEMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
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TAREA, 0.04 SUBBASIN AREA  STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	TAREA, 0.04 SUBBASIN AREA  STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	TAREA, 0.04 SUBBASIN AREA  PRECIPITATION DATA  STORM 7.00 BASIN TOTAL PRECIPITATION  1 INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	TAREA, 0.04 SUBBASIN AREA  STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	TAREA, 0.04 SUBBASIN AREA  STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	FRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.0	FRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.0	TAREA, 0.04 SUBBASIN AREA  STORM 7.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	FRECIPITATION DATA  STORM  TOO BASIN TOTAL FRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.0
FRECIPITATION DATA  FIG. SUBBASIN AREA  PRECIPITATION DATA  TINCREMENTAL PRECIPITATION  TOO 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	FRECIPITATION DATA  FIG. SUBBASIN AREA  PER STORM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	FRECIPITATION DATA  FEB STOCKM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	FRECIPITATION DATA  PH STORM TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	FRECIPITATION DATA  FINCREMENTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	PRECIPITATION DATA  STORM  STORM  1.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PRECIPITATION DATA  STORM  TAREA,  TAREA,  TAREA,  TAREA,  STORM  TO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION  TO 0.00  0.00	PRECIPITATION DATA  STORM  STORM  TAREA,  TAREA,  STORM  TO 0 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.	PRECIPITATION DATA  STORM  1 NOTEMBRITAL PRECIPITATION  1 NOTEMBRITAL PREPARATION  1 NOTEMBRITAL PROPERTY IMPERVICES ARRANGED PROPERTY IMPERVIEWS ARRANGED PRO
PRECIPITATION DATA  PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  PI O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	PHECIPITATION DATA  PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  PI O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	PE STORM CHARACTERIZIUS  TARBA, PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI OCO 0.00 0.00 0.00 0.00 0.00 0.00 0.00	PRECIPITATION DATA  TARRA, PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI OLOG 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PRECIPITATION DATA  TARBA, PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION  PI OCO 0.00 0.00 0.00 0.00 0.00 0.00 0.00	PRECIPITATION DATA  STORM  T.00 BASIN TOTAL PRECIPITATION  INCHEMENTAL PRECIPITATION  O.00   PRECIPITATION DATA  STORM  T.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION  TOTAL DATA  T.00 BASIN TOTAL PRECIPITATION  TOTAL DATA  T.00 C.00 C.00 C.00 C.00 C.00 C.00 C.00	PRECIPITATION DATA  STORM  TAREA, 0.04 SUBBASIN AREA  FRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION  TOO 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	PRECIPITATION DATA  STORM  10.04 SUBBASIN AREA  FRECIPITATION DATA  STORM  10.05  10.00  10.0	
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PH STOREM CHARACTERISTICS  PH STOREM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PH STOREM CHARACTERISTICS  PH STOREM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION DATA  PI OCCUPIO 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PH STOREAL CHARACTERISTICS  PH STOREAL TAREAL O.04 SUBBASIN AREA PRECIPITATION  PI NICHEMENTAL PRECIPITATION DATA  PI OLOGO 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	PHECIPITATION DATA  PER STORM 7.00 BASIN TOTAL PRECIPITATION  PI NCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Parecial Characteristics   Parecial Characteri	PRECIPITATION DATA  STORM  INCREMENTAL PRECIPITATION PATTERN  0.00	FRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.0	PRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  NO.00  0	PRECIPITATION DATA  STORM  TINCEMENTAL PRECIPITATION  10.00  0.00
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PH STOREM CHARACTERISTICS  PH STOREM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION DATA  PI OCO 0.00 0.00 0.00 0.00 0.00 0.00 0.00	PH STOREAL CHARACTERISTICS  PH STOREAL TAREAL O.04 SUBBASIN AREA  PRECIPITATION DATA  PI INCREMENTAL PRECIPITATION  PI O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	PH SUBBASIN CHARACTERISTICS  PH STORM 7.00 BASIN TOTAL PRECIPITATION  PI INCREMENTAL PRECIPITATION DATA  PI OCO 0.00 0.00 0.00 0.00 0.00 0.00 0.00	PH SUBBASIN CHARACTERISTICS  TAREA, 0.04 SUBBASIN AREA  PRECIPITATION DATA  STORM 7.00 BASIN TOTAL PRECIPITATION  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PHECIPITATION DATA  PRECIPITATION DATA  STORM  TAREA,  TOO BASIN TOTAL PRECIPITATION  PI  INCREMENTAL PRECIPITATION PATTERN  0.00  0	PRECIPITATION DATA  STORM  TINCEREMENTAL PRECIPITATION  O.00   FRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00  0.0	PRECIPITATION DATA  STORM  TOO BASIN TOTAL PRECIPITATION  1 NCREMENTAL PRECIPITATION PATTERN  0.00  0.	PRECIPITATION DATA  STORM  STORM  TOO BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION  STORM  TOO 0.00  0.00	
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# **US EPA ARCHIVE DOCUMENT**

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	TYPE OF INITIAL CONDITION	181.1	496.00	58.		* * * * *													
	PE OF I			58.		***													1
	ELEV T	158.0	495.50	š		* * * * * * *													- Constitution of the
	0.	135.1	495.00	58.		***													No. of Concession, Name of Street, or other Persons, Name of Street, or ot
	ITYP	112.3	494.50	58.															- Characteristics
		9.68	494.00	58.		* * *													
	ŢNS	67.0		58.	* *	*** *** ***					PRINT CONTROL HYDROGRAPH PLOT SCALE FOUNCH COMPUTED HYDROGRAPH FOUNCH COMPUTED HYDROGRAPH FOUNCH COMPUTED HYDROGRAPH FOUNCH HYDROUNT FIRST ORDINATE PUNCHED OR SAVED LAST ONDINATE PUNCHED OR SAVED FINE INTERVAL IN HOURS	Ø			NO		NO	Page 12	of the same of the
	HES/ N COEFFICIE		0 493.50		*	* * * * * * *					PRINT CONTROL HYDOCGRAPH PLOT SCALE POWCH COMPUTED HYDROGRAPH PUNCH COMPUTED HYDROGRAPH FINST HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVEI LAST ORDINATE PUNCHED OR SAVEI TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	Pa	The same of the sa
	SUBREAC CONDITIC	44.5	493.00	31.		* * * * * * *					PRINT CONTROL HYDOT CONTROL HYDOGRAPH PLOT SCALE PUNCH COMPUTED HYDROGE PUNCH COMPUTED HYDROGE PINST GNEDINATE PUNCHED LAST ORDINATE PUNCHED TIME INTERVAL IN HOURG	TERVAL I G DATE G TIME		N AREA	FLOW ASE FLOW ON CONST		OTAL PRE		
	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	22.2	492.50	11.		* * * * *								SUBBASIN AREA	S INITIAL BEGIN B RECESSI		BASIN		
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ROUTING	ROUTING FPS RIC X	ш		ы		* * * *	,		* +	· *	T CONTROL V IPRNT IPLOT GSCAL IPNCH IOUT ISAVI ISAVZ	DATA FOR IN JXMIN JXDATE	UNOFF DE	I CHARACI	TLOW CHARAC STRTQ QRCSN RTIOR	PRECIPITATION DATA	STORM		1
HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE		* * * *	***************************************	<	Pond3	******	OUTPUT C SE OS I I I SE I SE I SE I SE I SE I SE	TIME DAS XX JXI TXT	SUBBASIN RUNOFF DATA	SUBBASIN TA	BASE FLO SI QF RI	PRECIPIN	ເຮ		*
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	117 RS	118 SV	119 SE	120 SQ		* * *			121 KK		122 KO	126 IN		123 BA	124 BF		125 PB		
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havand	000000000000000000000000000000000000000	CTION COUS AREA		*	UNIT HYDR ND-OF-PERI 0.			RAPI IS I D OI OR S	NUMBER OF HYDROGRAPHS TO COMBINE
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	PAGE 12 TATATION PATTERN O.0 0 0.00 0.00 0.00 0.00 0.00 0.00 0.		GRAPH			* * * * *	Stplog		4 NUMBE
		0.00 100.00	DIMENSIONLESS UNITGRAPH TLAG 0.15 LA		4	* * * * * *	CNAME	VARIAE	MBINATION,
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, ,		152 LS	153 UD			* * * * * * * * * * * * * * * * * * *	154 KK	155 KO	156 HC

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NUMBER OF HYDROGRAPHS TO COMBINE \*\*\*
Page 13

	*****											
157 KK	* Stplog * * * * * * * * * * * * * * * * * * *		CNAME	ABC								
158 KO	OUTPUT CONTROL VARIABLES IPPLOT 0 QSCAL 0. IPNCH 0. IOUT 22 ISAVI 1 ISAV2 160 TIMINT 0.167	CONTROL V PRNT PLOT SCAL PNCH PNCH IOUT SAV1 SAV2	ARIABLES 4 0 0. 22 1160		PRINT CONTROL HYDROGRAPH FLOT SCALE HYDROGRAPH PLOT SCALE FONKE COMPUTED HYDROGRAPH SANYE HYDROGRAPH FIRST ORDINATE PUNCHED ON SAN LAST ORDINATE PUNCHED OR SAN TIME INTERVAL IN HOURS	PRINT CONTROL HYDROGRAPH PLOT SCALE FONCH COMPUTED HYDROGRAPH FYNEY HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED THE INTERVAL IN HOURS	0 0					
	HYDROGRAPH ROUTING	ROUTING	DATA									
159 RS	STORAGE ROUTING NSTPS RSVRIC X	OUTING PS IC X	1 N 484.00 0.00 W	NUMBER OF SUBREACH INITIAL CONDITION WORKING R AND D CO	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	s/ FICIENT		TYYP.		ELEV TYPE C	TYPE OF INITIAL CONDITION	Ö
160 sv	STORAGE		0.0	0.0	2.4	4.8	7.2	9.6	12.1	14.6	17.2	
162 SE	ELEVATION		484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
164 SQ	DISCHARGE		0.	7.	20.	37.	56.	.66	104.	131.	160.	
166 SE	ELEVATION		484.00 489.00	484.50 489.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
				į.		* *						
	STORAGE OUTFLOW ELEVATION 48	0.00 0.00 484.00	0.00 7.06 484.50	2.36 20.00 485.00	<u> </u>	STORAGE-OUTFLOW-ELEVATION DATA 4.76 7.18 9.64 36.70 56.50 79.00 485.50 486.00 486.50	LEVATION D 9.64 79.00 486.50	12.12 103.80 487.00	14.63 130.80 487.50	17.17	19.75 190.70	
	STORAGE 22: OUTFLOW 22: ELEVATION 48!	22.35 223.40 489.00	24.98 257.70 489.50	27.64 293.60 490.00								
				TIME	RUN FLOW IN CUB TIME IN HOURS,	ää	FF SUMMARY FEET PER SECOND AREA IN SQUARE MILES Page 14	ស្ន				

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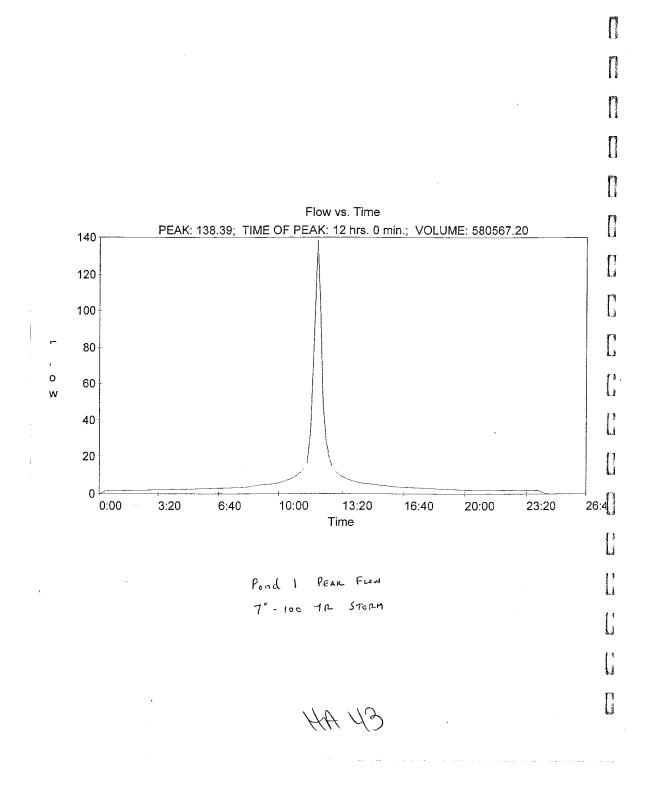
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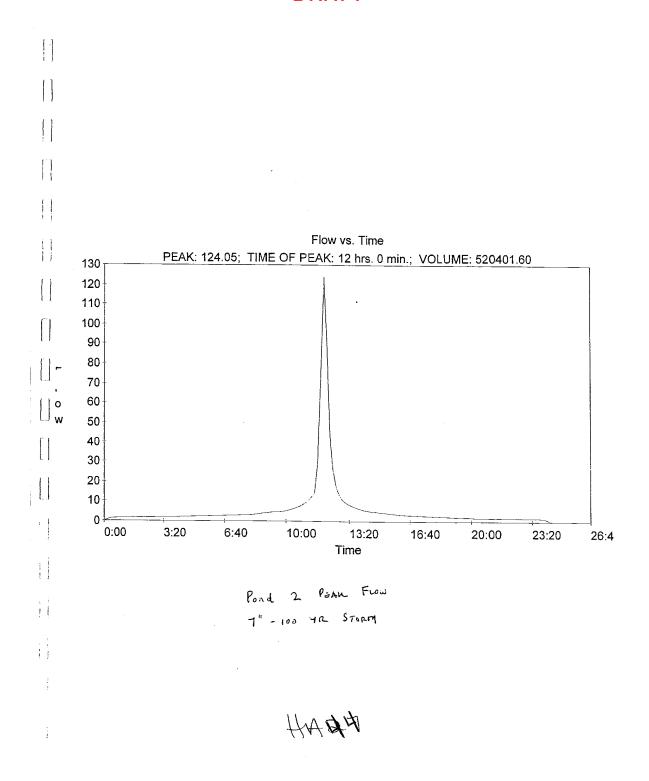
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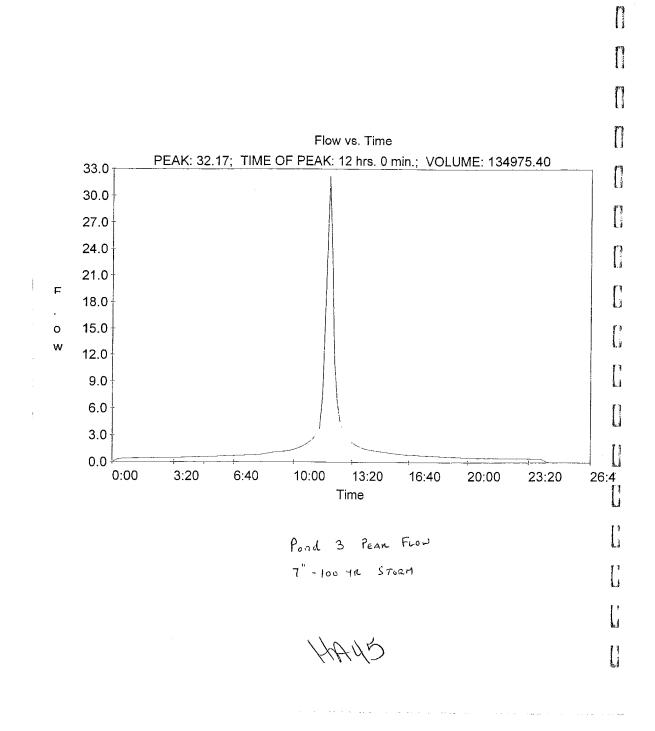
		TIME OF	MAX STAGE		13.67		12.67		17.50			15.17
		MAXIMUM	STAGE		486.41		486.21		492.68			485.63
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		JM PERIOD	72-HOUR	6	4.	ហ	12.	24.	11.	ä	29.	27.
	1.out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	7.	4.	6.	12.	25.	12.	2,	30.	28.
	havanal.out	AVERAGE FL	6-HOUR	19.		17.	15.	50.	18.	4.	43.	40.
		TIME OF	NEG 3	12.00	13.67	12.00	12.67	12.00	17.50	12.00	12.00	15.17
And the second s		PEAK	2	138.	φ.	124,	19.	291.	18.	32.	62.	42.
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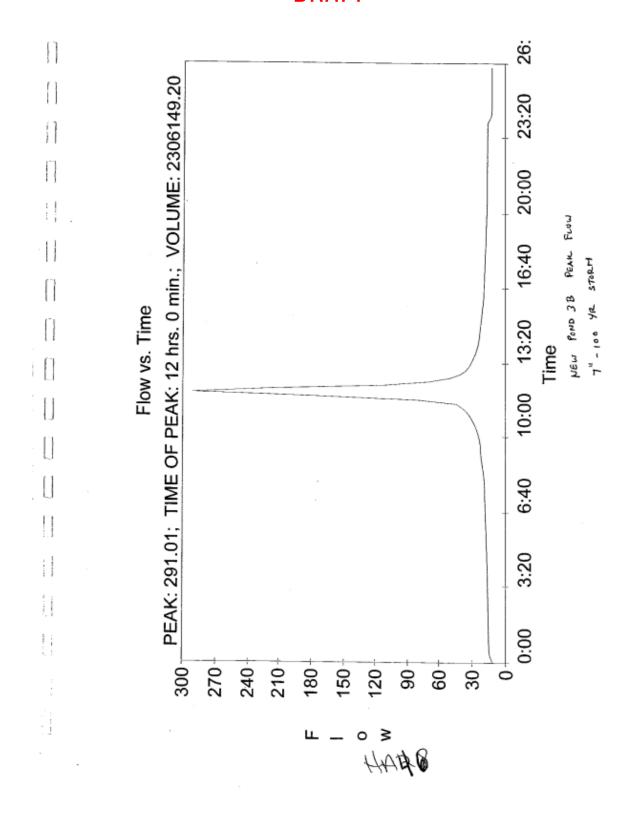
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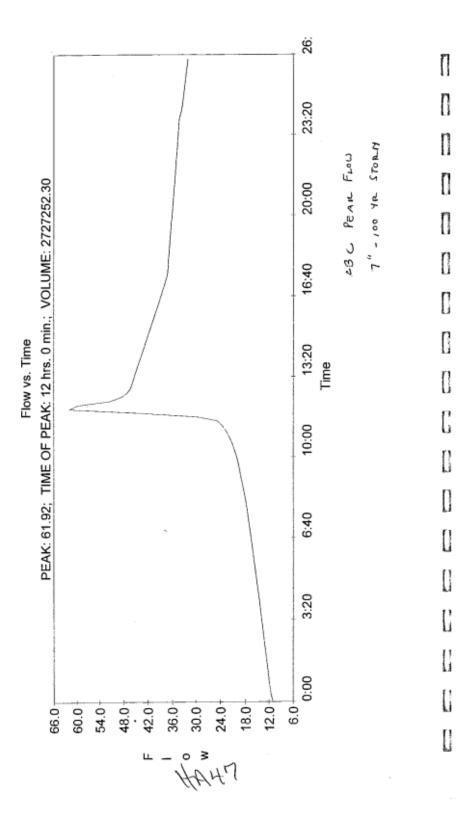


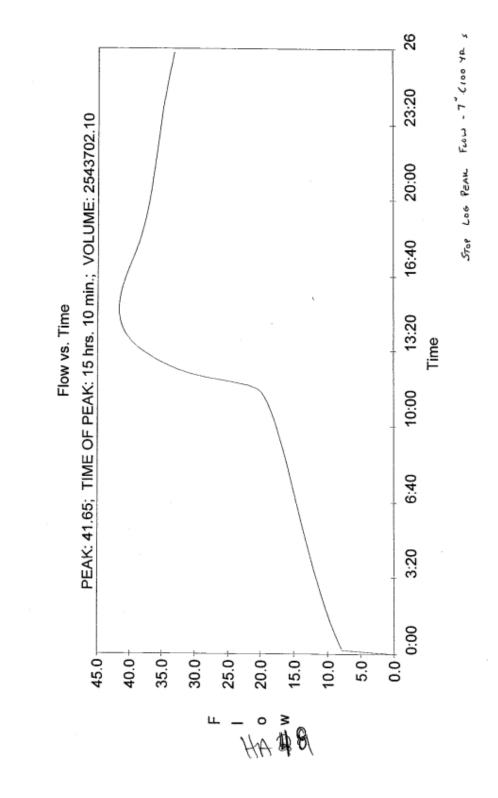




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U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 551-1748	9	PLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS REC1 (JAN 73), HECIGS, HECIDS, AND HECIKN.  OF VARIABLES -RYIMP- AND -RYIOR- HAVE CHAMSED FROW THOSE USED WITH THE 1973-STYLE INPUT STRUCT DF -AMSTK- ON PA-CAND MAS CHANGED WITH REVISIONS DATED 28 SEP 01. THIS IS THE FORTRANTY VERSION HERRAK OUTSION SUBMEGGINE, SINGLE EVENT DAMAGE CALCILATION, DSS.WRITE STRUE FREQUENCY, REHES AT DESIRED CALCULATION INTERVAL LOSS BATE:GREEN AND AMPT INFILTRATION	PAGE 1				
. ARMY OC ROLOGIC E 609 SE DAVIS, CY (9161	100 YR ST Discharge	DB, AND STALE THE FORT	10			0.0094 0.0208 0.0332 0.0466 0.0514	
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	havana2.out		# INTERVAL			:		RAPH Page 6
	른	OF SCALS	MPUTATION ROGRAPH (		GNO	:		7 SCALE HYDROGRA
U		PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE	MINUTES IN COMPUTATION INTERVAL STARTING DATE SPARTING TIME NUMBER OF HYDROGRAPH ORDINATES ENDING TIME ENDING TIME	0.17 HOURS 26.50 HOURS	SOURRE MILES FRET FRET PER SECOND ACRE-FEET ACRES FAHRENHEIT	:		PELIN COMPROL PLOT COMPUTED NYDROGRAPH PUNCH COMPUTED NYDROGRAPH PUNCH COMPUTED NYDROGRAPH
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		'N AREA			PRN 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00 0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA				* * * *			PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PAGE	
		S S SUBBASIN AREA		DASIN TOTAL	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.		UNITGRAPH 0.15 LAG		ιń	***	£			The state of the s
	DATA	SUBBASIN CHARACTERISTICS TAREA, 0.03	DATA	7.00		0.00 100.00 100.00	TESS UNIT		15.	***	C PAGE	Juman's	OUTPUT CONTROL VARIABLES 1 PROT 0 QSCAL 0. I PNCH 0	
	SUBBASIN RUNOFF DATA	BASIN CHAR TAREA,	PRECIPITATION DATA	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG		49.	* * * * * *	* * * * C * () * :	* * * * * * * *	PUT CONTRC IPRNT IPLOT QSCAL IPNCH	
	SUBBAS	SUBE	PREC		Ħ	SCS	SCS		54.	* * *	* * * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * * *	TOO	
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IOUT 22 SAVE HYDROGRAPH ON THIS UNIT ISAVI I FIRST ORIDINATE PUNCHED OR SAVED ISAVZ 160 LAST ORDINATE PUNCHED OR SAVED TIMINT 0.167 TIME INTERVAL IN HOURS	HYDROGRAPH ROUTING DATA	RAGE ROUTING 1 NUMBER OF SUBREACHES/ 1TYP ELEV TYPE OF INITIAL CONDITION RSVRIC 486.00 INITIAL CONDITION X 0.00 WORKING R AND COEFFICIENT	TORAGE 0.0 9.7 19.5 29.4 39.3 49.3 59.4 69.6 79.7	CHANGE 11. 31. 58. 89. 124. 163. 205. 251. 300.	VATION 486.00 486.50 487.00 487.50 488.00 488.50 489.00 489.50 490.00	***	******	* 13B * New proposed ash pond * * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES  IPRNT 0 PLOT CONTROL  IFLOT 0 PLOT CONTROL  OSCAL 0 HYDROGRAPH FLOT SCALE  IRNCH 1 PUNCH COMPUTED HYDROGRAPH  IOUT 22 SARE HYDROGRAPH ON THIS UNIT  ISAVI 1 FIRST ORDINATE PUNCHED OR SAVED  TIMINT 0.167 TIME INTERVAL IN HOURS	DATA FOR INPUT TIME SERIES  JXMIN 6 TIME INTERVAL IN MINUTES JXDATE 1JAN94 STARTING DATE JXTIME 0 STARTING TIME	IN RUNOFF DATA	SUBBASIN CHARACTERISTICS TARGA, 0.07 SUBBASIN AREA	FLOW CHARACTERISTICS STRTQ STRTQ 0.00 BEGIN BASE FLOW RECESSION RICH 1.00000 RECESSION CONSTANT
	4G DATA	48				***************************************		New proposed as		NPUT TIME SERIE 6 TIME 1JAN94 START 0 START	ara	TERISTICS 0.07 SUBBA	CTERISTICS 11.90 INITI 0.00 BEGIN 1.00000 RECES
IOUT ISAVI ISAV2 TIMINT	HYDROGRAPH ROUTIN	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	DISCHARGE	ELEVATION	安全 医水素 医水素 医皮肤炎	*****	* Pond3B * * *****	OUTPUT CONTROL IPRNT PROT OSCAL IPNCH IOUT ISAVI ISAVI TIMINT	TIME DATA FOR II JXMIN JXDATE	SUBBASIN RUNOFF DATA	SUBBASIN CHARAC' TAREA,	BASE FLOW CHARAC STRTQ QRCSN RTIOR
		78 RS	79 SV	80 SQ	81 SE	***		B2 KK	83 KO	87 IN		84 BA	85 BF

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	PATION	000000000000000000000000000000000000000	AREA	* *	UNIT HYDROGRAPH D-OF-PERIOD ORD 1.	** * * * * *		JE OGRAPH THIS UNIT MED OR SAVE ID OR SAVE	Page 11	
•	L PRECIPI	000000000000000000000000000000000000000	STRACTION SER PERVIOUS A		UNII 7 END-OE 3.	* * * * * * * * * * * * * * * * * * * *		CONTROL CONTROL CONTROL COMPUTED HYDROGRA HYDROGRAPH ON THIS ORDINATE PUNCHED ORDINATE PUNCHED INTERVAL IN HOORS		
	BASIN TOTAL PRECIPITATION	ON PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA PH	LAG	10.	*	D	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH OF THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LIAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		
ATA ATA	7.00	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.01 0.00	0.00 100.00 100.00	TLAG 0.15 LAC	33.	***	CNAME			
PRECIPITATION DATA	STORM	INCREMENTAL P. C.	LOSS RATE STRTL CRVNBR RTIMP DIMENSIONIE	TLAG	109.	* * * * * * *	* * * * *	OUTPUT CONTROL VAHIABLES  IPLOT  OSCAL  OSCAL  IPNCH  IOUT  ISAVI  ISAVZ  ISAVZ  IMINT  0.167		
PRECII		DNI	SCS LC	}	122.	* * * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * *	OUTPUT		L
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	HYDROGRAPH ROUTING DATA	TING DATA								
117 RS	STORAGE ROUTING NSTPS RSVRIC X	ING 1 492.00 0.00	NUMBER OF INITIAL WORKING R	1 NUMBER OF SUBREACHES/ 492.00 INITIAL COMDITION 0.00 WORKING R AND D COFFFICIENT	S/ FFICIENT		ITYP		ELEV TYPE	TYPE OF INITIAL CONDITION
118 SV	STORAGE	0.0	22.2	44.5	67.0	9.68	112.3	135.1	158.0	181.1
119 SE	ELEVATION	492.00	492,50	493.00	493.50	494.00	494.50	495.00	495.50	496.00
120 SQ	DISCHARGE	0.	11.	31.	58.	89.	124.	163.	205.	251.
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* * *	水水 水水水 放水水 不水的 化水子	* ** * * *	* * * * *	* * *	** ***	* * * * *	***	* * *	水水块 水水水 化苯酚 在原本 化水泥 化聚烷 不满的 医原体 化水水 化妆妆 化水水 化水水 化水水 化水水 化水石 化水石 化水石 化水石 化水石 化水石	* * *
	*****									
121 KK	* *									
	*******									
122 KO	OUTPUT CONTROL VARIABLES IPLOT QSCAL 0. IPLOT IONT 1 OUT 1 SAV2 1 SAV2 1 ISAV2	01 VARIABLES 4 0 0.12 22 1 1 1 0		PRINT CONTROL  PLOT CONTROL  WYDROGRAPH FLOT SCALE  BANE HYDROGRAPH  SANE HYDROGRAPH  CONTROL CONTROL  SANE CONTRACT  SANE HYDROGRAPH  SANE HYDROGRAPH  SANE HYDROGRAPH  SANE HYDROGRAPH  SANE SUNTROL   PRINT CONTROL PLOT CONTROL PLOT CONTROL PRINCOGRAPH PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	ت ت ت					
126 IN	TIME DATA FOR INPUT TIME JAMIN TAME C C CANDATE 1JAN94 OXTIME 0	INPUT TIME 6 1JAN94 0		SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME	NUTES					
	SUBBASIN RUNOFF DATA	DATA								
123 BA	SUBBASIN CHARACTERISTICS TAREA, 0.01		SUBBASIN AREA	area						
124 BF	BASE FLOW CHAN STRTQ QRCSN RTIOR	FLOW CHARACTERISTICS STRTQ 0.00 QRCSN 0.00 1	S INITIAL FLOW BEGIN BASE FI RECESSION COM	) INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT	ESSION					
	PRECIPITATION DATA	DATA								
125 PB	STORM	7.00	BASIN TOT.	BASIN TOTAL PRECIPITATION	TATION					
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havana2.out	000000000000000000000000000000000000000	A.		* *	UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 0. 0. 0.	* * * * *			PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	NUMBER OF HYDROGRAPHS TO COMBINE	*** Page 13	
hav		INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UNIT H END-OF-P O.	* * *			PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH FIRST ORDINATE PUNCHED ON SAN LAST ORDINATE PUNCHED ON SAN TIME INTERVAL IN HOURS	OGRAPHS	Δι	
	PERM 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS ;			۲	* *			PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGS BAVE HYDROGRAPH ON THE FFRST CORDINATE PUNCHEI LAST ORDINATE PUNCHEI TABET ORDINATE PUNCHED TIME INTERVAL IN HOUR	оғ нұрқ		
			APH LAG		1	* * *		Stplog		NUMBER		
	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 100.00 100.00	DIMENSIONLESS UNITGRAPH TLAG 0.15 LAG		4.	* * * * *		CNAME	OUTPUT CONTROL VARIABLES  IPLOT 0 QSCAL 0. IPNCH 0 IOUT 22 ISAV1 1 ISAV2 160 TIMINT 0.167	INATION 4		
		LOSS RATE STRTL CRVNBR RTIMP	MENSIONLE		13.	* * * * *	* :	* * * *	I CONTROL IPRNT IPRNT OSCAL IPNCH IOUT ISAVI ISAVI	HYDROGRAPH COMBINATION ICOMP		
	\$00000000000000 2 1	SCS 1.03	SCS DI		14.	* * *	*****	* * * * * * * * * * * * * * * * * * *	TUTTO	HYDROGE J		
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10 FC1		152 LS	153 UD			* * *		154 KK	155 KO	156 HC		1
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157 KK												
157 KK	****	* * * *										
	* Stplog * * * * * * * * * * * * * * * * * * *	10g * * * * *	CNAME	ABC								
158 KO	סטדו	OUTPUT CONTROL VARIABLES  I PROT  QSCAL  I PROCH  1 COUT  1 SAV1  1 SAV2   . VARIABLES 4 0 0 2 2 1 160 0 0 160		PRINT CONTROL HYDROGRAPH PLOT SCALE FUNCH COMPUTED HYDROGRAPH FUNCH COMPUTED HYDROGRAPH FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	ALE ROGRAPH THIS UNIT CHED OR SAVE	/ED SD						
	HYDROG	HYDROGRAPH ROUTING DATA	NG DATA									
159 RS	STOF	STORAGE ROUTING NSTPS RSVRIC X	80	NUMBER OF INITIAL ( WORKING R	1 NUMBER OF SUBREACHES/ 4.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	s/ FICIENT		ITYP		ELEV TYPE (	TYPE OF INITIAL CONDITION	CONDITIO
160 SV	ST	STORAGE	0.0	0.0	2.4	4.8	7.2	9.6	12.1	14.6	17.2	19.7
162 SE	SLEV	ELEVATION	484.00	484.50 489.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
164 SQ	DISC	DISCHARGE	223.	7. 258.	20.	37.	56.	79.	104.	131.	160.	191.
166 SE	ELEV	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
						* *						
				COMPUT	TED STORAGE	-OUTFLOW-E	COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	ATA				
	STORAGE OUTFLOW ELEVATION	0.00 0.00 484.00	0.00 7.06 484.50	2.36 20.00 485.00	4.76 36.70 485.50	7.18 56.50 486.00	9.64 79.00 486.50	12.12 103.80 487.00	14.63 130.80 487.50	17.17 159.80 488.00	19.75 190.70 488.50	
	STORAGE OUTFLOW ELEVATION	22.35 223.40 489.00	24.98 257.70 489.50	27.64 293.60 490.00								

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RUNOFF SUMMARY
FLOW IN COBIC FEET PER SECOND
TIME IN HOURS, AREA II SQUARE MILES
Page 14

	OF	3541		13.67		12.67		17.50			15.17	
	TIME OF	IL VHI		13.		12.		17			15	
	MAXIMUM	STAGE		486.42		486.21		492.68			485.63	
	BASIN	ANEA	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15	
	UM PERIOD	72-HOUR	.9	4	5.	12.	24.	11.	1.	29.	27.	
2.out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	7.	ъ	ý	12.	25.	12.	2.	30.	29.	
havana2.out	AVERAGE FI	6-HOUR	19.	7.	17.	15.	.05	18.	4	43.	40.	
	TIME OF	7 4 7 8	12.00	13.67	12.00	12.67	12.00	17.50	12.00	12.00	15.17	
	PEAK		139.	œ	124.	19.	291.	18.	32.	62.	42.	
	20	STATION	Pond1	Pipe1	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	*
	100	OPERATION	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO	*** NORMAL END OF HEC-1 ***
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O.5 PMP USING C. C. POLISHING POM @ Peups 1,2 &3 U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND SPREET DAVIS, CALIFORNIA 95616 (916) 551-1748 DiscHARGE Weir FLOOD HYDROGRAPH PACKAGE RUN

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HECIGS, HECIDB, AND HECIKM

THE DEFINITIONS OF VARIABLES -RTIME- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF "AMBKEA" ON REM-CARD MAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DABBERAR OUTPLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS.WRITE STAGE FREQUENCY,

DSS.READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMET INFITERATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT

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			19.75	488.5	190.7	488.5													

# **US EPA ARCHIVE DOCUMENT**

* HYDBOLOGIC ENGINEERING CENTER * 609 SECOND STREET * * DAVIS, CRLIFORNIA 95616 * * (916) 551-1748 * * (916)					*** *** *** *** *** *** *** *** *** *** *** ***				
Havana3.out	SCALE	MINUTES IN COMPUTATION INTERVAL STARTING DATE STARTING TIME NUMBER OF HYDROGRAPH ORDINATES ENDING DATE ENDING TIME CENTURY MARK			***			SCALE XDROGRAPH Page 6	Brown and humanand
	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE	MINUTES IN COMPUT STARTING DATE STARTING TIME NUMBER OF HYDROGE ENDING DATE ENDING TIME	0.17 HOURS 26.50 HOURS	SQUARE MILES FEET CUBIC FEET PER SECOND ACKE-FEET ACKES DEGREES FAHRENHEIT	*** ** ** **			PRINT CONTROL PLOT CONTROL PUPROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PUNCH	W
* * * * * * * * * *		N 94 N 94 N 94 N 94 N 94 N 94		SQUARE MILES INCHES FEET CUBIC FEET P. ACRE-FEET ACRES DEGREES FAHR	* * *				Personant Personal Pe
991 0.1E TIME	OUTPUT CONTROL VARIABLES  IPRNT  IPLOT  OSCAL  0.	TIME NO COLOR	COMPUTATION INTERVAL TOTAL TIME BASE	REA TON DEPTH EVATION LUME E.A.	* * * * * * * * * * * * * * * * * * * *	* *	* * *	OUTPUT CONTROL VARIABLES I PRNT 0 OCSCAL 0. I PNCH 1	
AAY 1	OUTPUT C EI SO	HYDROGRAPH NATI IDATI ITIM NDDATI NDTIM ICENT	COMPUT	IGLISH UNITS DRAINGE AREA PRECIPTATION DEPTH LENGHT, ELEVATION STORAGE VOLUME SURFACE AREA TEMPERATURE	* * *	*****	* Pondl * * * * * * * * * * * * * * * * * * *	OUTPUT SI SO SO	
M VERS RUN DATE	9	ŢĬ		ENGLI	* * * * * * * * * * * * * * * * * * * *			o,	The same of the sa
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		H	1 A	00					The second

IOUT 22 SAVE HYDROGRAFH ON THIS UNIT ISAVI 1 FIRST ORDINATE PUNCHED OR SAVED ISAV2 160 LAST ORDINATE PUNCHED OR SAVED TIMINT 0.167 TIME INTERVAL IN HOURS	TIME DATA FOR INPUT TIME SERIES JXMIN 5 TREE INTERVAL IN MINUTES JXXDATE 13A994 STRATTING DATE JXXTAME 1.0 STRATING TIME	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.04 SUBBASIN AREA	PRECIPIFATION DATA	STORM 16.00 BASIN TOPAL PRECIPITATION	INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	SCS LOSS RATE STRTL 0.00 INITIAL ABSTRACTION CRVNBR 100.00 CURVE NUMBER RIMP 100.00 PERCENT IMPERVIOUS AREA	SCS DIMENSIONLESS UNITGRAPH TLAG 0.15 LAG	***	UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 60. 54. 16. 5. 2. 1. 0.
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				ELEV TYPE	76.2	489.50	26.		* * *							I.
				13	65.0	489.00	26.		* * *							1.
				ITYP	53.8	468.50	26.		*** *** *** *** *** *** *** *** ***							
		9.0			42.8	488.00	26.		* * * * *					g o		
Havana3.out		RAPH IS UNIT D OR SAVE OR SAVEIS		CIENT	31.9	487.50	26.	* * *						RAPH IS UNIT D OR SAVEI OR SAVEI S	TES Page 8	
Ha		CONTROL CONTROL CONTROL GORDAPH PLOT SCALE GORDOTED HYDROGRE HYDROGRAPH ON THIS ORDINATE PUNCHED ORDINATE INTERVAL IN HOURS		REACHES/ ITION D COEFFI	21.2	487.00 4	26.		* * * *					COT SCALE ED HYDROG APH ON TH TE PUNCHE E PUNCHE LIN HOUR	L IN MINUTES E E Paq	
	υ	PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FUNCH COMPUTED HYDROGRAPH FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED THE INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COFFEICIENT	10.5	486.50 48			***					PRINT CONTROL HYDROCRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FYNE HYDROGRAPH ON THIS UNIT FYNEST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	SERIES TIME INTERVAL STARTING DATE STARTING TIME	
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*	Pipel * * *****	OUTPUT CONTROL VARIABLES IPPOT 0 OSCAL 0 IPNCH 0 IOUT 22 ISAV1 1 ISAV2 160 TIMINT 0.167	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE		*** *** *** ***	******	*	Pond2 *	**********	OUTPUT CONTROL VARIABLES  IPRNT 0 0 CSCAL 0 0 SCAL 1 1 IDNCH 1 1 ISAV1 1 1 ISAV2 160 TIMINT 0.167	TIME DATA FOR JAMIN JAMEN JATIME	Statement of the statem
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		IN AREA		BASIN TOTAL PRECIPITATION	ERN 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			U1 7 END- 1.	* * * * * *			PRINT CONTROL PLOT CONTROL PUNCH COMBUTED HYDROGRAPH PUNCH COMBUTED HYDROGRAPH PAGE
		S SUBBASIN AREA			TION PATT 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.		aph Lag		Š.	* * * * * * *	ļ	m)	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLA PUNCH COMPUTE
	F DATA	SUBBASIN CHARACTERISTICS TAREA, 0.03	1 DATA	16.00	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.00	0.00 100.00 100.00	ESS UNITGRAPH 0.15 LAG		15.	* * *		CNAME	CONTROL VARIABLES PRNT 4 PLOT 0 SCAL 0.
	SUBBASIN RUNOFF DATA	BASIN CHAE TAREA,	PRECIPITATION DATA	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG		49.	* * * * * * *	* * + + + + + + + + + + + + + + + + + +	* * * * * *	
	SUBB	SUE	PRE		н	SUS	SCS		54	* * * * *	***	*	OUTPUT
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		ELEV T)	69.6	58.	489.50	*****		·						
*		٥.	59.4	58.	489.00	***								
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Q			39.3	58.	488.00	**								Salar I result
HAVADA2.OUL FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE FUNCHED OR SAVED TIME INTERNAL IN HOURS		LENT	29.4	58,	487.50	* * *			PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH ROWED SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT PIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	S			SION Page 10	
Havana3.or FIRST ORDINATE PUNCHED OR SAL LASI ORDINATE PUNCHED OR SAVI TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	19.5	58.	487.00 46	* * * * *			PRINT CONTROL  PLOT CONTROL  HYDROGRAPH PLOT SCALE  FUNGH CORPUTED HYDROGRAPH  SAVE HYDROGRAPH ON THIS UNIT  LAST ORDINATE PUNCHED OR SAY  TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT Page	
HYDROGRE CORDINATE ORDINATE INTERVAL		1 NUMBER OF SUBREACHES/ 10 INTITAL CONDITION 10 WORKING R AND D COEFF	7 1			* * *		h pond	PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH PLOT SCALE PUNCH COMPUTED HYDROGI SAVE HYDROGRAPH ON THI FIRST ORDINATE PUNCHEE LAST ORDINATE PUNCHEE TAST ORDINATE PUNCHEE TAST ORDINATE PUNCHEE TIME INTERVAL IN HOUR	SERIES TIME INTERVAL STARTING DATE STARTING TIME		SUBBASIN AREA	AL FLOW BASE FLC SION CONS	
		1 NUMBER 00 INITI 00 WORKIN	9.7	31.	486.50			New proposed ash pond					TERISTICS 11.90 INITIAL FLOW 0.00 BEGIN BASE FI 1.00000 RECESSION CON	
22 1 160 0.167	HYDROGRAPH ROUTING DATA		0.0	11.	486.00	* * * *		New pro	OUTPUT CONTROL VARIABLES  IPROT 0 0 CSCAL 1 PROCH 1 LOUT 1 SAV1 1 SAV2 1 SAV2 1 SAV2 1 SAV2 1 SAV2 1 SAV3 1	DATA FOR INPUT TIME 6 JXMIN 6 JXDATE 1JAN94 JXTIME 0	DATA	SUBBASIN CHARACTERISTICS TAREA, 0.07	FLOW CHARACTERISTICS STRTQ 11.90 1 GRCSN 0.00 B RTICR 1.00000 B	
IOUT ISAV1 ISAV2 TIMINT	APH ROUT	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ARGE	TION	* * * *	* * *	* * * * * m *	T CONTROI IPENT IPEOT OSCAL IPEOT ISAVI ISAVI	DATA FOR JXMIN JXDATE JXTIME	SUBBASIN RUNOFF DATA	IN CHARA TAREA,	LOW CHAR STRTQ QRCSN RTIOR	L
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		78 R	2 6 C	8 08	81 SE	* * *		82 K	83 KO	87 IN		84 BA	8 8 8 8	
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Havana3.out PRECIPITATION DATA	STORM 16.00 BASIN TOTAL PRECIPITATION	INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	SCS LOSS RATE STRIL 0.00 INITIAL ABSTRACTION CRVNBR 100.00 CURVE NUMBER RTIMP 100.00 PERCENT IMPERVIOUS AREA	SCS DIMENSIONLESS UNITGRAPH TLAG 0.15 LAG	***	UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 122. 109. 33. 10. 3. 1	非常素 苦苦茶 化甘油 在书书 茶茶茶 层形层 化妆妆 化妆妆 化妆妆 化水铁 化水铁 化水铁 化水铁 化水铁 似状状 化妆料 化妆料 化妆料 化妆料 化水块 化水块 化妆妆 化水石 化环 化二苯甲酚 计	* Pipe3 * CNAME D	OUTPUT CONTROL VARIABLES  IPLOT 4 PRINT CONTROL  1PLOT 0 PLOT CONTROL  QSCAL 0. HYDROGRAPH ELOT SCALE  IPWCH 0 PUWCH COMPUTED HYDROGRAPH  LOUT 22 SAVE HYDROGRAPH ON THIS UNIT  ISAVI 1 FIRST ORDINATE PUNCHED OR SAVED  TISAVI 160 LAST ORDINATE PUNCHED OR SAVED  TIMINT 0.167 TIME INTERVAL IN HOURS	Page 11
	86 PB	E 60	113 LS	114 UD			*** *** ***	**** 115 KK * *	116 KO	

#AM#

	NDITION					* * * * * * * * * * * * * * * * * * * *												
	ELEV TYPE OF INITIAL CONDITION	181.1	496.00	58.		* * *												
	YPE OF IN			58.		* * * * * * * *												and the second
	ELEV T	158.0	495.50			* * * * * * *												
	Ωι	135.1	495.00	58.		* * * * *												
	ITYP	112.3	494.50	58.		***												
		9.68	494.00	.83		* *												
	ENT	67.0	493.50 4	58.	* *	*** *** ***				PH UNIT OR SAVED	S.			LON		NO	Page 12	
	CHES/ ON COEFFICI				*	* * * * * * *				HYDROGRA HYDROGRA H ON THIS PUNCHED C	IN MINOTE			n recessi Tant		ECIPITAT:	Ğ	
	1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	44.5	493.00	31.		* * * * *				PRINT CONTROL PLOT CONTROL PUNCORANH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FUNCH COMPUTED HYDROGRAPH FIRST ONDINATE PUNCHED ON SAVED LAST ORDINATE PUNCHED ON SAVED THE INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA	INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION		
	NUMBER ( INITIAL WORKING	22.2	492.50	11.		* * *								CS INITIA BEGIN RECESS				
NG DATA	4,	0.0	492.00			* * *				OUTPUT CONTROL VARIABLES  IPRNT 0 0 OSCAL 0. IPRNCH 1 I IOUT 1 I SAV2 160 TIMINT 0.167	TIME DATA FOR INPUT TIME  JXMIN  G JXDATE  JXNO94  OXTIME  0	DATA	SUBBASIN CHARACTERISTICS TAREA, 0.01	FLOW CHARACTERISTICS STRTQ 0.00 QRCSN 0.00 1	DATA	16.00		
HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	NOI	ARGE		* * * * * * * * * * * * * * * * * * * *	* *	* * * * *		T CONTROJ IPRNT IPLOT OSCAL IPNCH IOUT ISAVI ISAVI ISAVI	DATA FOR JXMIN JXDATE JXTIME	SUBBASIN RUNOFF DATA	SIN CHAR TAREA,	FLOW CHASTRE ORCSN RTIOR	PRECIPITATION DATA	STORM		
HYDROGRA	STORAG	STOR	ELEVATION	DISCHARGE		* * * * * * *	*****	* * * * * * * * * * * * * * * * * * *		natho	TIME	SUBBASI	SUBBA	BASE	PRECI			ľ
	10	>	ы	α		***	* *			0	z		ВА	B F		PB		
	117 RS	118 SV	119 SE	120 SQ		* * *		121 KK		122 KO	126 IN		123 B	124 B		125 P		L
										r75								
								H	P	7 1)								

127 PI			152 LS	153 UD			* ** * ** * **	154 KK *	Ś	Los KO	156 HC
н			SCS	scs		14.	* * * * *	* * * * * * * * * * * * * * * * * * *	****	a Hoo	HYDRC
INCREMENTAL		0.0000000000000000000000000000000000000	H	DIMENSIONLESS TLAG		13.	***	* * * * * BBC *	* * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES  IPROT 0  GSCAL 0.  IPROCH 0.  INOUT 22  ISAVI 1  ISAVI 160.	HYDROGRAPH COMBINATION
PRECIPITA	0.0000000000000000000000000000000000000	0.0000000000000000000000000000000000000	0.00 100.00	SS UNITGRAPH 0.15 LA		4	***	CNAME		VARIABLES 4 0 0 2 22 160	ENATION 4
PRECIPITATION PATTERN	000000		INITIAL A CURVE NUM PERCENT I	aph Lag		;	* * * * * *	Stplog		PRINT CONTROL HYDROGRAPH PLOT FUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH STRST ORDINATE PU LAST ORDINATE PU TIME INTERVAL IN	NUMBER OF HYDROGRAPHS TO COMBINE
RN	0.000.00	0.0000000000000000000000000000000000000	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UNI 7 END-O 0.	* * * *			PELTY CONTROL PLOT CONTROL PROGRAPH PLOT SCALE PRINCH COMPUTED HYPROGRAPH SAVE HYPROGRAPH ON THIS UNIT FIRST ONDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	HYDROGRAPH
20.00	000000000000000000000000000000000000000	0.01 0.02 0.00 0.00 0.00	<sup>4</sup> Area		*	UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 0.	***			LE THIS UNIT TED OR SAVE ED OR SAVE IRS	IS TO COMB
ה	000000000000000000000000000000000000000	0.01 0.01 0.00 0.00 0.00 0.00				aph Ordinates 0.	* * * * *			<u> </u>	INE
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HAGB

# **US EPA ARCHIVE DOCUMENT**

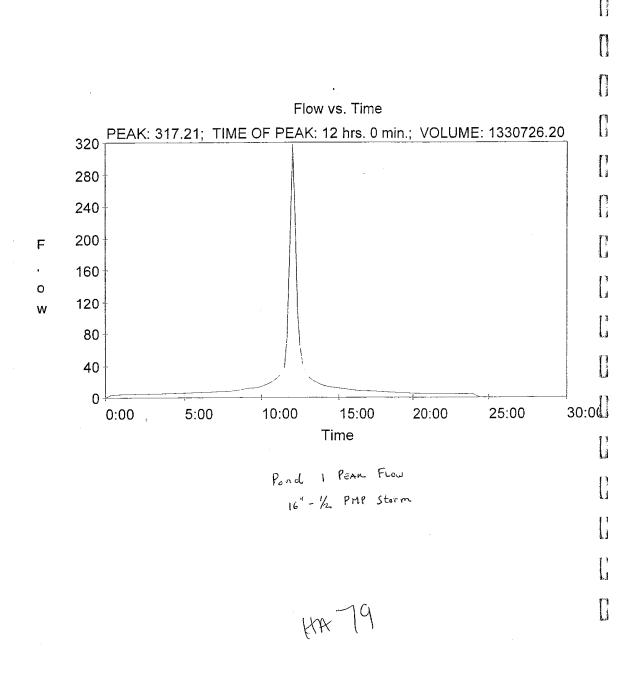
		CONDITION	19.7	488.50	191.	488.50					
		TYPE OF INITIAL CONDITION	17.2	488.00	160.	488.00		190.75			
		ELEV TYPE O	14.6	487.50	131.	487.50		17.17 159.80			
			12.1	487.00	104.	487.00		14.63 130.80			
		ITYP	9.5	486.50	79.	486.50		12,12 103.80 487.00		s,	
	9.0		7.2	486.00	56.	486.00		EVATION DE 9.48 79.00 486.50		FF SUMMARY C FEET PER SECOND AREA IN SQUARE MILES Page 14	
	E GRAPH HIS UNIT ED OR SAVE D OR SAVEI RS	ICIENT	4.8	485.50	37.	485.50	* *	OUTFLOW-EL 7.18 56.50 486.00	1	RUNOFF SUMMARY CUBIC FEET PER RS, AREA IN SC Page 14	
	PRINT CONTROL TOOT CONTROL TYDOROGRAPH PLOT SCALE WINDERCHONDED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	1 NUMBER OF SUBREACHES/ 484.00 INITIAL CONDITION 0.00 WORKING R AND D COFFFICIENT	2.4	485.00	20.	485.00		CONFUTED STORAGECOTFILOW-ELEVATION DATA 2.36 4.76 7.18 9.48 36.70 36.70 79.00 85.00 486.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE M FAGE 14	
ABC	PRINT CONTROL PLOT CONTROL HYDROGRAPH PL PUNCH COMPUTE SAVE HYDROGRA FIRST ORDINAT LAST ORDINATE TIME INTERVAL	NUMBER OF S INITIAL CO	0.0	484.50	7.	484.50		20.00 20.00 485.00	27.64 293.60 490.00	FITIME	
CNAME	0 0. 22 1 160 0.167 NG DATA		0.0	484.00	0.	484.00		0.00 7.06 484.50	24.98 257.70 489.50		
******** Stplog * CNAME ********* OUTPUT CONTROL VARIABLES	IPRNT IDLOT QSCAL QSCAL IPRUCH IOUT ISAVI ISAVI TISAVZ ITIMINT HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	NOIL	ARGE	TION		0.00 0.00 484.00	22.35 223.40 489.00		U
* * * * * * * * * * * * * * * * * * *	HYDROGH	STORA	STC	ELEVATION	DISCHARGE	ELEVATION		STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION		
157 KK 158 KO		159 RS	160 sv	162 SE	54 SQ	166 SE		3	EL		
ii ii		7	7	1,	164	16			C	j	
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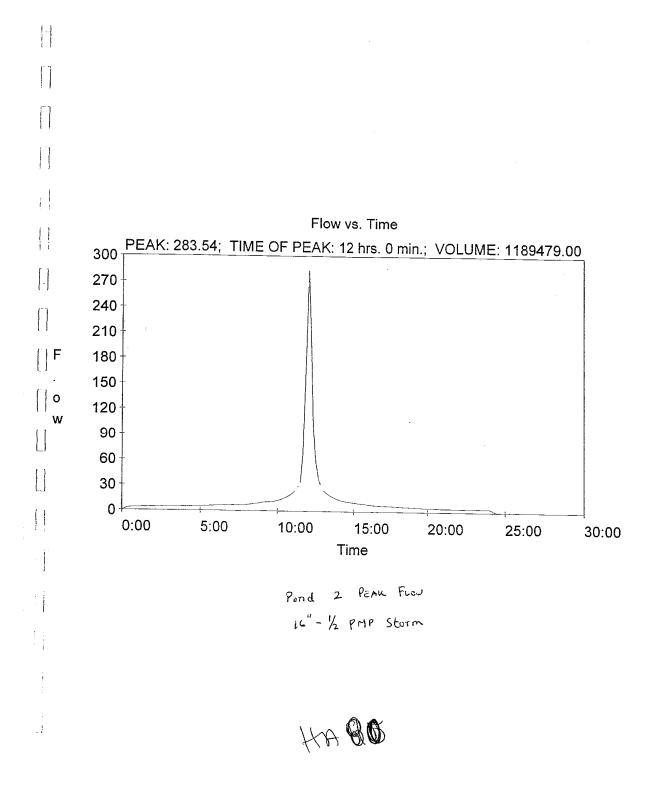
[]		TIME OF	MAX STAGE			13.17			12.67		;	14.17		15.00
Approximate Approx		MAXIMUM	STAGE			486.92			486.57					486.78
		BASIN	AREA	ć	70.0	*	0.03	0.03		0.07	0.07		0.15	0.15
		MUM PERIOD	72-HOUR				12.	16.		40.	22.	ţ~	50.	47.
	Havana3.out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	ני			14.	. 16.		43.	24.	4	54.	51.
	Havan	AVERAGE F.	6-HOUR	44.	21.		39.	29.		.66	39.	10.	95.	87.
		TIME OF	i.	12.00	13.17		12,00	12.67		12.00	14.17	12.00	12.00	15.00
		PEAK		317.	23.		284.	35.		650.	40.	74.	131.	93.
		STATION		Pond1	Pipel		Pond2	Pipe2		Pond3B	Pipe3	Pond3	ABC	Stplog
		OPERATION		HYDROGRAPH AT	ROUTED TO		HYDROGRAPH AT	ROUTED TO	me nakabbadan	HIDDOGRAFH AI	ROUTED TO	нуркоскарн ат	4 COMBINED AT	ROUTED TO
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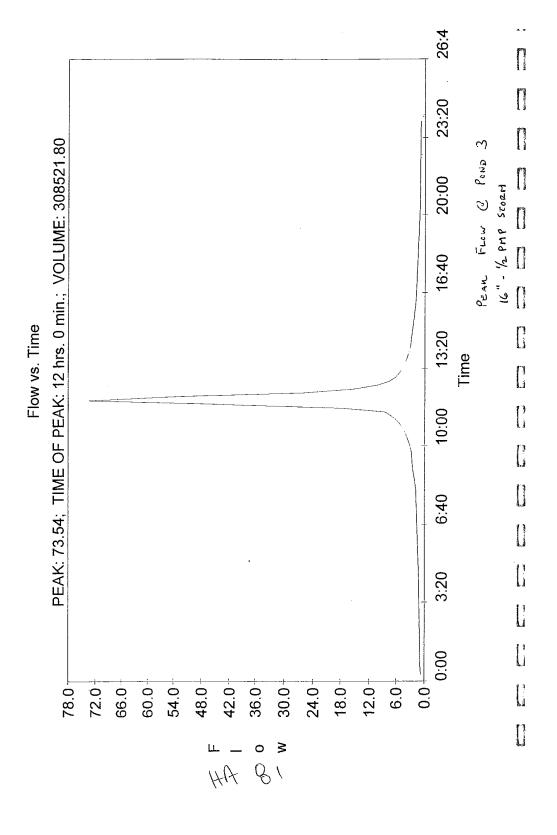
NORMAL END OF HEC-1

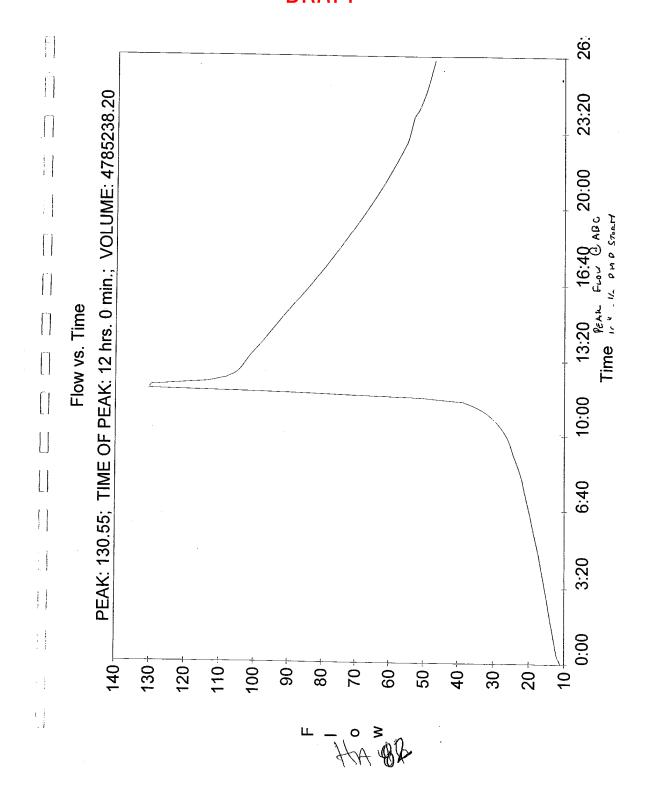
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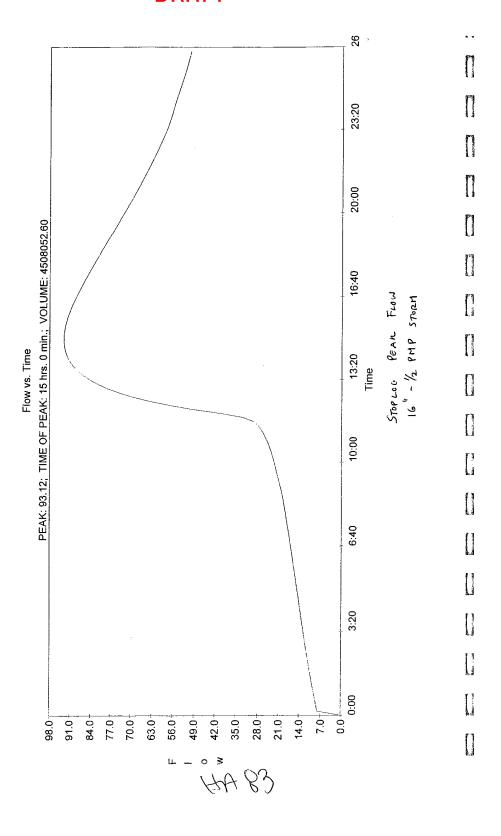
Page 15

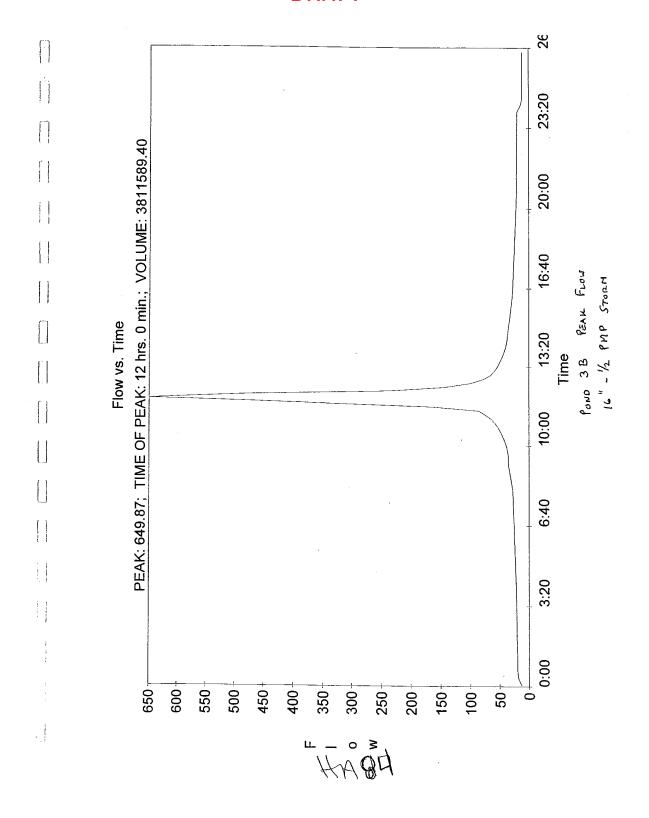












U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENUINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 551-1749	DENNE GOOD GHAN DISCHARGE	HECIGS, HECIDB, AND HECIKW.  WITH THE 1973-STYLE INDUT STRUCTURE.  B1. THIS IS THE FORTEANTY VERSION  DSS:WRITE STRGE FREQUENCY,  PT INFILTRATION	PAGE 1		0.0083 0.0094 0.0196 0.0228 0.035 0.0332 0.0452 0.0466 0.0598 0.0514 0.0764 0.0782
	(a) xxx xxxxxx xxxxxxx x x x x x x x x x	HEC-1 KNOWN AS HECI (JAN 73), HAVE CHANGED FROM THOSE USER O WITH REVISIONS DATED 28 SEP SIE EVENT DAMMGE CALCULATION, ERVAL LOSS RATE:GREEN AND AN	HEC-1 INPUT345678	0 160	0 1 22
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *  NAY 1991 *  VERSION 4.0.1E *  * RUN DATE TIME *		THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF THE DEFINITIONS OF VARIBBLES HTHMP- AND HITCR THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGE NEW OFFICKS: DANASRAM OUTHON SUBMERGENCE, SIND DSS. READ TIME SERIES AT DESTRED CALCULATION INTERINEMENTIC WAVE: NEW FINITE DIFFERENCE ALGORITHM	LINE ID2	: ID 2 ID 3 ID *ILAGRAM 4 IT . 10 IJAN94 5 IO 4	6 KK Pond1 8 BA 0.038 9 PB 16 10 10 IN 6 13AN94 * precipt 0.001 11 PC 0.002 0.0116 13 PC 0.032 0.033 14 PC 0.034 15 PC 0.034 16 PC 0.0494

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0.0931 0.11379 0.1379 0.1379 0.3544 0.8618 0.88728 0.9835 0.9838 0.9959 0.9959	76.24	. 6	171.25	œ :	0.0073 0.0073 0.0308 0.0543 0.0543 0.0754 0.1379 0.1379 0.1597 0.1597
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Have an example of the control of th	22 22 48	488	73.97	5.	22 0.0041 0.0269 0.0269 0.0538 0.0538 0.0538 0.0538 0.1074 0.1074 0.1598 0.1598 0.1598
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0.8308 0.83680 0.93680 0.9078 0.9263 0.9559 0.9685 0.9806 0.9806	29.4 88.77	pond 1 0.0031 0.0138	HEC-1. 4. 0. 0.0384 0. 0.0384 0. 0.0523 0. 0.0523 0. 0.0523 0. 0.0555 0. 0. 0.0555 0.	
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		9	3	

HA 37

Havana Power Plant Dynegy Midwest Generation, Inc. Havana, IL 

											AGE 4	
0.9758 0.9876 0.9989							0.0094 0.0208 0.0332 0.0466			0.7656	10	0.8162 0.8955 0.8977 0.9997 0.9997 0.9562 0.9507 0.9758 0.9758 0.9989
0.9746 0.9864 0.9978		181.12	496	251.08			0.0083 0.0196 0.0319 0.0452	0.0764	0.1156 0.1408 0.1733 0.2214	0.4308 0.7588	6	0.8122 0.8122 0.8744 0.9976 0.9174 0.9622 0.9846 0.9864
0.9734 0.9853 0.9967		158.04	495.5	205.5			0.0073 0.0185 0.0307 0.0438	0.0383	0.1135 0.1379 0.1697 0.2152	0.7514	60	0.808 0.8442 0.9425 0.9155 0.9155 0.948 0.961 0.961
0.9722 0.9841 0.9956		135.09	495	163.08			0.0062 0.0173 0.0294 0.0425	0.0358	0.1114 0.135 0.1663 0.2094	0.7434	7	0.8036 0.8036 0.8403 0.8934 0.9136 0.9597 0.9597 0.9597 0.9597
.out 0.9709 0.9829 0.9944		112,26	494.5	124.06			0.0051 0.0161 0.0281 0.0411	0.0333	0.1093 0.1323 0.163 0.204	0.735	9	0.799 0.8376 0.8676 0.8912 0.9117 0.9452 0.9584 0.9709
Havana4 0.9697 0.9818 0.9933	22	99.56	494	88.77	22		0.0041 0.015 0.0269 0.0398	0.0696	0.1072 0.1296 0.1598 0.1989	0.7252	NPOT	0.7942 0.8342 0.8649 0.9098 0.9438 0.9572 0.9697 0.9933
0.9685 0.9806 0.9922	00	66.98	493.5	57.66	1		0.0031 0.0138 0.0257 0.0384	0679	1271	.713	HEC-1 II	0.789 0.8308 0.8622 0.9868 0.9078 0.9423 0.9559 0.9685 0.9685
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# **US EPA ARCHIVE DOCUMENT**

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	* HYDROLOGIC ENGINEERING CENTER *  * VERSION 4.0.1E	5 IO OUTPUT CONTROL VARIABLES IPRINT 0 PLOT CONTROL GSCAL 0. HYDROGRAPH PLOT SCALE	IT HYDROGRAPH TIME DATA  NNIN  1 DATE 1.0AN-9 STRATING DATE  ITAME 0.000 STRATING THE  INC, 160 NUMBER OF HYDROGRAPH ORDINATES  NDATE 2.0AN-9 RNDING DATE  NDIME 0.230 ENDING THE  ICENT 19 CENTURY MARK	COMPUTATION INTERVAL 0.17 HOURS  TOTAL TIME BASE 26.50 HOURS	ENGLISH UNITS  DRAINAGE AREA  PRECIPETATION DEPTH INCHES  LENGTH, ELEVATION CUBIC FEET PER SECOND  STORAGE VOLUME  STORAGE VOLUME  ACRES FEET  TEMPERATURE  DEGREES FAHRENHEIT	化水体 化水体 化水水 化水水 化水水 化水水 化水水 化水水 化水水 化水水	6 KK * Pond1 * * ********************************	7 KO OUTDUT CONTROL VARIABLES 1 IPLOT 0 PLOT CONTROL QSCAL 0, HYDROGRAPH PLOT SCALE I PUNCH COMPUTED HYDROGRAPH PAGE 6	
j			H	A	<b>M</b> O				

# **US EPA ARCHIVE DOCUMENT**

IOUT 22 SAVE HYDROGRAPH ON THIS ONIT ISAVI 1 FIRST ORDINATE PUNCHED OR SAVED ISAVZ 160 LAST ORDINATE FUNCHED OR SAVED TIMINT 0.167 TIME INTERVAL IN HOURS	TIME DATA FOR INPUT TIME SERIES  JXMIN 6 TIME INTERVAL IN MINUTES  JXDATE 1JAN94 STARTING DATE  JXTIME 0 STARTING TIME	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA,	PRECIPITATION DATA	STORM 16.00 BASIN TOTAL PRECIPITATION									NOTIFIER TO LOCATE LOCATE TO LOCATE TO LOCATE LOC	PRECIPATION PAILERN	0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	00.0 00.0 00.0 00.0 00.0 00.0	0.00 0.00 0.01 0.01 0.01	1000	0.01 0.01 0.01 0.01 0.01 0.02 0.02	0.19 0.03 0.00 0.00	TO:0 TO:0 TO:0 Zo:0 Co:0	0.01 0.01 0.01 0.01	TO:0 TO:0 TO:0	0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00	00.0 00.0 00.0 00.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00		0.00 0.00 0.00 0.00 0.00	0.00 0.00		ACR TORE RESE	O O O O O O O O O O O O O O O O O O O	00.00	100.00	RIIMP 100.00 PERCENT IMPERVIOUS AREA	TO THE POST OF THE	DIMENSIONEESS ONLIG	LAG U.IS LAG	***	HONDOOD HONDOOD	7 NN-COLOUR T	60. 54. 16. 5		* ***		*****	L 550 G	/ abda			Second Se	The control of the co	
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rt T				42.8	488,00	74.			* * * * * *			e -	
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υ	PRINT CONTROL HYDEOGRAPH FLOT SCALE PUNCH COMPUTED HYDEOGRAPH FYNST HYDEOGRAPH ON THIS UNIT FIRST OPDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 16.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	5 21.2	0 487.00	. 26.			* * * * * * *			PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FUNCH COMPUTED HYDROGRAPH FINST CORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED THE INTERVAL IN HOURS	DATA FOR INPUT TIME SERIES JAMIN 6 TIME INTERVAL IN MINUTES JADATE 1JAN94 STARTING DATE JATIME 0 STARTING TIME PAG
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			69	251.	489.50					
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		ITYP	49.3	163.	488.50					
ED D			39.3	124.	488.00		۵			
Havana4.ou THIS UNIT HED OR SAVE ED OR SAVE JRS		, ICIENT	29.4	.68	487.50	* * *	RAPH IIS UNIT ED OR SAVED OR SAVED	Tes		SION Page 10
GRAPH ON THE PUNCHERALE PUNCHERAL		UBREACHES/ NDITION ND D COEFE	19.5	58.	487.00		OUL PLOT SCALE TRED HYDROG RRAPH ON THE RATE PUNCHE TR PUNCHEI AL IN HOUR	AL IN MINU TE ME	ey S	W FLOW RECES
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	SCIPITAT	000000000000000000000000000000000000000	TION		•	UNIT HY	* * * *		SCALE HYDROGRE ON THIS PUNCHED OUNCHED IN HOURS	å	
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			TYPE OF INITIAL CONDITION	181.1		251.		*											
П			S OF IN		4	73		* * *											
			ELEV TYPE	158.0	495.50	205.		* * * * *											
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	Havana4.out		LENT	67.0	493.50 49	58.	* * *	*** *** *** *** *** *** *** ***				PH UNIT OR SAVED				z		2	Page 12
	Нау		CHES/ ON COEFFIC:				*	* * *				SCALE YDROGRA; ON THIS UNCHED OF	MINUTES			ECESSIO		PITATIO	Pag
			SUBREA CONDITI	44.5	493.00	31.		* * * * *				VTROL FROL PH PLOT FPUTED H COGRAPH VINATE PUI	RVAL IN DATE TIME		AREA	LOW E FLOW F CONSTAN		AL PRECI	
			1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	22.2	492.50	11.		***				PRINT CONTROL  PLOY CONTROL  HYDROGRAPH PLOT SCALE  SAVE HYDROGRAPH  SAVE HYDROGRAPH  SAVE HYDROGRAPH  IAST ORDINATE PUNCHED ON SAVED  TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA	S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	
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		HYDROGI	STOR	STC	ELEVATION	DISCHARGE		**	*****	Pond3	* ***	OUTPU	TIME D	SUBBASIN	SUBBAS	BASE F	PRECIP	•	
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Hav	000000000000000	TION OUS ARE	,		UNIT H' ND-OF-PJ O.	*** *** ***		SCALE HYDROGRA ON THIS PUNCHED NUCHED	RAPHS T	* 60	
	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			7 18	* * * *		CONTROL CONTROL CONTROL CONTROL GRAPH PLOT SCALE I COMPUTED HYDROGRA HYDROGRAPH ON THI ONDINATE PUNCHED ORDINATE BUNCHED INTERVAL IN HOURS	F HYDROK		
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127		152 L	153 U			* * * *	154 KK	155 KO	156 HC		
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# **US EPA ARCHIVE DOCUMENT**

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		* * * * * * * * * * * * * * * * * * * *			CONDITION	19.7	488.50	191.	488.50					
		** ** ** ** ** ** ** ** **			OF INITIAL CONDITION	17.2	488.00	160.	488.00			19.75 190.70 488.50		
		* * * * * *			ELEV TYPE O	14.6	487.50	131.	487.50			17.17 159.80 488.00		
		**				12.1	487.00	104.	487.00			14.63 130.80 487.50		
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	ů t	* * * *	78.D			7.2	486.00	56.	486.00		STORAGE-OUTFLOW-ELEVATION DATA	9.64 79.00 486.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA. IN SQUARE MILES Page 14
	Havana4.out	* * * * * * * * * * * * * * * * * * * *	ALE ROGRAPH THIS UNIT CHED OR SAVI HED OR SAVI		s/ FFICIENT	4.8	485.50	37.	485.50	*	-outerow-e	7.18 56.50 486.00		RUNOFF SUMMARY CUBIC FEET PER RS, AREA.IN S PAGE 14
		* * * * *	SPLINT CONTROL PLOT CONTROL HYDROGRAPH BLOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	2.4	485.00	20. 294.	485.00			4.76 36.70 485.50		RUN LOW IN CUB: IN HOURS,
-		** ** ** ** ** **	PRINT CONTRO PLOT CONTROL PUNCH COMPIT SAVE HYDROGRAPH EIRST DOEDINAL LAST ORDINAL TIME INTERVAL		NUMBER OF SUBREACH! INITIAL CONDITION WORKING R AND D COI	0.0	484.50	7.	484.50		COMPUTED	2.36 20.00 485.00	27.64 293.60 490.00	TIME
		*** ***	L VARIABLES 4 0 0. 22 22 160 0.167	ING DATA	1 484.00 0.00	0.0	484.00	223.	484.00			0.00 7.06 484.50	24.98 257.70 489.50	
		X	******** OUTPUT CONTROL VARIABLES OUTPUT 0 IPLOT 0 OSCAL 0. IPNOT 0 INOT 22 ISAV1 15 ISAV1 16 ISAV2 160 TIMINT 0.167	HYDROGRAPH ROUTING	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	ELEVATION			0.00 0.00 484.00	22.35 223.40 489.00	
CANADA AND AND AND AND AND AND AND AND AN		* * * * * * *	**************************************	HYDRO	STO	δή	ятя	oisc	ELEV			STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
		*** *** *** 157 KK	158 KO		159 RS	160 SV	162 SE	164 SQ	166 SE			_		
# 1 					1	YA	g						C	J

	TIME OF MAX STAGE			13.17		12.67		14.17			15.00
	MAXIMUM			486.92		486.57		493.17			486.79
	BASIN	uguu	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15
	UM PERIOD	72-HOUR	14.	10.	12.	16.	40.	22.	ë.	50.	47.
4.out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	15.	11.	14.	16.	43.	24.	4.	54.	51.
Havana4.out	AVERAGE FL	6-HOUR	44.	21.	39.	28.	99.	39.	10.	.36	87.
	TIME OF	PEAK	12.00	13.17	12.00	12.67	12.00	14.17	12.00	12.00	15.00
	PEAK		317.	23.	284.	35.	650.	40.	74.	131.	93.
		STATION	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog
		OPERATION	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO
		+	+	+ +		+ +	+	+ +	+	+	+ +

\*\* NORMAL END OF HEC-1 \*\*\*

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# **US EPA ARCHIVE DOCUMENT**

**************************************	O.5 PMP Using BI @ Polishing Polo XX XX S. Wait Discharge @ Ponde 1,2 &3! XXXX X XXXX X XXX X XXX	(JAN 73), HECLGS, HECLDB, AND HECLKW. HOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. 5D 28 SEP 81. THIS IS THE FORTRANT? VERSION 5ULATION, DSS.WRITE STAGE FREQUENCY, 5EN AND AMPT INFILTRATION	PAGE 1			0.0062 0.0073 0.0083 0.0084 0.0173 0.0185 0.0196 0.0208 0.0424 0.0307 0.0319 0.0332 0.0425 0.0439 0.0452 0.0466 0.0568 0.0583 0.0598 0.0614 0.073 0.0774 0.0764 0.0782
	XXXXXX XXXXXXXX X X X X X X X X X X X	THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HECIGS, HECIDB, AND HECIKM.  THE DEFINITIONS OF VARIABLES -RITMP- AND -RITOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRANT7 VERSION DESCRIBABLE WOUTHING WITH PROGRESS ORICILATIONS, DAMBERAR OUTHOR DESCRIBABLE OF THE SERIES AT DESIRED CALCULATION INFERVAL LOSS RATE:GREEN AND AMPT INFILTRATION RINGERIAL DESCRIBABLES OF DESIRED CALCULATION INFERVAL LOSS RATE:GREEN AND AMPT INFILTRATION	HEC-1 INPUT LINE ID13456	1 ID 2 ID 3 ID **DIAGRAM 4 IT 10 1JAN94 0 160 5 IO 4	6 KK Pond1 7 KO 0 0 1 22 8 BA 0.0358 9 PB 16 10 IN 6 1JAN94 0	11 P. Precipi 0.001 0.002 0.0031 0.0041 0.0051 12 PC 0.0105 0.0116 0.0127 0.0138 0.0151 0.0051 13 PC 0.0105 0.0105 0.0124 0.0257 0.0269 0.0261 14 PC 0.022 0.0328 0.0371 0.0364 0.0369 0.0381 15 PC 0.048 0.049 0.0508 0.0538 0.0533 15 PC 0.063 0.0652 0.0568 0.0568 0.0112 Page 1

PAGE 2	
	0.0782 0.1439 0.1771 0.228 0.5679 0.7656
0.0955 0.1156 0.1156 0.1338 0.2214 0.1338 0.1338 0.1338 0.1338 0.1346 0.	0.095 0.1156 0.1156 0.1733 0.2214 0.4308 0.7588
0.0931 0.1135 0.1135 0.11379 0.1524 0.08128 0.9813 0.9853 0.9953	0.0931 0.1135 0.1135 0.1697 0.3544 0.7514
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			PAGE 3
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0.9734 0.9853 0.9967		158.04	495.5	57.66				0.0073 0.0185 0.0307						8	0.808 0.8442 0.8952 0.9155 0.9155 0.961 0.963
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D P P P P P P P P P P P P P P P P P P P	R K K	so vs	* 82 57	so pe	X X	8. 8.5	PB IN	* pro	ដូដូ	5 B	555	7 7 2 5 2 2	N N	ID.	5 7 7 7 7 2 2 2 2 2 3 3 5 5 6 6 7 7 7 7 8 6 7 8 7 8 7 8 7 8 7 8 7 8
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154   KK   ABC   CNAME   Stpleq   Havana5.out     155   KK   ABC   CNAME   Stpleq   O   22     156   KK   Stpleq   CNAME   ABC   O   22     159   KK   Stpleq   CNAME   ABC   O   22     159   KK   Stpleq   CNAME   ABC   O   22     150   SV   O   O   O   23     150   SV   O   O   O   23     150   SV   O   O   O   O     150   SV   O																						******	* FNGINEERS *
### Havana5.out 22				19.75	488.5	162.12	488.5															****	U.S. ARMY CORPS OF ENGINEERS
######################################				17.17	488		488															* * * * * *	-
Havana5.out  ABC 0 22  ABC 0 22  484 0 0 22  2.36 4.76 7.18 9.64 12.12  27.64 485.5 486 486.5 487  495 485.5 486 486.5 487  234.92 34.87 52.74 72.4 93.44  485 485.5 486 486.5 487  CM OR PUMP FLOW  OF DIVERTED OR PUMPED FLOW  Pond3  Pond3				14.63	487.5		487.5															*	* *
Havana5.c  Stplog  ABC  0 22  ABC  0 0 22  484 0 0 22  2.36 4.76 7.18  27.44 485.5 486  490 490 485.5 486  490 490 485.5 486  490 490 485.5 486  Pond3  Pond3				12.12	487		487																
ABC	out			9.64	486.5	72.4	486.5			LOW													
154	Havana5.	i	22	7.18	486	52,74	486			PUMPED F													
154	c	,	00	4.76	485.5	34.87	485.5		UMP FLOW	RTED OR													
154	Stplog	ABC	484	2.36	485 490	19.31	485	ETWORK	ION OR P	OF DIVE								1	Folia .	. :			
154			O ELEV	24.98	484.5		484.5	STREAM N	) DIVERS	RETURN						d3B V	v rpe3					ATION	* 1
154 KK 155 KK 156 HC 157 KK 158 KK 159 RS 150 SV 160 SV 161 SV 161 SV 162 SE 163 SE 164 SV 165 SE 164 SV 165 SE 167 SE 168 SE 168 SE 169 SE 169 SE 160 SE 16	ABC 0	4 Stplog	0 7	22.35	4884		484 489	GRAM OF	-	>)						Por	ă					THIS LOC	
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INPUT LINE NO. 6 6 44 44 44 115 115 115 115 115 1157	1.54 1.55	156	158 159	160 161	162 163	164 165	166 167 168	SCHEM	(V) ROUTIN	(.) CONNECT	Pond1	V Pipel								ABC	v Stplog	OFF ALSO COMF	
								_	LINE	NO.	φ	38	•	ੜਾ ਹਾ	92	82	115	ć	121	154	157	(***) RUN 1*******	*

MAY 1991 VERSION 4.0.1E RUN DATE TIME	· 《女子· · · · · · · · · · · · · · · · · · ·	5 IO OUTPUT CONTROL VARIABLES 1 IRRNT 4 1 IRLOT 0 QSCAL 0.	IT HYDROGRAPH TIME DATA INTINE 1JAN ITTIME 00 NDDATE NDDATE OTHER	COMPUTATION INTERVAL TOTAL TIME BASE	ENGLISH UNITS DRAINAGE AREA PRECIPITATION DEPTH LENGTH, ELEVATION FLOW STORAGE VOLUME STORAGE AREA TEMPERATURE	*** *** *** *** *** ***	6 KK * Pondl * * ********************************	7 KO OUTPUT CONTROL VARIABLES 1 IPAUT 0 0 GSCAL 0. I FNCH 1	(Spinishman Kasamanah
: Havana5.out	k · · · · · · · · · · · · ·	ARIABLES 4 PRINT CONTROL 0 PLOT CONTROL 0. HYDROGRAPH PLOT SCALE	DATA  10 MINUTES IN COMPUTATION INTERVAL 10AN94 STARTING DATE 0000 STARTING TIME 160 NUMBER OF HYDROGRAPH ORDINATES 2.5AN94 BUDING DATE 020 ENDING TIME 19 CENTURY MARK	ERVAL 0.17 HOURS BASE 26.50 HOURS	SQUARE MILES I INCHES I INCHES CUBIC FEET PER SECOND ACRE-FEET ACRES DEGREES FAHRENHEIT	*** ***		RIABLES  4 PRINT CONTROL  0 PLOT CONTROL  0. HYDROGRAPH ELOT SCALE  1 PUNCH COMPUTED HYDROGRAPH  Page 6	
out * HYDROLOGIC ENGINEERING CENTER * 609 SECOND STREET * * DAVIS, CALIFORNIA 95616 * * (916) 551-1748 * *	* * * * * * * * * * * * * * * * * * * *		RVAL			*** ***			

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SAVE HYDROGRAPH ON THIS UNIFERST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	MINUTES				PITATION	000000000000000000000000000000000000000	ON S AREA		* *	UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 2, 1.00.
Hav. SAVE HYDROGRAPH ON THI. FIRST ORDINATE PUNCHED LAST ORDINATE PUNCHED ( TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA		BASIN TOTAL PRECIPITATION	PERN 0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UI 7 END- 2.
						TION FATT- 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0		APH LAG		ī,
22 1 160 0.167	DATA FOR INPUT TIME JXMIN 6 JXDATE 1JAN94 JXTIME 0	DATA	ACTERISTICS 0.04	DATA	16.00	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	0,00 100.00 100.00	ESS UNITGR		16.
IOUT ISAV1 ISAV2 TIMINT		SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.04	PRECIPITATION DATA	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS UNITGRAPH TLAG 0.15 LA		54.
	TIME	SUBBAS	SUBB	PREC		N.	scs I	SCS		.09
	10 IN		8 BA		8d 6	11 PI	36 LS	37 UD		

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			TYPE OF INITIAL CONDITION				* * * * * * * * * * * * * * * * * * * *					
			OF INITIAI	87.6	490.00	26.	* **					
			ELEV TYPE (	76.2	489.50	26.	***					
				65.0	489.00	26.	** **					
			ITYP	53.8	488.50	26.	**					
	ED 30			42.8	488.00	26.	* * * * * *			5 D		
	PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FIRST OFFRENCH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ONDINATE PUNCHED OR SAVED THE INTERVAL IN HOURS		S/ FFICIENT	31.9	487.50	26.	*** ***			PRINT CONTROL HYDOC CONTROL HYDROGRAPH ELOT SCALE FUNCH COMPUTED HYDROGRAPH FYMEN HYDROGRAPH ON THIS UNIT FIRST OBDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	INUTES Page 8	
	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SANI TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COFFFICIENT	21.2	487.00	26.	**			PRINT CONTROL PLOT CONTROL HYDROGRAPH ELOT SCALE PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS INNI FIRST ORDINATE PUNCHED OR SAN TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME	
υ			NUMBER OF INITIAL ( WORKING R	10.5	486.50	σ.	* * * *					
CNAME	VARIABLES 4 0 0. 22 22 1 1 160 0.167	NG DATA		0.0	486.00	0.	* * * *			VARIABLES 4 0 0. 1 22 1 160	DATA FOR INPUT TIME 6 JYDAIR 1JAN94 JYTIME 0	
* * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES IPNUT O SCAL IPNCH IOUT ISAVI	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	****	*****	Pond2 * * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES    PRINT	TIME DATA FOR D XXMIN JXDATE JXTIME	
38 KK	39 PKO		40 RS	41 SV	42 SE	43 SQ	*** *** ***		44 KK	45 KO	48 IN	

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Dam Assessment Report

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The state of the s	5.out				000000000000000000000000000000000000000			GRAPH D ORDINATE 0	* * * * * * * * * * * * * * * * * * * *		თ
	Havana5.out			CIPITATION	000000000000000000000000000000000000000	ION OUS AREA		*** UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 1. 0. 0.	* * * *		SCALE YDROGRAPH Page
1		SUBBASIN AREA		BASIN TOTAL PRECIPITATION	TTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA		7 EN	* * * * * * * * * * * * * * * * * * * *		PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PAGE
				16.00 BASIN	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.00		UNITGRAPH 0.15 LAG		* * * *	В	
· · · · · · · · · · · · · · · · · · ·	FF DATA	ARACTERIST	ON DATA		PRECIPAL PRE	0.00 100.00 100.00	NLESS UNI	15	* * * * * * * * * * * * * * * * * * * *	CNAME	OL VARIABI
	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.03	PRECIPITATION	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.00 0.014 0.014 0.010 0.00 0.0	S LOSS RATE STRTL CRVNBR RTIMP	S DIMENSIONLESS TLAG	49.	*	Pipe2 * * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES 1 PRNT 0 1 PLOT 0 QSCAL 0. IPNCH 0
	SUBI	ıs	Id			SCS	scs	54.	* * * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * *	'no
		46 BA		47 PB	0 9	74 LS	75 UD		* * * *	76 KK	77 KO
			-			LLA	H G	¥			
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IOOT ISAVI ISAVZ IIMINT	HYDROGRAPH ROUTING	78 RS STORAGE ROUTING NSTES RSVRIC X	79 SV STORAGE	80 SQ DISCHARGE	81 SE ELEVATION		化苯苯 化水铁 医水头 水水头 水水水 计分类 计分别 医水果	**********		O <sub>M</sub>	IN TIME	SUBBASIN RUNOFF DATA	84 BA SUBBASIN C TARE	BF	The second secon

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			BASIN TOTAL PRECIPITATION	DERN O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UN 7 END-1	* * * * *			PRINT CONTROL PLOF CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAN LAST ORDINATE PUNCHED OR SAN ILME INTERVAL IN HOURS	
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	P P P P P P P P P P P P P P P P P P P	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			7 ENU 0,	***		PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS OF ETRAY ORDINATE PUNCHED OR LAST ORDINATE PUNCHED OR TIME INTERVAL IN HOURS	of HYDROGRA
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and a more			ESS UNITG		4,	* * * *	CNAME	VARIABLES  0 0 2 2 1 160 0.167	INATION 4
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	CONDITION	19.7	488.50	162.	488.50					The state of the s
	TYPE OF INITIAL CONDITION	17.2	488.00	139.	488.00		19.75 162.12 488.50			
		14.6	487.50	116.	487.50		17.17			
	ELEV	12.1	487.00	93.	487.00		14.63 115.56 487.50			
	ITYP	9.6	486.50	72.	486.50		12.12 93.44 487.00		S	
8 .		7.2	486.00	53.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA 2.36 4.76 7.18 9.64 13.1 34.87 52.74 72.40 85.00 485.50 486.00 486.50		F SUMMARY : FEET PER SECOND AREA IN SQUARE MILES Page 14	Andrew Commen
E GRAPH HIS UNIT ED OR SAVE RS	ICIENT	8.4	485.50	35.	485.50	* *	OUTFLOW-EI 7.18 52.74 486.00		FF SUMMARY C FEET PEF AREA IN S Page 14	Toyyour Congress of the Congre
ROL OL TELOT SCAL TELOT SCAL STARPH ON T WYTE PUNCHE ATE PUNCHE	UBREACHES/ NDITION ND D COEFF	2.4	490.00	19.	485.00		D STORAGE- 4.76 34.87 485.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE M Page 14	
ABC PRINT CONTROL PLOT CONTROL PLOT CONTROL PROGRAPH PLOT SCALE PRONCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT STATS TORDIVATE DUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	0.0	484.50	7.	484.50		COMPUTE 2.36 19.31 485.00	27.64 234.92 490.00	FL	
M	100	0.0	489.00	0.	489.00		0.00 6.95 484.50	24.98 210.47 489.50		and Symmetry
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Stplog ***  *** Coulbut Co	HYDROGR. STORA(	STO	ELEVATION	DISCHARGE	ELEVATION		STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION		
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an and a second		TIME OF	MAX STAGE			77.61	12,83		74.17			15.33	
· ·		MAXIMUM	STAGE		0 0		486,54		493.17			486.93	
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		M PERIOD	7.2-HOUR	14.	10.	12.	16.	40.	22.	'n.	50.	47.	
	.out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	15.	11.	14.	16.	43.	24.	4.	54.	51,	
	Havana5.out	AVERAGE FLO	6-HOUR	44.	21.	39.	27.	.66	39.	10.	94.	.98	
		TIME OF		12.00	13.17	12.00	12.83	12.00	14.17	12.00	12.00	15.33	
		PEAK		317.	. 23.	284.	33.	650.	40.	74.	130.	91.	
arm and		STATION		Pond1	Pipe1	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	*
17 Marie 18		OPERATION		HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	D TO	*** NORMAL END OF HEC-1 ***
		OPER		HYDR	ROUTI	HYDR(	ROUTE	HYDRC	ROUTE	HYDRO	4 COM	ROUTED TO	NORMAL END
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Dam Assessment Report

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* HYDROLOGIC ENGINEERING CENTER * 609 SECOND STREET * DAVIS, CALIFORNIA 95616 * (916) 551-1748 * ***********************************					*** *** *** *** *** *** *** *** ***		
* VERSION 4.0.1E * * * VERSION 4.0.1E * * * RUN DATE TIME * * * *******************************	5 IO OUTPUT CONTROL VARIABLES 1 PRANT 4 PRINT CONTROL 1 PLOT CONTROL GSCAL 0. HYDROGRAPH PLOT SCALE	IT HYDROGRAPH TIME DATA  NATA  10 MINUTES IN COMPUTATION INTERVAL  1DATE  1TAME  1TAME  NO,  160 NUMBER OF HYDROGRAPH ORDINATES  NDATE  NDATE  NDATHE  1230 REDING THE  ICENT  19 CENTURY MARK	COMPUTATION INTERVAL 0.17 HOURS TOTAL TIME BASE 26.50 HOURS	ENGLISH UNITS  DRAINGER, REBA  PRECIPITATION DEPTH INCHES  LENGTH, ELEVATION FEET  FLOW  STORAGE VOLUME  STORAGE VOLUME  ACRE-FEET  TEMPERATURE  DEGREES FAHRENHEIT	*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***	6 KK * Pondl * * ********************************	7 KO OUTPUT CONTROL VARIABLES  IPLOT 0 PLOT CONTROL  OSCAL 0. HYDROGRAPH PLOT SCALE  IPNCH 1 PUNCH COMPUTED HYDROGRAPH  Page 6
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Ė÷	TIME D	SUBBASIN RUNOFF	SUBBAS	PRECIP		INCR	000	00	00	00	0000	SCS LO	scs DI		• 09	* * * *	****	
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			TYPE OF INITIAL CONDITION					* * * * *					
			OF INITIA	87.6	490.00	209.		* * * * *					
		-	ELEV TYPE	76.2	489.50	171.		* * * * *					
				65.0	489.00	136.		*					
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	<b>Q</b>			42.8	488.00	74.		* * * *				<b>9</b> -	
	PLOY CONTROL HYDROGRAPH PLOY SCALE TONCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINARE PUNCHED OR SAVED FIRST ORDINARE PUNCHED OR SAVED FIRST ORDINARE PUNCHED OR SAVED FIRE INTERVAL IN HOURS		ES/ SFFICIENT	31.9	487.50	48.	*	***				PRINT CONTROL BLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SARE HYDROGRAPH ON THIS UNIT FIREY ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	INUTES
	PRINT CONTROL PLOT CONTROL HYDROGRAPH ELOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UP FIRST ORDINARE PUNCHED OR LAST ORDINARE PUNCHED OR THEN INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	21.2	487.00	26.		* * * * * * * * * * * * * * * * * * * *				PRINT CONTROL HYDROGRAPH FLOT SCALE FUNCH COMPUTED HYDROGRAPH FURE HYDROGRAPH FIRST HYDROGRAPH FIRST ORDINATE PUNCHED OR 1 LAST ORDINATE PUNCHED OR 1 TIME INTERNAL IN HOURS	SERIES TIME INTERVAL IN MINUTES
U			NUMBER OF INITIAL WORKING	10.5	486.50	9		* * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH PL BUNCH COMBUTE SAVE HYDROGRA FIRST ORDINAT LAST ORDINAT TIME INTERVAL	
CNAME	. VARIABLES 0 0 22 1 160 0 0160	ING DATA	1 486.00 0.00	0.0	486.00	0.		* * * * *				VARIABLES 4 0 0. 1 22 1 160 0.167	DATA FOR INPUT TIME JXMIN 6
* * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES  I IROT  QCAL  OCAL  IOUT  ISAN1  I ISAN2  I ISAN2  I ISNN  I	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE		*** ***	***************************************	Pond2 *	* ********	OUTPUT CONTROL VARIABLES  IPRNT 0  QGCAL 0.  IPNCH 1  IONT 22  IGAVI 1  ISAVI 1  ISAVI 160  TIMINT 0.167	TIME DATA FOR :
* * * * 38 WK 86	39 KO		40 RS	41 SV	42 SE	43 SQ		**	* *	44 KK *	* *	45 KO	48 IN

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		PITATION	000000000000000000000000000000000000000	ION IS AREA		*** JNIT HYDRO	D-OF-PERIO	* * * * * * *			SCALE IYDROGRAPH Page
N AREA		otal preci	ERN 0.00 0.00 0.00 0.01 0.01 0.01 0.00 0.00	. ABSTRACT NUMBER I IMPERVIO				* * * * * * * * * * * * * * * * * * * *			PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH PAGG
			110N PATT 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00		RAPH LAG		ις.	*	ı	Δ	
TERISTICS 0.03	ATA	16.00	PRECIPITAT 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0	100.00	ESS UNITG 0.15		15.	* * * * *		CNAME	OUTFUT CONTROL VARIABLES 1 IFOT 0 0 SCAL 0 I IPNCH 0
IN CHARAC TAREA,		STORM	EMENTAL 1	OSS RATE STRTL CRVNBR RTIMP	IMENSIONI TLAG		49.	*	* * *	* * * * *	JT CONTRO! IPRNT IPLOT QSCAL IPNCH
SUBBAS	PRECI		INCI	SCS	SCS		54.	* * * * * *	* * *	C. *	TOO
æ Æ		PB	19 PI	74 LS	75 UD			* * * * * * * * * * * * * * * * * * * *		76 KK	77 KO
	SUBBASIN CHARACTEKINIS. 0.03 SUBBASIN AREA	SUBBASIN CHARACIEKLETUS 0.03 PRECIPITATION DATA	SUBBASIN CHARACTERISTICS TAREA, PRECIPITATION DATA STORM 16.00	PRECIPITATION DATA  TYREA  TYREA  STORM  16.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00  0.00 0.00 0.00 0.00 0.00 0.00  0.00 0.00 0.00 0.00 0.00 0.00  0.00 0.00 0.00 0.00 0.00 0.00  0.01 0.01	PRECIPITATION DATA  TYREA, 0.03 SUBBASIN AREA  PRECIPITATION DATA  STORM 16.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PRECIPITATION DATA  STORM INCREMENTAL PRECIPITATION  INCREMENTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	SUBBASIN CHARACTELISILS SUBBASIN AREA  PRECIPITATION DATA  STORM INCREMENTAL PRECIPITATION  NOTE	PRECIPITATION DATA  STORM 16.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  O.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	PRECIPITATION DATA  STORM 16.00 BASIN TOTAL PRECIPITATION  INCREMENTAL PRECIPITATION PATTERN  10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	PRECIPITATION DATA STORM STEAM PRECIPITATION TRACES TO STORM 16.00 BASIN POTAL PRECIPITATION STORM 16.00 BASIN POTAL PRECIPITATION STORM 16.00 BASIN POTAL PRECIPITATION TRACES TO STORM 16.00 BASIN POTAL PRECIPITATION PATERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	SUBBASIN CHEANATH STATES AND AREA FREEDRITATION DATA STORES (10.00 B) SUBBASIN AREA FREEDRITATION BATTERN (10.00 B) SUBBASIN AREA FREEDRITATION AREA FREEDRITATION AREA FREEDRITATION AREA FREEDRITATION (10.00 B) SUBBASIN AREA FREEDRITATION

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/ l			TYPE C	9.69	251.	489.50		* * *						
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			0.	59.4	205.	489.00		* * * * *						
			ITYP	49.3	163.	488.50		*** *** *** *** *** *** *** *** *** ***						
				39.3	124.	488.00		* * *						
	HAVADAG.OUT SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE EUNCHED OR SAVED TIME INTERVAL IN HOURS		ŧ	44				* * * *		II SAVED AVED				01
П	Havane THIS UCHED OF HED OR		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	29.4	89.	487.50	*	* * *		PRINT CONTROL HYDROGRAPH ELOT SCALE HYDROGRAPH ELOT SCALE PUNCH COMPUTED HYDROGRAPH FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED THE INTERVAL IN HOURS	NUTES			ESSION Page 10
U	HAV. SAVE HYDROGRAPH ON THI. FIRST ORDINATE PUNCHED LAST ORDINATE PUNCHED TIME INTERVAL IN HOURS		REACHE DITION D COE	19.5	58.	487.00		*		PRINT CONTROL PLOT COURSOL PLOT COURSOL PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UITERST ORDINATE PUNCHED OR LAST ORDINATE PUNCHED OR THE INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT Page
	HYDROG ORDINA INTERVI		OF SUI AL CONI G R ANI	7				* * * *	poud t	PRINT CONTROL PLOT CONTROL HYDROGRAPH EL PUNCH COMPUTE SAVE HYDROGRA FIRST ORDINATI LAST ORDINATI	SERIES TIME INTERVAL STARTING DATE STARTING TIME		SUBBASIN AREA	L FLOW BASE FL ION CON
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. !	IOUT ISAV1 ISAV2 TIMINT	PH ROUT	STORAGE ROUTING NSTPS RSVRIC X	AGE	3CE	NO		* * * * *	: * * * *	IT CONTROL IPRNT IPLOT QSCAL IRNCH IOUT ISAV1 ISAV2 TIMINT	DATA FOR : JXMIN JXDATE	NUNOFF I	I CHARAC	TLOW CHAR? STRTQ QRCSN RTIOR
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			78 RS	79 SV	80 SQ	81 SE		** * * * * * * * * * * * * * * * * * * *	82 KK	83 KO	87 IN		84 BA	85 B B F
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:IPITATI	000000000000000000000000000000000000000	rion ous area		*	UNIT HYI ND-OF-PEI 3.	* * *		SCALE IYDROGRAJO ON THIS VUNCHED OF	Pag	
BASIN TOTAL PRECIPITATION	Nation 1	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			7 50	* * * * *		PRINT CONTROL HYDROGRAPH PLOT SCALE PONCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		
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υ,	NON I	SCS LOS	SCS DIN		122.	* * *	* * * * * * * * * * * * * * * * * * * *	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		
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	Havar		ES/ EFFICIE	67	493.50	S.	*	* * *				£	ALE ROGRAPH THIS U CHED OR HED OR	INUTES			SESSION		TATION	Page 12
			1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	44.5	493.00	31.		* * *				PRINT CONTROL PLOT CONTROL HYDROGRADH BYON SCATE	PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERNAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE	Ξ	K.	S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	
			ER OF S TIAL CO ING R A	22.2	492.50	11.		* *				PRINT CONTROL FLOT CONTROL	H COMPU HYDROG T ORDINA ORDINA	SERIES TIME INTERVAL STARTING DATE	STARTING TIME	SUBBASIN AREA	IAL FLOI V BASE I SSION CO		TOTAL	
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		HYDROGRAPH ROUTING DATA		0.0	492.00	0.		* * * * *				OUTPUT CONTROL VARIABLES 4 IPPNT 0 OSCAL	22 22 1 160 0.167	TIME DATA FOR INPUT TIME SERIES JXMIN JXDATE 1.7AAN94 STRRITI	0	SUBBASIN CHARACTERISTICS TAREA, 0.01	FLOW CHARACTERISTICS STRTQ 0.00 : QRCSN 0.00 I	ATA	16.00	
		H ROUTI	STORAGE ROUTING NSTPS RSVRIC X	EI (5	NO	38		* * *	*	* *	* *	CONTROL IPRNT IPLOT	IPNCH IOUT ISAV1 ISAV2 TIMINT	DATA FOR I JXMIN JXDATE	JXTIME SUBBASIN RINOFF DATA	CHARAC	FLOW CHARA STRTQ QRCSN RTIOR	PRECIPITATION DATA	NRM.	
		ROGRAP	STORAGE N: RS'	STORAGE	ELEVATION	DISCHARGE		*	******	Pond3	* *******	UTPUT C IP IP	AL HAN	ME DAT	TXT.	BBASIN	BASE FLOV STE QRC RTI	ECIPITA	STORM	
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Hava	000000000000000000000000000000000000000	TION OUS AREA		*	UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 0. 0. 0.	* * * * * * * * * * * * * * * * * * * *		SCALE HYDROGRA HYDROGRA FON THIS PUNCHED UNCHED O	GRAPHS T	* Ф	
; ;	0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			H	*		PRINT CONTROL HYDOCOMPAND HYDROGRAPH PLOT SCALE PUNCH COMPOTED HYDROGRAPH FYRST WASH HYDROGRAPH ON THIS UNIT FYRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	NUMBER OF HYDROGRAPHS TO COMBINE		
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		LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG		13.	* * *	* * * * * * * * * * * * * * * * *	T CONTROL IPPNT IPLOT QSCAL IPNCH IOUT ISAV1 ISAV2	HYDROGRAPH COMBINATION ICOMP		
		SCS LO	scs DI		14.	* * * *	* * * * * * * * * * * * * * * * * * *	ruarno .	HYDROG		
			0			* * * * *			7.		
		152 LS	153 UD			* * *	154 KK	155 KO	156 HC		
											F

FAY 127

Dam Assessment Report

# **EPA ARCHIVE DOCUMENT**

	**				ONDITION	19.7	488.50	162.	488.50				
7	**				OF INITIAL CONDITION	17.2	488.00	139.	488.00		19.75 162.12 488.50		
	***				ELEV TYPE O	14.6	487.50	116.	487.50		17.17 138.53 488.00		
1	**					12.1	487.00	93.	487.00		14.63 115.56 487.50		
	****				<b>AXII</b>	9.6	486.50	72.	486.50	į	ATA 12.12 93.44 487.00		ន
	* * * * *		Q Q			7.2	486.00	53.	486.00		LEVATION D 9.64 72.40 486.50		RUNOFF SUMMARY IN CUBIC FEET PER SECOND HOURS, AREA IN SQUARE MILES
	Havana6.out		LLE (OGRAPH THIS UNIT HED OR SAVE		,/ FICIENT	4.8	485.50	35.	485.50	*	-OUTFLOW-E 7.18 52.74 486.00		RUNOFF SUMMARY CUBIC FEET PER RS, AREA IN SI
	* * * *		PRINT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH THIS WALT PUNCH COMPUTED PUNCHED ON SAVED LAST ORDINATE PUNCHED OR SAVED TINE INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	2.4	485.00	19. 235.	485.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA 2.36 4.76 7.18 9.64 19.31 34.87 52.74 72.40 85.00 485.50 486.00 486.50		RUN FLOW IN CUB TIME IN HOURS,
	***	ABC			NUMBER OF INITIAL ( WORKING R	0.0	484.50 489.50	7.	484.50 489.50		COMPUT 2.36 19.31 485.00	27.64 234.92 490.00	FIME
	* * * *	CNAME	1 VARIABLES 4 0 0 2 2 1 160 0 0.167	NG DATA	1 484.00 0.00	0.0	484.00	186.	484.00		0.00 6.95 484.50	24.98 210.47 489.50	
	**	* * * * * * * * * * * *	OUTPUT CONTROL VARIABLES IPRNT 0 GSCAL 0 IPRNCH 0 IOUT 22 ISAV1 1 ISAV1 160 TIMINT 0.167	HYDROGRAPH ROUTING	STORAGE ROUTING NSTRS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	ELEVATION		0.00 0.00 484.00	22.35 186.15 489.00	
	**	**** Stplog ***	ITAO	HYDROG	STOF	ST	ELEV	DISC	ELEV		STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
	***	, 157 KK	158 KO		159 RS	160 SV	162 SE	164 SQ	166 SE			ш	

TIME OF	MAX STAGE		13.17		12.67		14.17			15.33	
MAXIMUM	STAGE		486.92		486.57		493.17			486.96	
BASIN	AREA	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15	
JM PERIOD	72-HOUR	14.	10.	12.	16.	40.	22.	ë.	50.	47.	
Havana6.out AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	15.	11.	14.	16.	43.	24.		54.	51.	
Havana6.out AVERAGE FLOW FO	6-HOUR	44.	21.	39.	28.	,66	39.	10.	95.	.986.	
TIME OF	PEAK	12.00	13.17	12.00	12.67	12.00	14.17	12.00	12.00	15.33	
PEAK	FLOW	317.	23.	284.	35.	650.	40.	74.	131.	92.	
	STATION	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	* * *
	OPERATION	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO	*** NORMAL END OF HEC-1 ***
	+	+	+ +	+	+ +	+	+ +	+	+	+ +	ON ***

HA 129

Effluent Pipe Analysis
Havana Power Station
East Ash Pond #3B

January 2, 2002 JHK

The discharge from pond #3 is carried to the Illinois River by a 36-inch round reinforced concrete pipe. The pipe is fitted with Anderson Seals – a three-part rubber joint seal that allows the pipe to operate under pressure without leakage at the joints. Under normal conditions, the pipe does not flow full. At high flow conditions, water will back up in the stop log structure, pressurizing the effluent pipe.

The following conditions were analyzed using the FlowMaster program from Haestad.

- 1. 100-year, 24-hour storm, will all ponds discharging through the effluent pipe.
- 2. The ½-PMP storm, with all ponds discharging through the effluent pipe.

The results of the pressure pipe analysis for each of the two conditions is summarized below:

Condition	Required Flow (cfs)	Pressure at Pipe Inlet
1	42	neg. head- pipe not full
2	93	9.99 psi (~23' head)

Condition 2 would cause some water to overflow from the manholes located along the length of the 36" effluent pipe, due to the high pressure. This is acceptable because of the small likelihood of the ½-PMP storm and general flooding in the area from sources other than the pond.

However, as an additional precaution, the standpipe in pond 2 will be modified to restrict water flow into pond 3 once pond 3B is put into service. Pipe diameter will be reduced from 3'  $\phi$  to 1.5'  $\phi$ . Two additional HEC-1 runs were made to investigate effects on possible pressure and flow through first manhole:

- Discharge from pond 2 reduced to reflect restricted flow. The HEC-1 analysis showed that flow at the outlet structure was reduced to 82 cfs, which translates into approximately a 13' head at the 1st manhole.
- 2. Same as above plus plant flow of 11.9 cfs stopped. This condition may require change in plant operating procedures if water is seen discharging through manhole. The HEC-1 analysis showed that flow at the outlet structure was reduced to 72 cfs, which translates into approximately a 6.9' head at the 1<sup>st</sup> manhole and 5.5' head at the 2<sup>nd</sup> manhole. The existing 1<sup>st</sup> manhole configuration shows that it is capable of containing up to 10.5' of head, which is greater than the 6.9' head calculated and 6.8' head at the 2<sup>nd</sup> manhole which is greater than the 5.5' calculated, therefore no overflow occurs once plant flow is stopped.



W 130

Eff. press.@93 cfs (0.5 PMP-16" storm) Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 62 cfs effluent flow
Flow Element	Pressure Pipe 93
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data		
Pressure at 2	0.00 psi	
Elevation at 1	464.00 ft	435
Elevation at 2	448.30 ft	
Length	3,684.00 ft	3, 5 %
C Coefficient	140.0	
Diameter	36.00 in	
Discharge	41.742.0 gal/min	- 93 cfg

Results					
Pressure at 1	9.99	psi	J. 2	3. i '	head
Headloss	38.75	ft			
Energy Grade at 1	489.74	ft			
Energy Grade at 2	450.99	ft			
Hydraulic Grade at 1	487.05	ft			
Hydraulic Grade at 2	448.30	ft			
Flow Area	7.07	ft²			
Wetted Perimeter	9.42	ft			
Velocity	13.16	ft/s			
Velocity Head	2.69	ft			
Friction Slope	0.0105	17 ft/ft			

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HA 131

terbury, CT 06708 (203) 755-1666 Page 1 of 1

4.3

### Eff. pipe press. @42cfs(100 yr storm 7") Worksheet for Pressure Pipe

Project Description	on
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 42 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	<del></del>	
Pressure at 2	0.00 psi	
Elevation at 1	464.00 ft	
Elevation at 2	448.30 ft	
Length	3,684.00 ft	
C Coefficient	140.0	
Diameter	36.00 in	
Discharge	18,850.0 gal/min = 4	2cfs

Results			_				
Pressure at 1	-2.95	psi	PIPE	Deas	NOT	FLOW	BULL
Headloss	8.89	ft					
Energy Grade at 1	457.74	ft					
Energy Grade at 2	448.85	ft					
Hydraulic Grade at 1	457.19	ft					
Hydraulic Grade at 2	448.30	ft					
Flow Area	7.07	ft²					
Wetted Perimeter	9.42	ft					
Velocity	5.94	ft/s					
Velocity Head	0.55	ft					
Friction Slope	0.0024	13 ft/ft					

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FlowMaster v5.15 Page 1 of 1



UBJECT: EFFLUENT PIPE ANALYSIS	DESIGNER: JHK
	Page:
	DATE:
·	
	•
STOPLOG STRUCTURE IN	POLISHING POND
INVERT ELEV. 463.5	
ESSURE HEAD	
	L = 3684'
	<i>i</i>
	36" & RRCCP Q
	RRCCP Q
	INVERT ELEV.
	446,8°
	0 -
SCHEMATIC OF EFF	FLUENT TIPE
HA 133	

### Submerged standpipe discharge Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pond 3B-Submerged standpipe flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data		_
Pressure at 1	0.43 psi	_
Pressure at 2	2.60 psi	
Elevation at 1	6.00 ft	
Elevation at 2	0.00 ft	
Length	150.00 ft	
C Coefficient	135.0	
Diameter	36.00 in	

Results		
Discharge	31,378.0	gal/min
Headloss	0.99	ft
Energy Grade at 1	8.51	ft
Energy Grade at 2	7.52	ft
Hydraulic Grade at 1	6.99	ft
Hydraulic Grade at 2	6.00	ft
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Velocity	9.89	ft/s
Velocity Head	1.52	ft
Friction Slope	0.0066	32 ft/ft

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Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15 Page 1 of 1

			0.5 PMP-16" storm) Pressure Pipe
Project Description	c:\haestad\fmw\hav	rana3h fm2	
Project File Worksheet	Pressure at 92 cfs		
Flow Element	Pressure Pipe		
Method Solve For	Hazen-Williams For Pressure at 1	iiiuia	
nput Data			
Pressure at 2 Elevation at 1	0.00 psi 465.00 ft		
Elevation at 2	448.30 ft		
Length	3,684.00 ft		
C Coefficient Diameter	140.0 36.00 in		
Discharge	36,805.0 gal/min	= 82 cfs	
Results Pressure at 1	6.06 ps	- 14'	head @ OUTLET STRUCT.
Headloss	30.69 ft		·
Energy Grade at		14'	3684 - 273) : 1296 @ 15 HANHOLE
Energy Grade at Hydraulic Grade			3684
Hydraulic Grade	at 2 448.30 ft		
Flow Area	7.07 ft <sup>2</sup>		
Wetted Perimete		0	
Velocity Velocity Head	11.60 ft/ 2.09 ft	5	•
Friction Slope	0.008330 ft/	ft	
		e	JEM HINGHOSE (700 FURTHER DIWNST
		•	, , , , , , , , , , , , , , , , , , , ,
		.11	1684 - 173 - 700) = 10.3 @ HEW HAPANE
		17 (	1624
			, ta C -
			- /
		HA	FlowMaster v5
АМ	Haestad Methods, Inc.	37 Brookside Ro	nd Waterbury, CT 06708 (203) 755-1666 Page 1 c

### Eff. press.@72 cfs (0.5 PMP-16" storm)

	Eff. press.@72 cfs (0.5 PMP-16" storm) Worksheet for Pressure Pipe
	Project Description
ſį	Project File c:\haestad\fmw\havana3b.fm2  Worksheet Pressure at 92 cfs effluent flow Flow Element Pressure Pipe
[-]	Method Hazen-Williams Formula Solve For Pressure at 1
$\{\}$	Input Data Pressure at 2 0.00 psi
	Elevation at 1 465.00 ft  Elevation at 2 448.30 ft  Length 3,684.00 ft
	C Coefficient 140.0 Diameter 36.00 in Discharge 32,316.0 gal/min = 72 cfs
f]	Results
	Pressure at 1 3.22 psi № 7.43' head € ουτίετ δταυστ.  Headloss 24.12 ft  Energy Grade at 1 474.03 ft  7.23' / 2/41' 275'
	Energy Grade at 2 449.91 ft 7.43 (3684 - 272) = 6.88 C 1 PANHOLE  Hydraulic Grade at 1 472.42 ft 3684  Hydraulic Grade at 2 448.30 ft
{ }	Flow Area 7.07 ft <sup>2</sup> Wetted Perimeter 9.42 ft £ of 3 Pipe = 4.63.5 Velocity 10.19 ft/s Velocity Head 1.61 ft GILADE ELEV. 465
13	Friction Slope 0.006547 ft/ft 468
. }	- 463 5 2 5 3.0' STICK-UP ABOVE GRADE
	3.0' EXTENSION PIECE 16.5' ABOVE & OF PIECE >7.43'
	@ NEW MANHOLE (700 FURTHER DISINSTRUAM)
[]	7.43' (3684'-273'-700') - 5.47' @ NEW MANRALE
	3684' GRADE EILY. 466' - 463.2' \$ OF PIPE
	12/14/01  08:29:31 AM  Haestad Methods, Inc. 37 Brookside Road, Waterbury CT 08:709, (202) 755, 1666  FlowMaster v5.15
. J	08:29:31 AM Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666 Page 1 of 1

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RNY CORPS OF ENCI COIC ENGINEERING 609 SECOND STREET 12, CALIEDRATA 95 (916) 551-1748 	
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0.8538 0.8538 0.9018 0.9921 0.9937 0.9582 0.9647 0.9977 0.9977	KK Pipe2 KO 0 RS 1 SV 0042vol SV 0 * pond2out \$ pond2out \$ 5.5 \$ SC 5.55	Pond3B 1 0.072 11.9 11.9 16.0022 0.0022	0.0345 0.0345 0.063 0.098 0.098 0.121 0.181 0.235 0.772 0.77
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{}	0.9746 0.9864 0.9978	181.12 496 57.66	0.0083 0.0196 0.0319 0.0558 0.0588 0.0968	0.7588	0.8122 0.8474 0.91763 0.91763 0.9176 0.9346 0.9494 0.9762 0.9764 0.9864	
	0.9734 0.9853 0.9967	158.04 495.5 57.66	0.0073 0.0185 0.0307 0.0583 0.0787 0.1338 0.1335	0.7514	0.8428 0.8328 0.8328 0.9933 0.9155 0.948 0.9734 0.9734	
	0.9722 0.9841 0.9956	135.09 495 57.66	0.0062 0.0173 0.0294 0.0425 0.0568 0.0578 0.1114		0.08 0.08 0.08 0.08 0.09 0.09 0.09 0.09	
	.out 0.9709 0.9829 0.9944	112.26 494.5 57.66	0.0051 0.0051 0.0161 0.0281 0.0411 0.0655 0.10892 0.10892	:	0.793 0.8376 0.8376 0.8912 0.9217 0.9284 0.9584 0.9584 0.9629 0.9829 0.9944	n
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SAVE HYDROGRAPH ON HAVARALOUT FIRST ORDINATE PUNCHED OR SAVED TAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	RVAL IN MINUTES DATE TIME		AREA		BASIN TOTAL PRECIPITATION	0.00 0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA		***	7 ENG-OF-PERIOD ORDINATES 2. 1. 0.	*** *** *** *** *** *** *** *** *** *** ***	Page 7
22 SAVE HYDR 1 FIRST ORD 160 LAST ORDI 0.167 TIME INTE	FUT TIME SERIES  6 TIME INTERVAL I 1JAN94 STARTING DATE 0 STARTING TIME	ľA	SRISTICS 0.04 SUBBASIN AREA	ľA	16.00 BASIN TOT	PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	0.00 INITIAL ABSTI 100.00 CURVE NUMBER 100.00 PERCENT IMPE	UNITGRAPH 0.15 LAG		16. 5.	化妆品 化分类 水果属 医甲状 苯苯胺	
IOUT ISAV1 ISAV2 TIMINT	TIME DATA FOR INPUT TIME JAMIN 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.04	PRECIPITATION DATA	STORM	INCREMENTAL PRE 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	SCS LOSS RATE STRTL CRVNBR RTIMP	SCS DIMENSIONLESS UNITGRAPH TLAG 0.15 LAC		60. 54.	** *** *** *** ***	****
	10 IN		g 8		ଷ୍ଟ	11 PI	36 LS	37 UD			* ***	*

				DITION					* * *					
				TYPE OF INITIAL CONDITION	87.6	490.00	26.		***					
				ELEV TYPE OF	76.2	489.50	26.		* **					·
					65.0	489.00	26.		* * *					
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		g o			42.8	488.00	26.		* * * * *					
	Havana.out	PRINT CONTROL  HUDOT CONTROL  HYDROGRAPH PLOT SCALE  PUNCH COMPUTED HYDROGRAPH  PUNCH COMPUTED HYDROGRAPH  FIRST CROINARE PUNCHED OR SAVED  LAST ORDINATE FUNCHED OR SAVED  TIME INTERVAL IN HOURS	-	SS/ SFFICIENT	31.9	487.50	26.	* *	**				PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	INOTES Page 8
		PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UN FIRST ORDINATE PUNCHED OR ; LAST ORDINATE FUNCHED OR ; TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 16.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	21.2	487.00	26.		* * * * * * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVI LAST ORDINATE PUNCHED OR SAVI TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINOTES STARTING DATE STARTING TIME
-	υ			NUMBER O INITIAL WORKING	10.5	486.50	9.		* *					SERIES TIME INT STARTING STARTING
i ;	CNAME	L VARIABLES  0 0.0 22 222 1 1 1 160	ING DATA	2.	0.0	486.00	0.		* * * * *				VARIABLES  4 0 0. 1 22 1 160 0.167	INPUT TIME 6 1JAN94 0
The state of the s	* * * * * * * * * * * * * * * * * * *	OUTDUT CONTROL VARIABLES IPRNT 0 OSCAL 0 OSCAL 0 IPRNCH 0 IOUT 22 ISAV1 1 ISAV2 160 TIMINT 0.167	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVAIC X	STORAGE	ELEVATION	DISCHARGE		化甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	******	Pond2 *	*********	OUTPUT CONTROL VARIABLES  IPLOT 0  QSCAL 0  IPNCH 1  IOUT 22  ISAV1 1  ISAV2 160  TIMINT 0.167	TIME DATA FOR INPUT TIME OXEIN 6 UNDATE 1JAN94 UXTIME 0
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		IPITATIC	000000000000000000000000000000000000000	TON TON AREA		*	UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 1. 0. 0. 0.	化水水 经有力 经存货 医原子 的复数		SCALE HYDROGRAI Pa	
4 AREA		BASIN TOTAL PRECIPITATION	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			-	* * * * *		PRINT CONTROL PYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PUNCH COMPUTED HYDROGRAPH	
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IN CHARAC TAREA,	PRECIPITATION DATA	STORM	INCREMENTAL F 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00	LOSS RATE STRTL CRVNBR RTIMP	MENSIONLE TLAG		д. О	* * *	* * * * * * * * * * * * * * * * * * * *	CONTROL IPRNT IPLOT QSCAL IPNCH	
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		PE OF INI			490.00	* **						
		ELEV TYE	69.6	29.	489.50	* *						
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		ITYP	49.3	29.	488.50	* * * * *						
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	HAVADA.OUT SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED ON SAVED LAST ORDINATE PUNCHED ON SAVED TIME INTERVAL IN HOURS	IENT	29.4	29.	487.50	* * * * * * *		PRINT CONTROL HYDROGRAPH PLOT SCALE POWCH COMPUTED HYDROGRAPH ETHST ORDINATE PUNCHED OR SAVED LAST ORDINATE FUNCHED OR SAVED THE INTERVAL IN HOURS	ν,			SION Page 10
	Havana.ou Ferst Hydrograph on this unit Ferst ordinate punched or sa Last ordinate ?unched or savitme interval in hours	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICENT	19.5	29.		**		PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE SAVE HYDROGRAPH SAVE HYDROGRAPH EFREY ORDINATE PUNCHED OR SAVEL LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT PAGE
	HYDROGRA: ORDINATE ORDINATE INTERVAL	NUMBER OF SUBREACHES, INITIAL CONDITION WORKING R AND D COEFF			0 487.00	* * * *	puod u	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLC PUNCT COMPUTEL SAVE HYDROGRAP FIRST ORDINATE LAST ORDINATE TIME INTERVAL	SERIES TIME INTERVAL STARTING DATE STARTING TIME		SUBBASIN AREA	AL FLOW BASE FLO SION CONS
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TPITATION	000000000000000000000000000000000000000	TION OUS AREA		*	UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 3. 0.00	* * * * * *			SCALE HYDROGRAI NON THIS PUNCHED OF	es Cu	
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PRECIPITATION DATA

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		E OF IN		496.00	٠,	* * *											
		LEV TYP	158.0	495.50	58.	***											
			135.1	495.00	58.	**											
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	al.	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	44.5	493.00 4	31.	* * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH FLOT SCALE BUNCH COMPUTED HYDROGRAPOGE RAVE HYDROGRAPH ON THE FIRST ORDINATE PUNCHED TAST ORDINATE TRYPHOGE THE INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		16.00 BASIN TOTAL PRECIPITATION	ũ
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		NUMBER INITIP WORKING	22.2	492.50	11.	* * * * *							SUBBASIN AREA	INITIAL BEGIN B RECESSI		BASIN T	
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	.ERNU 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			7 ENG 7	* * * * *		PERINT CONTROL PLOT CONTROL HYDROGRAPH DATA BAVE HYDROGRAPH ON THIS UN FIRST PONUMER PROMED ON FIRST ORDINATE PUNCHED ON TIME INTERVAL IN HOURS TIME INTERVAL IN HOURS	R OF HYDROG		
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		* * * * * * * * * * * * * * * * * * *			DITION	19.7	488.50	162.	488.50					
	9 9				TYPE OF INITIAL CONDITION	17.2	488.00 48	139.	488.00 48			19.75. 162.12 488.50		
		* * * * * *				14.6	487.50 48	116.	487.50 46			17.17 138.53 488.00		
{}	;	* * * * * * * * * * * * * * * * * * *			ELEV	12.1	487.00 4	93.	487.00 41			14.63 115.56 487.50		
					TYP	9.5	486.50 4	72.	486.50 4		ra Fa	12.12 93.44 487.00		<b>10</b>
	Havana.out	* * * * * * * * * * * * * * * * * * *	9.0			7.2	486.00	53.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	9.48 72.40 486.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MILES Page 14
	Havana, out	k	PLOT CONTROL PLOT CONTROL PLOT CONFUDE PLOT SCALE PRINCH COMPUTED #YDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		' FICIENT	4.8	485.50	35.	485,50	* *	-outflow-El	7.18 52.74 486.00		FF SUMMARY CFEET PER AREA IN S Page 14
	1 1 1	K K K K	PELINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH CONFUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAL LAST ORDINATE PUNCHED OR SAT THE INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	2.4	485.00 490.00	19.	485.00		ED STORAGE-	4.76 34.87 485.50		RUNC LOW IN CUBI IN HOURS,
	;	A A A A A A A A A A A A A A A A A A A			NUMBER OF SUBREACH: INITIAL CONDITION WORKING R AND D COI	0.0	484.50	7.	484.50		COMPUT	2.36 19.31 485.00	27.64 293.60 490.00	TIME
	:	CNAME	CONTROL VARIABLES PRAT PLOT 0 0 SCGAL 100T 22 SNA1 1 SAV2 1160 MINST 0.167	NG DATA	1 484.00 0.00	0.0	484.00	0. 210.	484.00			0.00 6.95 484.50	24.98 234.92 489.50	
المسمو	;	***  **  **  **  **  **  **  **  **  *		HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	ELEVATION			0.00 0.00 484.00	22.35 210.47 489.00	
		* * * * * * * * * * * * * * * * * * *	TUTPUO	HYDROG	STO	S	BLEV	DISC	ELEV			STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
		157 KK	11 58 K		159 RS	160 SV	162 SE	164 SQ	166 SE			м		<b>5</b>
					\.\	Δ.	(D)	y.						

	TIME OF			13.17		13.17		14.17			15.67
	MAXIMUM	SIAGE		486.92		486.71		493.17			486.72
	BASIN	AREA	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15
	PERIOD	72-HOUR	14.	10.	12.	11.	40.	22.	m'	45.	42.
ut	FOR MAXIMUN	24-HOUR	15.	11.	14.	12.	43.	24.	4.	49.	. 96.
Havana.out	AVERAGE FLOW FOR MAXIMUM PERIOD	6-HOUR	44.	21.	39.	. 61		39.	10,	86.	78.
	TIME OF	7 5 7	12.00	13.17	12.00	13.17	12.00	14.17	12.00	12.00	15.67
	PEAK T		317.	23.	284.	21.	.059	40,	74.	121.	82.
	100 A	STATION	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog
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Dam Assessment Report

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# **US EPA ARCHIVE DOCUMENT**

* U.S. ARMY CARPS OF ENGINEERS * HYDROLOGIC ENGINEERS * * PARY CARL STREET * 009 SECOND STREET * DAVIS, CALIFORNIA 9566 * (916) 551-1748	Rm # 2	), HECIGS, HECIDB, AND HECIKW. SED WITH THE 1973-STYLE INBUT STRUCTURE. EF 91. THIS IS THE FORTRANTY VERSION AMPT INEXITRATION	PAGE 1910			0.0073 0.0083 0.0094 0.0185 0.0196 0.0208 0.0307 0.0319 0.0332 0.0438 0.0452 0.0466 0.0583 0.0598 0.0614 0.0747 0.0764 0.0782
# FLOOD HYDROGRAPH PROCKAGE (HEC-1) * * FLOOD HYDROGRAPH PROCKAGE (HEC-1) * * * * * * * * * * * * * * * * * * *	XXX	THIS PROCRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HECIGS, HECIDB, AND HECIKM.  THE DEFINITIONS OF VARIABLES -RITMP- AND -RITOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -MASKE- ON RAL-CARD WAS CHANGED WITH REVISION BATED 28 SEP 81. THIS IS THE FORTRANT7 VERSION NEW OPTIONS: DAMBRER OUTFLOW SUBMERGENCE, SINGLE PREMACE CALCULATION, DSS:NRITE STRAGE FREQUENCY, CONS. RAPE: GREEN AND AMPT INFILTRATION REQUENCY, CALCULATION AND AMPT INFILTRATION FREQUENCY.	HEC-1 INPUT LINE ID	1 ID 2 ID 3 ID 4 IT 10 1JAN94 0 160 5 IO	6 KK Pondl 0 0 1 22 8 BA 0.0358 9 PB 16 10 IN 6 1JAN94 0	0.001 0.002 0.0031 0.0041 0.0051 0.0062 0.016 0.0162 0.016 0.0173 0.018 0.015 0.0161 0.0173 0.0232 0.0244 0.0257 0.0269 0.0281 0.0281 0.0281 0.0281 0.0281 0.0281 0.0281 0.0425 0.0494 0.0508 0.0523 0.0538 0.0411 0.0425 0.0646 0.0662 0.0679 0.0686 0.0712 0.073 Page 1

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A 0 4	KK Stplog KO 0 RS 1	22.35	100 e 1 V 484 489		484 489	SRAM OF	^)	>)					P04	Δi					(***) RUNOFF ALSO COMPUTED AT THIS LOCATION 1.************************************
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						SCHEMA	(V) ROUTING	(,) CONNECTOR	Pondl V	v Pipel							ABC	> 50	SO COMP
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HYDROLOGIC ENGINEERING CENTER * 609 SECOND STREET * DAVIS, CALLFORNIA 95616 * (916) 551-1746 * * * * * * * * * * * * * * * * * * *				** ** ** ** ** ** **		
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На Сово	SCALE	MINUTES IN COMPUTATION INTERVAL STRATING DATE STRATING TIME NUMBER OF HYDROGRAPH ORDINATES ENDING TIME CENDING TIME CENDING TIME OF THE CENDING THE CENTRAL THE CENTRA	Q	* * * * * *	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PAGE PAGE PAGE PAGE PAGE PAGE PAGE PAGE	
	HYCROGRAPH PLOT SCALE	MINUTES IN COME STARTING DATE STARTING TIME NUMBER OF HYDR ENDING DATE CENTURY MARK	SE 26.50 HOURS SE 26.50 HOURS SOUARE MILES INCHES FEET GUBIC FRET PER SECOND ACRE-FEET ACRES DEGREES PAHRENHEIT	*	CONTROL CONTROL SRAPH PLO COMPUTED	
* * * * * *			ASE 26.50 HOURS SQUARE MILES INCHES FEET PER SECC ACRESFEET ACRES DEGRESS PARRENHEIT	* * * * * * * * * * * * * * * * * * *		
* * * * * *	VARIABLES 0 0	E DATA 10 17AN94 0000 160 27AN94 0230 193	a n	*	VARIABI	Annual Control of the
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MAY 1991  VERSION 4.0.1E  RUN DATE TIME	TUTTO	HYDROG N N	ENGLISH UNITS FORLING FORLINGE AREA PRECIPTIVATION DI LENGTH, ELEVATII FLOW STORAGE VOLUME STORAGE VOLUME STORAGE AREA TEMPERATURE	* * * * * * * * * * * * * * * * * * *	OUTPUT CO LIPR LIPR OSC LIPR	
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	YDROGRAPH ORDINATE 1 RDINATE PU	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA		BASIN TOTAL PRECIPITATION	TERN 000000000000000000000000000000000000	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			7 EN 2	* * * * * *	
							PHON PAT 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00		LAG LAG		ιń	* * *	
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	IOUT ISAVI ISAV2 TIMINT		SUBBASIN RUNOFF	ASIN CHAR TAREA,	PRECIPITATION	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG		54.	*	* * *
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				ONDITION				******							
				TYPE OF INITIAL CONDITION	87.6	490.00	26.	*****							
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158 KO OUTPUT CONTROL VARIABLES  1870	
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STORAGE 22.35 24.98 27 OUFFLOW 210.47 234.92 293 ELEVATION 489.00 489.50 490	
	7. 64 3. 60 0.00
Page 19	RUNDEF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MILES Fage 14

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			TIME OF			13.17		13.17		14.17			15.50	
			MAXIMUM			486.92		486.71		492.96			486.48	
			BASIN		0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15	
			M PERIOD	72-HOUR	14	10.	12.	11.	28.	15.	m	39.	36.	
		out	FOR MAXIMU	24-HOUR	15.	11.	14.	12.	31.	16.	4.	42.	39.	
[	]	Havana.out	AVERAGE FLOW FOR MAXIMUM PERIOD	6-HOUR	44.	21.	39.	19.	. 88	29.	10.	.76.	. 68	
Language			TIME OF F	utas	12.00	13.17	12.00	13.17	12.00	14.00	12.00	12.00	15.50	
. [			PEAK		317.	23.	284.	21.	638.	30.	74.	112.	72.	
	designation of the state of the		200	STATION	Pondl	Pipe1	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	
-				NOTE	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	нүркоскарн ат	койтер то	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO	
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HA \$3 166 Page 15

**Energy Dissipation** July 24, 2001 **Havana Power Station** JHK East Ash Pond #3B Energy dissipation of the pond outflow is provided by large riprap at the downstream end of the existing effluent pipe. Since its installation, this riprap has provided good slope protection at the pipe discharge. During a period of lowering the pond by pulling stoplogs, the effluent pipe carried much higher flows than normal, and during this time the riprap held up and provided slope protection. Based on this historical information, it is a reasonable assumption that the riprap will continue to hold up and provide good energy dissipation and slope protection. No changes are proposed as part of construction of pond #3B.

HA 89

De-watering Method and Calculations Havana Power Station East Ash Pond #3B

November 5, 2001 JHK

In the event that the pond system would need to be de-watered, the stoplog structure in the polishing pond (pond #3) will be used. It will be possible to de-water half of the total reservoir in seven days using the stoplog outlet structure as outlined below.

The partition between pond 3B and pond 3 will be breached with Illinois Power earthmoving equipment stationed at the plant or by a contractor's equipment. This will equalize the level in these ponds at a level close to elevation 492.0 feet, since the elevation of pond 3B is at 492' and of pond 3 at elevation 486' with the bulk of the volume coming from pond 3B. The total volume of water will be 1321.1 acre-feet at the start of de-watering. To reduce the volume to 660 acre-feet, the water level will need to be reduced to elevation 476.75 feet. To lower the pond 15.25 feet, 23 of the eight-inch tall stoplogs will be to be removed. Over a seven-day period, this works out to removing one stoplog approximately every 7 hours. The breach between ponds 3 and 3B will be deepened as necessary while de-watering these ponds.

The average flow during de-watering will be 47.5 cfs. The effluent pipe would not flow full at this rate. The flow measurement device downstream of the stoplog structure will be monitored during de-watering to ensure stoplogs are being removed at a sufficient rate to de-water half the pond volume in 7 days.

Pond 1 and 2 will be full of ash by the time pond 3B is finished. Therefore, ponds 1 and 2 are not considered in the de-watering plan.

The following pages contain the calculations for the de-watering plan.

HA FB

e-watering avana Pov ast Ash Po	g Method and Calculations ver Station ond #3B		lovember 5, 2001 HK
ond 3-	Pool volume at elev. 486.0'	= 138,000 cu. Yd.	
		= 85.54 acre-ft.	
	Area at elev. 486' =	4.89 acres	
	Area at elev. 462' = =	94,471 sq. ft 2.17 acres	
	$\Delta = (4.89 - 2.17)/(486'-462')$	) = 0.113 acres/ft.	
= 85.54 a	cre-ft -½(4.89x2 - 0.113[486-y]	)(486-y)	
ond 3B-	Pool volume at elev. 492.0'	= 1,993,412 cu. Yd. = 1235.6 acre-ft.	
	Area at elev. 492' =	1,928,962.6 sq. ft. = 44.	28 acres
	Area at elev. 460' =	1,243,043 sq. ft. = 28.53	36 acres
	$\Delta = (44.28 - 28.536)/(492'-4)$	.60') = 0.492 acres/ft.	
= 1235.6	acre-ft -½(44.28x2 - 0.492[492	-y])(492-y)	
otal volum	e of pond system at elev. 486'	= 1235.6 + 85.54	
		= 1321.1 acre-ft.	
	•		
		x 169	

Pond 3 Volume = 85.54 acre-ft -(0.5)(4.89x2-0.113[486-y])(486-y)

Pond 3B Volume = 1235.6 acre-ft -(0.5)(44.28x2-0.492[492-y])(492-y)

### Havana De-watering volume calculations for Ponds 3 & 3B

rn .	Elev.(ft)	Pond 3	Pond 3B	Total volume
		volume (acre-ft)	volume (acre-ft)	(acre-ft)
1 1				
C1	492.00	85.54	1235.60	1321.14
	491.50	85.54	1213.52	1299.06
1 1	491.00	85.54	1191.57	<b>1277.11</b> .
	490.50	85.54	1169.73	1255.27
	490.00	85.54	1148.02	1233.56
1 1	489.50	85.54	1126.44	1211.98
	489.00	85.54	1104.97	1190.51
	488.50	85.54	1083.63	1169.17
11	488.00	85.54	1062.42	1147.96
	487.50	85.54	1041.32	1126.86
	487.00	85.54	1020.35	1105.89
	486.50	85.54	999.50	1085.04
	486.00	85.54	978.78	1064.32
	485.50	83.11	958.17	1041.28
	485.00	80.71	937.69	1018.40
	484.50	78.33	917.34	995.67
	484.00	75.99	897.10	973.09
	483.50	73.67	876.99	950.66
	483.00	71.38	857.01	928.38
[]	482.50	69.12	837.14	906.26
	482.00	66.88	817.40	884.28
	481.50	64.68	797.78	862.46
1.1	481.00	62.50	778.29	840.79
	480.50	60.35	758.91	819.27
	480.00	58.23	739.66	797.90
1 1	479.50	56.14	720.54	776.68
: I : : : : : : : : : :	479.00	54.08	701.53	755.61
	478.50	52.04	682.65	734.70
i I	478.00	50.04	663.90	713.93
	477.50	48.06	645.26	693.32
( . )	477.00	46.11	626.75	672.86
1.1	476.50	44.18	608.36	652.55
	476.00	42.29	590.10	632.39
LJ	475.50	40.42	571.95	612.38
f i	475.00	38.59	553.93	592.52
-	474.50	36.78	536.04	572.81
: )	474.00	35.00	518.26	553.26

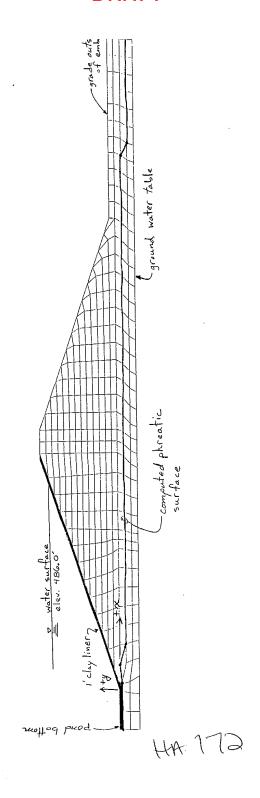


Seepage Analysis Havana Power Station East Ash Pond #3B July 23, 2001 JHK

The new pond will have a polypropylene liner that is impermeable for practical purposes. Since there is no seepage under normal conditions, an "adverse" condition was analyzed to determine what would happen should the liner be damaged. The following calculations are for the full head of the pond being applied directly to the one-foot clay layer under the synthetic liner. This condition could occur if the liner were to have a significant tear or puncture.

The computer program Boss Seep2D was used to analyze the embankment of pond 2 for seepage. Pond 3B is adjacent to pond 2 and has similar properties to pond 2 with a smaller head, therefore Boss Seep2D was not run for pond 3B on the basis of comparison. The clay layer has a very low permeability compared to the sandy soils which form the embankment, and seepage through the clay flows nearly straight down to a phreatic surface elevation below the toe of the embankment. Therefore, seepage on the downstream face of the embankment should not occur, and a toe drain system is not needed. The Seep2D analysis for pond 2 is attached for reference.





Havana East Ash Pond #2 Seepage Analysis

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		USPAR2	.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00	K, & K. in Atyr. in above table  Mat. # lis clay @ 1.0 * 10 cm/sec permeability.  Mat. # 2 is sand @ 2.54 * 10 cm/sec permeability.
		S USPAR1	.1000E-02 .1000E-02 .1000E-02 .1000E-02 .1000E-02 .1000E-02	above table 0 * 10 cm
PLANE FLOW PROBLEM	000	MATERIAL PROPERTIES ANGLE	.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00	Tyr. in lay @ 1.
PLANE FLC	t Ash Pond #2 NODAL POINTS393 ELEMENTS359 DIFF. MATERIALS 12 OF DATUM	MATER	.1035E+01 .2628E+05 .0000E+00 .0000E+00 .0000E+00 .0000E+00	K, & Kz in ft/yr. In Mat. # 1 is clay @ 1. Mat. # 2 is sand @
		5	K1 1035E+01 .2628E+05 .0000E+00 .0000E+00 .0000E+00	$\frac{\lambda}{4}$ $\left  \begin{array}{c} \lambda \\ \alpha \\ \beta \end{array} \right $
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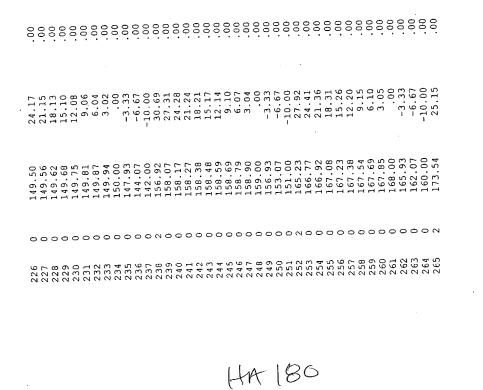
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Havana Power Plant Dynegy Midwest Generation, Inc. Havana, IL 

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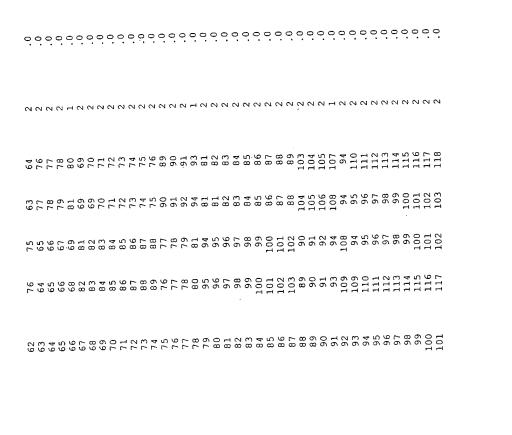
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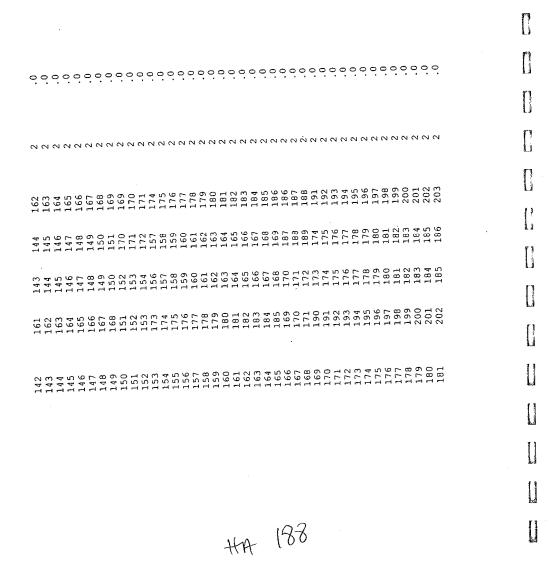




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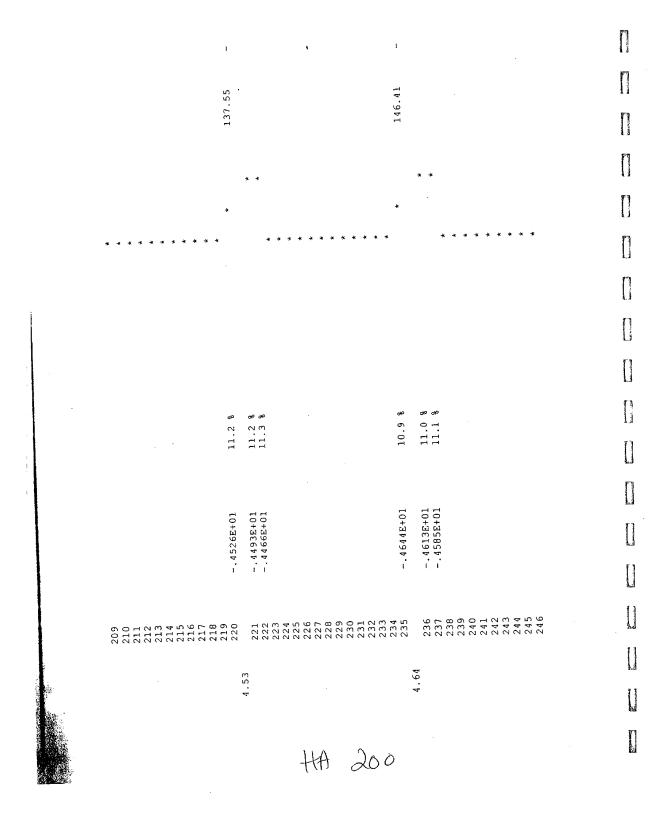
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AND HEADS	PERCENTAGE OF AVAILABLE HEAD	. o . o . o	3.0 % 50.7 %	49.4 % 3.0 %	27.2 % 3.0 %	97.7 % 95.6 %	52.9 % 3.0 %	999.7 .00.0 .4 &		3.0.8	99.3 % 99.4 %
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 . 4337 135 000			- 3333E+01 - 4774E+04 - 1390E+03 - 30000E+001 - 1333E+01 - 4774E+04 - 1390E+03 - 3000E+01 - 0000E+01 - 333E+01	9000.
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381 382 384 385 386 390 390 393	FLOW (-) =		ELMT V1	1221E+03 2679E-02 3242E-02 4219E+03 5692E-02 6258E-02 7107E+02

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.232E-01 .222E-01 .494E+01 .171E-02 .262E-01	. 000E+01 . 257E-01 . 260E-01 . 382E+00 . 267E-01 . 263E-01 . 209E+00 . 270E-01 . 271E-01 . 271E-01 . 275E-01	. 973E-02 . 279E-01 . 279E-01 . 282E-02 . 283E-01 . 283E-01 . 285E-01 . 285E-01 . 100E-02	.289E-01 .289E-01 .295E-02 .294E-01 .306E-01 .305E-01
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-,274E-03 -,101E-03	84	0E-0	127E-0	348E-0	133E-C	362E-C	139E-0	378E-C	147E-0	396E-(	157E-(	419E-	168E-	442E-	180E-	467E-	93E-	4955-	2086-	560E-	238E-	677E-	294E-	7386-03	330E-	.803E-	366E-	857E-	393E-	971E-	4.8.1.E	73E	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	749E-	A 7 E	1 6	.128E
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Dam Breach Analysis Havana Power Station East Ash Pond #3B

December 14, 2001 JHK

The dam breach analysis was done with the use of two computer programs by Boss Corporation. The first was BREACH and the second was DAMBRK. The critical section for the dam breach analysis was taken as the northeast side of pond 3B. This portion of the dam is adjacent to a rural road with houses nearby and a manufacturing facility across the road. This section of the dam is not the highest portion, but it does represent the greatest risk of safety to life and property. The facility/houses would have a combined occupancy of 10 to 15 during a rainstorm event.

Using the BOSS BREACH computer program, possible failure of the dam via overtopping will be modeled. The polypropylene liner and one-foot clay layer are ignored in the modeling due to limitations in the program and their relative small effects during a dam failure. BREACH modeled the erosion of the dam due to a ½-PMP (i.e.; a 16" rain in 24 hours) rainstorm washing out the top of the dam, overtopping occurring and then erosion of a section of the dam. The HEC-1 analysis results giving the maximum stage elevation of approximately 494' during the ½-PMP rainstorm were used as a top of the dam input to the BREACH and DAMBRK models. The topographic plans showing that the area near the northeast corner of the dam had a minimum elevation of 467', therefore this elevation was used as the input to the BREACH and DAMBRK models for the bottom of the dam. Pond water below this elevation is ignored when computing reservoir volumes. For flows into the pond during the failure, it was assumed that overtopping would begin at hour 4 of a ½-PMP storm event. The distribution of this storm is shown on the following pages. In addition to this, a plant flow of 11.9 cfs is added.

From the soil reports, the average  $D_{50}$  value for embankment materials is 0.346 mm. The density for 95% of standard Proctor is 105.6 pcf. The  $\phi$  angle is 30.4°, and the soil has negligible cohesion (C= 10 psf is used as a non-zero value).

The BREACH model indicated that the dam would be protected by the vegetation for a period of time, but that failure of the dam would occur after the vegetation had eroded away. BREACH indicated a peak outflow of 14,693 cfs during the dam failure with a final breach bottom width of 9.5 feet. The side slopes of the breach were approximately 1:1.

DAMBRK was run to analyze the flood crest from the dam to the manufacturing facility and nearby houses. No analysis was done downstream of the manufacturing facility and houses since modeling the flow around the structures with DAMBRK would be very difficult, and give somewhat questionable results. Furthermore, the risk to life safety is greatest at these structures.

The closest house is approximately 200' from the top of the dam and the INTERMET-Havana Foundry manufacturing facility is approximately 650 feet from the top of the dam.

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Dam Breach Analysis Havana Power Station East Ash Pond #3B December 14, 2001 JHK September 1

To run DAMBRK, several criteria had to be selected and assumptions made in order for the program to run. These are listed below:

- 1. A Manning's coefficient value of 0.04 for the entire downstream channel.
- 2. The maximum top width of the downstream channel of 200 feet.
- A constant turbine outflow of 100 cfs was used in order to avoid computational problems with the program.
- 4. A constant inflow of 165 cfs into the pond. This is the sum of the maximum value of the inflow hydrograph used in BREACH plus the 100 cfs assumed for turbine flow.
- 5. The grade is approximately at elevation 467 along the entire channel. A fictitious channel of 10-foot width and a constant slope of 15 feet per mile was added to avoid computational problems in the program.

The key results of the DAMBRK run are summarized below:

- Maximum outflow of 16,295 cfs. This was considered close enough to the 14,693 cfs value (~10%) calculated by BREACH to be acceptable.
- 2. The maximum stage of the breach wave is about 10 feet with a velocity of 9.3 ft/sec., at a distance of about 500 feet (.075 miles) from the dam.

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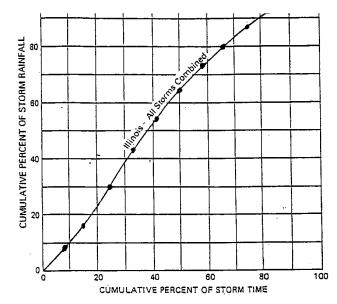


Figure 4. Median time distribution derived from combining all 261 storms from the central Illinois network

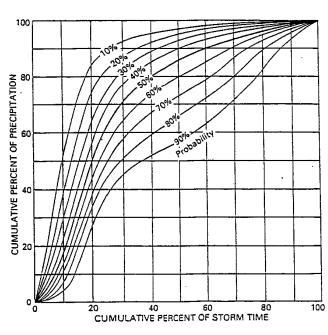


Figure 5. Time distribution of areal mean rainfall in first-quartile storms

From: <u>Time Distributions of Heavy Rainstorms in Illinois</u> by Floyd Huff, Illinois State Water Survey, 1990

HA W9 224

### Flow into pond 3B from the 1/2-PMP storm by 2-hr. intervals

hour	% storm	% precipitation	delta % precip.	inches rain	avg. cfs	avg.+plant inflow
2 4 6 8 10 12 14 16 18 20 22 24	8.33 16.66 25.00 33.33 41.66 50.00 58.33 66.66 75.00 83.33 91.66 100.00	8 16 30 42 53 66 74 80 87 92 96	8 8 14 12 11 13 8 6 7 5 4	1.28 1.28 2.24 1.92 1.76 2.08 1.28 0.96 1.12 0.8 0.64	30.35 30.35 53.12 45.53 41.73 49.32 30.35 22.76 26.56 18.97 15.18 15.18	42.25 42.25 65.02 57.43 53.63 61.22 42.25 34.66 38.46 30.87 27.08

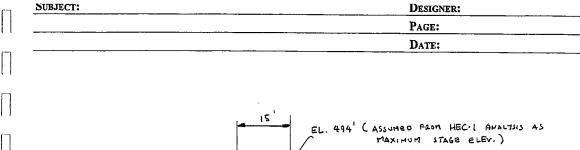
Total rainfall = 16.00

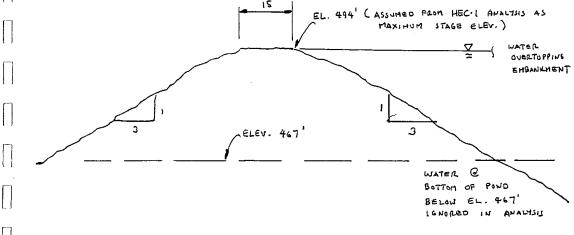
Avg. cfs = (in. rain)\*2,048,802 sq. ft./[(12"/ft)(2 hrs \*60 min/hr\*60 sec/min)]

Plant inflow = 11.9 cfs



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HAVORO 226

SUBJECT:

BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :

PAGE 1 11/09/2001

BREACH (tm) BOSS

Copyright (C) 1988 Boss Corporation All Rights Reserved

Version Serial Number : 22205

#### PROGRAM ORIGIN :

Boss Breach (tm) is an enhanced version of Professor D. L. Fread's July 1988 NWS BREACH program.

#### DISCLAIMER :

Boss Breach (tm) is a complex program which requires engineering expertise boss Breach (tm) is a complex program which requires engineering expertito use correctly. Boss Corporation assumes absolutely no responsibility for the correct use of this program. All results obtained should be carefully examined by an experienced professional engineer to determine if they are reasonable and accurate.

Although Boss Corporation has endeavored to make Boss Breach error free, the program is not and cannot be certified as infallible. Therefore, Boss Corporation makes no warranty, either implicit or explicit, as to the correct performance or accuracy of this software.

In no event shall Boss Corporation be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of purchase or use of this software. The sole and exclusive liability to Boss Corporation, regardless of the form of action, shall not exceed the purchase price of this software.

### PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :

: Calculate peak outflow during dam failu DESCRIPTION

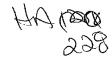
ENGINEER : JHK DATE OF RUN

: 11/09/2001

TIME OF RUN : 2:51 pm

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BOSS BREACH ver		East Ash Pond #3B	PAGE
PROJECT NUMBER			11/09/200
INPUT DATA :			
INFLOW HYDROG			
Time	Upstream		
Elapsed			
TIN(I) (hr)	QIN(I)		
2.00	42.3 42.3 65.0		
4.00	65.0		
6.00	57.4		
6.00 8.00 10.00	53.6		
10.00	61.2		
12.00	53.6 61.2 42.3 34.7		
14.00	34.7		
RESERVOIR VO	LUME DESCRI	IPTION :	
Elevation	Surface Area		
HSA(T)			
HSA(I) (ft MSL)			
(ft MSL)	(acres)		
(ft MSL)	(acres)		
(ft MSL)  494.00 467.00	(acres) 45.3 31.2		
(ft MSL)  494.00 467.00 .00	(acres) 45.3 31.2		
(ft MSL)  494.00 467.00 .00	(acres) 45.3 31.2		
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(ft MSL) 494.00 467.00 .00 .00 .00 .00	45.3 31.2 .0 .0 .0	N DESCRIPTION :	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00 .00 .00	(acres) 45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	N DESCRIPTION :	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00 .00 .TAILWATER CR	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00 .00 .TAILWATER CR	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00 .00 .TAILWATER CR	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00 .00 TAILWATER CR Elevation  HSTW(I) (ft MSL)	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00 .00 TAILWATER CR Elevation  HSTW(I) (ft MSL)	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00 .00 TAILWATER CR Elevation  HSTW(I) (ft MSL)	45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00  TAILWATER CR  Elevation  HSTW(I) (ft MSL)  466.90 467.00	(acres)  45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)0340 .0350 .0350	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00  TAILWATER CR Elevation HSTW(I) (ft MSL) 466.90 467.00	(acres)  45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)0340 .0350 .0350 .0000	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00  TAILWATER CR Elevation  HSTW(I) (ft MSL) 466.90 467.00 470.00 .00	(acres)  45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)0340 .0350 .0350 .0000	
(ft MSL) 494.00 467.00 .00 .00 .00 .00 .00 .00  TAILWATER CR	(acres)  45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)0340 .0350 .0350 .0000	
(ft MSL)  494.00 467.00 .00 .00 .00 .00 .00  TAILWATER CR Elevation  HSTW(I) (ft MSL) 466.90 467.00 470.00 .00	(acres)  45.3 31.2 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	Tailwater Manning n CMTW(I)0340 .0350 .0350 .0000	



BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	PAGE 3
RESERVOIR AND OVERTOPPING BREACH DESCRIPTION :	
Initial Reservoir Water Surface Elevation (ft MSL, HI)	494.00
Dam Bottom Elevation (ft MSL, HL)	467.00
Dam Top Elevation (ft MSL, HU)	494.00
Spillway Crest Elevation (ft MSL, HSP)	.00
Dam Crest Length (ft, CRL)	550.00
Dam Crest Width (ft, WC)	15.00
Ratio of Breach Width to Flow Depth (BR)	2.000
Initial Breach Depth on Downstream Face (ft, H)	.1000

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Section Confession

S BREACH version 1.10 ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER :	PAGE 4
DAM INNER CORE DESCRIPTION :	
D50 Grain Size (mma, D50C)	.000
Ratio of D90 to D30 Grain Sizes (UNFCC)	.000
Porosity Ratio (PORC)	.000
Unit Weight (lb/cu ft, UWC)	.00
Manning n of Core Material (CNC)	.0000
Internal Friction Angle (degrees, AFRC)	.00
Cohesive Strength (lb/sq ft, COHC)	.00
Average Upstream & Downstream Inner Core Slope (ZC)	1 : .00
DAM OUTER CORE DESCRIPTION :	
D50 Grain Size (mm, D50S)	.346
Ratio of D90 to D30 Grain Sizes (UNFCS)	2.500
Porosity Ratio (PORS)	.360
Unit Weight (lb/cu ft, UWS)	105.00
Manning n of Core Material (CNS)	.0000
Internal Friction Angle (degrees, AFRS)	30.40
Cohesive Strength (lb/sq ft, COHS)	10.00
Average Clay Plasticity Index (PI)	.00
CA Clay Critical Shear Stress Coefficient (CA)	.020
CB Clay Critical Shear Stress Coefficient (CB)	.600



SS BREACH version 1.10		PAGE 5
PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :		11/09/2001
DAM FACE DESCRIPTION :		
Upstream Face Slope (ZU)	1 (vertical) :	3.00
Downstream Face Slope (ZD)	1 (vertical) :	3.00
Downstream Face D50 Grain Size (mm, D50DF)		.000
Downstream Face D90 to D30 Grain Size Ratio	(UNFCDF)	.000
Average Grass Length (inches, GL)		3.00
Grass Condition Factor (1=good, 0=none, GS)		.80
Maximum Grass-Lined Channel Velocity (ft/sec	, VMP)	1.50
BOUNDARY CONDITIONS :		
Simulation Duration (hr, TEH)		12.00
Basic Time-Step Size (hr, DTH)		.005
Iteration Error Tolerance (%, ERR)		.01
Downstream River Bottom Slope (ft/mi, SM)		5.000
Maximum Allowable Breach Bottom Width (ft, E	MX)	.000
Discharge Plot Time-Step Interval (FPT)		10.00
Time-step at which Plotting Starts (TPR)		.00

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Non-Section 1

BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B	PAGE 6
PROJECT NUMBER :	11/09/2001
INTERNAL COMPUTATION CHECKS :	
Avg. inner & outer matl. internal friction angle	(rad, AFRA) 30.40
Equation 21 Thetal' (radians, TH1)	60.20
Equation 13 Critical Depth H1' (ft, H1)	.67
Equation 21 Theta2' (radians, TH2)  Equation 13 Critical Depth H2' (ft, H2)	45.30 2.16
Equation 21 Theta3' (radians, TH3)	37.85
Equation 13 Critical Depth H3' (ft, H3)	6.95
HAO	NR

S BREACH version 1.10 ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER :	PAGE 7
PAILURE CODES (KG) :	
ALDONE CODES (NO)	
0 = No erosion of grassed face	
l = Erosion of dam downstream face	
2 = Erosion of dam upstream face 3 = Draining of reservoir with breach size continuing to inc	rease
4 = Piping mode	
5 = Collapse mode	
PPP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :	
<pre>1 = Depth of erosion perpendicular to downstream face 2 = Length of breach along downstream face</pre>	
<pre>3 = Increase in breach width</pre>	
4 = Elevation of top of piping breach	
HP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :	
1 = Erosion width across top of dam	
<pre>2 = Erosion depth at upstream face</pre>	
<pre>3 = Breach flow depth 4 = Piping head</pre>	
4 - Elbing head	
S BREACH version 1.10	PAGE 60
S BREACH version 1.10 ROJECT TITLE : Havana East Ash Pond #3B	PAGE 60
ROJECT TITLE : Havana East Ash Pond #38	
ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER :	
S BREACH version 1.10 ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER : MARY OF OUTPUT RESULTS :	
ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER :  MARY OF OUTPUT RESULTS :  GENERAL RESULTS :	
ROJECT TITLE : Havana East Ash Pond #38 ROJECT NUMBER :  MARY OF OUTPUT RESULTS :  GENERAL RESULTS :	
MARY OF OUTPUT RESULTS :  GENERAL RESULTS :  Total Number of Iterations	11/09/2001
ROJECT TITLE : Havana East Ash Pond #38 ROJECT NUMBER :  MARY OF OUTPUT RESULTS :  GENERAL RESULTS :	11/09/2001 0 .01
MARY OF OUTPUT RESULTS :  GENERAL RESULTS :  Total Number of Iterations	11/09/2001
MARY OF OUTPUT RESULTS :  GENERAL RESULTS :  Total Number of Iterations  Time of Breach Failure (hr, TFHI)	11/09/2001 0 .01
ROJECT TITLE : Havana East Ash Pond #38 ROJECT NUMBER:  MARY OF OUTPUT RESULTS :  GENERAL RESULTS :  Total Number of Iterations  Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)	0 .01 2290
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations  Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)	11/09/2001 0 .01 2290 7.708
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)	11/09/2001 0 .01 2290 7.708
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)  Time at which Significant Rise in Outflow Begins (hr, TB)  Dam Top Elevation (ft MSL, HU)	11/09/2001 0 .01 2290 7.708 .029 5.711
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)  Time at which Significant Rise in Outflow Begins (hr, TB)  Dam Top Elevation (ft MSL, HU)  Outflow at Time Zero (cfs, QO)	11/09/2001 0 .01 2290 7.708 .029 5.711 494.00
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)  Time at which Significant Rise in Outflow Begins (hr, TB)  Dam Top Elevation (ft MSL, HU)  Outflow at Time Zero (cfs, QO)  Simplified Time of Breach Failure (hr, TFH)	11/09/2001 0 .01 2290 7.708 .029 5.711 494.00 .0
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)  Time at which Significant Rise in Outflow Begins (hr, TB)  Dam Top Elevation (ft MSL, HU)  Outflow at Time Zero (cfs, QO)	11/09/2001  0 .01 2290 7.708 .029 5.711 494.00 .0 .452
MARY OF OUTPUT RESULTS:  GENERAL RESULTS:  Total Number of Iterations Time of Breach Failure (hr, TFHI)  Total Time-Steps Used (I)  Total Elapsed Time (hr, T)  Outflow Hydrograph Rising Limb Duration (hr, TRS)  Time at which Significant Rise in Outflow Begins (hr, TB)  Dam Top Elevation (ft MSL, HU)  Outflow at Time Zero (cfs, QO)  Simplified Time of Breach Failure (hr, TFH)  TFH - Time of failure (hr) which is a linear equivalent of	11/09/2001  0 .01 2290 7.708 .029 5.711 494.00 .0 .452

HA 233

September 1

	the outflow hydrograph	rising limb	duration (TF	S) obtained
	by integrating breach o T=0 to T=Peak Outflow (	utflow (QB) TP).	versus time	from
<u></u>				
				1
		4	A do	4

BOSS BREACH version 1.10	PAGE 61
PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	11/09/2001
OUTPUT RESULTS AT TIME OF PEAK OUTFLOW :	
Elapsed Time (hr, TP)	5.791
Spillway Outflow (cfs)	0.
Breach Outflow (cfs, QBP)	14693.
Total Outflow (cfs, QP)	14693.
Breach Top Width (ft, BRW)	79.0
Breach Bottom Width (ft, BO)	9.5
Breach Side Slope Relative to Vertical (degrees, Z)	52.15
OUTPUT RESULTS AT END OF BREACH ANALYSIS :	
Breach Depth (ft, BRD)	27.0
Breach Bottom Elevation (ft MSL, HC)	467.0
Breach Side Slope Relative to Vertical (degrees, AGL)	52.15
Reservoir Water Surface Elevation (ft MSL, HY)	475.9

HA 235

OUTPUT HYDRO	OGRAPH PLO							
TIME DISCHARGE (hr) (cfs)								
60. 20060.	2060.	4060.	6060.	8060.	10060.	12060.	14060.	16060
5.701 *		•	•				•	
5.751 *	•							
5.801 .	-				-	•	. *	
5.851 . 12982		•		•	•		* .	
5.901 .					•	* .		
5.951 .					•			
6.001 . 9696					* .			
6.051 .	•				* .	•		
6.101 .		•	•	*		•		
6.151 . 7500			-	* .				
6.201 .		•	•	* .		-		
6.251 . . 6422	•		. *	•	•			
6.301 . . 5967		•	*	-		•	•	
6.351 . . 5559		•	* .	•			•	
6.401 . 5190			* .					
6.451 . 4857		•	* .	-				
6.501 . 4555		, *	•	•	•			
6.551 . . 4280		.*	•	. •	•			
6.601 .		*	•		•	•		
6.651 .		*.	•	•	•	•	•	
6.701 .		* .	•	•	٠			
6.751 . . 3395		* .	•	•	•			
6.801 . . 3217		* .	•	-	•	•		
6.851 . . 3052			•	•	•			
6.901 . . 2900		* -	•	•	•			
6.951 . 2759		•				•	•	

HA 1025

7.001 .		•	•	•	•	•	•	-	
7.051 . . 250	. *	•	•	•	•	•	•	•	•
7.101 . . 239	. *	•	•	•	•	•	•		•
7.151 .	.*	•	•	•	•	•	•	•	•
7.201 .	.*	•	٠	•	• *	•	•	•	•
7.251 .	*	•		•		•	•	1	•
7.301 .	*	•	•		•	•	•	•	
7.351 .	*.		-		•	•	•	•	•
7.401 .	*.		•		•	•		•	•
7.451 .	*.		٠	•	•	•		•	•
7.501	* .				•	. •		•	•
7.551 .	* .		•	•	•	•		•	•
7.601	* .		•	-		•	•		•
7.651 .	* .			٠	•	-	•		•
7.701 .	* .		٠	•	•		•		

END OF OUTPUT

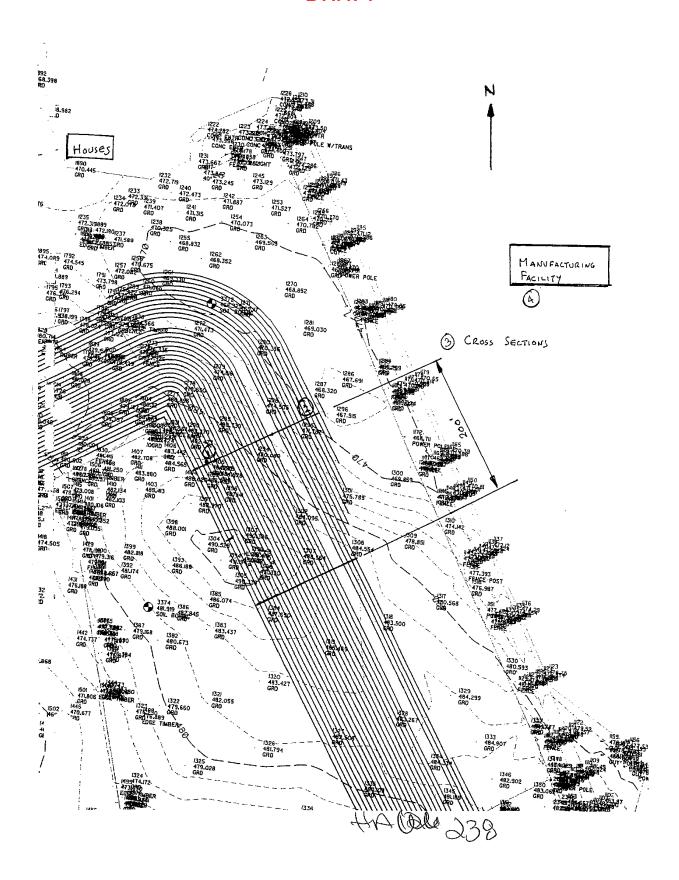
HA 237

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BOSS DAMBRK version 3.00

PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 38

PAGE 1

11/09/2001

BOSS DAMBRK (tm)

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Version : 3.00 Serial Number : 23619

Illinois Power Co.

### PROGRAM ORIGIN :

Boss Dambrk (tm) is an enhanced version of Professor D. L. Fread's 1991 NWS DAMBRK program.

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#### PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B

: South East side dam break analysis DESCRIPTION

: John Kao ENGINEER DATE OF RUN : 11/09/2001 TIME OF RUN : 4:04 pm

HA 239

PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B		:
INPUT DATA SUMMARY :		
INPUT CONTROL PARAMETERS :		
Problem Specification Option	13	
Number of Dynamic Routing Reaches (KKN)	1	
Type of Reservoir Routing (KUI)	1	(dynamic
Number of multiple dams/bridges (MULDAM)	1	
No. of Reservoir Inflow Hydrograph Points (ITEH)	2	
No. of Informational Cross-Sections (NPRT)	3	
Flood-Plain Routing (KFLP)	. 0	(no)
SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :		

HA 0040

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 3

CROSS-SECTION NUMBERS COINCIDENT WITH UPSTREAM DAM FACE (IDAM)

1

RESERVOIR VOLUME DESCRIPTION :

Elevation vs. Surface Area Table

HA 24)

S DAMBRK version 3.00 ROJECT TITLE : Havana East Ash Pond ROJECT NUMBER : Pond 3B		AGE 4 09/2001
DAM NUMBER : 1		
RESERVOIR AND BREACH PARAMETERS :		
Initial Elevation of Water Surface (YO, ft MSL)		494.00
Breach Side Slope (2)	1:	1.0
Breach Bottom Elevation (YBMIN, ft MSL)		467.0
Breach Base Width (BB, ft)		9.5
Time of Breach Formation (TFH, hr)		0.0
RESERVOIR DESCRIPTION :		494.0
Top of Dam Crest Elevation (HD, ft MSL)		494.0
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)		0.0
Spillway Gate Center Elevation (HGT, ft MSL)		0.0
Uncontrolled Spillway Discharge Coefficient (CS)		0.0
Spillway Gate Discharge Coefficient (CG)		0.0
Dam Overtopping Discharge Coefficient (CDO)		1320.0
Turbing Discharge (OT ofc)		100 0

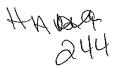


SS DAMBRK VE PROJECT TITLE PROJECT NUMBE	: Havana East Ash Pond	PAGE 5
BOUNDARY COM	IDITIONS :	
Hydrograp	oh Time Intervals (DHF, hr)	0.0
Routing E	eriod (TEH, hr)	2.0
Breach De	velopment Exponent (BREX)	0.0
Mud/Debri	s Flow Parameter (MUD)	(
Dry Bed F	outing Parameter (IWF)	(
Hydraulic	Radius Computation Parameter (KPRES)	0 (R=A/B)
Landslide	Simulation (KSL)	0 (none
Critical	Flow Froude Number (DFR)	0.950
	QI(K)	
0.00		

HA 243

Park Control

OJECT TITLE : Havana East Ash Pond OJECT NUMBER : Pond 3B		PAG 11/09
UMMARY OF PROGRAM CONTROL PARAMETERS :		
Problem Specification Option (KKN, KUI, MULDAM, ID	м) 13	
Number of Cross-Sections Entered (NS)	4	
Number of Top Widths Entered (NCS)	8	
Number of Cross-Sectional Hydrographs to Plot (NTT)	0	
Flow Type Parameter (KSUPC)	3	(mixed f
	J	(IIIIXCG L
Number of Lateral Inflow Hydrographs (LQ)	0	/mrxed r
Number of Lateral Inflow Hydrographs (LQ)  Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS :		INTXEG E
Number of Points in Gate Control Curve (KCG)	0	(mexec E
Number of Points in Gate Control Curve (KCG)	0	
Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS:  Max Discharge at Downstream End (QMAXD, cfs)	0	0
Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS:  Max Discharge at Downstream End (QMAXD, cfs)  Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)	0	0 -1
Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS:  Max Discharge at Downstream End (QMAXD, cfs)  Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)  Initial Time-Step Size (DTHM, hr)	0	0 -1 0
Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS:  Max Discharge at Downstream End (QMAXD, cfs)  Max Lateral Outflow due to flood Wave (QLL, cfs/ft)  Initial Time-Step Size (DTHM, hr)  Time at which Dam Starts to Fail (TFI, hr)	0	0 -1
Number of Points in Gate Control Curve (KCG)  HANNEL-VALLEY BOUNDARY CONDITIONS:  Max Discharge at Downstream End (QMAXD, cfs)  Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)  Initial Time-Step Size (DTHM, hr)  Time at which Dam Starts to Fail (TFI, hr)  Theta Weighting Factor (FII)	0	0 -1



PROJECT TITLE PROJECT NUMBER	sion 3.00 : Havana : Pond 3B	East Ash P	ond	PAGE 7
CROSS-SECTION	NUMBER :	1		
Cross-Sect	ion Locati	on (XS(I),	mi)	1.000
Flooding E				0.000
DOWNSTREAM RE	CACH NUMBER	1: 1		
Boach Cont	raction-Ex	mansion Co	efficient (FKC)	0.000
			polated Cross-Sections	(DXM, mi) 0.000
CROSS-SECTION				
Elevation	Channel Top	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I)	

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Section 1

Section 2

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	BOSS DAMBRK ve PROJECT TITLE PROJECT NUMBE	: Havana	East Ash	Pond		PAGE 8
	CROSS-SECTIO	N NUMBER :				
1 }	Cross-Sec	tion Locat	ion (XS{I)	, mi)		1.038
	Flooding	Elevation	(FSTG(I),	ft MSL)		0.000
	DOWNSTREAM R	EACH NUMBE	R: 2			
	Reach Con	traction-E	xpansion C	oefficient (FKC	5)	0.000
ſĪ	Minimum D	istance Be	tween Inte	rpolated Cross	-Sections (DXM, mi	0.001
	CROSS-SECTION	N and REAC	H DESCRIPT	ION :		
	Elevation	Channel Top Width	Manning	Storage Top		
П	HS(K,I) (ft MSL)	BS(K,I) (ft)		Width BSS(K,I) (ft)		
	466.43		0.0400	0.0		
			0.0400	0.0		
	467.00		0.0400	0.0		
	482.00 487.00	200.0	0.0400	0.0		
t 1	492.00			0.0		
	496.00	200.0 200.0		0.0 0.0		
	498.00	200.0	0.0400	0.0		
[_]						



PROJ	AMBRK ver ECT TITLE ECT NUMBER	sion 3.00 : Havana : Pond 3B	East Ash P	ond		PAGE 9
CRO	SS-SECTION	NUMBER :	3 			
	- 64	ion Locati	on (XS(I).	mi)		1.070
		levation (				0.000
DO	NSTREAM RE	ACH NUMBER	: 3			
	- 1 74	wastion=Ev	mansion Co	efficient (FKC)		0.000
	Minimum Di	stance Bet	ween Intel	polated Cross-S	ections (DXM, mi)	0.001
CRO	OSS-SECTION	and REACH	DESCRIPT	ON :		
		Channel Top Width BS(K,I)	Manning	Storage Top Width		
	HS(K,I) (ft MSL)	(ft)		(ft)		
	466.99 467.00 472.00 487.00	10.0 10.0 140.0 200.0 200.0 200.0	0.0400 0.0400 0.0400 0.0400 0.0400 0.0400 0.0400	0.0 0.0 0.0 0.0 0.0 0.0		

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BOSS DAMBRK VER PROJECT TITLE PROJECT NUMBER	: Havana Eas	st Ash Pond	PAGE 10 11/09/2001
CROSS-SECTION	NUMBER:	1 -	
Cross-Sect	ion Location	(XS(I), mi)	1.099
Flooding E	levation (FS	rg(I), ft MSL)	0.000
CROSS-SECTION	DESCRIPTION	:	
HS(K,I)	Channel St. Top To Width Wi BS(K,I) BS (ft) (f	p dth S(K,I) t)	
465.52 466.99	10.0 10.0 90.0 200.0 200.0	0.0	

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BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 11

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Hr 249

2 3

PROJECT TITLE : Havana East Ash Pond	PAGE 12
PROJECT NUMBER : Pond 3B	11/09/2001
DISTANCE BETWEEN INTERPOLATED CROSS-SECTIONS (DXM) THAT WILL BE USED IN COMPUTATIONS :	
Down Interp.	
Stream Cross Reach Section	
I=1,NS1 DXM(I) (mi)	
1 101.0000 2 0.0010	
3 0.0010	
Total number of cross-sections (original+interpolated)	63
Maximum number of cross-sections allowed	300
•	
\\\	
HA 000	

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 13

11/09/2001

### OUTPUT DATA SUMMARY :

#### CROSS-SECTION and REACH SUMMARY :

	oss ction	Cross Section	Bottom Elevation	Reach Number	Reach Length	Reach Slope
Nu	mber	Location (mi)	(ft MSL)		(mi)	(ft/mi)
	1	1.000	467.000			15.000
	2	1.038	466.430	]	0.038	
	3	1.070	465,950	2	0.032	14.999
	_				0.029	14.828
	4	1.099	465.520	•	0.023	14.020

HA 251

1.3

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond	PAGE 14
PROJECT NUMBER : Pond 3B	11/09/2001
RE-NUMBERED DAM/BRIDGE CROSS-SECTIONS :	
Dam/ Revised Bridge Cross	
Section Number	
1 1	
Number of Intermediate Cross-Sections (NN(NS))	63
Number of Time Steps (NNU)	2
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
HA 1839	

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 15

INITIAL	CONDITIONS	TABLE	:
---------	------------	-------	---

Cross Section Number	Cross Section Location XI (mi)	Normal Flow Water Elevation YN (ft MSL)	Normal Flow Depth DEPN (ft)	Critical Flow Water Elevation YC (ft MSL)	Critical Flow Depth DEPC (ft)	(0 = sub) (1 = sup) IFR	Count for Computing Nrml Dpth ITN	Computing Crtl Dpth ITC
1	1.000		2.29	468.39	1.39	0		
2			0.98	467.17	0.74			
3			0.99			_		_
4			1.01					
5	1.041		1.02					
6			1.04			_		
7			1.05				12	
8								
ğ								
10						C		
11				_				
12								
13 14					0.92			
15								
16			1.21			· .		•
1							•	•
11		467.43					12	
15		467.43					12	
20							) 12	
2							) 12	
2:						,	0 12	
2							0 13	
2			`			,	0 13	
2 2				3 467.1		•	0 1: 0 1:	-
2	-					•	0 1:	•
2			1.43			-	0 1	_
	9 1.06	5 467.45				•	0 1	
	0 1.06					0	0 1	
3	1 1.06					-	0 1	
3	2 1.06						0 1	2 12
	3 1.06			-		2	-	2 12
	4 1.07		•					2 12
	5 1.07				7 1.2	_	-	2 12 2 12
	16 1.07 17 1.07							2 12 2 12
	8 1.07	-					-	.2 12
	1.07							2 12
	1.07							2 12
	1.07							2 12
	12 1.07							2 12
	13 1.07							12
	14 1.08							12 12
	45 1.08							12 12
	46 1.08							12 12
	47 1.08		-	-			-	12 12
	48 1.08					15	0	12 12
	<b>ո</b> գ 1.08	3. 20/.3						

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PROJECT	PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER: Pond 3B 11/09/2001							
Cross Section Number	Cross Section Location	Normal Flow Water	Normal Flow Depth		Flow Depth	(0 = sub)	Count for Computing	Iteration Count for Computing
I	XI (mi)	Elevation YN (ft MSL)	DEPN	Elevation YC. (ft MSL)	DEPC	(1 = sup) IFR	Nrml Dpth ITN	Crtl Dpth ITC
50	1.086	467.50	1.79	467.17	1.46	0	12	12
51	1.087			467.17	1.47	ō		
52	1.088	467.51	1.83	467.17	1.49	0	12	
53	1.089	467.51	1.84	467.17	1.50	0	12	
54	1.090	467.51	1.86	467.17	1.52	0	12	
55	1.091	467.52	1.88	467.18	1.54	0	12	12
56	1.092	467.52	1.89	467.17	1.55	0	12	12
57	1.093	467.52	1.91	467.17	1.56	0	12	. 12
58	1.094	467.52	1.93	467.17	1.58	0	12	12
59	1.095	467.52	1.94	467.17	1.59	0	12	12
60	1.096	467.53	1.97	467.17	1.60	0	12	
61	1.097	467.53	1.98	467.17	1.62	. 0	12	
62				467.17	1.64	0	12	
63	1.099	467.54	2.02	467.17	1.65	0	12	

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BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B

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11/09/2001

#### SUMMARY OF INITIAL DOWNSTREAM BOUNDARY CONDITIONS :

Cross-section Number at Downstream End of Model (IN) Initial Water Surface Elev. at Downstream End (YNN, ft MSL) Initial Flow Depth at Downstream End (DEP, ft) 467.538

#### COMPUTED STEP BACKWATER TABLE :

Cross Section Number	Cross Section Location	Flow	Backwater Water Surface Elevation	Backwater Water Depth	Count for Computing Backwater
I	х	QIL	YIL	DEP	ITB
~	(mi)	(cfs)	(ft MSL)	(ft)	
			467 555	2.020	5
62	1.098	100.0			5
61	1.097	100.0		2.021	
60	1.096	100.0	467.584	2.020	5
59	1,095	100.0	467.597	2.018	5
58	1.094	100.0	467.609	2.015	5
57	1.093	100.0	467.620	2.011	5
56	1.092	100.0	467.630	2.006	5
55	1.091	100.0	467.640	2.001	5
54	1.090	100.0		1,995	5
		100.0		1.989	5
53	1.089			1.982	5
52	1.088	100.0		1.975	5
51	1.087	100.0	467.673	1.975	5

HA-255

49 1.085   100.0   467.687   1.959   58   48   1.084   100.0   467.693   1.951   1.951   47   1.083   100.0   467.700   1.942   58   46   1.082   100.0   467.700   1.934   58   45   1.081   100.0   467.711   1.924   59   44   1.080   100.0   467.717   1.915   58   43   1.079   100.0   467.727   1.896   59   41   1.077   100.0   467.732   1.886   59   41   1.076   100.0   467.732   1.886   59   40   1.076   100.0   467.732   1.876   59   58   40   1.076   100.0   467.732   1.876   59   58   58   59   59   59   59   59	(mi) (cf  1.086 49 1.085 48 1.084 47 1.083 46 1.082 45 1.081 44 1.080 43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.055 18 1.057 20 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	YIL   DEP   ITB
49 1.085 100.0 467.687 1.959 48 1.084 1.084 100.0 467.693 1.951 5 47 1.083 100.0 467.700 1.942 5 46 1.082 100.0 467.706 1.934 5 1.081 100.0 467.711 1.924 5 1.081 100.0 467.711 1.924 5 1.081 100.0 467.711 1.924 5 1.081 100.0 467.711 1.924 5 1.081 100.0 467.717 1.915 5 1.081 1.079 100.0 467.722 1.906 5 1.081 1.077 100.0 467.727 1.896 5 1.081 1.076 100.0 467.737 1.876 5 1.073 1.073 100.0 467.731 1.876 5 1.074 100.0 467.741 1.865 5 1.074 100.0 467.746 1.855 1.844 1.072 100.0 467.750 1.844 1.072 100.0 467.754 1.833 1.071 100.0 467.758 1.823 1.071 100.0 467.762 1.811 1.069 100.0 467.765 1.800 5 1.069 100.0 467.765 1.800 5 1.069 100.0 467.775 1.766 1.080 1.080 1.066 100.0 467.775 1.766 1.080 1.080 1.066 100.0 467.775 1.766 1.080 1.080 1.066 100.0 467.775 1.766 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.080 1.08	49 1.085 48 1.084 47 1.083 46 1.082 45 1.081 44 1.080 43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.046	100.0 467.687 1.959 5 100.0 467.687 1.951 100.0 467.700 1.942 5 100.0 467.706 1.934 100.0 467.706 1.934 100.0 467.711 1.924 5 100.0 467.712 1.906 100.0 467.727 1.896 100.0 467.737 1.896 100.0 467.737 1.876 100.0 467.737 1.876 100.0 467.737 1.876 100.0 467.737 1.876 100.0 467.737 1.885 100.0 467.731 1.865 100.0 467.741 1.865 100.0 467.750 1.844 100.0 467.754 1.833 100.0 467.754 1.833 100.0 467.755 1.800 100.0 467.756 1.811 100.0 467.765 1.800 100.0 467.765 1.800 100.0 467.765 1.800 100.0 467.775 1.766 100.0 467.775 1.766 100.0 467.775 1.766 100.0 467.779 1.754 100.0 467.782 1.777 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.796 1.742 100.0 467.796 1.742 100.0 467.791 1.706 100.0 467.791 1.706 100.0 467.791 1.694 100.0 467.799 1.669 100.0 467.801 1.656 100.0 467.801 1.656 100.0 467.801 1.656 100.0 467.801 1.651
48	48 1.084 47 1.083 46 1.082 45 1.081 44 1.080 43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.065 28 1.066 29 1.065 28 1.066 29 1.055 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.055 18 1.055 18 1.055 18 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.693 1.951 55 100.0 467.700 1.942 100.0 467.700 1.934 55 100.0 467.711 1.924 55 100.0 467.711 1.915 55 100.0 467.717 1.915 55 100.0 467.722 1.906 55 100.0 467.723 1.886 55 100.0 467.737 1.876 55 100.0 467.731 1.865 55 100.0 467.731 1.865 55 100.0 467.734 1.865 55 100.0 467.736 1.855 100.0 467.746 1.855 100.0 467.750 1.844 55 100.0 467.750 1.844 55 100.0 467.750 1.843 55 100.0 467.751 1.800 55 100.0 467.752 1.800 55 100.0 467.752 1.800 55 100.0 467.762 1.811 55 100.0 467.762 1.811 55 100.0 467.762 1.811 55 100.0 467.763 1.766 55 100.0 467.772 1.777 55 100.0 467.772 1.777 55 100.0 467.779 1.754 55 100.0 467.782 1.742 55 100.0 467.783 1.718 55 100.0 467.796 1.681 55 100.0 467.796 1.681 55 100.0 467.796 1.681 55 100.0 467.796 1.681 55 100.0 467.796 1.681 55 100.0 467.804 1.664 55 100.0 467.804 1.664 55 100.0 467.804 1.654 55 100.0 467.804 1.654 55 100.0 467.804 1.654 55 100.0 467.806 1.631 55 100.0 467.806 1.631 55 100.0 467.809 1.619 55
47	47 1.083 46 1.082 45 1.081 44 1.080 43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047 10 1.046	100.0 467.700 1.942 5 100.0 467.706 1.934 5 100.0 467.706 1.934 5 100.0 467.711 1.924 5 100.0 467.717 1.915 5 100.0 467.722 1.906 5 100.0 467.722 1.896 5 100.0 467.732 1.886 5 100.0 467.731 1.876 5 100.0 467.741 1.865 5 100.0 467.746 1.855 5 100.0 467.746 1.855 5 100.0 467.758 1.823 5 100.0 467.758 1.823 5 100.0 467.758 1.823 5 100.0 467.758 1.823 5 100.0 467.758 1.823 5 100.0 467.758 1.811 5 100.0 467.765 1.800 5 100.0 467.765 1.766 5 100.0 467.779 1.777 5 100.0 467.779 1.754 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.742 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.794 1.694 5 100.0 467.795 1.669 5 100.0 467.804 1.654 5 100.0 467.804 1.654 5 100.0 467.804 1.654 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.801 1.656 5
45	45 1.081 44 1.080 43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.059 1 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	100.0 467.711 1.924 5.5 100.0 467.717 1.915 5.5 100.0 467.722 1.906 5.5 100.0 467.722 1.896 5.5 100.0 467.732 1.886 5.5 100.0 467.731 1.876 5.5 100.0 467.731 1.865 5.5 100.0 467.741 1.865 5.5 100.0 467.746 1.855 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.805 1.80
44       1.080       100.0       467.717       1.915       5         43       1.079       100.0       467.722       1.906       5         42       1.078       100.0       467.732       1.886       5         41       1.076       100.0       467.731       1.876       5         39       1.075       100.0       467.731       1.876       5         38       1.074       100.0       467.746       1.855       5         37       1.073       100.0       467.750       1.844       5         36       1.072       100.0       467.758       1.823       5         34       1.070       100.0       467.758       1.823       5         32       1.068       100.0       467.765       1.811       5         33       1.067       100.0       467.765       1.801       5         31       1.067       100.0       467.769       1.789       5         31       1.067       100.0       467.779       1.777       5         30       1.068       100.0       467.779       1.754       5         29       1.065       100.0	43 1.079 42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	100.0 467.717 1.915 5 100.0 467.717 1.906 5 100.0 467.722 1.906 5 100.0 467.732 1.886 5 100.0 467.731 1.876 5 100.0 467.731 1.876 5 100.0 467.741 1.865 5 100.0 467.746 1.855 1.805 1.806 1.855 1.806 1.855 1.806 1.855 1.806 1.855 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806 1.806
42         1.078         100.0         467.727         1.896         5           41         1.077         100.0         467.732         1.886         5           40         1.076         100.0         467.731         1.876         5           39         1.075         100.0         467.746         1.855         5           38         1.074         100.0         467.750         1.844         5           36         1.072         100.0         467.758         1.823         5           36         1.071         100.0         467.758         1.823         5           34         1.070         100.0         467.765         1.800         5           32         1.068         100.0         467.769         1.789         5           31         1.067         100.0         467.775         1.776         5           32         1.068         100.0         467.775         1.789         5           31         1.067         100.0         467.779         1.754         5           28         1.064         100.0         467.782         1.742         5           28         1.065         100.	42 1.078 41 1.077 40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.059 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	100.0 467.727 1.896 5 100.0 467.732 1.886 5 100.0 467.732 1.886 5 100.0 467.737 1.876 5 100.0 467.741 1.865 5 100.0 467.741 1.865 5 100.0 467.750 1.844 5 100.0 467.750 1.833 5 100.0 467.758 1.823 1 100.0 467.758 1.823 1 100.0 467.762 1.811 5 100.0 467.765 1.800 5 100.0 467.769 1.789 1 100.0 467.772 1.777 5 100.0 467.772 1.777 5 100.0 467.773 1.754 5 100.0 467.779 1.754 5 100.0 467.782 1.742 5 100.0 467.788 1.718 1 100.0 467.788 1.718 1 100.0 467.791 1.706 5 100.0 467.794 1.694 5 100.0 467.799 1.669 5 100.0 467.799 1.669 5 100.0 467.801 1.656 5 100.0 467.804 1.644 18 100.0 467.804 1.644 18 100.0 467.804 1.631 18 100.0 467.804 1.644 18 100.0 467.806 1.631 18 100.0 467.809 1.619 5 100.0 467.809 1.619 5
41 1.077 100.0 467.732 1.886 55 40 1.076 100.0 467.737 1.876 55 38 1.075 100.0 467.741 1.865 55 38 1.074 100.0 467.750 1.844 55 36 1.072 100.0 467.750 1.844 55 36 1.072 100.0 467.754 1.833 55 1.071 100.0 467.758 1.823 55 34 1.070 100.0 467.758 1.823 55 37 1.068 1.068 100.0 467.765 1.800 55 32 1.068 100.0 467.765 1.777 30 1.066 100.0 467.772 1.777 30 1.066 100.0 467.772 1.777 35 31 1.065 100.0 467.772 1.777 35 36 1.065 100.0 467.782 1.742 55 29 1.065 100.0 467.782 1.742 55 29 1.065 100.0 467.782 1.742 55 25 1.061 100.0 467.788 1.718 55 1.730 55 1.062 100.0 467.788 1.718 55 1.730 55 1.062 100.0 467.799 1.669 55 1.062 100.0 467.799 1.669 55 1.061 100.0 467.799 1.669 55 1.061 100.0 467.799 1.669 55 1.061 100.0 467.799 1.669 55 1.061 100.0 467.799 1.669 55 1.056 100.0 467.799 1.669 55 1.056 100.0 467.801 1.655 65 55 100.0 467.801 1.655 65 55 100.0 467.801 1.655 65 55 100.0 467.801 1.656 100.0 467.801 1.656 55 100.0 467.804 1.654 55 1.056 100.0 467.801 1.656 55 100.0 467.804 1.654 55 1.056 100.0 467.804 1.654 55 1.056 100.0 467.804 1.654 55 1.056 100.0 467.804 1.654 55 1.056 100.0 467.804 1.654 55 1.056 100.0 467.804 1.654 55 1.051 100.0 467.804 1.654 55 1.051 100.0 467.804 1.654 55 1.051 100.0 467.801 1.655 55 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.804 1.558 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0 467.805 1.555 1.555 1.555 1.051 100.0	40 1.076 39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.057 20 1.057 20 1.057 20 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047 10 1.046	100.0 467.732 1.886 100.0 467.737 1.876 100.0 467.741 1.865 100.0 467.746 1.855 100.0 467.750 1.844 100.0 467.751 1.833 100.0 467.752 1.833 100.0 467.752 1.811 100.0 467.765 1.800 100.0 467.765 1.800 100.0 467.775 1.777 100.0 467.775 1.777 100.0 467.775 1.777 100.0 467.775 1.774 100.0 467.775 1.754 100.0 467.775 1.766 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.785 1.730 100.0 467.791 1.706 100.0 467.793 1.669 100.0 467.794 1.694 100.0 467.795 1.669 100.0 467.804 1.644 100.0 467.804 1.644 100.0 467.806 1.631 100.0 467.806 1.631 100.0 467.809 1.619 100.0 467.809 1.619
39 1.075 100.0 467.741 1.865 55 38 1.074 100.0 467.746 1.855 55 37 1.073 100.0 467.750 1.844 55 36 1.072 100.0 467.754 1.833 55 37 1.071 100.0 467.758 1.823 55 38 1.071 100.0 467.765 1.801 55 38 1.069 100.0 467.765 1.800 55 32 1.068 100.0 467.765 1.789 53 31 1.067 100.0 467.765 1.789 53 31 1.066 100.0 467.775 1.777 55 30 1.066 100.0 467.775 1.777 55 29 1.065 100.0 467.779 1.754 55 28 1.064 100.0 467.782 1.742 55 28 1.063 100.0 467.785 1.730 55 26 1.062 100.0 467.781 1.718 55 25 1.061 100.0 467.791 1.706 55 25 1.061 100.0 467.791 1.706 55 24 1.060 100.0 467.794 1.694 55 23 1.059 100.0 467.796 1.681 55 22 1.058 100.0 467.796 1.681 55 22 1.056 100.0 467.796 1.681 55 21 1.057 100.0 467.804 1.644 55 22 1.056 100.0 467.804 1.654 55 21 1.055 100.0 467.804 1.654 55 21 1.055 100.0 467.804 1.654 55 21 1.055 100.0 467.804 1.654 55 21 1.055 100.0 467.804 1.544 55 21 1.055 100.0 467.804 1.544 55 21 1.055 100.0 467.804 1.544 55 21 1.055 100.0 467.804 1.544 55 21 1.055 100.0 467.804 1.544 55 21 1.050 100.0 467.804 1.544 55 21 1.051 100.0 467.804 1.544 55 21 1.053 100.0 467.804 1.544 55 21 1.054 100.0 467.804 1.544 55 21 1.055 100.0 467.804 1.544 55 21 1.057 100.0 467.804 1.544 55 21 1.058 100.0 467.804 1.544 55 21 1.057 100.0 467.804 1.544 55 21 1.057 100.0 467.804 1.555 55 21 1.058 100.0 467.804 1.544 55 22 1.058 100.0 467.804 1.558 55 23 1.040 100.0 467.818 1.568 55 24 1.040 100.0 467.820 1.555 55 25 1.041 1.047 100.0 467.821 1.592 55 25 1.041 100.0 467.823 1.490 55 26 1.042 100.0 467.833 1.463 55 27 1.043 100.0 467.835 1.450 55 28 1.044 100.0 467.835 1.450 55 29 1.046 100.0 467.835 1.450 55 20 1.047 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55 20 1.040 100.0 467.835 1.450 55	39 1.075 38 1.074 37 1.073 36 1.072 35 1.071 34 1.070 33 1.068 31 1.066 29 1.065 28 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.055 18 1.057 20 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.741 1.865 5.5 100.0 467.746 1.855 100.0 467.754 1.833 100.0 467.754 1.833 100.0 467.758 1.823 100.0 467.765 1.800 5.100.0 467.765 1.800 5.100.0 467.765 1.800 5.100.0 467.765 1.777 100.0 467.772 1.777 100.0 467.772 1.777 100.0 467.773 1.754 100.0 467.779 1.754 100.0 467.782 1.742 5.100.0 467.788 1.718 100.0 467.788 1.718 100.0 467.788 1.718 100.0 467.794 1.694 1.694 100.0 467.799 1.669 100.0 467.799 1.669 100.0 467.804 1.694 100.0 467.806 1.631 100.0 467.804 1.694 100.0 467.806 1.631 100.0 467.806 1.631 100.0 467.806 1.631 100.0 467.806 1.631 100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.809 1.619 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801 1.606 5.100.0 467.801
37         1.073         100.0         467.750         1.844         5           36         1.072         100.0         467.754         1.833         5           35         1.071         100.0         467.762         1.811         5           34         1.069         100.0         467.765         1.800         5           32         1.068         100.0         467.772         1.777         5           31         1.067         100.0         467.772         1.777         5           30         1.066         100.0         467.772         1.777         5           29         1.065         100.0         467.772         1.776         5           28         1.064         100.0         467.782         1.742         5           28         1.063         100.0         467.782         1.742         5           27         1.063         100.0         467.785         1.730         5           26         1.062         100.0         467.791         1.706         5           24         1.060         100.0         467.794         1.694         5           22         1.058         100.	37 1.073 36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	100.0 467.750 1.844 5.100.0 467.754 1.833 5.100.0 467.754 1.833 5.100.0 467.754 1.800 5.100.0 467.765 1.800 5.100.0 467.765 1.800 5.100.0 467.775 1.777 1.00.0 467.775 1.776 5.100.0 467.775 1.776 5.100.0 467.775 1.754 5.100.0 467.782 1.742 1.00.0 467.785 1.730 5.100.0 467.785 1.730 5.100.0 467.785 1.730 5.100.0 467.781 1.706 5.100.0 467.791 1.706 5.100.0 467.791 1.706 5.100.0 467.791 1.694 5.100.0 467.791 1.694 5.100.0 467.799 1.669 5.100.0 467.790 1.669 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.631 1.600 5.100.0 467.800 1.600 5.100.0 467.800 1.600 5.100.0 467.800 1.600 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0 5.100.0
36         1.072         100.0         467.754         1.833         35           35         1.071         100.0         467.758         1.823         5           34         1.070         100.0         467.765         1.811         5           33         1.069         100.0         467.765         1.800         5           32         1.068         100.0         467.7769         1.789         5           31         1.067         100.0         467.775         1.776         5           30         1.066         100.0         467.779         1.754         5           29         1.065         100.0         467.785         1.730         5           28         1.064         100.0         467.785         1.730         5           28         1.063         100.0         467.785         1.718         5           26         1.062         100.0         467.788         1.718         5           25         1.061         100.0         467.791         1.706         5           24         1.060         100.0         467.799         1.669         5           23         1.059         10	36 1.072 35 1.071 34 1.070 33 1.069 32 1.068 31 1.067 30 1.066 29 1.065 28 1.064 27 1.063 26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.754 1.833 5 100.0 467.758 1.823 100.0 467.762 1.811 100.0 467.765 1.800 5 100.0 467.765 1.789 100.0 467.772 1.777 100.0 467.772 1.777 100.0 467.775 1.766 100.0 467.779 1.754 100.0 467.782 1.742 100.0 467.788 1.718 100.0 467.788 1.718 100.0 467.788 1.718 100.0 467.791 1.706 100.0 467.791 1.694 100.0 467.799 1.669 100.0 467.799 1.669 100.0 467.804 1.644 100.0 467.806 1.631 100.0 467.804 1.644 100.0 467.806 1.631 100.0 467.809 1.619 100.0 467.809 1.619
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31	31	100.0 467.772 1.777 5 100.0 467.775 1.766 5 100.0 467.775 1.754 5 100.0 467.782 1.742 5 100.0 467.785 1.730 5 100.0 467.785 1.730 5 100.0 467.781 1.706 5 100.0 467.794 1.694 5 100.0 467.794 1.694 5 100.0 467.799 1.669 5 100.0 467.801 1.656 5 100.0 467.801 1.656 5 100.0 467.804 1.644 5 100.0 467.806 1.631 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.809 1.619 5
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27	26 1.062 25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.785 1.730 5 100.0 467.788 1.718 5 100.0 467.791 1.706 5 100.0 467.794 1.694 5 100.0 467.799 1.681 5 100.0 467.801 1.656 5 100.0 467.804 1.644 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.801 1.606 5
25	25 1.061 24 1.060 23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.791 1.706 5 100.0 467.794 1.694 5 100.0 467.796 1.681 5 100.0 467.799 1.669 5 100.0 467.801 1.656 5 100.0 467.804 1.644 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.811 1.606 5
23         1.059         100.0         467.796         1.681         5           22         1.058         100.0         467.799         1.6669         5           21         1.057         100.0         467.804         1.656         5           20         1.056         100.0         467.804         1.644         5           19         1.055         100.0         467.806         1.631         5           18         1.054         100.0         467.809         1.619         5           17         1.053         100.0         467.811         1.606         5           16         1.052         100.0         467.813         1.593         5           15         1.051         100.0         467.818         1.568         5           13         1.049         100.0         467.818         1.568         5           12         1.048         100.0         467.820         1.555         5           12         1.048         100.0         467.824         1.529         5           10         1.046         100.0         467.824         1.529         5           10         1.046         100	23 1.059 22 1.058 21 1.057 20 1.056 19 1.055 18 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.047	100.0 467.796 1.681 5 100.0 467.799 1.669 5 100.0 467.801 1.656 5 100.0 467.804 1.644 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.811 1.606 5
22       1.058       100.0       467.799       1.669       5         21       1.057       100.0       467.801       1.656       5         20       1.056       100.0       467.804       1.644       5         19       1.055       100.0       467.806       1.631       5         18       1.054       100.0       467.809       1.619       5         17       1.053       100.0       467.811       1.606       5         16       1.052       100.0       467.816       1.581       1.593       5         15       1.051       100.0       467.816       1.581       5         14       1.050       100.0       467.818       1.568       5         13       1.049       100.0       467.822       1.542       5         12       1.048       100.0       467.822       1.542       5         11       1.047       100.0       467.824       1.529       5         10       1.046       100.0       467.824       1.529       5         10       1.045       100.0       467.828       1.503       5         8       1.044	22 1.058 21 1.057 20 1.056 19 1.055 18 1.054 17 1.053 16 1.052 15 1.051 14 1.050 13 1.049 12 1.048 11 1.046	100.0 467.799 1.669 5 100.0 467.801 1.656 5 100.0 467.804 1.644 5 100.0 467.806 1.631 5 100.0 467.809 1.619 5 100.0 467.811 1.606
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13	12 1.048 11 1.047 10 1.046	
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8     1.044     100.0     467.830     1.490     5       7     1.043     100.0     467.831     1.476     5       6     1.042     100.0     467.833     1.463     5       5     1.041     100.0     467.835     1.450     5       4     1.040     100.0     467.837     1.437     5       3     1.039     100.0     467.838     1.423     5       2     1.038     100.0     467.840     1.410     5		
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5     1.041     100.0     467.835     1.450     5       4     1.040     100.0     467.837     1.437     5       3     1.039     100.0     467.838     1.423     5       2     1.038     100.0     467.840     1.410     5		
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	1 1.000	100.0 494.000 27.000 (

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DAMBRK vei ROJECT TITLE ROJECT NUMBER		East Ash Pond	PAGE 19
INITIAL COND			
Interp.	Initial	Initial	
Cross-	Water	Flow	
Section	Elevation	ODT (T)	
I	YI(I) (ft MSL)	QDI(I) (cfs)	
1	494.00	100.0	
2	467.84	100.0	
3	467.84	100.0 100.0	
4 5	467.8 <b>4</b> 467.83	100.0	
6	467.83	100.0	
7	467.83	100.0	
8	467.83	100.0	
9		100.0 100.0	
10		100.0	
11 12		100.0	
13		100.0	
14		100.0	
15		100.0 100.0	
16 17		. 100.0	
18		100.0	
19		100.0	
20		100.0	
21		100.0 100.0	
22 23		100.0	
24		100.0	
25		100.0	
26		100.0	
27		100.0 100.0	
28 29		100.0	
30		100.0	
31	467.77	100.0	
32		100.0	
33		100.0 100.0	
34 35		0	
. 36		100 0	
37		100.0	
38			
. 39			
40			
41 41		100 0	
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4		100.0	
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4:	6 467.73	100.0	

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BOSS DAMBRK version 3.00 PAGE 20 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B 11/09/2001 INITIAL CONDITIONS : Interp. Cross-Initial Initial Water Section Elevation ODI(I) YI(I) (ft MSL) (cfs) 467.70 100.0 47 467.69 100.0 467.69 467.68 100.0 100.0 49 50 51 52 53 54 55 56 57 58 60 61 62 467.67 100.0 467.67 467.66 100.0 100.0 467.65 100.0 467.64 467.63 100.0 100.0 467.62 100.0 467.61 100.0 467,60 467.58 467.57 100.0 100.0 467.54 100.0 ROUTING COMPLETED : Number of Time Steps Used (KTIME) 177 Maximum Number of Time Steps Allowed 1199 Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.00 CONSERVATION OF MASS RESULTS : Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 21 11/09/2001

FLOOD (	REST SUMMA	ARY :						
Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)		od vation MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
			2.005	17.30		0.00	0.00	0.00
1.000	494.00	16295	0.005 0.080	8.90		0.00	0.00	0.02
1.038	477.62	16295 16206	0.080	8.94		0.00	0.00	0.02
1.039	477.60	16206	0.080	8.97		0.00	0.00	0.02
1.040	477.58 477.56	16224	0.080	9.01		0.00	0.00	0.02
1.041	477.54	16230	0.080	9.04		0.00	0.00	0.02 0.02
1.042 1.043		16234	0.080			0.00		0.02
1.043		16235	0.080			0.00	0.00	0.02
1.045						0.00		0.03
1.046						0.00		0.03
1.047						0.00		0.03
1.048		16218				0.00		0.03
1.049						0.00		0.03
1.050						0.00		0.03
1.051						0.00		0.03
1.052						0.00		
1.053						0.00		
1.054						0.00		
1.055					J	0.00		
1.056					3	0.00		
1.057					}	0.00		
1.058		-				0.00		
1.060						0.00		
1.06			0.080			0.00		
1.062	-	3 15910				0.00		
1.06						0.00		
1.06	4 477.10					0.00		
1.06						0.00		0.03
1.06						0.0		
1.06						0.0	0.00	
1.06				·		0.0		
1.06					8	0.0		
1.07		-	-		1	0.0		
1.07 1.07				5 9.2	4	0.0		
1.07						0.0		
1.07	-		3 0.07			0.0		
1.07						0.0	•	
1.07		8 1537				0.0	-	
1.07						0.0		
1.07	8 476.8					0.0		
1.07						0.0	-	
1.08						0.0	-	0.03
1.08			·			0.0		
1.08						0.0	0.0	
1.08				-		0.0	0.0	0.03
1.08	34 476.6	23 1336	,,	-				

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BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Fond PROJECT NUMBER : Pond 3B

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11/09/2001

#### FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
1.085	476.61	15369	0.090	9.70	0.00	0.00	0.03
1.086	476.59	15369	0.085	9.75	0.00	0.00	0.03
1.087	476.56	15369	0.085	9.81	0.00	0.00	0.03
1.088	476.53	15368	0.085	9.87	0.00	0.00	0.03
1.089	476.50	15366	0.085	9.93	0.00	0.00	0.03
1.090	476.47	15365		10.00	0.00	0.00	0.03
1.091	476.44	15362	0.085	10.07	0.00	0.00	0.03
1.092	476.41	15358	0.085	10.16	0.00	0.00	0.03
1.093	476.37	15354	0.085	10.25	0.00	0.00	0.03
1.094	476.34	15348	0.085	10.36	0.00	0.00	0.03
1.095	476.30	15340	0.085	10.47	0.00	0.00	0.03
1.096	476.25	15330	0.085	10.60	0.00	0.00	0.03
1.097	476.20	15340	0.085	10.75	0.00	0.00	0.03
1.098	476.15	15353	0.085	10.93	0.00	0.00	0.03
1.099	476.09	15363	0.085	11.16	0.00	0.00	0.03

END OF OUTPUT

HA 1349

Slope Stability Analysis Havana Power Station East Ash Pond #3B

September 10, 2001 JHK

Slope stability calculations were done with the computer Slope/W produced by Geo-Slope International. The Spencer method of analysis was used.

Because the embankment will be made of highly permeable, sandy soil, and the pond will have an impermeable liner, there will not be any cases where the undrained strength of the sand will control. For all significant load conditions, the embankment will be in the consolidated-drained condition. As shown in other portions of these calculations, any seepage that would get through the liner system would migrate nearly straight down through the embankment until reaching the water table.

Based on these characteristics of the embankment, no rapid drawdown or partial pool analysis was done. The embankment was analyzed for water to the normal operating elevation of 492 feet and ash fill to 492 feet. For each of these, both seismic and non-seismic conditions were analyzed for both low and high water table. This resulted in eight separate cases being analyzed. These are summarized in the table below along with the minimum factor of safety for each case as computed by Slope/W.

Because the clay liner will be only one-foot thick, it was ignored during slope stability calculations. Its primary purpose is seepage control, not strength. For water-filled pond conditions, the clay liner was given no strength. For the ash-filled pond conditions, the clay was given the same strength properties as the ash to simplify data input. Both of these assumptions are on the conservative side. The actual weight of the clay was used on all cases.

The properties for deposited fly ash are typical values for this type of material. The properties for all other soils are from soil tests performed specifically for this project. See the Soil Reports section of these calculations for further information.

The embankment will be made of the on-site sandy soil compacted to 95% of standard Proctor density. The top ten feet of existing material is somewhat loose with a density of a little less than 95% standard Proctor density. During construction, it is likely that this material will consolidate some, but this was ignored when estimating soil properties for the upper foundation layer. The same soil properties were used for the embankment as the upper foundation layer, which is conservative. Compaction to 95% standard Proctor density will actually give slightly better strength. The deeper foundation soils are somewhat denser than 95% standard Proctor density. The properties used for the deeper foundation soils are shown on the lab reports.

The project is in earthquake zone 1. A seismic factor of 0.025 was applied to determine earthquake forces.

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Slope Stability Analysis Havana Power Station East Ash Pond #3B September 10, 2001 JHK 14

In all cases without earthquake forces, the factor of safety was greater than 1.5. In all cases with earthquake forces, the factor of safety was greater than 1.0. Therefore, it was concluded that the embankment has adequate strength. It should also be noted, that in all the cases the minimum factor of safety was associated with slips on the downstream face of the embankment that did not penetrate to the upstream face. The graphical output shows the slip surface associated with the minimum factor of safety.

The full printout for a Slope/W run is quite large. To avoid printing a lot needless pages in this report, only sample pages are included. Full program output can be provided if needed. The following sheets contain summary information for the slope stability analysis. The content of these pages is as follows:

- 1. Table of analyzed conditions and corresponding factor of safety.
- 2. Summary of soil properties
- 3. Summary of ground water elevations.
- 4. Sketch of embankment geometry
- 5. Graphical computer summary of each load case.
- 6. First and last page from a typical analysis printout.

HA 262

Slope Stability Analysis Havana Power Station East Ash Pond #3B

September 10, 2001 JHK

#### **Summary of Analysis Conditions**

#### **Analysis Case**

	1A	1B	2A	2B	3A	3B	4A	4B
Factor of Safety	1.56	1.57	1.62	1.50	1.61	1.52	1.61	1.48
Water-filled pond	X	$\mathbf{x}$	X	$\mathbf{x}$				
Ash-filled/pond by					$\mathbf{X}_{2}$	X	X	X
No seismic factor	X		X		X		X	
Seismic factor applied		X		X		X		$ \mathbf{X}_{i} $
High ground water elevation	X	X			X	X		
Lowiground water elevation		30-10-14	$\mathbf{X}$	X			$\mathbf{X}$	$ \mathbf{X} $

#### Soil Properties;

Deep Foundation Soils

Density 118.7 pcf

Phi Angle Cohesion 34 degrees

0.0

Shallow Foundation Soils And Embankment Density Phi Angle 103.7 pcf 26 degrees

Cohesion

0.0

Clay Liner

Density Phi Angle 118.7 pcf N/A

Cohesion

N/A

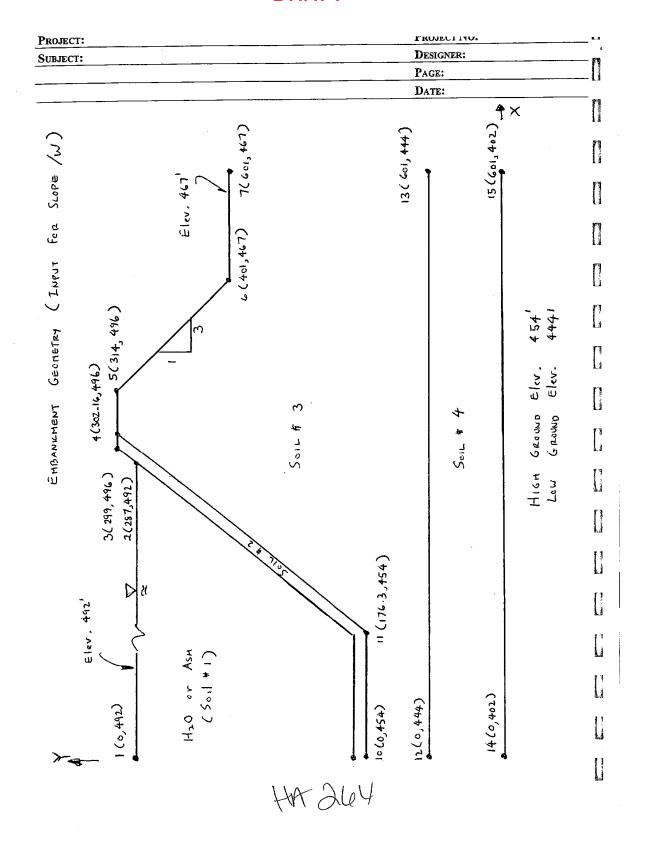
Ash

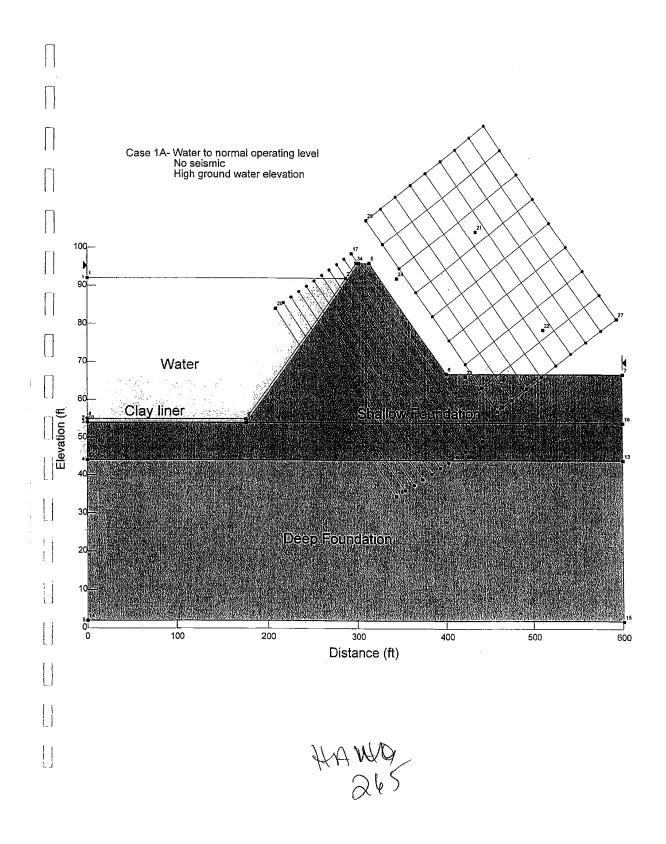
Density Phi Angle 90 pcf (saturated weight)

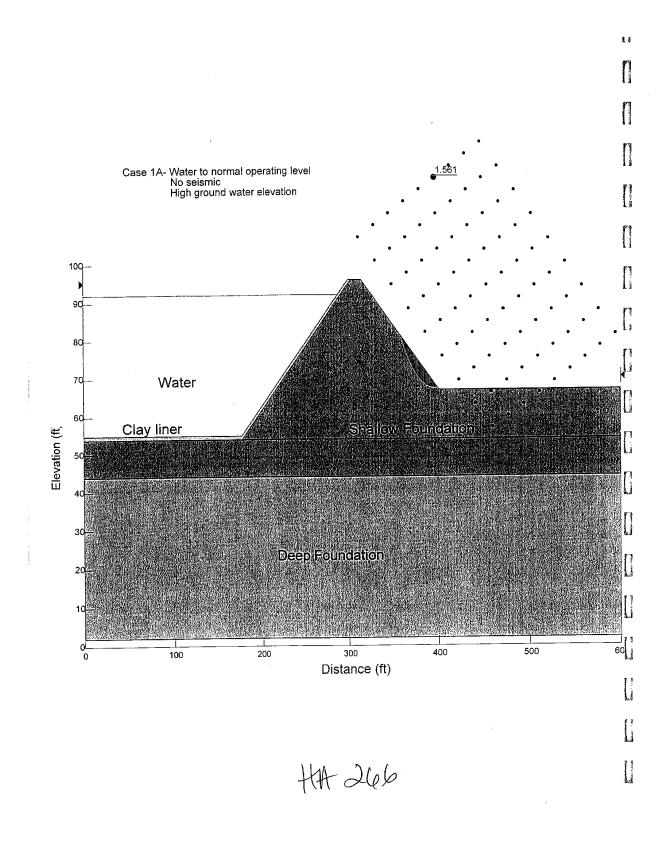
Cohesion

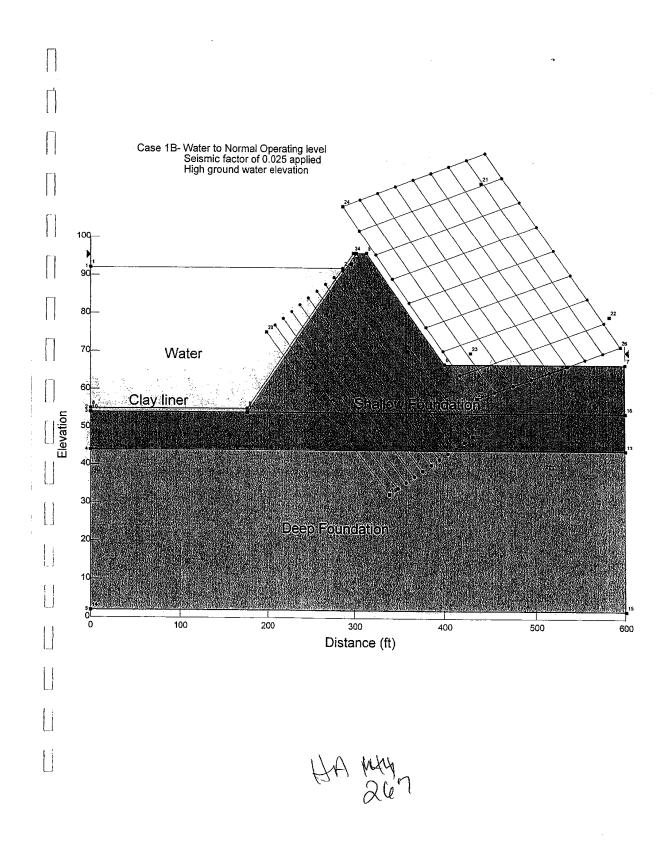
20 degrees 0.0

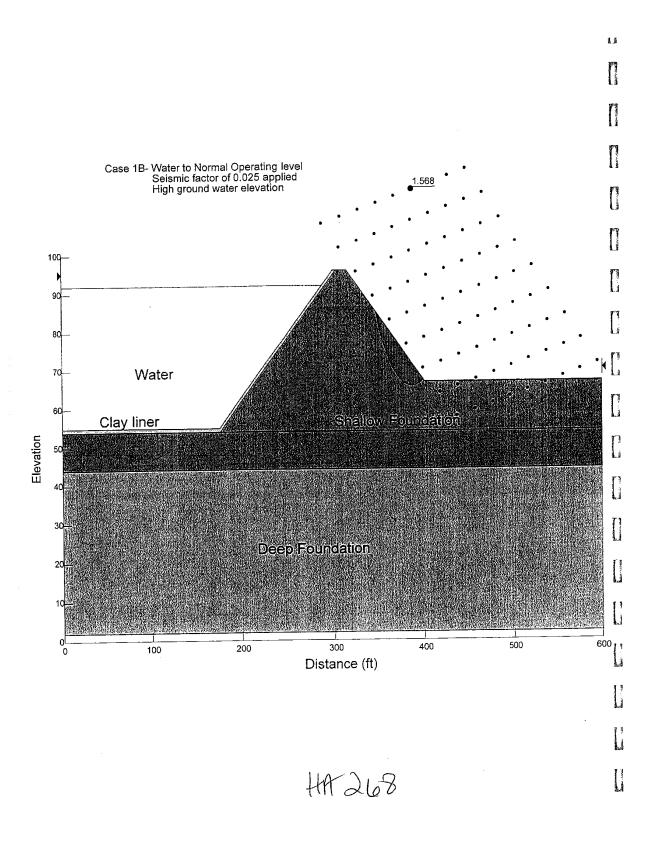
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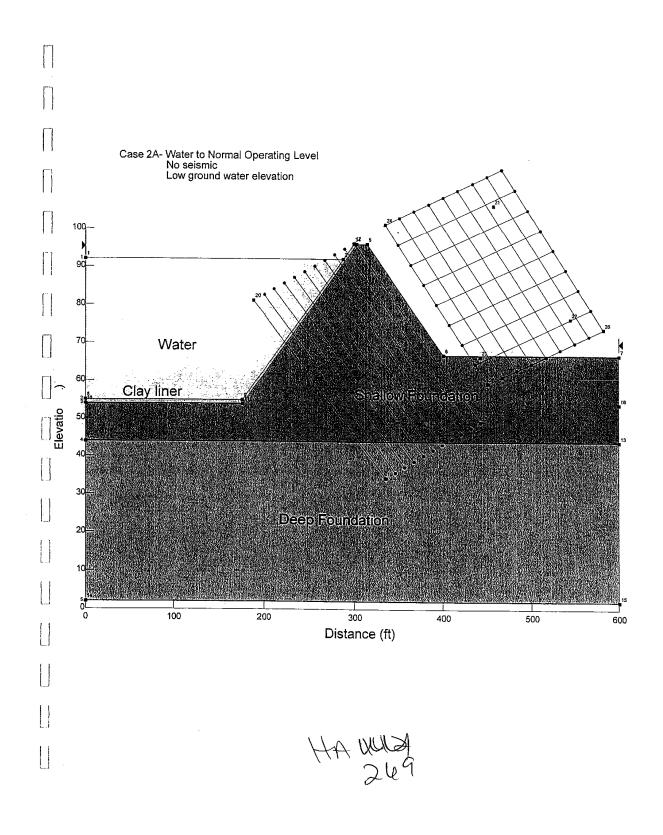


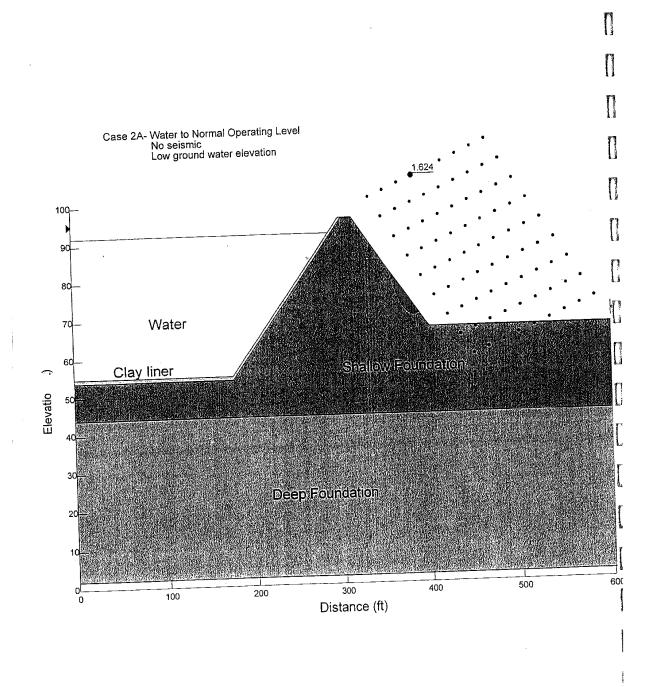




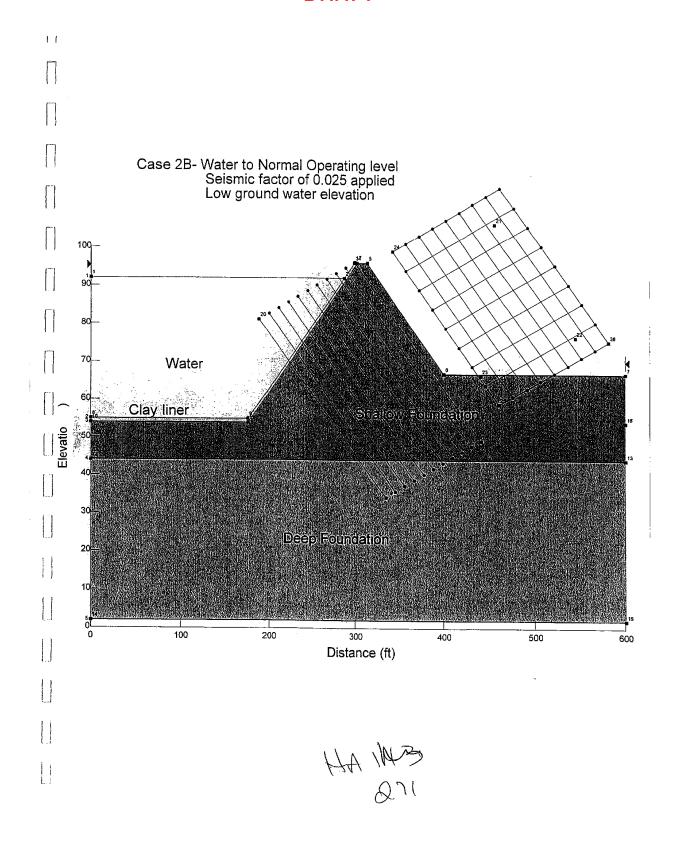


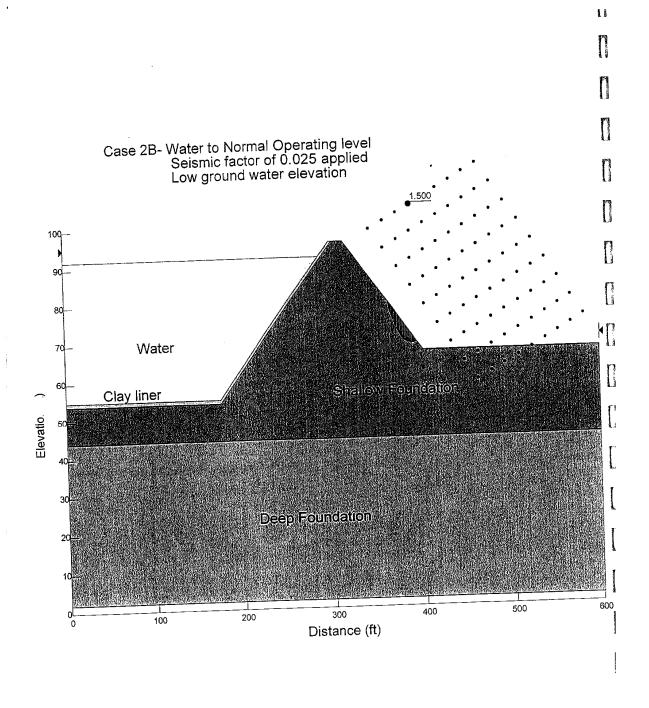




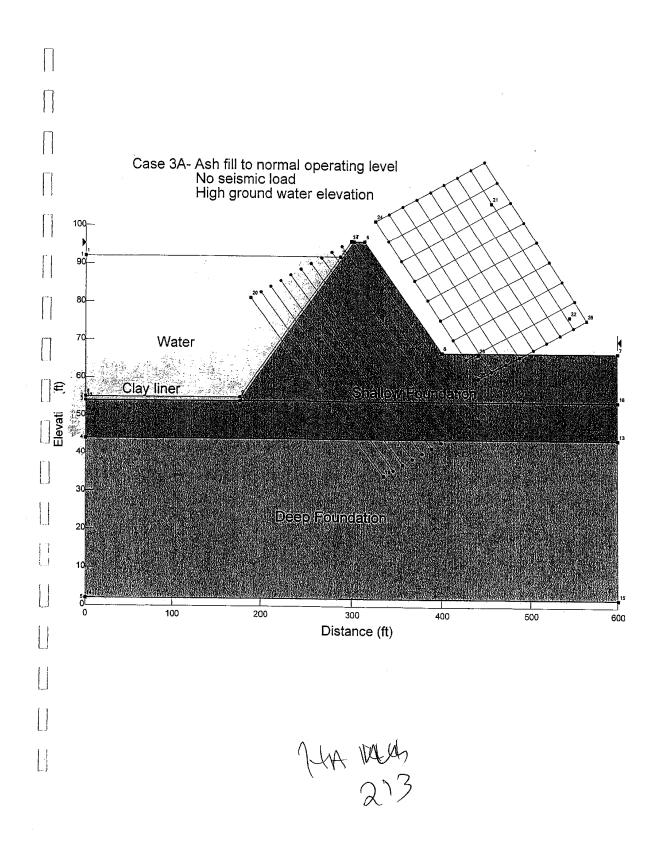


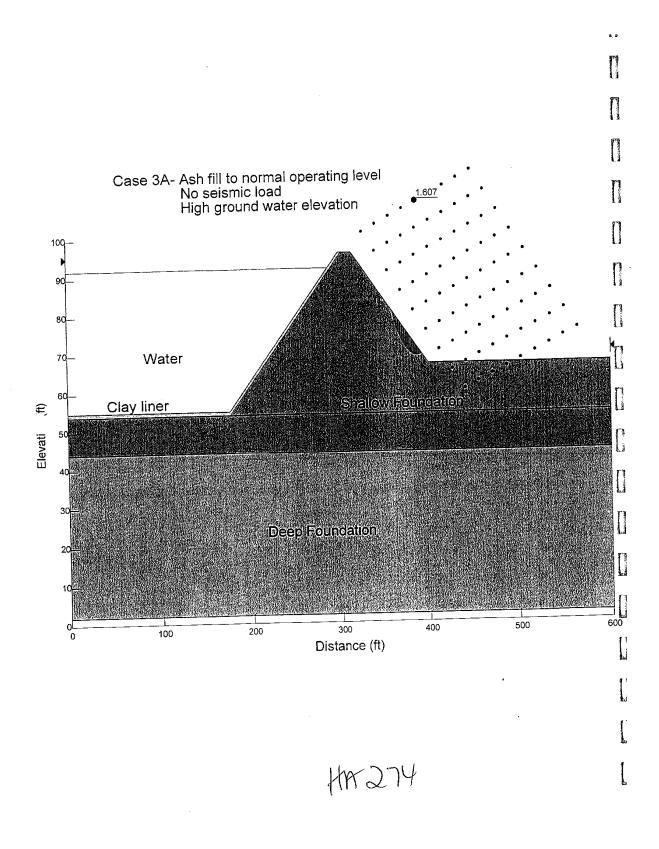
HA 270

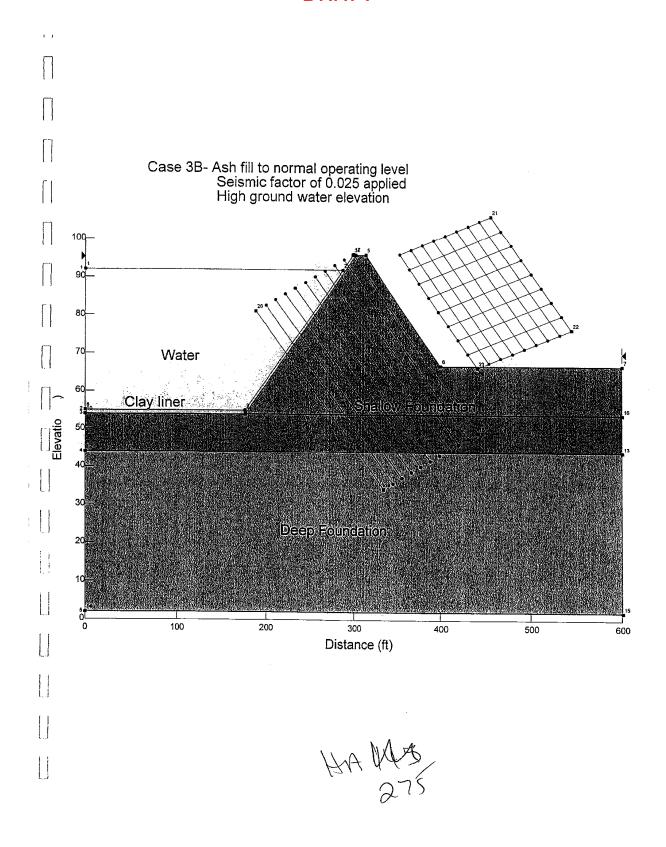


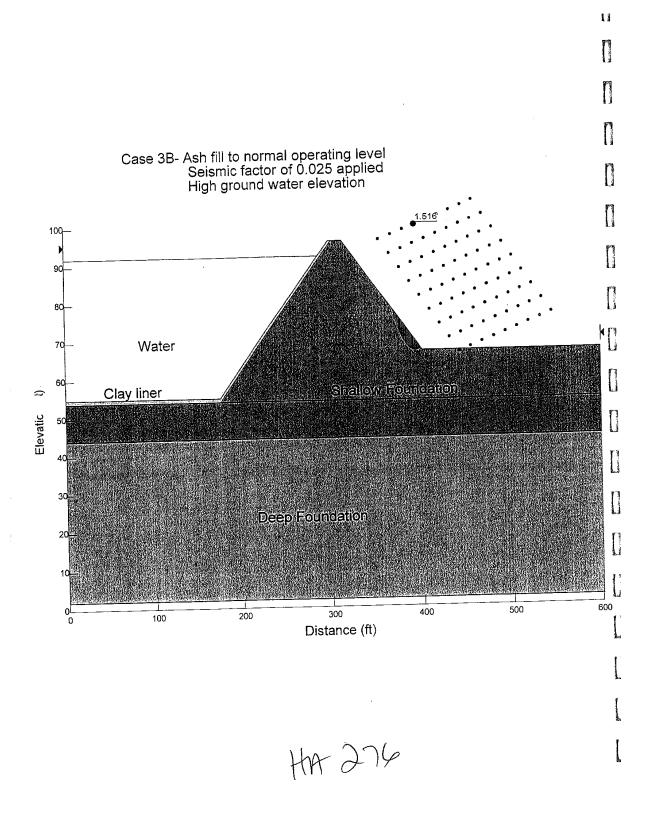


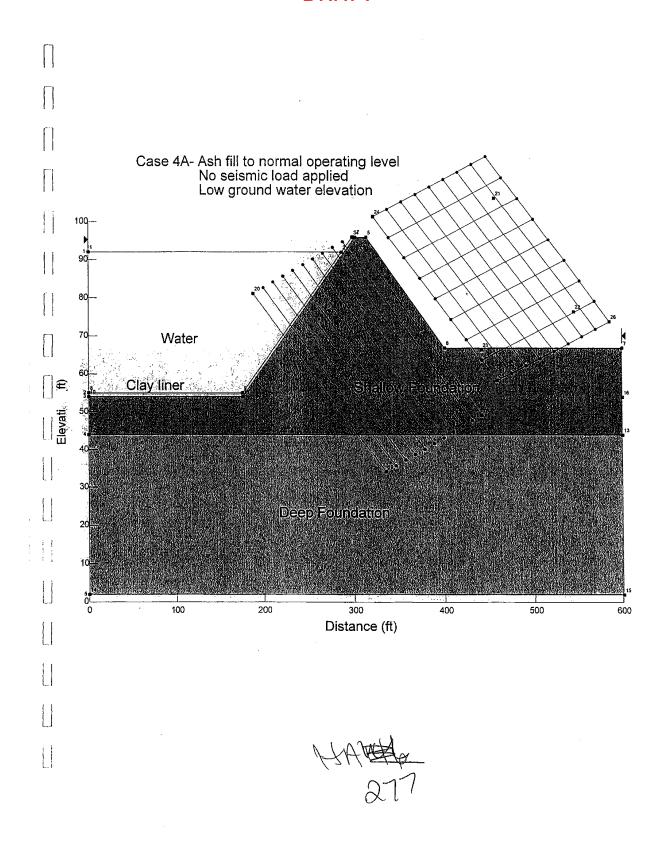
HA 272

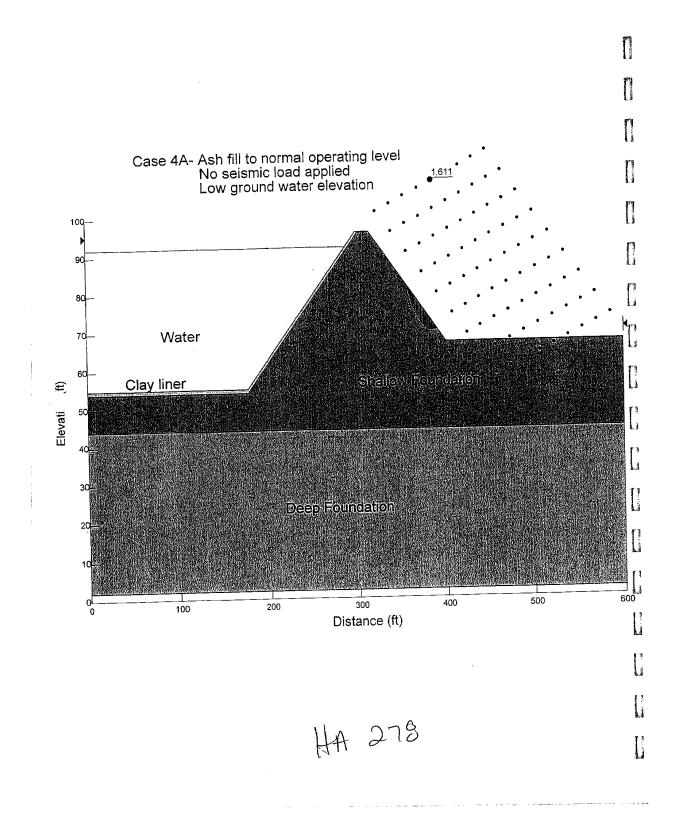


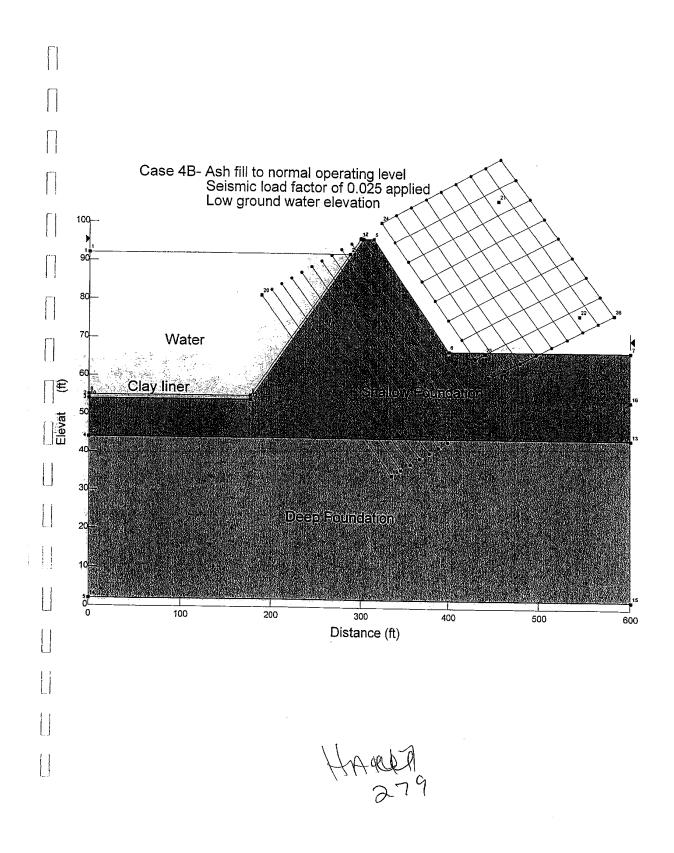


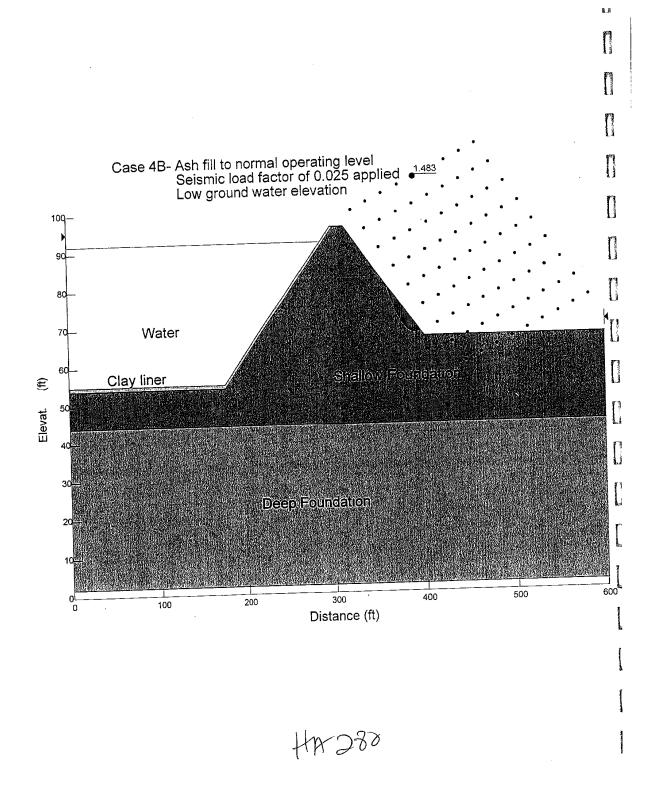












BORING NO. B-01 DATE 6-27-01 W. & A. FILE NO. 1656 SHEET 1 0F 34	2406 West PEORIA,	Nebrasi	a Avenue	4		RING	
PROJECT ILLINOIS POWER ASH POND EXTEN	SION		_ LOC	ATION H	avana,	Illin	ois
BORING TYPE Hollow-Stem Auger			_ DRIL	LED BY FO	ehl y Cloud	P W	232
BORING TYPE HOLLOW-Ster Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C.					AT ELEVATI		450.
GROUND SURFACE ELEVATION 467.8	SEEP	JND WATI	ER ELEVAT	IONAT	24+		452.
BORING DISCONTINUED AT ELEVATION 406.8	GROU	JND WAT	ER ELEVAT	TON AT C	OMPLETION		449.
DESCRIPTION	DEPTH IN FEET	SAMPLE	N	Qp	Qυ	Dø	М
Brown SANDY LOAM	6*		1	<u> </u>	<del>                                     </del>		+
Loose, Brown, Fine-Grained SAND	-						
With Considerable Silty Clay	<u> </u>						ł
		SS	9	1 -	-		14
	4 -	<del> </del> _	+	<del> </del>	1		1 2 3
	-						1.
		SS	10	T			13
		22	10	1			13
Medium-Density, Light Brown, Fine-	<u> </u>						
Grained SAND	<b>8</b> –	SS	15	T -	-	-	3
			İ			-	١.
		SS	14	-	-	-	3
	10						
	12-		↓				<u> </u>
		SS	13	-	-		4
	<b>H</b>						
	<u> </u>			ļ <u>.</u>			<u> </u>
	-16-	SS	12	ļ <u>.</u>			4
Loose, Light Brown, Fine-Grained	·F						
SAND							
	-20-	SS	5	-	<u> </u>		17
	<del>  </del>		+		<del> </del>		+
	<b> </b>						
	-24-						
·		SS	8	-	-	-	_
							1
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER		Qp - CA	LIBRATEC	PENETRO	METER RE	ADING -	T.S.F.
FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Qu - UN Dd - NA	CONFINE TURAL DE	O COMPRE	SSIVE STR Y - P.C.F.	ENGTH -	T.S.F.
5 I - SHELBY TUBE SAMPLE		Mc - NA	ATURAL M	DISTURE C	ONTENT -		ያ ስር ሀ ል
. \	A MA 2	<\(\bar{A}\)			PE:	ORIA, ILLIN	IOIS

ORING NO. — (CON LILINOIS Power Ash Pond Extens Havana, Illinois	ntinuatio		····	SHEET _	2	— <sup>OF</sup> <del>1</del> (	34 5 <del>56</del>
CATION Havaila, 1111111111				W. & A. F	ILE NO.		
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	Z	Qp	Qu	Dσ	Мс
ee Sheet 1 of 34							
	_30	SS	10	_	_	_	_
			10		:	i	
	-						
	34						
edium-Density, Light Brown, Fine-	T	CC	19		_	_	_
Coarse-Grained SAND And Fine-		SS	15				
					ĺ		
	_38						
	_	SS	25	_	-	_	-
	42						
	_ 72	,			Ì		
		SS	25	-	-	-	-
	46	•				İ	
							ļ
	-						
,	50					}	
	_ 30	SS	26	-	-	-	-
	_						
	-						
· ·	_ 54						
		SS	28	-	-	-	-
·							

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	RING L				DATE	6-27-	01
PROJECT Illinois Power Ash Pond Extens LOCATION Havana, Illinois			<del></del>	SHEET _ W. & A. F		OF <del>1 6</del>	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Mc
See Sheet 2 of 34					-		
• •							
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND	_60	SS	29	- <b>-</b>	-	-	+
EXPLORATORY BORING DISCONTINUED	_					:	
·	_64				1		
	-						
	_68						
	-						
	_72						
	_ 76						,
	- 80					:	
	<b>— 84</b>						
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	(	Qu - UNCO Dd - NATUI	NFINED :	ENETROMI COMPRESS DENSITY - STURE COM	SIVE STRE P.C.F. NTENT - %	NGTH - T.S	I.F. S.F. DCIATES

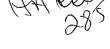
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DATE 5-25-01  W. & A. FILE NO. 1656 SHEET 4 OF 34 PROJECT ILLINOIS POWER ASH POND EXTEN	2406 West EORIA, SION	Nebraska ILLINOI	Avenue S 61604	TION HE	avana,		ois
BORING TYPE Hollow-Stem Auger	_ WEAT	HER CON	ITIONS -	Partly	r Cloud	dy & M:	148.5
SOIL CLASSIFICATION SYSTEM U.S. B. S. C.	_ SEEP	AGE WATE	R ENCOU	NTERED A	24+(P	10N	151.2
BORING DISCONTINUED AT ELEVATION 435. 7	_ GROU	IND WATER	ELEVAT	ION AT CO	MPLETIO	N	150.5
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Мс
Brown SANDY LOAM	3*			<b> </b>			
Medium, Dark Brown SANDY CLAY	-						
		66	19	1.1	0.8	112	9
		SS	13	1.1	0.0		<del>-  </del>
Medium-Density, Brown, Fine-Grained	  - 5 -			<u> </u>		<u> </u>	
SAND With Considerable Silty Clay		SS	19	<del>  -</del> -	-	<del></del>	11
Medium-Density, Light Brown, Fine-							
Grained SAND		SS	18		-		4
BI dines similar							
·	<u></u> 10−	SS	20	-	_	-	4
	-	33	20				
Loose, Light Brown, Fine-Grained						<del> </del>	
SAND	ļ	SS	_9			-	4
	  -15−						
	_13-	SS	10		-		6
	<u> </u>						
·	-20-						
		_55	_10	<del>-</del>	_==	<u>-</u>	17
Medium-Density, Light Brown, Fine- To Medium-Grained SAND							
	-25-					<del> </del>	
	<u> </u>	SS _	13_	<del>  -</del>			
Medium-Density, Light Brown, Fine-							
To Medium-Grained SAND And Fine-	<del>- 30 -</del>			<del> </del>			_
Grained GRAVEL	<b></b>	SS	16	<del> </del>		<del></del>	-
EXPLORATORY BORING DISCONTINUED	<u> </u>					<u></u>	
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Dd - NAT	ONFINED	PENETRO COMPRE VOISTURE C	SSIVE STF ( - P.C.F. ONTENT - VHITNE	RENGTH -	T.S.F.

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BORING NO. B-03 DATE 6-26-01 W. & A. FILE NO. 1656 SHEET 5 OF 34	2406 West PEORIA, I	ORPORATED Nebraska	Avenue	4		RING	
PROJECT ILLINOIS POWER ASH POND EXTER BORING LOCATION See Plot Plan Sheet	NSION			ALION	vana,	Illin	ois
BORING TYPE Hollow-Stem Auger	-		DRIL	Partly	Cloud	fv & M	ild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.				INTERED A			451.
GROUND SURFACE ELEVATION 466.9	GROL	ND WATE	R ELEVAT	IONAT	24+(P	) HRS.	455.
BORING DISCONTINUED AT ELEVATION 435.9	GROU	ND WATE	R ELEVAT	ION AT CO	MPLETIO	N	454.
DESCRIPTION	DEPTH	SAMPLE TYPE	N	Qр	Qu	D₫	М
Brown, Fine-Grained SAND With Some Organic Vegetation	5*						
Medium-Density, Light Brown, Fine- Grained SAND	<u> </u>	SS	18	<del> </del>		<del></del>	5
wa wasabib biinin		در		+			<del></del>
	_ 5 _			<u> </u>			
		SS	17	<del>  -</del>	<b>-</b>	-	3
•		SS	12	-	_	-	3
	<del> </del> 10−	SS	13	<del>  _</del>		_	4
•		22	13	<del> </del>		-	-
Loose, Light Brown, Fine-Grained	<b>-</b>						<u> </u>
SAND		SS	10	<u> </u>			7
	1.5					<u> </u>	
	- 15 -	SS	8	-	-	-	16
·			_				
	-						
Loose, Orange-Brown, Fine- To	-						
Medium-Grained SAND	-20-			<b>_</b>		ļ	<u> </u>
		SS	7	-		-	<del>  -</del>
	L						
Medium-Density, Orange-Brown, Fine-							
To Medium-Grained SAND							
	-25-	SS	20	† <u>-</u>	_	<del>  -</del>	<u> </u>
		beri beri					1
	-						
Medium-Density, Gray-Brown, Fine-	-						
To Coarse-Grained SAND	30-						ļ
	30	SS	28		_		
EXPLORATORY BORING DISCONTINUED							
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER		Qp - CAI	LIBRATER	PENETRO	METER RI	EADING -	T.S.F.
FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE		Dd - NAT	TURAL DE	PENETRO D COMPRE RY DENSIT' OISTURE C	/ ~ P.C.F.		T.S.F.



ORING NO.5-04 ITE 6-25-01 8 A. FILE NO. 1656	'NEY ( 2406 West EORIA,	Nebraska	S 6160	4	BO	RING	
TILINGIS POWER ASH PUND EXIEM	SION		LOCA	ATION H	avana,	Illin	ois
PINGLOCATION See Plot Plan Sheet			DRIL	LED BY FO	ept	for L. M.	ात -
HING TYPE Hollow-Stem Auger	_ WEAT	HER CON	DITIONS .	NTEDED :	T EL EVAT	ION 1	449.5
IL CLASSIFICATION SYSTEM U. S. B. 5. C. OUND SURFACE ELEVATION 466. 0	_ SEEP	ND WATE	R ELEVAT	IONAT	24+	HRS	
RING DISCONTINUED AT ELEVATION 405. 0	_ GROU	IND WATE	R ELEVAT	ION AT C	OMPLETIO	N	451.9
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Мс
rown SANDY LOAM Organic Topsoil oft, Brown And Dark Brown SANDY	8*						
		SS	5	0.5	0.4	110	11
	- 4	-					
edium, Brown SANDY CLAY LOAM				ļ	ļ. <u></u>	<del> </del>	<del> </del>
		SS	15	1.2	0.9	114	13
pose, Brown, Fine- To Medium-	8 -	SS	7		<del> </del>	-	5
allied Swap	8-						
ose, Light Brown, Fine- To dium-Grained SAND		SS	6	-	-		12
CIUE CIGINES DANS							
	-12-						
		SS	5		-	-	19
		_					
	-16-	SS	5	-		<del>-</del>	18
	L						
ery Loose, Brown, Fine- To Medium-							
rained SAND With Some Silty Clay							_ ]
	-20-	SS	3	-	-	-	22
	<del>  </del>						
	<u> </u> -						
ery Loose, Light Brown, Fine- To							
EATAM OIGINES DINID	-24-	Ī					
		SS	2	-	-	-	-
			_				
BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES - SPLIT SPOON SAMPLE - SHELBY TUBE SAMPLE		Dd - NAT	URAL DR'	PENETRO COMPRE Y DENSITY DISTURE C	′ - P.C.F.		.s.ғ. г.s.ғ.

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ORING NO.B-04  OJECT Illinois Power Ash Pond Extended Havana, Illinois	nsion				7	OF 1656		
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qи	D.d	Mc	
ee Sheet 6 of 34	_ 30	SS	4	_	1	· -	-	
	_ 34	SS	3		-	-	-	
ledium-Density, Light Brown, Medium To Coarse-Grained SAND And Fine- Grained GRAVEL	38	SS	26	-	-	-	-	
ledium-Density, Light Brown And Gray-Brown, Fine- To Coarse-Grained GAND And Fine- To Medium-Grained GRAVEL	46	ss	23	-	-	-	-	
•	_ 50	SS	25	-		-	-	
	_ 54	SS	20	-	-	-	_	

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ORING NOB-04  OJECT Illinois Power Ash Pond Extended Havana, Illinois	ension			SHEET _ W. & A. F	8 OF 1		34 .656	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dø	Мс	
See Sheet 7 of 34								
	<u> </u>							
Medium-Density, Gray-Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL		SS	20	_	-	-	-	
EXPLORATORY BORING DISCONTINUED								
	_ 64							
		, ;						
	68					:		
	-							
	_ 72							
	-							
	_ 76							
	_							
	_ 80							
	84					1		

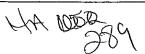
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WHITNEY & ASSOCIATES BORING NOB-05 **BORING LOG** DATE 6-27-01 2406 West Nebraska Avenue W. & A. FILE NO. 1656 PEORIA, ILLINOIS 61604 OF 34 SHEET 9 PROJECT ILLINOIS POWER ASH POND EXTENSION LOCATION Havana, Illinois BORING LOCATION See Plot Plan Sheet DRILLED BY Fehl WEATHER CONDITIONS Partly Cloudy & Mild BORING TYPE Hollow-Stem Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C 452.1 SEEPAGE WATER ENCOUNTERED AT ELEVATION \_ GROUND WATER ELEVATION AT 24+ 456.2 CAVE IN 466.9 GROUND SURFACE ELEVATION \_ HRS. \_ 405.9 451.1 BORING DISCONTINUED AT ELEVATION GROUND WATER ELEVATION AT COMPLETION DESCRIPTION  $Q_p$ Dσ Мс Brown SANDY LOAM Organic Topsoil Loose, Brown, Fine-Grained SAND With Considerable Silty Clay 10 107 13 SS Medium, Brown SANDY CLAY LOAM SS 12 0.7 0.5 100 20 Loose, Light Brown, Fine-Grained 8 SS 8 8 5 14 - 12-8 16 Loose, Light Brown, Fine- To 10 Medium-Grained SAND 19 16 Loose, Brown, Fine-Grained SAND With Some Silt 20 9 SS 24 Loose Brown, Fine- To Medium-Grained SS SAND With Some Coarse-Grained Sand N - BLOWS DELIVERED PER FOOT 8Y A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - %



- WHITNEY & ASSOCIATES -

B-05		NG L				6-27 <b>-</b> 01		
ORING NO. B-05  Illinois Power Ash	linois Power Ash Pond Extension				10	<sup>OF</sup> 1€	34 556	
CATION Havana, Illinois					W. & A. F	ILE NO		
DESCRIPTION		DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Мс
See Sheet 9 of 34								
Medium-Density, Light Brow Brown, Fine-Grained SAND	And	_						
	-	_30	SS	15	-	-	-	-
		- 34					:	
		_	SS	20	-	-		-
		_ 38						
$m_{\chi} t$		_	SS	21	-	-	-	-
	-	_ 42						
Medium-Density, Brown, Med Coarse-Grained SAND	iium- To	_ 46	SS	16	-	-	-	_
Medium-Density, Brown, Medium To Coarse-Grained SAND With Some Fine- Grained Gravel	dium- To	_			-			
	June 1211C	_ 50	SS	18	_	-	-	-
Medium-Density, Brown, Me Coarse-Grained SAND	dium- To	<b>54</b>	SS	21		-	_	_

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BORING NO. 1903	BORING L (CONTINUATIO		•		DATE	06-27	
PROJECT Illinois Power Ash Pond Extended Havana, Illinois	tension	SHEET _ W. & A. F	_ OF 16	34 - <sup>OF</sup> 1656			
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	N
See Sheet 10 of 34							
	_						
	_60	SS	23	-	-	-	.
EXPLORATORY BORING DISCONTINUED							-
	64						
	-						
	_ 68						
	_						
	_ 72						
	_						
	_ 76						
	- 80					ļ	
	_						
	84				;		
· · · · · · · · · · · · · · · · · · ·							
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES 5 - SPLIT SPOON SAMPLE I - SHELBY TUBE SAMPLE	Q	p - CALIBR u - UNCON d - NATUR	RATED PE	ENETROME COMPRESSI DENSITY - I	TER READ	ING - T.S.I GTH - T.S.	F. .F.
I - SHELBY TUBE SAMPLE	A DX		AL MOIS	TURE CON	TENT - %	& ASSO	

TE	406 West ORIA, I	Nebraska				RING	
EET 12 OF 34 POWER ASH POND EXTENS	SION		LOCA		vana,	IIIIn	018
See Plot Plan Sheet			DRILL	ED BY Fe	Cloud	v & M.	ild
Hollow-Stem Auger	_ WEAT	HER CON	JI 110143 _				449.4
IL CLASSIFICATION SYSTEM U.S.B.S.C.	SEEPA	GE WATE	R ENCOUN	NTEHED A	4+(P)	HRS	451.3
OUND SURFACE ELEVATION	_ GROU	ND WATE	R ELEVATI	ON AT CC	MPLETION	٠	448.8
RING DISCONTINUED AT ELEVATION 425. 6	DEPTH	SAMPLE TYPE	N	Qp	Qu	Da	Mc
DESCRIPTION	IN FEET	TYPE					
Brown SANDY LOAM	8	i i					
ledium-Density, Light Brown, Fine- Grained SAND							6
Lained Swar		SS	12		<u> </u>	ļ <u> </u>	+
							<u>                                     </u>
oose, Light Brown, Fine-Grained	<del> - 5 -</del>	SS	7				3
SAND							1 1.
Very Loose, Brown, Fine-Grained SAND		SS	4	<u> </u>			18
		35		-	-		
	L <sub>10</sub> -					ļ	10-
	_10_	SS	3_		<u> </u>		18
	.  .						
Loose, Brown, Fine-Grained SAND		SS	7	-	-	-	19
	-15-	<del> </del> _	9	<del> </del>	<del> </del>	<del>  -</del> -	<del>  -  </del>
		SS		-	<del> </del>	<del> </del> -	
			ļ				
Medium-Density, Brown, Fine-Grained							
<del></del>	-20-	SS	12	-	-		
	-	1-55	T				
	٥٤	L			ļ	<u> </u>	
	-25-	SS	13		<del>  -</del> -		
	_ <del> </del>						1 1
Medium-Density, Brown, Medium- To			1				
Coarse-Grained SAND And Fine- 10	-30-	<b></b>	ļ	<del> </del>	+	+	
Medium-Grained GRAVEL		SS	23	<del> </del>		+	
EXPLORATORY BORING DISCONTINUED							
		Q <sub>0</sub> · C	ALIBRATEI	D PENETR	OMETER F	READING	- T.S.F.
I - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Qu - D	ACIBHATEI NCONFINE ATURAL D ATURAL M	ED COMPH RY DENSI LOISTURE	TY - P.C.F. CONTENT	- %	SOCIATES

BORING NO. 8-07 DATE 6-26-01 W. & A. FILE NO. 1656 SHEET 13 OF 34	NEY &	ORPORATED Nebraska	Avenue		ВО	RING	LOC
PROJECT ILLINOIS POWER ASH POND EXTEN	SION		LOCA	TION H	vana,	Illin	ois_
BORING TYPE Hollow-Stem Auger			DRILL	ED BY FO	Clon	dy & M:	ात
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.	_ WEAT	HER CON	R ENCOU	NTERED A	T ELEVAT	ION	451
GROUND SURFACE ELEVATION 470. 0			R ENCOU				452 451
BORING DISCONTINUED AT ELEVATION 439.0			RELEVAT	ON AT CO	MPLETIO	<u> </u>	451
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qpi	Qu	Da	M
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	4"						
		SS	5	-	-	102	14
Madium Brown CANDY LOLM							
Medium, Brown SANDY LOAM	<u> </u> 5	SS	6	0.8	0.5	100	14
					<del></del> -	T	<u> </u>
Loose, Brown, Fine-Grained SAND		SS	4			<del>  _</del> -	14
		دد		-	-	<del>-</del>	
	-10-					<u> </u>	L.
•	ļ- <del></del>	SS	4	-	-	<del>-</del> -	13
Jag <sup>2</sup> r.							
		SS	6		-	-	-
Loose, Brown, Fine- To Coarse-	-15-						
Grained SAND		SS	6	-	-		4
Loose, Brown, Fine-Grained SAND	_						
	-20-	SS	4		_	<del>-</del>	19
							-
	<b>-</b>	'					
	-25-						<u> </u>
		SS			-	-	
<del></del>							
Medium-Density, Brown, Fine-Grained SAND	-30-						
Janu Janu Janu Janu Janu Janu Janu Janu	-30-	SS	17			_	
EXPLORATORY BORING DISCONTINUED							
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE		Dd - NAT	IBRATED CONFINED URAL DR' URAL MO	COMPRE DENSITY	SSIVE STF ! - P.C.F.	EADING - 1 RENGTH -	T.S.F. T.S.F.

TE 6-28-01 &A. FILE NO. 1656	406 West ORIA, I	Nebraska	Avenue 5 61604			RING I	
DEET 14 OF 34 OJECT ILLINOIS POWER ASH POND EXTENS	NOI			TION Ha			
SINGLOCATION See PLOT Plan Sileet		HER COND	DRILLI	ED BY Fe	Cloud	y & Mi	ld
RING TYPE Hollow-Stem Auger		OF MIATER	- CNCOII	TEDED A	FIFVAII	ON	<u>151.4</u> 165.1 CAV
U.S.B.S.C.  OUND SURFACE ELEVATION 474.6	GROU	ND WATER	ELEVATION	DN AT	4+([/	HRS	453.8 II
RING DISCONTINUED AT ELEVATION 443.6		ND WATER	ELEVATI			<u> </u>	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dø	Mc
Brown SANDY LOAM	3"						
oose, Light Brown, Fine-Grained							
SAND With Some Silty Clay		SS	6	-	_	-	8
	<del> </del>						
	  - 5 -	CC	6	<del> </del>		<del>i -</del>	6
	<u> </u>	SS	ū .				
						ļ. <u> </u>	8
		SS	5	<u> </u>		<del>  -</del> -	<del>                                     </del>
	<u></u>	SS	6				9
·							
Loose, Light Brown, Fine- To Medium-		SS	9		<del></del> -	-	4
Grained SAND	<u> </u>	55_					
Medium-Density, Light Brown, Fine-	  - 15 -						5
Grained SAND		SS_	16	<del></del>	<del>  -</del>	<del> </del>	+
	-						
	-20-						
	20	SS	16	<del>  -</del> -		<u> </u>	18
	<u> </u>						
•							
Loose, Light Brown, Fine-Grained	_25-			+		<del>  -</del>	
SAND		SS	8_	+	<del>                                     </del>		
	L						
	<del>-30-</del>	SS	10			<u> </u>	
PORTING DISCOUTINIED	+				T		
EXPLORATORY BORING DISCONTINUED		ــــــــــــــــــــــــــــــــــــــ	1			EADING	
BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE		Qu - UN	ICONFINE	D PENETRI ED COMPR RY DENSIT IOISTURE	ESSIVE SI TY - P.C.F. CONTENT	- %	T.S.F.

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BORING NOB-09 DATE 6-26-01 W. & A. FILE NO. 1656 SHEE 15 OF 34	NEY (	Nebraska Nebraska	Avenue S 6160	4		RING	
PROJECT ILLINOIS POWER ASH POND EXTENS	SION		LOCA	TION Ha	vana,	Illing	is
BORING LOCATION See Plot Plan Sheet			DRIL	LED BY Fe	hl Class		1.7
BORING TYPE Hollow-Stem Auger SOIL CLASSIFICATION SYSTEM U.S. B.S.C.				Partly			.1a .54.
SOIL CLASSIFICATION SYSTEM U.S. B. S. C.  GROUND SURFACE ELEVATION 488. 7	SEEP/	AGE WATE	R EL EVAT	INTERED A	T ELEVAT		77.
BORING DISCONTINUED AT ELEVATION 427.7				TON AT CO		_ ,,,,,,,,	68.
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	N
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Some Silty Clay	4*	ITPE					
		SS	6	_	-	-	6
	- 4 -						
		SS	7		_	_	5
							۲,
Loose, Brown, Fine-Grained SAND							
•	8 -	SS	6	ļ- 	-	<u> </u>	6
•••	-12-	SS	6	-	-	-	5
		rc .	-	<del>  _</del>	<u> </u>	<del> </del>	-
·		SS	8	<del>  -</del>	<del>  -</del>	-	6
						-	L
	-16-	SS	10	<del>  -</del>		<del>  -</del>	-7
Medium-Density, Light Brown, Fine-	_						
Grained SAND	-20-	SS	15	-	-	<del>  -</del>	4
	-24-						
		SS	18	-	_	_	2
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE S - SHELBY TUBE SAMPLE	1	Qu - UN Dd - NA	CONFINE	D PENETRO D COMPAI RY DENSIT OISTURE O	ESSIVE ST Y - P.C.F.	RENGTH -	T.S.F T.S.F

6-26-01 **BORING LOG** BORING NO.B-09 DATE . (CONTINUATION) 34 16 Illinois Power Ash Pond Extension <sup>OF</sup> 1656 SHEET LOCATION Havana, Illinois W. & A. FILE NO. Мс DEPTH SAMPLE IN FEET TYPE Qu Dα Qp Ν DESCRIPTION See Sheet 15 of 34 30 25 SS 34 Medium-Density, Light Brown, Fine-SS 16 To Medium-Grained SAND 38 26 SS Medium-Density, Light Brown, Fine-Grained SAND SS 24 46 Medium-Density, Light Brown, Fine-Grained SAND With Fine-Grained <u>Gr</u>a<u>vel</u> Medium-Density, Light Brown, Medium-SS 26 To Coarse-Grained SAND 54 28 SS Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - % N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE WHITNEY & ASSOCIATES

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BORING NOB-09				•			
ROJECT Illinois Power Ash Pond E OCATION Havana, Illinois	Extension			SHEET _ W. & A. F	17	<sup>OF</sup> 16	34 556
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	, N	Qp	Qu	D₫	Mc
See Sheet 16 of 34				ł			
Dense, Light Brown, Medium- To Coarse-Grained SAND With Fine- Grained Gravel		SS	31	-	-		_
EXPLORATORY BORING DISCONTINUE	D						
	_64						
	_ 68						
	_						
	<b>- 72</b>						
	<b>76</b>						
	-						
	- 80						
	_						
	- 84						
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMME FALLING 30 INCHES - SPLIT SPOON SAMPLE - SHELBY TUBE SAMPLE	(	70 - NA 1UF	AL DRY	ENETROME COMPRESSI DENSITY - I	P.C.F.	DING - T.S.I IGTH - T.S.	F. F.

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A FILE NO. 1656	406 West ORIA, I	k ASS ORPORATED Nebraska LLINOIS	Avenue			RING I	
TUTNOTS POWER ASH POND EXTENS	ION		LOCA"	HON -E-	hl	***	
See Plot Plan Sheet		HER COND	DRILL	Fe Partly	Cloud	y & Mi	14
RING TYPE Hollow-Stem Auger U.S.B.S.C.	WEAT	HER COND	ITIONS _	<u>_</u>			
CLASSIFICATION SYSTEM 475.3	GROU	IND WATER	ELEVATION	DNAT.	4+	HDC '	162.5 CAV 155.7 IN
DUND SURFACE ELEVATION 414. 3	GROU	ND WATER	ELEVATI	ON AT CO	MPLETIO	V	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Mc
	8"						
rown SANDY LOAM  oose, Brown, Fine-Grained SAND With  ome Silty Clay	_		*				
OMC DIFF		SS	-6			-	6
· ·	<del>,-</del>	-					<del>                                     </del>
	- 4 -	]					
oose, Light Brown, Fine-Grained		SS	7	-	-	-	8
							<del>  17  </del>
	<u> </u>	55	7		-	-	1/
						ļ <u>.</u>	<del>                                     </del>
		SS	8	<del>-</del> _		-	14
	-12-	<u> </u>			<u> </u>	ļ	7
		SS	10		<u>-</u>	<u> </u>	<del>  ' </del>
		1					
edium-Density, Light Brown, Fine-		ļ			<del> </del> -		-
Grained SAND	-16-	SS_	13_		<u> </u>	<del>  -</del> -	6
				,	1		
	Γ						
Loose, Light Brown, Fine- To	-20-	SS	9	-	-	-	3
Medium-Grained SAND		<del> </del>		<del>                                     </del>		T -	
	H						
	-24-	_					
				_	-	_	19
		SS	8				
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES 5 - SPLIT SPOON SAMPLE 7 - SHELBY TUBE SAMPLE	<u> </u>	Qu - UN	CONFINE	PENETRO D COMPRI RY DENSIT DISTURE (	ESSIVE ST Y - P.C.F. CONTENT	- %	T.S.F. - T.S.F.

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ORING NO.B-10  OUBCT Illinois Power Ash	(CONTINU				DATE 19		34
DCATION Havana, Illinoi	B	·		SHEET W. & A. F	ILE NO	OF 10	656
DESCRIPTION	DEI IN F	PTH SAMPLE	N	Qp	Qu	D.d	Мс
See Sheet 18 of 34							
Medium-Density, Light Bro To Medium-Grained SAND	wn, Fine-	0 SS	13	-	-	-	_
	_ 3-	4					
	_	SS	16	-	-	-	-
Medium-Density, Light Bro To Coarse-Grained SAND And Grained GRAVEL		8					
Medium-Density, Light Bro Medium- To Coarse-Grained		2	25	_	-	<b>-</b>	-
Fine- To Medium-Grained G	RAVEL 46	SS 6	25	-	-	-	_
Medium-Density, Dark Brow Coarse-Grained SAND	n, Fine- To		; ; ;				
	- 50	o ss	26	-	-	-	-
Dense, Dark Brown, Fine-	To Coarse 5	4 SS	36	-	-	-	-
- BLOWS DELIVERED PER FOOT BY A 140 FALLING 30 INCHES 5 - SPLIT SPOON SAMPLE - SHELBY TUBE SAMPLE	LB. HAMMER	Qp - CALII Qu - UNCO Dd - NATU	BRATED P DNFINED (	ENETROME COMPRESS DENSITY - STURE CON	P.C.F.		i.F. 3.F.

ORING NO.B-10	(CONTINUATIO				20		
OJECT Illinois Power Ash Pond CATION Havana, Illinois	Excension			SHEET _	ILE NO	- <sup>OF</sup> ±1	556
CATION HEVEILE, IIII							<del></del> 1
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Mc
See Sheet 19 of 34							
Dense, Dark Brown, Medium- To Coarse-Grained SND And Fine- To Medium-Grained GRAVEL	60	SS	35	-	-	-	-
EXPLORATORY BORING DISCONTIN	UED						
	_ 64						
	_ 68						
	_ 72						
	_					į	
	_ 76						
			<b>!</b>				
	80						
	-						
	- 84						

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BORING NO.8-11 DATE 6-28-01	TNEY &	ORPORATED Nebraska	Avenue	1	ВО	RING	LOG
PROJECT ILLINOIS POWER ASH POND EXTE	NSION		LOCA	TION Ha	vana,	Illin	ois
BORING LOCATION See Plot Plan Sheet			Delt	EDBy Fe	hI	<u> </u>	
BORING TYPE Hollow-Stem Auger	WEAT	HER CON	DITIONS _	Partly	Cloud	y & M	ild
SOIL CLASSIFICATION SYSTEM U.S. B. S. C.	SEEP	AGE WATE	R ENCOU	NTERED A	T ELEVATI	ON _	452.7
GROUND SURFACE ELEVATION 467.6	GROL	ND WATE	RELEVATI	ON AT	4+(P)	HAS.	453.1
BORING DISCONTINUED AT ELEVATION 436.6	GRỌL	IND WATE	R ELEVATI	ON AT CO	MPLETIO	v	452.4
DESCRIPTION	DEPTH	SAMPLE	N	Qp	Qu	D₄	Mc
Brown SANDY LOAM	7*	1175		<del></del>			
Loose, Light Brown, Fine-Grained SAND With Some Silty Clay	-						
		SS	8	<u> </u>	-		9
Trans Process Process Carps	-						
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	<b>├</b> 5 −	SS	9			<u> </u>	11
aich considerable office Cisa	<b>—</b>	22	3_	ļ	_	<u> </u>	+ * * -
Loose, Brown, Fine-Grained SAND	-				E	Ī	
manny and a man was an annual winds.		SS	6	-			10
	_					-	
Loose, Brown, Fine-Grained SAND	- - - 10-						
With Considerable Silty Clay	10	SS	5	- ]	_	-	16
	_						
Loose, Brown, Fine-Grained SAND	<u> </u>						<b>—</b>
	-	SS	5	-			19
	<b>⊢15</b> −	SS	4		_		<del>  _  </del>
			-3	-			+
	-20-						
	20	SS	8			-	-
•							
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND	_						
	25-			<del></del>	<del></del>		1
		SS	12	<del>-</del>	-	-	<del>  -</del>
	-						
Medium-Density, Light Brown, Fine- Grained SAND	- -30-		1.5	_			
EXPLORATORY BORING DISCONTINUED		SS	_16				
ENLTOKATOKI DOKTAO DISCOMITADED							
I - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE		Qu - UNO	IBRATED CONFINED TURAL DRY	COMPRE Y DENSITY ISTURE C	SSIVE STF ' - P.C.F. ONTENT -	RENGTH - %	T.S.F. T.S.F.



Oning No.	RING LO				24		34
ROJECT Illinois Power Ash Pond Extendocation Havana, Illinois	B1011			SHEET W. & A. F	ILE NO	- <sup>0</sup> 1	656
OCATION TRAVELLE,							<u> </u>
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D₫	Mc
See Sheet 23 of 34							
Dense, Gray-Brown, Fine- To Medium- Grained SAND And Fine-Grained GRAVEL	_ 60	SS	35	-	-	-	-
EXPLORATORY BORING DISCONTINUED							
	64					:	
	-						
	_ 68				ļ	ALL INVESTIGATION OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPE	
	-						
	_ 72						
	_						
	_ <b>76</b>						
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	_ 80		<u></u>				
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	- 84				and the second		

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WHITNEY & ASSOCIATES BORING NOB-13 **BORING LOG** DATE \_\_6-25-01 2406 West Nebraska Avenue W. & A. FILE NO. 1656 PEORIA, ILLINOIS 61604 \_\_or\_\_34 SHEET 25 PROJECT ILLINOIS POWER ASH POND EXTENSION LOCATION Havana, Illinois BORING LOCATION See Plot Plan Sheet DRILLED BY Fehl BORING TYPE Hollow-Stem Auger WEATHER CONDITIONS Partly Cloudy & Mild U.S.B.S.C. SOIL CLASSIFICATION SYSTEM \_ 449.0 SEEPAGE WATER ENCOUNTERED AT ELEVATION  $\_$  GROUND WATER ELEVATION AT 24+ HRS. 466.5 GROUND SURFACE ELEVATION 455.9 \_ HRS.\_ BORING DISCONTINUED AT ELEVATION 405.5 448.6 GROUND WATER ELEVATION AT COMPLETION . DESCRIPTION DEPTH IN FEET Qρ Qu  $D_d$ Mc Brown SANDY LOAM Loose, Light Brown And Brown, Fine-Grained SAND With Some Silty Clay 7 -SS -11 9 55 10 Very Loose, Light Brown, Fine-Grained SAND 6 8 SS 3 4 12-Loose, Light Brown, Fine-Grained SAND SS \_ 6 6 10 -16 Loose, Light Brown, Fine- To Medium-Grained SAND 20 SS 8 18 -24-SS 10 N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - % WHITNEY & ASSOCIATES

ORING NOB-13  OJECT Illinois Power Ash Pond Extendation Havana, Illinois	sion	N)		SHEET W. & A. FI		_ OF 175	34 56
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Мс
	JIN FEET						
See Sheet 25 of 34  ledium-Density, Gray-Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL	30	SS	12		-	-	-
	38	SS	13	-	-	-	-
	<b>42</b>	SS	16	-		-	
Medium-Density, Brown, Fine- To Medium-Grained SAND Medium-Density, Brown, Medium- To Coarse-Grained SAND	<b>46</b>	SS	20	-	_		-
	<b>- 50</b>	SS	23	-	-	-	-
	- 54	SS	18	PENETAOI O COMPRES	<b></b>	-	-

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BORING NOB-13  PROJECT Illinois Power Ash Pond Exte	CONTINUATION			•	DATE		
LOCATION Havana, Illinois	HBION			SHEET W. & A. F	ILE NO.	_ OF 16	556
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qυ	Da	1
See Sheet 26 of 34							
Medium-Density, Brown, Fine- To Medium-Grained SAND	-						
	_60	SS	17	_	-	-	-
EXPLORATORY BORING DISCONTINUED						·	
	_64						
	-						
	_68						
	_ 72						
	-						
	<b> 7</b> 6						
	-						
	- 80						
	84						

HA DOOS

FILE NO. 1656	06 West ORIA, I	ASS DAPORATED Nebraska LLINOIS	Avenue			RING L	
TILINOTS POWER ASH POND EXTENS	ION		LOCAT	ION Ha	vana,	Illino	18
See Plot Flan Buccs		HER COND	DRILLE	DBY Fe	Cloud	y & Mi	.ld
G TYPE HOLLOW-SCEN RUGGE			- ENCOIG	ITEDEN AT	FIFVALL	UN	54.4
CLASSIFICATION STSTEM	GROU	ND WATER	ELEVATION	DN AT	47(17	. HRS	53.8
ND SURFACE ELEVATION 481. 9  IG DISCONTINUED AT ELEVATION 450. 9	GROU	ND WATER	ELEVATI	ON AT CO	MPLETIO	<u> </u>	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	Ν	Qр	Qu	D₫	Мс
	6*						
own SANDY LOAM ose, Gray Brown, Fine-Grained						1	
ND With Some Silty Clay	<del></del>	SS	8	-	-	-	9
_							
ose, Light Brown, Fine-Grained	  - 5 -	SS	7			-	8
ND		55					
dium-Density, Dark Brown, Fine-						<u> </u>	9
ained SAND With Considerable	<u> </u>	SS	10				<del> </del>
ity Clay	10						<del> </del>
	-10-	SS	11			<del> </del> -	15
dium-Density, Brown, Fine-Grained		SS	12	-	-	_	14
ND With Some Silty Clay							
	-15-		15	<del>  _</del>	_	-	20_
		SS	1-12-				
	L	1	İ				
	_						
dium-Density, Light Brown, Fine-				<u> </u>		<u> </u>	ļ
ained SAND	-20-	SS	13	<u> </u>	<u> </u>	<del>  -</del> -	5
	-						
							-
edium-Density, Light Brown, Fine-	_ 25-				+-	+	5_
Medium-Grained SAND		SS	15_	<del> </del> -	†- <u>-</u> -		
						,	
		**	<u></u>				
	<del>-30</del> -	SS	13_	J_=	<u> </u>	<u> </u>	15
EXPLORATORY BORING DISCONTINUED	<del>                                     </del>						
CADILING THEI DOUTED DIDOCH	4	1	1			READING	

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BORING NO.8-15 DATE 6-27-01 W. & A. FILE NO. 1656 SHEET 29 OF 34	2406 West PEORIA,	Nebrask	a Avenue		<b>!</b>	RING	LOG
PROJECT ILLINOIS POWER ASH POND EXTEN	SION		LOCA		vana,	Illin	ois
BORING LOCATION See Plot Plan Sheet BORING Type Hollow-Stem Auger			DRIL	LED BY FE	hl	/ 0 W	
BORING TYPE HOLLOW-Stem Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C.				Partly			450. B
GROUND SURFACE ELEVATION473. 2		IND WATE		INTERED A	T ELEVAT 24+	10N	<del>451. 4</del>
BORING DISCONTINUED AT ELEVATION 412. 2				TION AT CO	OMPLETIO		449.6
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Mc
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Some Silty Clay	5"	1112					
	Γ'	SS	5	T -	† <u>-</u> –	-	10
	- 4 -						
		SS	6	-	-	-	11
Loose, Brown, Fine-Grained SAND With Trace Of Silty Clay	- 8 -	SS	8		-	-	9
Loose, Light Brown, Fine-Grained SAND		SS	9	-	-	-	8
Medium-Density, Light Brown, Fine-	-12-						
Grained SAND		SS	13	<del>-</del>	-	<u>-</u>	8
	-16-	SS	17	-		-	3
Loose, Light Brown, Fine-Grained SAND							
	-20-	SS	8	-	-	-	4
Loose, Light Brown, Fine- To Medium-Grained SAND	-24-	SS	8	-	-	<del>-</del> ,	16
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES - SPLIT SPOON SAMPLE - SHELBY TUBE SAMPLE		Ud - NAT	URAL DR'	PENETROI COMPRES Y DENSITY HISTURE CO	' - P.C.F. ONTENT -	%	
HA	aley	30	)	—— V	HITNEY PE	' & ASS ORIA, ILLING	OCIATE:

ORING NO.B-15  OJECT Illinois Pove	or Ash Pond Exten	ntinuation sion	· -,		SHEET	30	6-27-	
CATION Havana, Ill	inois				W. & A. FI	LE NO		
DESCRIP	TION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D,d	Mc_
See Sheet 29 of 34								
Medium-Density, Ligh To Medium-Grained SA	nt Brown, Fine-	_30	SS	15	-	•	-	-
Medium-Density, Lig To Coarse-Grained SA Grained GRAVEL	nt Brown, Fine-	34	SS	18	1	· -	-	-
		38  42	SS	23			-	_
Medium-Density, Lig To Coarse-Grained S Grained GRAVEL	ht Brown, Medium	46	SS	24	-		-	-
		<b>- 50</b>	SS	23	-		-	
		54	SS	24	PENETRO		-	-

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# DRAFT

DJECT Illinois Power Ash Pond Extension							01
CATION Havana, Illinois	ension			SHEET _ W. & A. F	31 ILE NO	<sup>.of</sup> 1€	34 56
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Мс
ee Sheet 30 of 34							
edium-Density, Light Brown, Fine- o Medium-Grained SAND	60	SS	26	-	-	•	1
EXPLORATORY BORING DISCONTINUED							
	_64						
	_68					4	
	72						
	_						
	_76						
	_						
	80						
	84						

44 MOSA

BORING NO. B-16 6-27-01 v. & A. FILE NO. 1656 P.	'NEY & INC 2406 West EORIA, I	ORPORATE: Nebraska	Avenue			RING	
TILINOIS POWER ASH POND EXTEN	SION		LOCA	TION Ha	vana,	Illin	ois
ORINGLOCATION See Plot Plan Sheet	<del></del>		DRILL	FE FE	h1		
ORING TYPE HOLLOW-Stem Auger ORING TYPE U. S. B. S. C. ROUND SURFACE ELEVATION 468. 9 ORING DISCONTINUED AT ELEVATION 407. 9	_ SEEP/	AGE WATE	DITIONS _ ER ENCOU! A ELEVAT!	NTERED A	T ELEVAT	ION	450.1 451.4 449.7
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE		Qp	Qu	D⊲	Мс
	8*	1175					
Brown SANDY LOAM Loose, Brown And Light Brown, Fine- Grained SAND With Some Silty Clay							
		SS	8		-		9
	<del>-</del> 4 <del>-</del>	<u> </u>					
		SS	9	-	-	-	11
Medium-Density, Brown And Light Brown, Fine-Grained SAND	- 8 -	SS	15	-			3
		SS	19	-		·	4
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	- 12-						
10 Wedinm-plained pwwn		SS	16	-	-	-	7
Medium-Density, Light Brown, Fine-					_		
Grained SAND	-16-	SS	14		<u>-</u>		4_
Loose, Light Brown, Fine- To Medium-Grained SAND	-20-	SS	8	-		<u></u>	17
USGIOR OF STREET SAME	-24-	SS	5	-	-	-	_
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	I	Qu - UNG Dd - NAT	LBRATED CONFINED TURAL DRI TURAL MO	COMPRE: DENSITY	SSIVE STR - P.C.F.	ENGTH -	T.S.F. T.S.F.

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ORING NO. 13	ORING L				DATE		
ROJECT Illinois Power Ash Pond Extended Havana, Illinois	ension			SHEET _	33 FILE NO	OF 1	34 650
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Τ
See Sheet 32 of 34							
Medium-Density, Light Brown And Gray-Brown, Fine- To Medium- Grained SAND							
		SS	15	-	-	-	
	_34	SS	15	-	-	-	
edium-Density, Gray-Brown And Light	38	-		771			
rown, Fine- To Coarse-Grained SAND	42	SS	17	-	-	-	
	<b> 4</b> 6	SS	19	-	<u>-</u>	-	•
	_ 50						
		SS	26	-	-	-	-
	- 54	SS	24	_	_	_	



p_16	BORING LO				DATE	6-27-	01
ORING NO. 8-16_	(CONTINUATIO						34
Hayana, Illinois	xtension				ILE NO	OF 16	56
CATION Havana, Illinois				<del></del>			Mc
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D₫	1010
See Sheet 34 of 34				•			
	-						ļ
							ļ
	60	SS	23	_	_	_	-
				<del> </del>	<del> </del>		
EXPLORATORY BORING DISCONTINUE	D –	,					
	_64		ì				
	-04					ì	
	_ 68		}		ļ		
			ļ				
	<b>72</b>						
	_ 76						
	[ 78						
	- 80						
	-			-			
						,	
	- 84						
f	ļ						
I - BLOWS DELIVERED PER FOOT BY A 140 LB. HAM FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	IMER			PENETRO COMPRE Y DENSIT' DISTURE C	ONTENT -		

HA 312

13

2x2 box culvert under nighway /o
Worksheet for Rectangular Channel

Project Description	on
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	2x2 Box Culvert
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

					_	
٠	Input Data				_	
•	Mannings Coefficient	0.013				
	Channel Slope	0.0370	00 ft/ft			
	Depth	2.00	ft	₹.	FULL	FLO W
	Bottom Width	2.00	ft	J	1 * -	•

Results		
Discharge	67.11	cfs
Flow Area	4.00	ft²
Wetted Perimeter	6.00	ft
Top Width	2.00	ft
Critical Depth	3.27	ft
Critical Slope	0.0114	96 ft/ft
Velocity	16.78	ft/s
Velocity Head	4.38	ft
Specific Energy	6.38	ft
Froude Number	2.09	
Flow is supercritical.		

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Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15 Page 1 of 1



#### Check ditch for 1/2 PMP Worksheet for Trapezoidal Channel

Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Auxiliary Spillway for Havana Polishing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.031	•
Channel Slope	0.00960	00 ft/ft
Left Side Slope	5.0000	00 H : V
Right Side Slope	5.00000	00 H : V
Bottom Width	10.00	ft
Discharge	100.00	cfs

Results		
Depth	1.33	ft
Flow Area	22.18	ft²
Wetted Perimeter	23.58	ft
Top Width	23.31	ft
Critical Depth	1.19	ft
Critical Slope	0.0149	04 ft/ft
Velocity	4.51	ft/s
Velocity Head	0.32	ft
Specific Energy	1.65	ft
Froude Number	0.81	
Flow is subcritical.		

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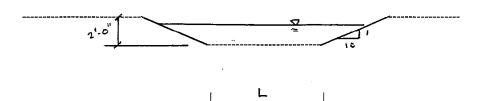
Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15 Page 1 of 1

HA 314

Auxiliary Spillway Analysis Havana Power Station East Ash Pond #3B October 8, 2001 JHK

Check auxiliary spillway at the polishing pond for the following new flows of  $\frac{1}{2}$ -PMP storm of 100 cfs and 100-year, 24-hr. storm of 44 cfs. Spillway will act as a weir. Ignore sloping sides when determining capacity of weir.



For the 100 cfs flow, allow H to be up to 1.5' For the 44 cfs flow, allow H to be up to 1.0'

$$Q = CLH^{1.5}$$
  $C = 2.70$ 

Calculate required width of spillway, L:

For Q= 100 cfs  $L= 100/[(2.7)(1.5)^{1.5}] = 20.2$ 

For Q= 44 cfs  $L=44/[(2.7)(1.0)^{1.5}]=16.3$ 

Existing spillway is 20°. Note: spillway L does not take into consideration sloping portion of spillway, which would increase the flow going through spillway. Also, these flows assume that effluent pipe is completely blocked, which is unlikely. The auxiliary spillway

is not needed to meet the state dam safety criteria.



Auxiliary Spillway Analysis Havana Power Station East Ash Pond #3B October 8, 2001 JHK

The stoplog structure in the polishing pond is both the primary and emergency spillway for the pond system. Calculations elsewhere in this document show that it has sufficient capacity for the maximum design storm.

The auxiliary spillway from the polishing pond is an existing one. As part of this new pond 3B, an additional spillway, connecting pond 3B to the polishing pond, will be added. The critical flow, since both the existing spillway and the new spillway are the same size and dimensions, will come from the existing spillway in the polishing pond where the flow is greater. This calculation checks the existing spillway for the higher discharge resulting from adding a new pond to the system.

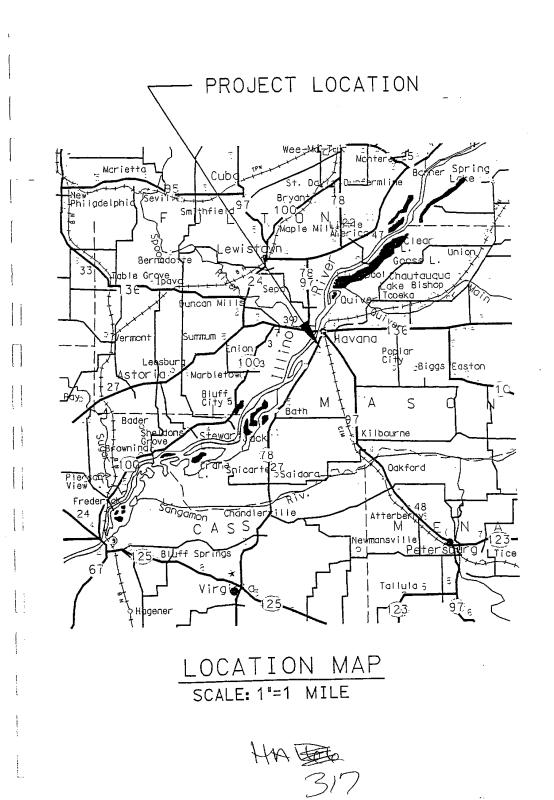
The stoplog structure discharges into a 36-inch round reinforced concrete pipe that routes the water to the Illinois River. Should a blockage ever occur in the 36-inch pipe, performance of the stoplog structure would be reduced. To provide for a controlled discharge in the event of a blockage of the 36-inch pipe, an auxiliary spillway was installed in pond #3 as part of the previous pond addition work. There will also be an auxiliary spillway installed between new pond #3B and polishing pond #3, to provide a path for the water should the outlet for pond #3B become blocked.

Since the auxiliary spillway is not the emergency spillway, but is in addition to it, there is no specified design flow. However, since its purpose is to back up the emergency spillway, it is appropriate to use the same design flows for each. As stated above, the existing spillway for polishing pond #3 has the critical water flow. The design flow for the 100-year, 24-hour storm is 44 cfs, and the design flow for the ½-PMP storm is 100 cfs. The auxiliary spillway was analyzed as a broad crested weir. It has a maximum head of 2-feet. The width is sufficient to carry 44 cfs with a 1-ft head and 100 cfs with a 1.5-ft head.

Any water that discharges over the auxiliary spillway from the polishing pond #3 will flow north parallel to Highway 78 to a 2-ft square box culvert located south of the railroad tracks on the north edge of the pond system. The culvert flows westward under the highway, eventually discharging into a large swale draining into the Illinois River. The box culvert will control the maximum flow into the river. It has a full flow capacity of 67 cfs. Flow in excess of this, would cause minor flooding of the highway.

It would be very unlikely that the auxiliary spillway would ever see a discharge. Regular pond observation by the plant would detect high pond levels and corrective action would be taken. Plant flows can be shut down in a short time if critical pond levels are reached.

HM 316



Document 9: Design Calculations and Commentary

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 3 of 8

#### Response to Request No. 3:

The East Ash Pond System is designed to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist discharges to the East Ash Pond System of the following materials as identified in the Havana Power Station's National Pollutant Discharge Elimination System (NDPES) permit:

Unit 6 bottom ash sluice water Unit 6 dry fly ash handling area drainage Dredged material Units 1-6 demineralizer regenerant wastes Unit 6 condensate polisher wastes

The North Ash Pond System is intended to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist of discharges to the North Ash Pond System of the following materials as identified in the Havana Power Station's NPDES permit:

Units 1-6 ash hopper overflow
Units 1-6 boiler blowdown
Units 1-6 demineralizer regenerant wastes
Units 6 condensate polisher wastes
Units 1-6 floor and sump drainage
Units 1-5 miscellaneous heat exchangers
Units 1-5 ash handling equipment drainage
Unit 6 coal pile runoff
Unit 6 transformer drains
Unit 6 roof drainage
Yard area runoff
Water softener backwash
Service water strainer backwash
Units 1-6 nonchemical metal cleaning waste

Unit 6 cooling tower blowdown
Winter low point drain line
Accumulated coal barge stormwater
Reverse osmosis unit concentrate
Reverse osmosis unit maintenance waste
Activated carbon treatment system effluent
Groundwater remediation project discharge
Units 1-6 water sampling system drains

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 4 of 8

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management units(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

#### Response to Request No. 4:

The cells of the East Ash Pond System were designed by and constructed under the supervision of a registered Professional Engineer employed by DMG or the previous owner/operator of Havana Power Station, Illinois Power Company. In 2008 and 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the East Ash Pond System. Prior to that, beginning in approximately 1990 and through 2007, the safety of East Ash Pond System was inspected annually by a registered Professional Engineer employed by DMG or Illinois Power Company.

DMG was unable to locate any records to determine whether the North Ash Pond System was or was not designed by a Professional Engineer. DMG was also unable to locate any records to determine whether the North Ash Pond System was or was not constructed under the supervision of a Professional Engineer. In 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the North Ash Pond System.

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

#### Response to Request No. 5:

DMG last assessed and evaluated the safety (i.e., structural integrity) of both the North Ash Pond System and the East Ash Pond System in March 2009. The East Ash Pond System was also assessed and evaluated for safety in 2008. Those assessments/evaluations were conducted by Ken Berry, a registered Professional Engineer employed by URS Corporation. Mr. Berry, a Senior Project Manager in the Geotechnical Engineering Group of URS Corporation, is a geotechnical engineer with experience in landslides, levees, foundations,

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 5 of 8

geotechnical instrumentation, and general construction. His recent experience includes a design project for the New Orleans levees, a load test on an I-wall and levee in New Orleans, and investigations for 30 miles of levee analyses in the counties east of St. Louis, Missouri. Mr. Berry received his BSCE from North Carolina State University in 1989 and his MSCE (geotechnical) from Virginia Polytechnic Institute and State University in 1990. He is registered as a Professional Engineer in Missouri and Illinois and has been employed by URS Corporation since 1991. Prior to 2008 (i.e., beginning in approximately 1990 and through 2007), a registered Professional Engineer employed by DMG or Illinois Power Company (the previous owner/operator of Havana Power Station) with experience in dam safety annually inspected the safety of the cells of the East Ash Pond System.

DMG has not yet received URS' report of the March 2009 dam inspections at Havana Power Station. After receipt of URS' report, DMG will assign a Professional Engineer to ensure that all required corrective actions are implemented. At that time, DMG will determine whether company employees or contractors will be used to perform any identified corrective actions. DMG has not yet had the opportunity to develop or implement any corrective actions.

DMG plans to have a qualified Professional Engineer perform safety (i.e. structural integrity) inspections of both the East Ash Pond System and North Ash Pond System in 2010.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

#### Response to Request No. 6:

The IDNR OWR last inspected the safety (structural integrity) of the East Ash Pond System prior to the filling each cell with water. Specifically, IDNR OWR last inspected Cell 1 in 1990; Cells 2 and 4 in 1997, and Cell 3 in 2003. IDNR did not provide and DMG does not have copies of those IDNR inspection reports. DMG is not aware of a planned state or federal inspection or evaluation of the East Ash Pond System in the future.

To the best of DMG's knowledge, no federal or state agency regulatory official has inspected or evaluated the safety (structural integrity) of the North Ash Pond System. DMG is not aware of a planned state or federal inspection or evaluation of the North Ash Pond System in the future.

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 6 of 8

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

#### Response to Request No. 7:

No federal or state regulatory officials have conducted any assessment, evaluation or inspection of the North Ash Pond System or the East Ash Pond System at Havana Power Station within the past year.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of material currently stored in each of the management unit(s). Please provide the date that the volume measurement was taken. Please provide the maximum height of the management units(s). The basis for determining maximum height is explained later in this Enclosure.

#### Response to Request No. 8:

The East Ash Pond System has a total surface area of 90 acres. The estimated design storage volume of each cell in the East Ash Pond System at normal pool elevation is as follows: Cell 1 - 520 acre-feet (ac-ft); Cell 2 - 620 ac-ft; Cell 3 - 1,410 ac-ft; and Cell 4 - 75 ac-ft. The total estimated design volume of the East Ash Pond System is 2,625 ac-ft. The estimated volume of materials currently stored in each cell is as follows: Cell 1 - 506 ac-ft; Cell 2 - 565 ac-ft; Cell 3 - 310 ac-ft; and Cell 4 - 7 ac-ft. Because no recent volume measurements have been taken for any of the cells in the East Ash Pond System, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of each cell in the East Ash Pond System is approximately as follows: Cell 1 - 25 feet; Cell 2 - 40 feet; Cell 3 - 38 feet; and Cell 4 - 40 feet.

The North Ash Pond System has a surface area of approximately 6 acres. The estimated design storage volume of the North Ash Pond System is 25 ac-ft. The estimated volume of materials currently stored is 5 ac-ft. Because no volume measurements have been taken for the single cell of the North Ash Pond, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of the North Ash Pond System is approximately 22 feet.

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 7 of 8

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

#### Response to Request No. 9:

To the best of DMG's knowledge, there have been no spills or unpermitted releases of coal combustion residues or byproducts to surface water or to the land from either the East Ash Pond System or North Ash Pond System at Havana Power Station in the last ten years.

All discharges from the East Ash Pond System and North Ash Pond System in the last ten years in excess of Havana Power Station's NPDES permit limitations have been reported to the Illinois Environmental Protection Agency, in accordance with NPDES permit reporting requirements. For purposes of responding to this request, DMG did not consider infrequent exceedances of NPDES permit pollutant discharge limits (e.g. TSS) to be "unpermitted releases" within the scope of the EPA's request and, thus, they are not identified in this response. To the extent EPA interprets this request differently, DMG objects to the request because it is vague, overly broad, and too indefinite for reasonable interpretation.

10. Please identify all current legal owner(s) and operator(s) at the facility.

#### Response to Request No. 10:

Dynegy Midwest Generation, Inc. is the current legal owner and operator of Havana Power Station.

\*\*\*\*\*

In accordance with and for purposes of the following certification, all portions of this response are hereby identified as information for which the certifying authorized representative cannot personally verify their accuracy.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 8 of 8

on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: Q. Kuk Millis

Name: A. Kiek Millis

Title: Plant Manager

cc: Rich Eimer, Executive Vice President, Generation Operations Keith McFarland, Vice President, Midwest Fleet Operations James Ingram, Vice President & Group General Counsel, Environmental



Photo 1: (EAPS) Cell 1 Along S Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 2: (EAPS) Cell I Looking Toward N of Cell I (downstream side), Havana Power Plant, Havana, IL, 05.27.09



Photo 3: (EAPS) Cell I, Lower Edge of SW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 4: (EAPS) Cell 1 SE Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 5: (EAPS) Cell 1, SE Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 6: (EAPS) Cell 1, SW Corner, Havana Power Plant, Havana, IL, 05.27.09

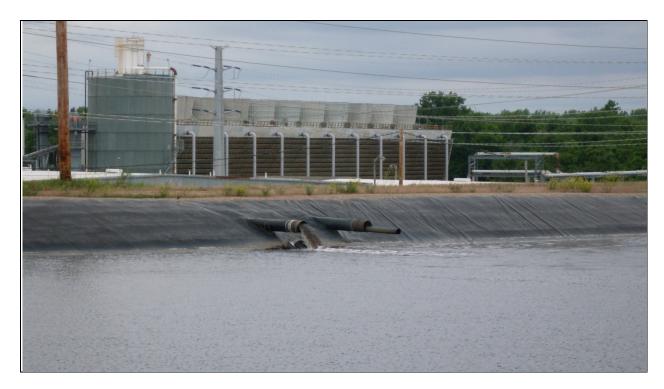


Photo 7: (EAPS) Cell 2, Coal Pile Runoff (mostly storm water), Havana Power Plant, Havana, IL, 05.27.09



Photo 8: (EAPS) Cell 2, NW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 9: (EAPS) Cell 2, NW Corner Looking at Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 10: (EAPS) Cell 2, NW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09



Photo 11: (EAPS) Cell 2, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 12: (EAPS) Cell 2 NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 13: (Cell 2) NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 14: (EAPS) Cell 2, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 15: (EAPS) Cell 4, Emergency Spillway (along W edge into roadway; towards plant), Havana Power Plant, Havana, IL, 05.27.09



Photo 16: (EAPS) Cell 4, W Edge (energy dissipater of emergency spillway), Havana Power Plant, Havana, IL, 05.27.09



Photo 17: (EAPS) Cell 2, Staff Gage, Havana Power Plant, Havana, IL, 05.27.09



Photo 18: (EAPS) Cell 2, N Edge (looking E toward Cell 3 wetting structure), Havana Power Plant, Havana, IL, 05.27.09



Photo 19: (EAPS) Between Cell 3 and Cell 2 (looking S), Havana Power Plant, Havana, IL, 05.27.09



Photo 20: (EAPS) Cell 3 Extra Fly Ash Basin in SE Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 21: (EAPS) Cell 3, Fly Ash Outfall Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 22: (EAPS) Cell 3, Looking N From S Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 23: (EAPS) Cell 3, NW Corner (bottom ash outfall area) I of 2, Havana Power Plant, Havana, IL, 05.27.09



Photo 24: (EAPS) Cell 3, NW Corner (bottom ash outfall area) 2 of 2, Havana Power Plant, Havana, IL, 05.27.09



Photo 25: (EAPS) Cell 3, NE Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 26: (EAPS) Cell 3, NE Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 27: (EAPS) Cell 3, NE Corner Looking W (abandoned factory), Havana Power Plant, Havana, IL, 05.27.09



Photo 28: (EAPS) Cell 3, NE Corner Looking W Toward Bottom Ash Discharge Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 29: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 30: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 31: (EAPS) Cell 3, NW Corner Looking N Toward Barn Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 32: (EAPS) Cell 3, NNW Corner (polypropylene liner), Havana Power Plant, Havana, IL, 05.27.09



Photo 33: (EAPS) Cell 3, NNW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09



Photo 34: (EAPS) Cell 3, NNW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 35: (EAPS) Cell 3, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 36: (EAPS) Cell 3, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 37: (EAPS) Cell 3, Open Trough Fly Ash Discharge, Havana Power Plant, Havana, IL, 05.27.09



Photo 38: (EAPS) Cell 3, NW Corner Looking SE, Havana Power Plant, Havana, IL, 05.27.09



Photo 39: (EAPS) Cell 4, Primary Spillway from Cell 4 to River, Havana Power Plant, Havana, IL, 05.27.09



Photo 40: (EAPS) Cell 3, Pipe at SE of Cell 3 (fabrication over synthetic liner), Havana Power Plant, Havana, IL, 05.27.09



Photo 41: (EAPS) Cell 3, Ponding S of Cell 3 at Toe of Embankment (no flow), Havana Power Plant, Havana, IL, 05.27.09



Photo 42: (EAPS) Cell 3, S Edge Embankment (1 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 43: (EAPS) Cell 3, S Edge Embankment (2 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 44: (EAPS) Cell 3, S Edge Embankment (3 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 45: (EAPS) Cell 3, S Edge Looking E (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 46: (EAPS) Cell 3, S Edge Looking E (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 47: (EAPS) Cell 3, E Edge Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 48: (EAPS) Cell 3, S of Cell 3 Area Leading to Ponding, Havana Power Plant, Havana, IL, 05.27.09



Photo 49: (EAPS) Cell 3, S of Extra Fly Ash Basin, Havana Power Plant, Havana, IL, 05.27.09



Photo 50: (EAPS) Cell 3, SE Corner Looking N (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 51: (EAPS) Cell 3, SE Corner Looking N (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 52: (EAPS) Cell 3, SE Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 53: (EAPS) Cell 3, Staff Gage and Primary Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 54: (Cell 3) SW Edge Corner (cell 4 to the East/right), Havana Power Plant, Havana, IL, 05.27.09



Photo 55: (EAPS) From Toe of Cell 3 (NE corner) Looking Toward Adjacent House, Havana Power Plant, Havana, IL, 05.27.09



Photo 56: (EAPS) From Toe of Cell 3 (NE corner) Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 57: (EAPS) Between Cell 3 and Cell 4 Overflow Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 58: (EAPS) Cell 3, Vegetation Along S Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 59: (EAPS) Cell 3, W Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 60: (EAPS) Cell 4, Intersection of Cell 1 and Cell 4 (NE of Cell 1) Mainly Storm Water, Havana Power Plant, Havana, IL, 05.27.09



Photo 61: (EAPS) Cell 4, Looking SE at Cell 1, Havana Power Plant, Havana, IL, 05.27.09



Photo 62: (EAPS) Embankment between Cells 3 and 4 Havana Power Plant, Havana, IL, 05.27.09



Photo 63: (NAPS) Culverts from Coal Pile to NAPS (upstream side), Havana Power Plant, Havana, IL, 05.27.09



Photo 64: (NAPS) Coal Pile Runoff Coming into NAPS, Havana Power Plant, Havana, IL, 05.27.09



Photo 65: (NAPS) Coal Runoff (culverts connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09



Photo 66: (NAPS) Coal Runoff (culvert connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09



Photo 67: (NAPS) Into Downstream Pond, Havana Power Plant, Havana, IL, 05.27.09



Photo 68: (NAPS) Wall of Incision, Havana Power Plant, Havana, IL, 05.27.09



Photo 69: (NAPS) Upstream (plant behind), Havana Power Plant, Havana, IL, 05.27.09



Photo 70: (NAPS) West of NAPS Looking at IL River, Havana Power Plant, Havana, IL, 05.27.09



Photo 71: (NAPS) Looking S at Incision Wall, Havana Power Plant, Havana, IL, 05.27.09



Photo 72: (NAPS) Culvert Connecting Two Cells, Havana Power Plant, Havana, IL, 05.27.09



Photo 73: (SAPS) Southernmost Embankment Looking East, Havana Power Plant, Havana, IL, 05.27.09



Photo 74: (SAPS) Looking East Over Capped Cell, Havana Power Plant, Havana, IL, 05.27.09



Photo 75: (SAPS) Overlooking Closed Pond (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 76: (SAPS) Overlooking Closed Pond (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 77: (SAPS) Stop Log Structure (similar design to EAPS), Havana Power Plant, Havana, IL, 05.27.09



Photo 78: (SAPS) Westernmost Embankment Looking S, Havana Power Plant, Havana, IL, 05.27.09

Site Name: Havana Power Plo Unit Name: East Ash Pandsys		(4ce)			
Unit I.D.:		1	Hazard Potential Classification High S	ignifican	t Low
Inspector's Name: Clfighton S	MITH	n/La	auren Ohotzke		
Check the appropriate box below. Provide comments who construction practices that should be noted in the comme	en approp	<u>oriate. If r</u> n. For lar	not applicable or not available, record "N/A". Any unusual or ge diked embankments, separate checklists may be used	conditions for differe	or ent
embankment areas. If separate forms are used, identify a	pproximat	te area th	at the form applies to in comments.		
	Yes	No		Yes	No
Frequency of Company's Dam Inspections?	Ani	nual	18. Sloughing or bulging on slopes?		_X
2. Pool elevation (operator records)?	yar	ies	19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Val	1185	20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N	/A	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	Beir	Fled	Is water exiting outlet, but not entering inlet?	1	X
<ol> <li>If instrumentation is present, are readings recorded (operator records)?</li> </ol>	N/	A	Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?	N	14
Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	N	14
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?	N	/ A
11. Is there significant settlement along the crest?		×	Over widespread areas?	N	14
12. Are decant trashracks clear and in place?	N/	A	From downstream foundation area?	N	14
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?	N.	14
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?	N	114
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	×	see
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?		1010
Major adverse changes in these items coufurther evaluation. Adverse conditions no volume, etc.) in the space below and on the	oted in the back	these it of this	ems should normally be described (extent,	locatio	n,
Inspection Issue #	Comr	nents			
#1 Standing	Wa	ter	in areas of toe bu	1	Nas
deemed	+2	be	from recent rain,		

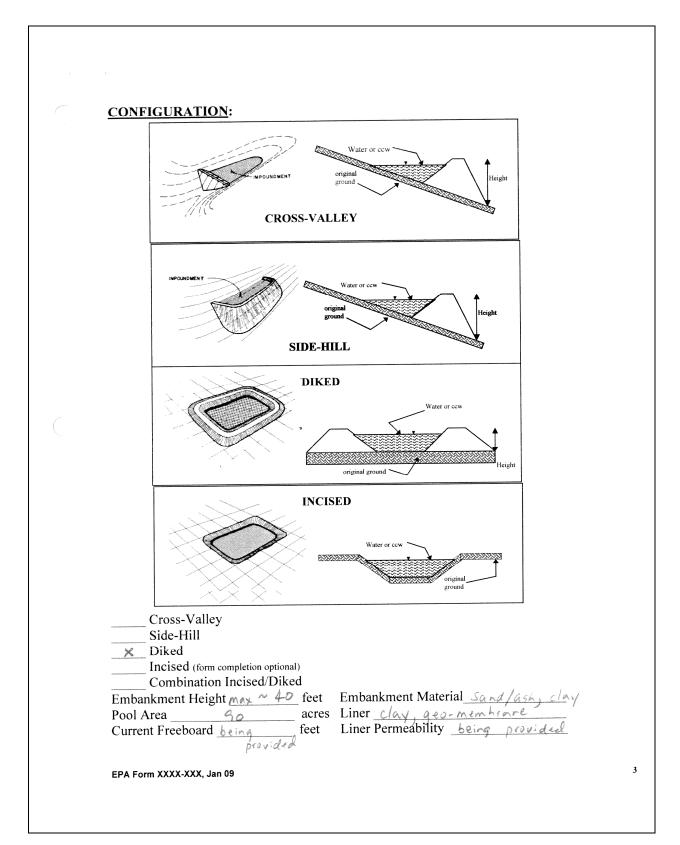
#### U. S. Environmental Protection Agency

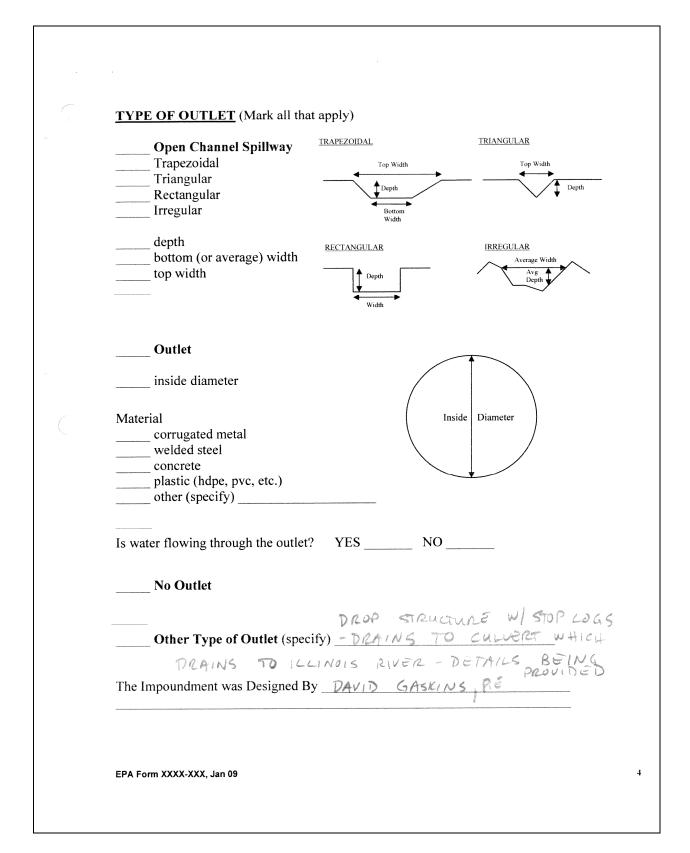


#### Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # Date	INSPECTOR Lawren Ohotzke
Impoundment Name Havana - East Ash Impoundment Company Dynesy EPA Region T State Agency (Field Office) Addresss  Name of Impoundment East Ash Po Sax 19 (Report each impoundment on a separate form under Permit number)	
New Update	
Is impoundment currently under construction? Is water or ccw currently being pumped into the impoundment?  IMPOUNDMENT FUNCTION:	Yes No X
Nearest Downstream Town: Name Hava na Distance from the impoundment Impoundment Location: Longitude Go Degrees Of Latitude Go County MA	Minutes 44.59 Seconds Minutes 36.35 Seconds
Does a state agency regulate this impoundment? YE	S _ X _ NO
If So Which State Agency? 111123 Dept of	F Natural Resources Don Safety
EPA Form XXXX-XXX, Jan 09	1

LOW HAZARD POTENTIAL: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of numan life and low economic and/or environmental losses. Losses are principally imited to the owner's property.  SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant nazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant nazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.  HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause	following would occur	AL (In the event the impoundment should fail, the ):
Classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally imited to the owner's property.  SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant mazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant mazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.  X HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.  DESCRIBE REASONING FOR HAZARD RATING CHOSEN:  Homes are located immediately downstream of century #3, #150 16 DNR - Dam Sefety Aug.		
mazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant mazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.  X HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.  DESCRIBE REASONING FOR HAZARD RATING CHOSEN:  Homes are located immediately downstream of cent #3, Also 14 DNR - Daym So fety has	classification are those human life and low eco	where failure or misoperation results in no probable loss of pnomic and/or environmental losses. Losses are principally
DESCRIBE REASONING FOR HAZARD RATING CHOSEN: Homes are located immediately downstream of CEN #3, Also IC DNR - Dam Sofety has	hazard potential classif in no probable loss of l damage, disruption of hazard potential classif	fication are those dams where failure or misoperation results human life but can cause economic loss, environmental lifeline facilities, or can impact other concerns. Significant
	agricultural areas but confrastructure.  HIGH HAZA potential classification	ould be located in areas with population and significant  RD POTENTIAL: Dams assigned the high hazard
	agricultural areas but coinfrastructure.  HIGH HAZA potential classification loss of human life.  DESCRIBE REASON	RD POTENTIAL: Dams assigned the high hazard are those where failure or misoperation will probably cause NING FOR HAZARD RATING CHOSEN:
	Agricultural areas but confrastructure.  X HIGH HAZA potential classification loss of human life.  DESCRIBE REASON Homes are a few #3,	RD POTENTIAL: Dams assigned the high hazard are those where failure or misoperation will probably cause NING FOR HAZARD RATING CHOSEN:  Located immediately downstream file of the DNR - Dam Sofety has
	Agricultural areas but confrastructure.  X HIGH HAZA potential classification loss of human life.  DESCRIBE REASON Homes are a few #3,	RD POTENTIAL: Dams assigned the high hazard are those where failure or misoperation will probably cause NING FOR HAZARD RATING CHOSEN:  Located immediately downstream file of the DNR - Dam Sofety has
	agricultural areas but coinfrastructure.  X HIGH HAZA potential classification loss of human life.  DESCRIBE REASON Homes are	RD POTENTIAL: Dams assigned the high hazard are those where failure or misoperation will probably cause NING FOR HAZARD RATING CHOSEN:  Located immediately downstream file of the DNR - Dam Sofety has
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Has there ever been a failure at this site? YES	NOX
If So When?	
If So Please Describe :	

If So When?	N/A		
	scribe:		

Has there ever been any measure Phreatic water table levels base at this site?	ed on past seepages or brea YES	ches NO	X
If so, which method (e.g., piez	cometers, gw pumping,)?	NIA	
			***************************************
			***************************************
Visit and the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the se			

Site Name: Havana Power P	ant	Date: 5/27/09	
Unit Name: North Ash Pond Sy	stem 12		Continues from an experience of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the continues of the cont
Unit I.D.:	olimen a serial.	Hazard Potential Classification: High Si	gnificant Low
Inspector's Name: Claighton Su	with ILa	uren ohotzke	and the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of th
i i i I I Decide composto uso	n appropriate If	not applicable or not available, record "N/A". Any unusual ci rge diked embankments, separate checklists may be used for	onditions or or different
onstruction practices that should be noted in the commer mbankment areas. If separate forms are used, identify ap	proximate area th	hat the form applies to in comments.	The same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the sa
SEE NOTE BELOW	Yes No		Yes No
Frequency of Company's Dam Inspections?	N/A	18. Sloughing or bulging on slopes?	NIA
2. Pool elevation (operator records)?	NIA	19. Major erosion or slope deterioration?	NIA
Decant inlet elevation (operator records)?	N/A	20. Decant Pipes:	
4. Open channel spillway elevation (operator records)?	NIA	Is water entering inlet, but not exiting outlet?	NVA
5. Lowest dam crest elevation (operator records)?	N/A	Is water exiting outlet, but not entering inlet?	NA
If instrumentation is present, are readings recorded (operator records)?	NYA	Is water exiting outlet flowing clear?	MA
7. Is the embankment currently under construction?	NIA	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	N/A	From underdrain?	NIA
Trees growing on embankment? (If so, indicate largest diameter below)	NIA	At isolated points on embankment slopes?	N/A
10. Cracks or scarps on crest?	NIA	At natural hillside in the embankment area?	NA
11. Is there significant settlement along the crest?	NIA	Over widespread areas?	NA
12. Are decant trashracks clear and in place?	NIA	From downstream foundation area?	NA
Depressions or sinkholes in tailings surface or whirlpool in the pool area?	N/A	"Boils" beneath stream or ponded water?	NIA
14. Clogged spillways, groin or diversion ditches?	N/A	Around the outside of the decant pipe?	NIA
15. Are spillway or ditch linings deteriorated?	NA	22. Surface movements in valley bottom or on hillside?	NA
16. Are outlets of decant or underdrains blocked?	NA	23. Water against downstream toe?	N/A
17. Cracks or scarps on slopes?	NXA	24. Were Photos taken during the dam inspection?	×
volume, etc.) in the space below and on the	oted in these ne back of thi	items should normally be described (extent,	location,
Inspection Issue #	Comments		
# 1 THE	MORTH	ASH POND SYSTEM IS	NOT AN
IMPO	UNDMEN	IT, BUT AN INCISION, A	LSD, IT
17,50	sives i	COAL PILE RUNDIFF, NO	T cew.
		*	
· , M	UST ON	CHECKLIST IS NOT	erre CABL

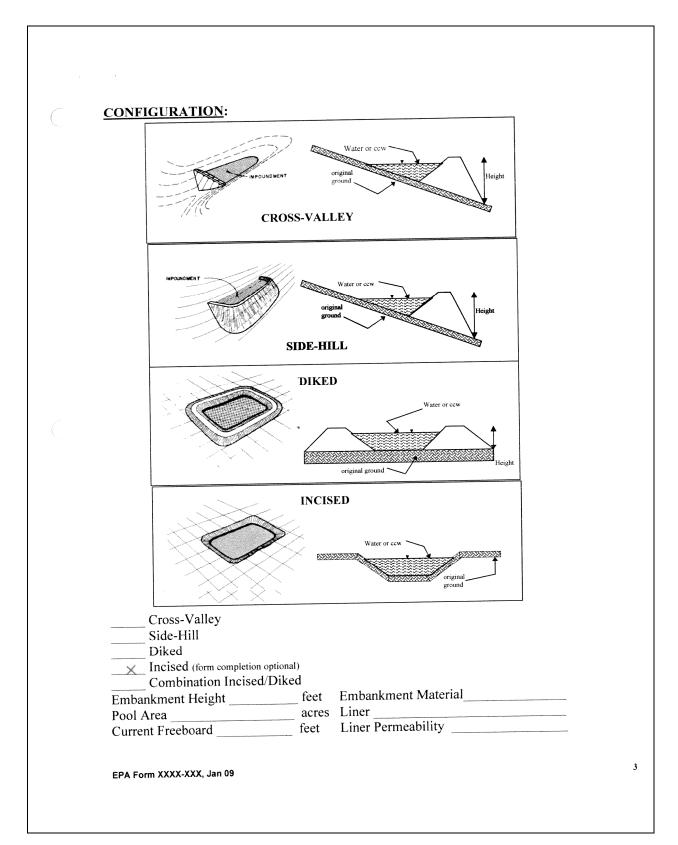
#### U. S. Environmental Protection Agency



#### Coal Combustion Waste (CCW) N/A

	S Permit #		cleightonswith/
Impoundment NPDE	S Permit #	INSPECTOR	<u> Lauvenonarke</u>
Date			
Impoundment Nan	ne		
Impoundment Con	npany		
State Agency (Fiel	d Office) Addresss		
Name of Impound (Report each impo Permit number)	mentundment on a separate form u		
NewU	odate		
		Yes	No
Is impoundment co	urrently under construction?		manifestation delicate accommon manifestation
Is water or ccw cu	rrently being pumped into		
the impoundment.			additional confirmation and the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the
	T FUNCTION:		
Nearest Downstre	am Town: Name Hava impoundment 1855 tha	Na	
Distance from the	impoundment <u>less tha</u>	n ho miles	
Impoundment Location:	Longitude 90 Degrees	04 Minutes 4	4.59 Seconds
200	Latitude 40 Degrees	16 Minutes 3	6.35 Seconds
	State County	Masova	
Does a state agend	ey regulate this impoundment?	YESNO	<u>×</u>
If So Which State	Agency?	44 mg/m	
EPA Form XXXX-XXX, J	lan 09		t

	NIÀ
HAZARD POTENTIAL (In the elollowing would occur):	event the impoundment should fail, the
LESS THAN LOW HAZ. he dam results in no probable loss osses.	<b>ARD POTENTIAL:</b> Failure or misoperation of of human life or economic or environmental
classification are those where failur	<b>TIAL:</b> Dams assigned the low hazard potential re or misoperation results in no probable loss of or environmental losses. Losses are principally
hazard potential classification are t in no probable loss of human life b damage, disruption of lifeline facil- hazard potential classification dam	D POTENTIAL: Dams assigned the significant those dams where failure or misoperation results out can cause economic loss, environmental ities, or can impact other concerns. Significant as are often located in predominantly rural or atted in areas with population and significant
HIGH HAZARD POTEN potential classification are those will loss of human life.	NTIAL: Dams assigned the high hazard where failure or misoperation will probably cause
DESCRIBE REASONING FOR	HAZARD RATING CHOSEN:
	2



Open Channel Spillway TRAPEZOIDAL TRIANGULAR
Trapezoidal Triangular Rectangular Irregular  Depth Bottom Width Top Width Top Width Top Width Depth Depth Depth Depth Depth
depth bottom (or average) width top width  width  RECTANGULAR  Average Width  Average Width  Depth  Depth  Depth  Depth  Depth
Outlet
inside diameter
Material  corrugated metal welded steel concrete plastic (hdpe, pvc, etc.) other (specify)
Is water flowing through the outlet? YES NO
No Outlet
Other Type of Outlet (specify)
The Impoundment was Designed By

	N/A
Has there ever been a failure at this site? YES	NO
If So When?	
If So Please Describe:	
EPA Form XXXX-XXX, Jan 09	

	N/A	NO
Has there ever been significant seepages at this	site? YES	NO
If So When?		
IF So Please Describe:		
II So I lease Decement		
EPA Form XXXX-XXX, Jan 09		

Has there ever been any measures undertaken to monitor/lower  Phreatic water table levels based on past seepages or breaches at this site?  YESNO			
If so, which method (e.g., piezometers, gw pumping,)?			
If so Please Describe :			

#### Havana Power Plant Site Visit Attendance Sheet

May 27, 2009

Name	Company	Phone	E-mail
Rick Diericx	Dynegy	618-206-5912	Rick Diericx Dynegy.com
David Gaskins	Engineering Design Services	217-692-2685	david@eds7.com
Jim Watson	Dynegy-HA	309-543-8777	jim.watson@dynegy.com
Phil Morris	Dynegy	618-206-5934	phil.morris@dynegy.com
Joe Kimlinger	Dynegy	618-410-6534	<u>joe.kimlinger@dynegy.com</u>
Chris Lieberman	IEPA/BOL/Permits	217-524-3294	<u>chris.lieberman@illinois.gov</u>
Ted Dragovich	IEPA	217-524-3306	ted.dragovich@illinois.gov
Doug Van Nattan	IEPA/BOL/Permits	217-524-7505	doug.vannattan@illinois.gov
Ken Berry	URS	314-429-0100	kenneth_berry@URScorp.com
Cleighton Smith	Dewberry	856-802-0843	cleighton.smith@dewberry.com
Lauren Ohotzke	Dewberry	856-802-0843	lohotzke@dewberry.com

#### **Havana Power Plant Meeting Notes**

May 27, 2009

- Dam Safety Assessment
  - o Records, Design Drawings, Calculations, etc.
  - Visual Observation
- Ken (URS) did previous inspection in November
- Almost all drawings of cells done by Dynegy
  - Cleighton reviewed all drawings, placing post-its on those he wanted electronic copies of (Dynegy would be providing those docs)
- Testing done to reach ground water was performed to see if ash is leaking into wells, etc.
- Cells 1, 2, 3, 4 (polishing pond)
- Calculations reviewed
  - $_{\odot}$  Copy of entire calc documents (all done by Dynegy) will be send via PDF to Cleighton
- Breach mapping done to determine speed which would flow out
  - $_{\odot}$  No banks to contain downstream flow so it is difficult to model because the flow could go "anywhere" and "everywhere"
- Height of embankment (max. height) needed for cells in question
  - Reference contour for elevations and slope determination of cell walls (will also be available in calculations)
- Any breach would go right into the Illinois River
- No major housing settlements near "closed" western cell (all along the Illinois River)
- Contact Phil for URS stuff (not Ken, directly)
- ~50% ash sold

#### Havana Power Plant Site Walk Notes

Π9

- Overall High Hazard
- Plant not operating during our visit due to shut down for construction
- Cells 1, 2, 3, 4 are lined (have an impervious layer)
- Cells on river side are note lined (do not have an impervious layer)
- Culverts are checked daily to insure clear/not cloqged
- N. Ash Pond System (NAPS) communicates from 1 side of "road" to the other
- Downstream of (NAPS) looks more like an incision than an impoundment
- No combustion waste maintained (no DNR permits)
- Tertiary cell of NAPS (inactive)
  - All cleaned out
    - No longer takes CCW
    - Only water other than rain water from the dredging of river spoils
- Ash lines running under roadway to cells 1 through 4
  - Lined/covered in a fabric with solid concrete/mortar/grout (no aggregate) pumped into it
- Cell 1 (scalping pond)
  - Mostly closed (over half)
  - Not accepting any new ash
  - Physically, the piping is not hooked up
  - Typically mow top of embankment until where slope makes unsafe for mowers
  - Trees along just beyond tow of embankment
  - SE corner= no trees, just grass
  - $\circ$  NE mainly storm water
- Cell 3
  - Some ponding along S edge
  - Extra fly ash basin in SE corner

Havana Power Plant Site Walk Notes

May 27,