COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF KENTUCKY UTILITIES COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AND APPROVAL OF AMENDMENT TO ITS 2016 COMPLIANCE PLAN FOR RECOVERY BY ENVIRONMENTAL SURCHARGE	))))))	**CASE NO: 2017-00483**

APPLICATION

Kentucky Utilities Company ("KU"), pursuant to KRS 278.020(1), KRS 278.183, and 807 KAR 5:001 Sections 14 and 15, hereby petitions the Kentucky Public Service Commission ("Commission") to issue an order approving the recovery of the cost through its Environmental Cost Recovery ("ECR") Surcharge tariff of KU's amendment to Project 36 of its 2016 Environmental Compliance Plan ("2016 ECR Plan") and granting KU a Certificate of Public Convenience and Necessity ("CPCN") for the (1) construction of an amended Phase II of the landfill at the E.W. Brown Generating Station ("Brown" or "Brown Station") and (2) capping and closing of any remaining surface area of the Brown Main Ash Pond. The Amendment to 2016 Environmental Compliance Plan is attached as Application Exhibit 1. In support of this Application, KU states as follows:

1. The full name and mailing address of KU are: Kentucky Utilities Company, Post Office Box 32010, 220 West Main Street, Louisville, Kentucky 40202. KU may be reached by electronic mail at the electronic mail addresses of its counsel set forth below.

2. KU is a utility engaged in the electric business. KU generates and purchases electricity, and distributes and sells electricity at retail in the following counties in Central, Northern, Southeastern, and Western Kentucky:

Adair	Edmonson	Jessamine	Ohio
Anderson	Estill	Knox	Oldham
Ballard	Fayette	Larue	Owen
Barren	Fleming	Laurel	Pendleton
Bath	Franklin	Lee	Pulaski
Bell	Fulton	Lincoln	Robertson
Bourbon	Gallatin	Livingston	Rockcastle
Boyle	Garrard	Lyon	Rowan
Bracken	Grant	Madison	Russell
Bullitt	Grayson	Marion	Scott
Caldwell	Green	Mason	Shelby
Campbell	Hardin	McCracken	Spencer
Carlisle	Harlan	McCreary	Taylor
Carroll	Harrison	McLean	Trimble
Casey	Hart	Mercer	Union
Christian	Henderson	Montgomery	Washington
Clark	Henry	Muhlenberg	Webster
Clay	Hickman	Nelson	Whitley
Crittenden	Hopkins	Nicholas	Woodford
Daviess			

3. KU was incorporated in Kentucky on August 17, 1912, and in Virginia on November 26, 1991 (and effective as of December 1, 1991), and is in good standing in both Kentucky and Virginia. Copies of KU's good standing certificates from the Kentucky Secretary of State and the Virginia State Corporation Commission are attached as Application Exhibit 2.

4. Pursuant to KRS 278.380, KU waives any right to service of Commission orders by mail for purposes of this proceeding only. Copies of all orders, pleadings and other communications related to this proceeding should be directed to:

Robert M. Conroy
Vice President, State Regulation and Rates
LG&E and KU Services Company
220 West Main Street
Louisville, KY 40202
robert.conroy@lge-ku.com

Rick Lovekamp
Manager, Regulatory Strategy/Policy
LG&E and KU Services Company
220 West Main Street
Louisville, KY 40202
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Allyson K. Sturgeon
Senior Corporate Attorney
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sara.judd@lge-ku.com

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2000 PNC Plaza
500 West Jefferson Street
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kendrick.riggs@skofirm.com

Monica Braun
Mary Ellen Wimberly
Stoll Keenon Ogden PLLC
300 West Vine Street, Suite 2100
Lexington, Kentucky 40507-1801
monica.braun@skofirm.com
maryellen.wimberly@skofirm.com

Request for Certificate of Public Convenience and Necessity

5. KU proposes to amend Project 36 of its 2016 ECR Plan to construct an amended Phase II of the Coal Combustion Residuals ("CCR") landfill at Brown and cap and close any remaining surface area of the Brown Main Ash Pond. Based on KU's current projected needs for CCR disposal at Brown, Amended Project 36 involves the construction of a smaller Phase II Landfill than was originally proposed in Project 36 and the cap and closure of any remaining surface area of the Brown Main Ash Pond. The amendment to Project 36 will allow KU to continue to comply with the U.S. Environmental Protection Agency's ("EPA's") federal

Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities ("Federal CCR Rule").[1]

6. The Commission originally approved construction of Phase II of the landfill at Brown ("Brown CCR Landfill") in KU's 2016 ECR Plan proceeding.[2] Construction of Phase II was delayed because decreased CCR production from the Brown generating units delayed the need for Phase II. KU allowed the 2016 CPCN for Project 36 to expire in August 2017 before construction of Phase II began. KU reported the expiration of the 2016 CPCN for Project 36 in two ECR reports.[3]

7. Based upon these evaluations, including the retirement of Brown Units 1 and 2 and forecasted reductions in CCR, KU now proposes to amend Project 36 and construct a smaller Phase II Landfill than was originally approved and cap and close any remaining surface area of the Brown Main Ash Pond.

8. Statement of Need (807 KAR 5:001 § 15(2)(a)): In support of KU's position that the public convenience and necessity requires the proposed construction of an amended Phase II of the Brown CCR Landfill and the cap and closure of any remaining surface area of the Brown Main Ash Pond, R. Scott Straight explains in his testimony that the revised scope of Project 36 reflects KU's forecasted reductions in CCR and thus Project 36 remains a necessary facility for KU's compliance with the Federal CCR Rule.[4] When the Kentucky Division of Waste Management issued the permit for the Special Waste Landfill at Brown, it set forth a 10 foot

[1] The Federal CCR Rule defines CCR as "fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers." 40 CFR 257.53. This definition includes what is commonly referred to as gypsum.

[2] *In the Matter of: The Application of Kentucky Utilities Company for Certificates of Public Convenience and Necessity and Approval of its 2016 Compliance Plan for Recovery by Environmental Surcharge*, Case No. 2016-00026, Order at 33 (Ky. PSC Aug. 8, 2016).

[3] *2016 ECR Plan Status Update Report Quarterly Report – Update #5* at 4 (Oct. 30, 2017); *2016 ECR Plan Status Update Report Quarterly Report – Update #4* at 3 (July 28, 2017). All quarterly reports are filed in the "Post-Case Filing" of Case No. 2016-00026.

[4] Direct Testimony of R. Scott Straight at 1.

differential height limit for each successive phase of lateral expansion such that the volume of CCR disposed in each phase can be no more than 10 feet higher than adjoining phase(s). Because of this permit condition, the initial capacity of Phase I is limited to a height of 10 feet. As shown in Exhibit SAW-1 Table 5 to the testimony of Stuart A. Wilson, based on the revised projected CCR production at Brown, Phase I storage capacity will likely not be depleted until 2020 or later, well before coal fired generation will cease at Brown Unit 3. And, as a result of the revised projected CCR storage needs at Brown, Phase III of the current landfill is not necessary to support the expected operation of Brown Unit 3 for the remaining life of the generation unit. Instead, KU is proposing to construct a smaller portion of Phase II than originally proposed, and cap and close any remaining surface area of the Brown Main Ash Pond to comply with Kentucky environmental regulations. As Mr. Wilson describes in his testimony, constructing an amended Phase II of the Brown CRR Landfill, and capping and closing any remaining surface area of the Brown Main Ash Pond is the most cost-effective means of ensuring continued operation of Brown and compliance with the Federal CCR Rule and state environmental regulations.

9. Description of Proposed Construction (807 KAR 5:001 § 15(2)(c)): KU is requesting a CPCN to construct Amended Project 36, including the costs to design and construct an amended Phase II of the Brown CRR Landfill, as well as the costs to cap and close any remaining surface area of the Brown Main Ash Pond. Originally, the Brown CCR Landfill was planned to serve as the entire cap for the Brown Main Ash Pond once Phase III was constructed. As Phase III is no longer needed, KU must cap and close any remaining surface area of the Brown Main Ash Pond. Details of the construction of amended Phase II of the Brown CCR Landfill and the cap and closure of the Brown Main Ash Pond are further described in detail in

the testimony of Mr. Straight. Construction is expected to begin in August 2018. The amended Phase II of the Brown CCR Landfill is expected to be available for commercial operation before the end of 2019.

10. There are no utilities, corporations, or persons with whom the proposed new construction is likely to compete.

11. Permits or Franchises (807 KAR 5:001 § 15(2)(b)): KU will submit to the Kentucky Division of Waste Management a request to modify existing operating permits to reflect the construction of the amended Phase II of the Brown CCR Landfill, and will file a copy of the application with the Commission when it is available. KU will also seek any applicable construction permits. Once the amended Phase II is constructed, the Brown Main Ash Pond will still be required to be closed per the requirements of the 2014 Special Waste Permit. A copy of the 2014 Special Waste Permit is attached as Application Exhibit 3. The requirements of the 2014 Special Waste Permit are explained in the testimony of Gary H. Revlett.

12. Maps and Drawings of Proposed Construction (807 KAR 5:001 § 15(2)(d)(1) and (2)): The required maps and drawings for KU's proposed construction of the amended Phase II of the Brown CCR Landfill and the capping and closing of the remaining surface area of the Brown Main Ash Pond are attached in Application Exhibit 4.

13. Financing Plans (807 KAR 5:001 § 15(2)(e)): The total projected capital cost of this facility at Brown is $14.7 million which KU seeks to recover through the ECR mechanism as part of its 2016 ECR Plan Amended Project 36. KU expects to finance the cost of the facility with a combination of new debt and equity. The mix of debt and equity used to finance the project will be determined so as to allow KU to maintain its strong investment-grade credit

rating. KU's proposed financing of such costs is identical to the proposed financing of its 2016 ECR Plan.

14. Estimated Cost of Operation (807 KAR 5:001 § 15(2)(f)): The proposed construction is not anticipated to create incremental operating and maintenance costs, and the Company is not seeking ECR recovery of such costs in this proceeding, as reflected on tab 2 of Application Exhibit 1. O&M costs related to amended Phase II will be similar to costs incurred in Phase I and are not distinguishable. KU plans to continue to recover its Brown CCR Landfill O&M costs through its environmental surcharge as part of Project 29 in KU's 2011 ECR Plan.

Request for Authority for Recovery by Environmental Surcharge of KU's Amended Project 36 in the 2016 ECR Plan

15. KU received approval to recover the costs of projects in its 2016 ECR Plan, including Project 36, in Case No. 2016-00026.[5] The scope of Project 36 in KU's 2016 ECR Plan has changed; and the CPCN associated with the construction of Project 36 has lapsed. With this Application, KU requests authority to recover the costs of Amended Project 36 through its ECR Surcharge tariff.

16. This Application and supporting testimony and exhibits are available for public inspection at the KU office located at 100 Quality Street, Lexington, Kentucky. The Company is giving notice to the public of the proposal to recover the costs of Amended Project 36 through its existing environmental surcharge tariff by newspaper publication, through a bill insert in monthly billings to its customers, and through posting the published notice at the offices and places of business of the Company where bills are paid. The Company is also posting this Application on its website (http://www.lge-ku.com). An initial Certificate of Notice and

[5] *In the Matter of: The Application of Kentucky Utilities Company for Certificates of Public Convenience and Necessity and Approval of its 2016 Compliance Plan for Recovery by Environmental Surcharge*, Case No. 2016-00026, Order at 33 (Ky. PSC Aug. 8, 2016).

Publication is filed with this Application. A Certification of Completed Notice and Publication will be filed with the Commission upon the completion of this notice.

17. Pursuant to KRS 278.183(1), KU is "entitled to the current recovery of its costs of complying with the Federal Clean Air Act as amended and those federal, state, or local environmental requirements which apply to coal combustion wastes and byproducts from facilities utilized for production of energy from coal in accordance with the utility's compliance plan."

18. KU is amending one project from its approved 2016 ECR Plan. Amended Project 36 will enable Brown Station to continue to comply with the Federal CCR Rule and state environmental regulations by constructing additional landfill capacity that better meets KU's projected CCR storage needs and completing the closure of the Brown Main Ash Pond. The environmental regulations creating the need for Amended Project 36 are detailed in the testimony of Mr. Revlett. The testimony of Mr. Straight describes the design and construction for amended Project 36 and the cost of the project. The testimony of Mr. Wilson demonstrates how Amended Project 36 will enable KU to cost effectively satisfy those regulatory requirements. The total capital cost of Amended Project 36 is estimated to be $14.7 million, which KU seeks to recover through the ECR mechanism as part of its 2016 ECR Plan.

19. A detailed summary of the facts and compliance requirements supporting this Application is set forth in the direct testimony and exhibits of the Company's witnesses:

- The testimony of Robert M. Conroy, Vice President, State Regulation and Rates, presents an overview of KU's requested amendment to Project 36 and supporting testimony, and requests the continued use of a 9.70%

return on common equity for purposes of calculating the overall return component of the environmental surcharge until KU's next base rate case.

- R. Scott Straight, Vice President, Project Engineering, presents testimony that describes the engineering and construction aspects of Amended Project 36 and explains how it differs from the project that was approved as part of KU's 2016 ECR Plan in Case No. 2016-00026. Mr. Straight also discusses how Amended Project 36 continues to comply with the Federal CCR Rule.
- Gary H. Revlett, Director, Environmental Affairs, presents testimony discussing the environmental requirements that necessitate Amended Project 36 and discusses how KU's proposed amendment to Project 36 allows KU to continue to comply with the requirements.
- Stuart A. Wilson, Director, Energy Planning, Analysis, and Forecasting, presents testimony on the analysis and cost-effectiveness of Amended Project 36.

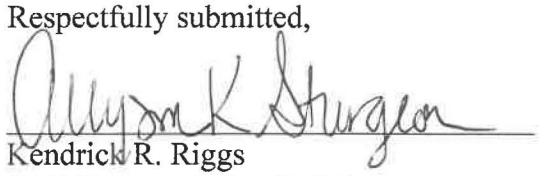
20. KU is proposing no changes to its Environmental Cost Recovery Surcharge tariff sheets, P.S.C. No. 18, Original Sheet No. 87 and Original Sheet No. 87.1 *Adjustment Clause ECR*, other than to change their issue and effective dates. KU is filing its Environmental Cost Recovery Surcharge tariff sheets, attached as Application Exhibit 5, for the purpose of obtaining the Commission's approval of the recovery of the costs of Amended Project 36 in 2016 Environmental Compliance Plan by the proposed assessment through this tariff provision. In accordance with KRS 278.183(2), the ECR tariff has an issue date of January 26, 2018, and is proposed to be effective on July 31, 2018. Therefore, bills issued on and after August 30, 2018,

will reflect the revised environmental surcharge beginning with the expense month of July 2018 (i.e., beginning with the expense month six months after the filing of this Application).

WHEREFORE, Kentucky Utilities Company respectfully asks the Commission to enter an order on or before July 25, 2018: (1) granting KU a Certificate of Public Convenience and Necessity to construct Amended Project 36; (2) approving the amendment to Project 36 in KU's 2016 ECR Plan for purposes of recovering the costs of this project through the environmental surcharge mechanism; (3) approving the proposed environmental surcharge tariff for recovery of the costs of Amended Project 36 in KU's 2016 ECR Plan effective for bills rendered on and after August 30, 2018 (i.e., beginning with the expense month of July 2018); (4) approving the recovery of the overall rate of return requested herein; (5) approving the modification of ES Form 2.01; and (6) granting such other relief as KU may be entitled under law.

Dated: January 26, 2018

Respectfully submitted,



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LG&E and KU Services Company
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Louisville, Kentucky 40202
Telephone: (502) 627-2088
Fax: (502) 627-3367
allyson.sturgeon@lge-ku.com

Counsel for Kentucky Utilities Company

CERTIFICATE OF COMPLIANCE

In accordance with 807 KAR 5:001 Section 8(7), this is to certify that Kentucky Utilities Company's January 26, 2018 electronic filing is a true and accurate copy of the documents being filed in paper medium; that the electronic filing was transmitted to the Commission on January 26, 2018; that there are currently no parties that the Commission has excused from participation by electronic means in this proceeding; that an original and one copy of the filing is being hand-delivered to the Commission on January 26, 2018; and that on January 26, 2018, electronic mail notification of the electronic filing will be provided to the following:

Rebecca Goodman
Lawrence W. Cook
Office of the Attorney General
Office of Rate Intervention
700 Capitol Avenue, Suite 20
Frankfort, KY 40601
Rebecca.Goodman@ky.gov
Larry.Cook@ky.gov

Michael L. Kurtz
Boehm, Kurtz & Lowry
36 East Seventh Street, Suite 1510
Cincinnati, OH 45202
mkurtz@BKLlawfirm.com

Allyson K. Sturgeon

Counsel for Kentucky Utilities Company

Kentucky Utilities Company

Application Exhibit 1

Amended 2016 Environmental Compliance Plan

KENTUCKY UTILITIES COMPANY

Amendment to 2016 ENVIRONMENTAL COMPLIANCE PLAN (Case No. 2017-00483)

Project	Air Pollutant or Waste/By-Product To Be Controlled	Control Facility	Generating Station	Environmental Regulation / Regulatory Requirement	Environmental Permit	Actual or Scheduled Completion	Actual (A) or Estimated (E) Projected Capital Cost ($Million)
Amended 36	Fly & Bottom Ash, Gypsum	CCR Storage Landfill (Phase II) and Main Ash Pond Closure	Brown Station	EPA CCR Rule / 401 KAR Chapter 45	Division of Waste Mgmt - Landfill Permit and Division of Water - KPDES Permit	2019	$14.7 (E)
							$14.7

KENTUCKY UTILITIES COMPANY

Amendment to 2016 ENVIRONMENTAL COMPLIANCE PLAN (Case No. 2017-00483)

Project	Air Pollutant or Waste/By-Product To Be Controlled	Control Facility	Generating Station	Estimated Annual Operations and Maintenance Costs (Through 2026)								
				2018	2019	2020	2021	2022	2023	2024	2025	2026
Amended 36	Fly & Bottom Ash, Gypsum	CCR Storage Landfill (Phase II) and Main Ash Pond Closure	Brown Station	$0	$0	$0	$0	$0	$0	$0	$0	$0

NOTE: O&M costs related to Amended Phase II will be similar to costs incurred in Phase I and are not distinguishable. KU plans to continue to recover its Brown CCR Landfill O&M costs through its environmental surcharge as part of Project 29 in KU's 2009 ECR Plan.

Kentucky Utilities Company

Application Exhibit 2

Good Standing Certificates - Kentucky and Virginia

Commonwealth of Kentucky
Alison Lundergan Grimes, Secretary of State

Alison Lundergan Grimes
Secretary of State
P. O. Box 718
Frankfort, KY 40602-0718
(502) 564-3490
http://www.sos.ky.gov

Certificate of Existence

Authentication number: 196544
Visit https://app.sos.ky.gov/ftshow/certvalidate.aspx to authenticate this certificate.

I, Alison Lundergan Grimes, Secretary of State of the Commonwealth of Kentucky, do hereby certify that according to the records in the Office of the Secretary of State,

KENTUCKY UTILITIES COMPANY

is a corporation duly incorporated and existing under KRS Chapter 14A and KRS Chapter 271B, whose date of incorporation is August 17, 1912 and whose period of duration is perpetual.

I further certify that all fees and penalties owed to the Secretary of State have been paid; that Articles of Dissolution have not been filed; and that the most recent annual report required by KRS 14A.6-010 has been delivered to the Secretary of State.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Official Seal at Frankfort, Kentucky, this 4th day of December, 2017, in the 226th year of the Commonwealth.

Alison Lundergan Grimes
Secretary of State
Commonwealth of Kentucky
196544/0028494

Commonwealth of Virginia

State Corporation Commission

CERTIFICATE OF GOOD STANDING

I Certify the Following from the Records of the Commission:

That KENTUCKY UTILITIES COMPANY is duly incorporated under the law of the Commonwealth of Virginia;

That the date of its incorporation is November 26, 1991;

That the period of its duration is perpetual; and

That the corporation is in existence and in good standing in the Commonwealth of Virginia as of the date set forth below.

Nothing more is hereby certified.

Signed and Sealed at Richmond on this Date:
December 4, 2017

Joel H. Peck

Joel H. Peck, Clerk of the Commission

CISECOM
Document Control Number: 1712045761

Kentucky Utilities Company

Application Exhibit 3

2014 Special Waste Permit

Steven L. Beshear
Governor

Leonard K. Peters
Secretary

ENERGY AND ENVIRONMENT CABINET
Division of Waste Management
200 Fair Oaks, 2nd Floor
FRANKFORT, KY 40601
TELEPHONE: 502-564-6716
FACSIMILE: 502-564-3492
waste.ky.gov

October 14, 2015

Mr. W. Paul Puckett
Kentucky Utilities, Environmental Affairs Department
P.O. Box 32010
Louisville, Kentucky 40232

Certified Mail No. Delivered via UPS

RE: Site-Wide Groundwater Remedial Action Plan
E.W. Brown Generating Station
Agency Interest No. 3148
Application I.D. No. ARM20150001
Mercer County

Dear Mr. Puckett:

The Kentucky Division of Waste Management (DWM), Solid Waste Branch has completed review of application referenced above. DWM hereby approves this application. Please find enclosed a copy of the approved application and the revised construction permit. The response to comments document is also enclosed and addresses the public comments received.

Be advised that if you consider yourself aggrieved by the issuance of this permit, you have the right to file a petition demanding a hearing with the Cabinet pursuant to KRS 224.10-420(2) and 401 KAR 45:040 Section 2(6). This right shall be limited to a period of thirty (30) days from the receipt of the permit. If you have any questions regarding this matter please contact Lindsey Briggs at (502) 564-6716, extension 4665.

Sincerely,

Kenneth Melton for

Danny Anderson, P.E.
Manager, Solid Waste Branch

Enclosures
DA/jnn

c: Paul Puckett via email: Paul.Puckett@lge-ku.com
Alison Dunn via email: Alison.Dunn@amecfw.com

ORIGINAL

RESPONSE TO TECHNICAL NOTICE OF DEFICIENCY (NOD) No.1 SITEWIDE GROUNDWATER REMEDIAL ACTION PLAN

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY
AGENCY INTEREST #3148

19 June 2015

Prepared For:

Kentucky Utilities Company
Generation Services

Kentucky Utilities Company
815 Dix Dam Road
Harrodsburg, KY 40330

Prepared By:

Amec Foster Wheeler Environment & Infrastructure, Inc.
11003 Bluegrass Parkway, Suite 690,
Louisville, Kentucky 40299

Project No. 567530023

Nielsen, Jamie (EEC)

From:	Nielsen, Jamie (EEC)
Sent:	Thursday, October 08, 2015 9:42 AM
To:	Green, Lawrie (EEC)
Cc:	Paul.Puckett@lge-ku.com
Subject:	FW: Replacement Pages-EW Brown GWAP
Attachments:	Page 6-2 Revised in 2015-09-29 GW-RAP.PDF

Lawrie,

This revised page 6-2 should be incorporated into the application.

Thanks,
Jamie

From: Puckett, Paul [mailto:Paul.Puckett@lge-ku.com]
Sent: Thursday, October 08, 2015 8:15 AM
To: Nielsen, Jamie (EEC)
Subject: Replacement Pages-EW Brown GWAP

Jamie,

The attached documents are the ones that will be used to replace the outdated ones. I'll bring four sets of each with me.

W. Paul Puckett
Senior Engineer | Environmental Affairs Department | LG&E and KU Energy Services
220 West Main Street, Louisville, KY 40202
O: 502-627-4659 | M: 502-648-7842 | F: 502-217-4836
lge-ku.com

APPROVED
COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR
ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
Ken Nutt for Danny Anderson
SIGNATURE
Branch Manager OCT 14 2015
TITLE DATE

3148
ARM20150001

220 West Main Street
PO Box 32010
Louisville, KY 40232

September 29, 2015

Kentucky Department for Environmental Protection
Division of Waste Management
200 Fair Oaks, 2nd Floor
Frankfort, Kentucky 40601
(502) 564-6716

Attention: Mr. Danny Anderson, P.E. - Manager, Solid Waste Branch

Subject: NOD #2 Site-wide Groundwater Remedial Action Plan
Kentucky Utilities – E.W. Brown Generating Station, Mercer County, KY
(A.I. #3148, ARM20150001)

Dear Mr. Anderson:

Kentucky Utilities Company (KU) has received the Technical Notice of Deficiency (NOD) #2, dated August 21, 2015 relating to the Site-wide Remedial Action Plan for the subject facility. The Division of Waste Management had the following comment:

1. *DWM asks for the lower bench of the Main Ash Pond Dam slope to be monitored for the life of the cut-off wall for potential vertical and horizontal movements.*

KU recently installed a series of survey monuments on the upper bench of the dam of the former Main Ash Pond. KU is currently monitoring the upper bench monuments visually on a weekly basis and is funding a quarterly evaluation by a KY-registered professional land surveyor on those same monuments to measure the locations relative to an established baseline. A report comparing the baseline, historical, and current data is issued as part of the quarterly survey. These activities are being performed as part of the company's self-initiated program to evaluate the on-going integrity of its berms.

In accordance with DWM's request, KU will install and monitor a similar system of monuments on the lower bench of the dam as shown on the attached drawings BR0-C-01445 Rev. F and BR0-C-01453 Rev. F. Upon completion of the installation of the monuments on the lower bench, KU will modify the weekly and quarterly inspections and reporting described previously to include the lower bench monuments.

The requested certification statement relating to this items is attached, along with the referenced drawings.

In summary, KU agrees with the request. Since KU has agreed to DWM's request, KU believes that all outstanding concerns relating to this project have been resolved. If this is the case, please contact me at (502) 627-2940 and KU will prepare the necessary copies for insertion into the original submission. Otherwise, feel free to contact me if you have any questions or need additional information regarding this document.

Sincerely,

W. Paul Puckett, P.E.
Senior Engineer, Environmental Affairs Department.

Enclosures:
Certification Statement
Drawing Numbers: BRO-C-01453 & BRO-C-01445

Cc: Jeff Heun – Manager, Major Capital Projects, Project Engineering

Certification Statement
Site-wide Groundwater Remedial Action Plan-NOD #2 Response
KU's E.W. Brown Generating Station
AI 3148; Application ID No. ARM20150001

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for such violations.

Gary H. Revlett 9-29-2015

Original Signature of Responsible Official Date

Gary H. Revlett, Director of Environmental Affairs
Typed Name & Title of Responsible Official

Kentucky Utilities Company (LG&E and KU Energy)
Name of Corporation

amec foster wheeler

19 June 2015

Mr. Danny Anderson, P.E.
Manager, Solid Waste Branch
Division of Waste Management
Kentucky Dept. for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, KY 40601

ORIGINAL

Subject: **Response to Technical Notice of Deficiency (NOD) No.1**
Sitewide Groundwater Remedial Action Plan
Kentucky Utilities (KU) - E.W. Brown Generating Station
Burgin, Mercer County, Kentucky
Agency Interest No. 3148
Application ID No. ARM20150001
AMEC Project No. 567530023

Dear Mr. Anderson:

On behalf of LG&E and KU Services Company (LG&E-KU), Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has prepared this document to respond to the Technical Notice of Deficiency No.1 (NOD1), Sitewide Groundwater Remedial Action Plan, issued by the Kentucky Division of Waste Management (DWM), contained in a letter to Mr. Jeffrey S. Fraley of Kentucky Utilities (KU) dated 12 May 2015.

The comments in NOD1 are addressed below in numerical order. For ease of review, the DWM's requests are shown in *italics*, followed by responses in regular (non-italic) **bolded font**. A signed Certification Statement is included in Attachment 1, and other supporting documents are provided in subsequent attachments.

1. *Please fix the grammatical error present in the third paragraph on page 2.9.*

Two typos were found in the referenced paragraph and have been corrected on the attached copy of Page 2-9 (Attachment 2).

2. *Plan sheets must be signed, sealed, and dated by a professional engineer licensed in the Commonwealth of Kentucky pursuant to KRS 322.*

The attached copies of the Plates (Plates 1 and 2) and the plan sheets in Appendices A, B, and C have been signed, sealed and dated by a Professional Engineer licensed in Kentucky. They are provided in Attachment 2.

Amec Foster Wheeler Environment & Infrastructure, Inc.
11003 Bluegrass Pkwy, Suite 690
Louisville, Kentucky 40299
Tel (502) 267-0700
Fax (502) 267-5900
amecfw.com

3. *Provide a narrative depicting a concrete pouring schedule for the cut-off wall including, at a minimum, anticipated daily pour quantities and location of cold seams.*

A total of approximately 168 cubic yards (cy) of concrete is required for the cut-off wall with approximately 56 cy for the foundation/footing and 112 cy for the wall.

Please note that the *"contractor's approach (means and methods)"* may differ from the *"engineers approach"* described herein, i.e. the order of the wall segments placed could be different or the construction of the foundation may be completed in segments similar to the wall construction segments.

It is possible that the entire footing for the wall, or a total of 56 cy of concrete placed (approximately 6 or 7 truckloads), can be poured in one day (or multiple days). Following approximately 12 hours of cure time for the foundation concrete to allow worker access, the forms and reinforcement for the walls would be installed. As indicated on the cut-off wall drawings, a cold joint is located between the footing and each wall segment which includes a water stop and development reinforcement extending from the footing into the wall segment. The cut-off wall will be constructed in 6 segments of varying wall heights with the highest segment at the middle of the wall alignment and five segments with reducing wall height towards each end of the wall (south and north wall legs). Expansion and control joints for the wall are located between wall segments as shown on the drawings and would be the location for cold joints. It is anticipated that the concrete for the walls will be placed in lifts at an approximate maximum rate 3 to 4 feet per hour to minimize loading of the wall forms but still provide fresh concrete between subsequent lifts. It is expected that wall Segment 1 would be poured first in a single day requiring a total of 56 cy of concrete placed. An expansion joint is located between Segment 1 (middle segment) and each adjacent south and north wall leg Segment 2, which includes a water stop and dowel bars to maintain wall alignment. It is anticipated wall Segments 2 and 3 on both sides of Segment 1 would also be placed in a single day requiring a total of 34 cy of concrete placed. A control joint is located at the end of each Segment 3 between the next wall segment (Segment 4 on the south leg of the wall and Segment 5 on the north leg of the wall) which includes a water stop and development reinforcement extending between adjacent wall segments. Finally, wall Segments 4, 5, and 6 would be placed in a single day requiring a total of 22 cy of concrete placed.

4. *Please specify the methods and instruments that will be used to monitor for potential slope movement on the ash pond dam during cut-off wall construction.*

The downstream slope of the existing ash pond east embankment (Main Pond Dam) includes two benches. The upper bench includes a monitoring system that consists of a series of monuments which can detect both vertical and horizontal movement. We intend to install similar monuments on the lower bench which is in close proximity to the proposed cut-off wall and seepage collection system

Using this type of system allows the horizontal movement to be detected by line-of-sight without the use of optical assistance. Horizontal and vertical movement can also be detected using standard surveying equipment: level, level rod and measuring tape. This system allows monitoring of each monument compared to the adjacent monument.

Monitoring will be conducted on both benches weekly throughout the construction process and for one month following completion on the seepage collection system.

Note: The monitoring system is shown as slide #18 on the PowerPoint presentation provided in Attachment 4.

5. *Provide a slope stability analysis for the existing ash pond dam during and following construction of the cut-off wall.*

AMEC Foster Wheeler has analyzed the stability of the main pond east embankment using the computer software Geo/slope for both the "during construction" phase and post-construction phase. We used the geotechnical parameters for each embankment layer from the original design work done in 1990s by FMSM (now Stantec). The target factors of safety were obtained from "*Guidelines for the Geotechnical Investigation and Analysis of Existing Earth Dams*" by the Kentucky Division of Water (DOW). AMEC Foster Wheeler analyzed the embankment for the following conditions:

Total Stress;
Effective Stress;
Effective Stress with Seismic Load;
Effective Stress with Seismic Load and Flooded Toe; and,
Effective Stress and Rapid Drawdown of Flood Event.

In summary all analyses, except for the short-term exposure of the maximum cut-slope, are above Target Factors of Safety, and the short-term exposure has a factor of safety of at-least 1.252. More detailed information on the stability analyses, including search arrays, soil parameters, slope geometry and minimum Factors of Safety, is contained in the PowerPoint presentation provided in Attachment 4.

6. *Section 2.3.2: Clarify that, in the future, any leachate disposal or management facilities change from those currently permitted shall require a permit modification per 401 KAR 45:040, Section 3.*

KU understands that future changes in leachate disposal or management facilities, from those specified in the approved Special Waste Landfill Permit, will require a permit modification per 401 KAR 45:040, Section 4. This clarification has been added to the corrected pages in Attachment 2.

7. *Section 4.4.1: Provide a timeline for when the entire main ash pond's surface will be covered by the clay-mix soil cover (plan indicates two-thirds of the surface is currently covered).*

The entire surface of the Main Ash Pond will be covered with a clay-mix soil layer by December 2016. This is consistent with Section 6.4.1 of the Sitewide Groundwater Remedial Action Plan, as well as the Implementation Schedule contained in the Main Ash Pond Closure Plan (AMEC, 25 April 2015), submitted prior to issuance of Solid Waste Permit # SW08400010. This clarification has been added to Page 4-4 (Attachment 2).

Closing

If you have any questions regarding this submittal, please do not hesitate to contact Jeff Heun of LG&E-KU at (859) 367-1275.

Sincerely,
Amec Foster Wheeler Environment & Infrastructure, Inc.

Nicholas G. Schmitt, P.E.
Senior Principal Engineer

Alison L. Dunn, P.G.
Associate Hydrogeologist

Attachments

Attachment 1 – Certification Statement
Attachment 2 – Replacement Text Pages
Attachment 3 – Stamped Plan Sheets
Attachment 4 – Dam Stability Analysis

cc: Lindsey Briggs, P.E., DWM - Solid Waste Branch
Jeffrey S. Fraley, KU
Jeffrey B. Heun, LG&E-KU
W. Paul Puckett, LG&E-KU
Kathleen D. Regan, Amec Foster Wheeler

CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitted false information, including the possibility of fine or imprisonment for such violations."

Jeffrey S. Fraley
Original Signature of Responsible Official

6/19/2015
Date

Jeffrey S. Fraley
Typed Name of Responsible Official

General Manager – E.W. Brown
Title

220 West Main Street
PO Box 32010
Louisville, KY 40232

March 26, 2015

Kentucky Division of Waste Management
Solid Waste Branch, Second Floor
200 Fair Oaks Lane
Frankfort, Kentucky 40601
(502) 564-6716

Attention: Mr. Danny Anderson, P.E. - Manager, Solid Waste Branch

Subject: Site-wide Groundwater Remedial Action Plan
Kentucky Utilities – E.W. Brown Generating Station
A.I. #3148/Application ID ARM20150001

Dear Mr. Anderson:

This letter was prepared in response to the Administrative Notice of Deficiency #1, dated March 19, 2015 which identified two items that were necessary before the application could be deemed administratively complete. Each of two items is restated below, in italics, followed by Kentucky Utilities Company's (KU's) response.

1. *Pursuant to 401 KAR 45:250, Section 2(1)(f)(7), please submit the $500 filing fee by providing a check made payable to the Kentucky State Treasurer.*

A check, prepared as described, is enclosed with this document.

2. *Page iii of the submittal lists the mailing address for the Permittee as 815 Dix Dam Road, Harrodsburg, KY 40330; our records indicated the P O Box used above.*

The permittee mailing information was inadvertently mixed with the facility address. Please maintain the mailing address for the permittee as described in the correspondence and as listed below:

Kentucky Utilities Company
220 W. Main Street, P.O. Box 32010
Louisville, KY 40232

Please contact me at (502) 627-2940 if you have any questions or need additional information regarding this document.

Sincerely,

W. Paul Puckett

W. Paul Puckett, P.E.
Senior Engineer, Environmental Affairs Department.

Enclosure:
Check #88567 for $500, payable to "KY State Treasurer"

Cc: Jeffrey S. Fraley-General Manager, E.W. Brown Generating Station
Jeff Heun – Manager of Major Capital Projects, Project Engineering
Alison L. Dunn, P.G. – Senior Project Manager, AMEC

amec foster wheeler

27 February 2015

Mr. W. Paul Puckett
Kentucky Utilities Company
815 Dix Dam Road
Harrodsburg, KY 40330

Subject: **Sitewide Groundwater Remedial Action Plan**
E.W. Brown Generating Station
Mercer County, Kentucky
Agency Interest #3148, Activity ID No. AIN20120001
Project No. 567530023

Dear Mr. Puckett:

Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler) has prepared this Groundwater Remedial Action Plan for submittal to the Kentucky Department for Environmental Protection, Division of Waste Management (DWM) on behalf of Kentucky Utilities Company (KU).

Please contact Alison Dunn if you have any questions about this document.

Sincerely,
Amec Foster Wheeler Environment & Infrastructure, Inc.

Alison L. Dunn, P.G.
Hydrogeologist / Associate Project Manager
859-566-3729
Alison.Dunn@amecfw.com

Kathleen D. Regan, P.E.
Associate Engineer
859-566-3724
Kathleen.Regan@amecfw.com

cc: Nicholas G. Schmitt, P.E., Amec Foster Wheeler

amec
foster
wheeler

SITEWIDE GROUNDWATER REMEDIAL ACTION PLAN

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY
AGENCY INTEREST #3148

27 February 2015

Prepared For:

Kentucky Utilities Company

Generation Services

Kentucky Utilities Company
815 Dix Dam Road
Harrodsburg, KY 40330

Prepared By:

Amec Foster Wheeler Environment & Infrastructure, Inc.
13425 Eastpoint Centre Drive, Suite #122
Louisville, Kentucky 40223

Project No. 567530023

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DOCUMENT INFORMATION

FACILITY INFORMATION

KDEP Agency Interest No.: 3148

Solid Waste Permit No.: SW8400010

Facility Name: E.W. Brown Generating Station

Facility Address: 815 Dix Dam Road
Harrodsburg, Kentucky 40330

PERMITTEE INFORMATION

Company Name: Kentucky Utilities Company

Mailing Address: 815 Dix Dam Road
Harrodsburg, Kentucky 40330

Authorized Signer: Jeffrey S. Fraley
General Manager, E.W. Brown Generating Station

Additional Contact: W. Paul Puckett
Engineer, Environmental Affairs Department
LG&E and KU Energy

E-mail Address: paul.puckett@lge-ku.com

Telephone No.: (502) 627-4659

Fax No.: (502) 217-4836

PREPARER INFORMATION

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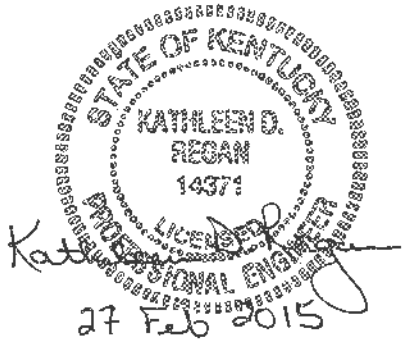
   Kentucky Registration No.: 14371

   Company Name: Amec Foster Wheeler

   Address: 2456 Fortune Drive, Suite 100
   Lexington, Kentucky 40509

   Telephone No.: (859) 566-3724



2.	Geologist:	Alison L. Dunn, P.G.
	Kentucky Registration No.:	1006
	Company Name:	Amec Foster Wheeler
	Address:	2456 Fortune Drive, Suite 100 Lexington, Kentucky 40509
	Telephone No.:	(859) 566-3729
3.	Geotechnical Engineer:	Nicholas G. Schmitt, P.E.
	Kentucky Registration No.:	10311
	Company Name:	Amec Foster Wheeler
	Address	11003 Bluegrass Parkway, Suite 690 Louisville, Kentucky 40299
	Telephone No.:	(502) 267-0700

CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitted false information, including the possibility of fine or imprisonment for such violations."

Jeffrey S. Fraley
Original Signature of Responsible Official

2/27/15
Date

Jeffrey S. Fraley
Typed Name of Responsible Official

General Manager – E.W. Brown
Title

ACRONYMS

°C	degrees centigrade
µg/m^3	micrograms per cubic meter
µg/L	micrograms per liter
Ag	silver
Al	aluminum
As	arsenic
ASTM	American Society of Testing Materials
Ba	barium
Be	beryllium
BGS	below ground surface
Ca	calcium
cfs	cubic feet per second
Co	cobalt
COD	chemical oxygen demand
COI(s)	constituent(s) of interest
cm/sec	centimeters per second
Cr	chromium
Cu	copper
DO	dissolved oxygen
DOW	Division of Water in the Kentucky Department for Environmental Protection (KDEP)
DWM	Division of Waste Management in the KDEP
Fe	iron
f_{oc}	fraction organic carbon
ft	feet
ft^3	cubic feet
ft/day	feet per day
ft/ft	feet per foot
ft/min	feet per minute
ft/yr	feet per year
ft BGS	feet below ground surface
ft MSL	feet above mean sea level
g/cm^3	grams per cubic centimeter
gpm	gallons per minute
HCl	hydrochloric acid
Hg	mercury
HSA	hollow stem auger
i	hydraulic gradient
I.D.	inside diameter
ID	identification
in/H_2O	inches of water
IUPPS	Indiana Underground Plant Protection Service
K	hydraulic conductivity
K	potassium
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
KU	Kentucky Utilities Company
L/day	liters per day
L/min	liters per minute

ACRONYMS (cont'd)

lb/ft^3	pounds per cubic foot
MCL(s)	maximum contaminant level(s) for drinking water
Mg	magnesium
mgd	million gallons per day
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
mi	mile
ml/min	milliliters per minute
Mn	manganese
mm	millimeter
mm^2/s	square millimeters per second
MS	mass spectrometry
mS/cm^2	milliSiemens per square centimeter
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolts
n	porosity
Na	sodium
NFA	No Further Action
Ni	nickel
No	number
NTU(s)	nephelometric turbidity unit(s)
O_2	oxygen
O.D.	outside diameter
ORP	oxidation-reduction potential
Pb	lead
POC	perimeter of compliance
PPE	personal protective equipment
ppm	parts per million
ppmv	parts per million by volume
PVC	polyvinyl chloride
QA/QC	quality assurance / quality control
ROW	right-of-way
RSD	relative standard deviation
RQD	rock quality designation
Sb	antimony
SC	specific conductance
scfh	standard cubic feet per hour
Se	selenium
sec	second
SIM	selected ion monitoring
SMP	Soil Management Plan
SSI	Supplemental Site Investigation
SU	standard units (pH)
SW	Solid Waste
TDS	total dissolved solids
TOC	total organic carbon
TOR	top of riser
TWA	time-weighted average

ACRONYMS (cont'd)

USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UST	underground storage tank
WET	whole effluent toxicity
v	seepage velocity
V	vanadium
Zn	zinc

1.0 INTRODUCTION

This section reviews the site history, regulatory background and general objectives for the proposed remedial action plan.

1.1 SITE LOCATION

The Kentucky Utilities Company (KU) E.W. Brown Generating Station ("plant") is located in the southern portion of the Inner Bluegrass region, on the east edge of Mercer County, approximately 3.8 miles northeast of the city of Burgin. The area is relatively remote, with limited access to transportation, other than rail (**Figure 1**).

1.2 SITE HISTORY

The E.W. Brown Generating Station is located on the west side of the Dix River next to a hydroelectric dam (Dix Dam) built by KU in the 1920s. A coal-fired generating plant (currently consisting of three units) has been operated at the site since the 1950s, and more recently a combustion turbine (CT) generating plant (consisting of seven CT units that can be fueled by either fuel oil or natural gas) has been added to the Station to meet peak demands.

The plant has handled coal and generated coal ash and CCR since coal combustion began in the 1950s. Historically, CCR consisted primarily of bottom ash and fly ash generated from coal combustion. Beginning in 2009, gypsum began to be produced from scrubbers installed to remove sulfur from the plant's air emissions. Up until the present, ash produced from coal combustion has been transported by water flow (sluicing) to settling ponds. The first pond, referred to as the Main Ash Pond, or Main Pond, was located directly south of the Generating Station. As the Main Pond filled, it was expanded twice, in 1973 and 1989, to its current surface area (approximately 114 acres). The volume of CCR contained in the Main Pond is estimated to be approximately 6 million cubic yards. In the 2000s, a second pond (referred to as the Auxiliary Pond) was constructed as a temporary settling pond until the Main Pond could be expanded again. In late 2008, the Main Pond was taken out of service, and the sluicing operation was switched to the Auxiliary Pond. The Auxiliary Pond, as currently constructed, is expected to be full by 2019.

Storage of CCR over time has occupied a large portion of the available property, and is currently constrained within the property boundaries. However, because the surrounding area is rural (agricultural and recreational), further expansion of the plant area is considered undesirable. Therefore, construction of a special waste landfill over the top of the Main Pond was proposed, as a long-term disposal facility for CCR (including bottom ash, fly ash and gypsum) generated by the plant. A CCR treatment area, where future CCR materials will be dried and conditioned prior to landfilling, is also being constructed adjacent to the landfill, on the northeast corner of the Main Pond.

1.3 REGULATORY BACKGROUND

In 2011, KU began the application process for a permit for a Special Waste Landfill for disposal of CCR at the E.W. Brown Generating Station, to be constructed over the top of the former CCR disposal unit referred to as the Main Pond. The application was made to the Kentucky Department for Environmental Protection (KDEP) Division of Waste Management (DWM).

Groundwater monitoring began in 2011 in support of the application for the new landfill, and continued after that for baseline and assessment purposes. The monitoring identified water quality impacts in springs and drains discharging in the vicinity of the Main Pond, as well as other springs on or near the plant property. A *Groundwater Assessment Plan* (GWAP) was submitted to the DWM in late 2012, and approved by letter on May 1, 2013. A *Groundwater Assessment Report* (GWAR), which included a comprehensive review of the groundwater data collected through early 2013, was submitted to the DWM on September 30, 2013. A Technical Notice of Deficiency (NOD#1) on the GWAR was issued by the DWM on June 3, 2014. In a subsequent meeting and in a written response to the GWAR NOD#1 (dated August 12, 2014), KU agreed that additional groundwater data would be collected for supplemental assessment purposes. A *Groundwater Assessment Report Update* (GWAR Update) is currently in preparation, and will include the data collected in the interim.

The DWM issued a permit (SW08400010) to construct the new landfill on July 30, 2014, and construction of the landfill is currently on-going. A condition of the permit was that a *Sitewide Groundwater Remedial Action Plan* (GW-RAP) be submitted and approved by DWM prior to the issuance of an operating permit for the new Special Waste Landfill. This document has been prepared to fulfill that condition.

1.4 OBJECTIVES

The purpose of this GW-RAP is to comply with the landfill permit condition requiring a Remedial Action Plan, including the regulation referenced therein, 401 KAR 45:160 (*Surface and groundwater monitoring and corrective action for special waste sites or facilities*). Specifically, the requirements for a Remedial Action Plan are described in 401 KAR 45:160, Section 5(9) and include:

- The specific methods to be used to abate groundwater contamination from the facility;
- The specific methods to be used to prevent further groundwater contamination; and
- The means used to restore or replace public or private water supplies affected by contamination from the facility.

This last requirement is not applicable to the E.W. Brown plant, because no public or private drinking water supplies have been found to be affected by plant activities. Therefore, this document focuses on describing the means for abating and preventing impacts to groundwater from the plant's activities.

1.5 REPORT ORGANIZATION

This Remedial Action plan is divided into seven sections. After the Introduction, Section 2 discusses Site Background, including the physical setting, conceptual site model and changes in operating process that are affecting surface and groundwater flows at the site. Section 3 presents the objectives for the planned remedial actions for groundwater sitewide. A discussion of Interim Remedial Measures (measures already conducted or underway at the site) is presented in Section 4. The methodologies proposed to evaluate the effectiveness of the IRMs and evaluation of subsequent remedial measures are presented in Section 5. The Implementation Schedule and References are presented in Sections 6 and 7, respectively.

2.0 SITE BACKGROUND

2.1 PHYSICAL SETTING

A detailed description of the physical setting of the E.W. Brown Station has been provided previously in the GWAR (AMEC, September 2013). Selected information from that document is summarized below.

2.1.1 Topography and Local Drainage

The Dix River above Dix Dam forms Herrington Lake, extending approximately 35 miles to the south. The water level in Herrington Lake fluctuates between elevations of 715 and 760 feet. The E. W. Brown Generating Station and the associated CCR ponds are located on the west side of Herrington Lake, just upstream of Dix Dam.

The CCR ponds (The Main Pond and the Auxiliary Pond) are located adjacent to (and east of) a north-south topographic divide that separates the Dix River valley from the valley of Cedar Branch to the west (**Figure 1**). In the vicinity of the site, the highest elevations along the topographic divide are on the order of 920 feet. Due to rock removal for construction, typical elevations along the divide in the vicinity of the CCR ponds are approximately 900 ft. Cedar Branch, to the west of the divide, is a smaller stream than Dix River and flows north and approximately parallel to the Dix River. Both streams flow into the Kentucky River approximately 2 miles north of the plant, and less than a half-mile apart from each other, at an elevation of approximately 515 feet. A small portion of the E.W. Brown property drains to Cedar Branch. Most of the property (including the CCR ponds) drains to Herrington Lake just above Dix Dam. **Plate 1** is a regional map showing the property and the surrounding areas included in hydrologic studies of the site. **Plate 2** is a closer view of the CCR ponds and the drainage features immediately surrounding them.

The Main Pond (which has been inactive since late 2008) is located in a former tributary valley of the Dix River, approximately 2,000 feet upstream of Dix Dam. The bottom of the tributary valley, which was flooded by the damming of Dix River, is referred to as Curds Inlet. The tributary valley immediately to the south of the valley occupied by the Main Pond, is occupied by the Auxiliary Pond. The stream flowing through the bottom of this valley (below the Auxiliary Pond) is referred to as HQ Stream. It discharges to a smaller inlet referred to as HQ Inlet. Curds and HQ Inlets meet and flow together into Herrington Lake.

CCR in the Main Pond was built up over several decades, beginning in the late 1950s, through a series of successively higher embankments using both upstream and downstream construction. The maximum thickness of the ash, in the deepest part of the tributary valley, is estimated to be 120 to 130 feet. The Auxiliary Pond has been in operation since late 2008, and has been expanded once. The crest elevation of the current embankments containing both CCR ponds is approximately 900 feet (close to the watershed divide elevation). The surface of the

existing CCR in the Main Pond is dry, and slopes from approximately 890 to 880 feet, from west to east and then south, draining to a spillway (referred to as the "old riser") in the southeast corner of the Main Pond. The maximum operating surface elevation of the water in the Auxiliary Pond is 894 (approximately 150 feet above the level of Herrington Lake).

The land immediately east of the CCR ponds slopes eastward toward Lake Herrington, from elevations of approximately 850 feet to the lake level. Drainage in this area includes:

- The ditch receiving discharge from the old riser in the Main Pond (the former Main Pond Principal Spillway), which flows north and then east to the plant's discharge Station 001, monitored under the Division of Water (DOW) Kentucky Pollutant Discharge Elimination System (KPDES) program.

- The principal discharge line from the Auxiliary Pond (the active sluice pond), consisting of a buried pipeline that runs east and then north to a headwall where it joins the Main Pond spillway ditch just above KPDES 001. The water monitored at KPDES 001 flows into Curds Inlet.

- A stream running parallel to the Auxiliary Pond discharge pipeline, which was constructed for mitigation purposes, as replacement for the stream valley occupied by the Auxiliary Pond. This stream also services as the emergency overflow spillway for the Auxiliary Pond. This stream runs north and discharges to a rock quarry (referred to as Old Quarry or East Quarry). The East Quarry discharges to the KPDES 001 channel just downstream of the KPDES 001 monitoring point.

- HQ stream, which receives under-drainage from the valley underlying the Auxiliary Pond, and flows east to Herrington Lake, discharging into HQ Inlet.

2.1.2 Geology and Groundwater

The tributary valleys occupied by the CCR ponds are incised through limestone, shale and dolomite of the Middle Ordovician Lexington Limestone formation, and into the underlying High Bridge Group. The geology of the site is illustrated on the map provided with this report as **Figure 2**.

Existing CCR in the Main Pond overlies (from bottom to top) the Tyrone Formation (the uppermost formation in the High Bridge Group), the Curdsville/Logana Member, and the lower section of the Grier Member of the Lexington Limestone. Generally a relatively thin (less than 5 feet) veneer of clay residuum is present locally over bedrock. However, the areas surrounding the Main Pond and the Auxiliary Pond have been significantly altered by removal of overburden and rock, and placement of man-made rock fill.

Groundwater flow at the site occurs primarily in bedrock, through a relatively shallow system of fractures and poorly to moderately well developed solution channels, generally following topographic gradients. Extensive hydrogeologic characterization activities were performed in 2011 and 2012, relying primarily on dye tracing, to confirm groundwater flow paths. These

investigations and assessment results were documented in the GWAR (AMEC, September 2013). Many of the springs identified in both the Dix River and Cedar Branch watersheds, monitored in the dye trace studies, occur between elevations of 835 feet and 810 feet, and appear to emerge in the upper Tyrone, just below the contact with the overlying Curdsville Member of the Lexington Limestone, most likely due to the presence of bentonite beds in this horizon. Bedrock above this level is assumed to be seasonally dry and only intermittently saturated, with localized flow occurring from recharge into fractures and conduits. Some of the monitored "springs" at the site occur deeper in the Tyrone, at elevations closer to perennial or frequently flowing surface drainage. The discharges into Curds Inlet, at the toe of the Main Pond eastern embankment, emerge at an elevation of about 750 feet, and are assumed to be comprised of discharge from the embankment seepage collection system, mixed with groundwater discharge from bedrock.

Groundwater flow through the watershed containing the active and inactive CCR ponds has been confirmed to emerge in springs east of the CCR ponds, in ditches or streams or directly into inlets leading to Herrington Lake. Curds and HQ Inlets receive the groundwater discharges from the area of the CCR ponds, as well as the plant's surface water discharges permitted through the KPDES program. A surface water divide occurs immediately west of the CCR ponds, between the watershed containing the CCR ponds and the Cedar Branch watershed to the west. Dye tracing has confirmed that a groundwater divide is coincident with this surface water divide, and that groundwater does not flow west into the Cedar Branch watershed from the area of the CCR ponds.

2.1.3 Surface Water Hydrology

Herrington Lake has a surface area of 4.6 square miles (mi^2), a volume of 254,000 acre-ft, a length of 35 mi (at full pool), and mean and maximum depths of 78 ft and 250 ft, respectively. Currently KU manages the pool of Herrington Lake so that the base level is set to 725 feet in winter, and 740 feet in summer. In response to precipitation events, the lake level fluctuates higher (occasionally over 750 feet, the bottom level of the spill gates in Dix Dam) for limited periods of time, usually in spring. The 100-year flood elevation shown on Federal Emergency Management Agency (FEMA) mapping of the lake is 760 feet.

The U.S. Environmental Protection Agency (U.S.EPA, 1977) estimated the mean flow through Herrington Lake to be 593 cubic feet per second (cfs). The United States Geologic Survey (USGS, Crain and others, 2000) reported the mean annual discharges for Dix River in 1995 and 1996 were 442 and 591 cfs, respectively, and estimated that average annual runoff in the watershed ranges from 18 to 20 inches. Under low flow conditions, the flow out of Herrington Lake occurs as seepage through Dix Dam. Minimum seepage rates provided by KU for the 10-year period from 2000 through 2009 ranged from less than 10 to 46 cfs, and averaged 22 cfs.

Although most of the property occupied by the E.W. Brown Generating Station drains to Herrington Lake, a portion of the property drains to Cedar Branch, which flows approximately

parallel to the Dix River in the next watershed to the west. The Cedar Branch watershed is 4.1 mi^2 in surface area. Cedar Branch flows into the Kentucky River at Shakers Landing. Flows measured by Amec Foster Wheeler at the mouth of Dix River just above its confluence with the Kentucky River, in the spring and summer months of 2011 and 2012, ranged from zero to greater than 25 cfs. Both the Dix River and Cedar Branch flow into the Kentucky River just upstream of Lock 7, less than a half-mile apart from each other. The historic High Bridge (a steel railroad bridge) crosses the Kentucky River Palisades between the mouths of Dix River and Cedar Branch. Under low flow conditions, the flow in the Kentucky River at Lock 7 is on the order of 60 cfs.

2.2 CONCEPTUAL SITE MODEL

Water circulating through the site is influenced by surface water used for cooling, water-borne transport of CCR, infiltration, seepage, and surface water discharges. The following subsections present the overall site water balance, followed by a discussion of groundwater flow across the site.

2.2.1 Groundwater Flow

A generalized conceptual model of groundwater flow in the vicinity of the CCR ponds has been developed from the results of dye trace studies performed in 2011 and 2012, along with a comparison of water elevations at springs and streams to piezometric elevations. The findings are discussed in detail in the GWAR, and are summarized below. Locations are shown on **Plates 1 and 2**.

At the time of the dye injections in 2011 and 2012, the Auxiliary Pond was already being used as the active sluice pond for CCR at the plant. Use of the Main Pond for sluice water had been discontinued, and grading of the surface had been initiated to prevent standing water from accumulating. As a result, the CCR in the Main Pond had been partially drained. The CCR in the Main Pond was deposited between elevations of about 770 and 890 feet, with minimal separation from the underlying bedrock. Data collected to date indicates that the CCR in the Main Pond is still saturated in its bottom sections (just above bedrock), and is mostly unsaturated in the upper sections, with some thin saturated, discontinuous lenses (perched zones) occurring above the saturated zone.

In the dye trace studies,, dyes were injected into surface or near-surface bedrock features close to the edge of the Main Pond, at elevations of 868 to 885 feet above NAVD88. One dye was injected into the Main Pond CCR in its bottom section, but was never recovered. The monitored springs emerge at elevations between 746 and 828 feet. Many of the springs identified in both the Dix River and Cedar Branch watersheds occur between elevations of 835 feet and 810 feet, and appear to emerge in the upper Tyrone. Some springs occur deeper in the Tyrone, at elevations closer to perennial or frequently flowing surface drainage.

The springs in the Dix River watershed immediately downgradient of the CCR ponds include:

- The discharges at the toe of the Main Pond embankment (Dam Toe, including CH-040, CH-041 and CH-042), emerging at elevations of 752 to 754 feet. Estimates of combined flow at the toe of the Main Pond embankment range from 20 to 300 gpm, or 0.03 to 0.4 mgd.

- Ditch Spring (CH-044) and Beaver Dam Cave Spring (CH-045), discharging to the Main Pond outfall ditch above and south of Curds Inlet, at elevations between 820 and 827 feet. The combined flows measured in Ditch Spring and Beaver Dam Cave Spring range from 8 to 155 gpm, or 0.01 and 0.2 mgd.

- Briar Patch (CH-057) and HQ (CH-046) Springs discharging to HQ Inlet via HQ Stream. Combined flows from these springs range from 400 to 3,000 gpm (0.6 to 4 mgd).

These springs east of the CCR ponds did not go dry during the 2011-2012 study period, even during the very dry summer months of 2012. This is most likely due to a combination of ongoing drainage from the CCR in the Main Pond, which is still saturated to higher levels than the underlying bedrock, and possible leakage from the Auxiliary Pond discharge pipeline (discussed in more detail below, in Section 4.3).

By contrast, in dry conditions, natural recharge is insufficient to maintain flow in bedrock above the lake level to the north, south and west. Although they go dry on a seasonal basis, in wet conditions, flows from the springs to the west and the north (which include Stonewall Spring, Railroad Spring, and the Webb Spring Complex) range up to 200 gpm (0.3 mgd). The springs to the south (Rockhouse, Hardin and Hardin 2) were only monitored for a short period during a relatively dry year, and a representative range of flows is not yet available for these springs.

It has been concluded in previous reports that groundwater flow in bedrock above the level of Herrington Lake under natural conditions is localized in relatively shallow conduit systems that closely follow topographic gradients. The flow is intermittent, tending to dry up in prolonged periods with no recharge. The CCR in the Main Pond, which is saturated in its lower section, acts as a reservoir and potential source of recharge to groundwater in the underlying bedrock, which ultimately flows to Herrington Lake. The Auxiliary Pond discharge pipeline has recently been identified as another potential source of recharge to the groundwater flow system east of the CCR ponds, to be addressed in the planned remedial actions. West of the divide, dye tracing results indicate there is little potential for groundwater from the area of the CCR ponds to reach Cedar Branch.

2.2.2 Constituents of Interest (COIs)

The GWAR (AMEC, September 2013) contains a comprehensive review of the groundwater quality data collected through early 2013. The full water quality characterization list required by DWM Solid Waste regulations and guidance for sampling groundwater in the vicinity of coal ash

landfills (as specified in specified in 401 KAR 45:160, Section 7.2 (a), plus boron) contains 23 parameters, including 5 indicator parameters (pH, SC, COD, TOC and TDS) and 18 individual inorganic elements and compounds, mostly metals. Samples were collected over multiple sampling rounds in 2011, 2012 and early 2013 from 12 springs in the vicinity of the site, including three springs designated as background springs, seven springs and seeps identified by dye tracing as being downgradient from the Main Pond, and two additional springs to the north and northwest. More limited sampling was performed of various surface water bodies, including Herrington Lake, Cedar Branch, and their tributaries.

The data from the three designated background springs (Stonewall Spring, Rockhouse Spring and Hardin Spring) were pooled and used to develop local background concentrations for the parameters without regulatory MCLs. The data from the other nine springs (including the seven downgradient springs) were compared either to the regulatory MCLs (if available) or to the local background concentrations.

An initial risk assessment was performed as part of the GWAR to further evaluate the potential impacts associated with specific elements or compounds. The conclusions drawn from the groundwater characterization and risk assessment studies performed to date are summarized as follows:

- Based on review of the 23 parameters required to be monitored in groundwater, 13 parameters were identified as having multiple exceedances in more than one spring. They included three indicator parameters (SC, TDS and COD), and ten specific elements or compounds (arsenic, boron, calcium, chloride, iron, magnesium, nickel, potassium, sodium and sulfate). These specific elements and compounds, referred to as constituents of interest, were carried through to the preliminary risk assessment. Ten parameters (including two indicator parameters and eight specific elements or compounds) were eliminated; however, the DWM has requested that selenium and lead be added back to the list of COIs and addressed in future risk assessments for the site. The list of COIs for the site, therefore, includes 12 specific elements and compounds: arsenic, boron, calcium, chloride, iron, lead, magnesium, nickel, potassium, selenium, sodium and sulfate

- The potable water use pathway is not a complete pathway for the site, since no users of potentially impacted groundwater for potable supply have been identified. The intake for the Harrodsburg Water Plant is downstream of the E.W. Brown Generating Station, but records indicate that the treated water from the plant is not impacted by the COIs associated with CCRs.

- Of the 10 COIs evaluated in the initial risk assessment (not including lead and selenium), five (calcium, chloride, nickel, potassium, and sodium) were found to pose no significant risk to human health or aquatic organisms at the concentrations detected in groundwater, based on comparison to risk-based screening levels.

- Two more COIs (boron and magnesium) have had only minor/infrequent exceedances of risk-based screening levels, and are not considered to be constituents of concern with regard to human health or aquatic organisms.

- Arsenic and iron are the COIs most directly associated with coal ash in the CCR ponds, and primarily the (inactive) Main Pond. Arsenic is an identified carcinogen, and has very low risk-based screening levels. As such, it is the risk driver for the discharges from the site. However, the risk-based screening levels for arsenic were derived by USEPA based on dissolved (not total) metals in the water column, using data for the most toxic (trivalent) form of arsenic. Biomonitoring (WET testing) of the discharge from the active CCR Pond (KPDES 001, the discharge from the Auxiliary Pond) since 2009 has shown no significant toxicity of the discharge, even though it contains concentrations of arsenic at similar levels to the impacted groundwater springs. These results indicate that the form of arsenic (as well as the other metals) contained in the discharges from the site's CCR is either not bioavailable in significant amounts, or not bioavailable in the dissolved and toxic form on which the water quality criteria are based.

- Sulfate appears to be associated with gypsum (calcium sulfate) handling in the Gypsum Processing Plant (located west of the divide in the Cedar Branch watershed) and in the CCR ponds. It is not considered a constituent of concern with regard to human health. However, sulfate has been found to exceed ecological screening levels for aquatic organisms in two locations: in the springs discharging to Herrington Lake via HQ Inlet southeast of the (inactive) Main Pond and east of the (active) Auxiliary Pond, and in Railroad Spring to the northwest of the Main Pond, which discharges into the Cedar Branch watershed. Gypsum is relatively soluble, and there appears to be enough attenuation capacity (primarily from dilution) in both locations to reduce the concentrations below screening levels within a short distance of these discharges. However, continued monitoring was recommended in the GWAR, and interim remedial actions (described in this Plan) are in process to address sulfate impacts.

2.2.3 Potential Source Areas

Review of the groundwater data included in the GWAR indicated that the distribution pattern was different for some of the COIs than others, as follows:

- The highest concentrations of arsenic and iron were measured in samples from the springs east of the (inactive) Main Pond that discharge into Curds Inlet (Dam Toe Right, Ditch Spring, and Beaver Dam Cave Spring). Arsenic was also detected in the springs discharging to HQ Inlet (Briar Patch and HQ Springs), but at lower concentrations, and iron was not found to exceed background in those springs.

- Concentrations of calcium, chloride, magnesium and sulfate were generally higher in the springs discharging to HQ Inlet (Briar Patch Spring and HQ Spring) than in the springs discharging to Curds Inlet. Concentrations of these parameters were also elevated in Railroad Spring, northwest of the Main Pond, which flows into the Cedar Branch watershed.

- Boron, potassium and sodium tended to be distributed fairly consistently between the springs east of the CCR ponds and Railroad Spring to the northwest. It should be noted that, while elevated relative to background, these elements have had only few or no exceedances of the risk-based criteria derived in the initial risk assessment.

- The Webb Spring Complex, located north of the CCR ponds and discharging to Dix River downstream of Dix Dam, tended to have lower concentrations and significantly fewer exceedances than the other springs in the assessment. A direct connection between this spring complex and activities at the E.W. Brown Station to the south has not been established.

Based on the distribution of COI exceedances in groundwater and understanding of groundwater flowpaths developed from the GWAR, KU identified several potential source areas to be addressed in the GW-RAP. These were:

- The Gypsum Processing Plant (GPP), located northwest of the Main Pond, to the west of the divide between the Dix River and Cedar Branch watersheds.

- The West Quarry (also known as Quarry 2 & 3). This series of quarries was excavated along the ridge at the watershed divide, on the west side of the Main Pond, and was used as a source of rock for construction of the Auxiliary Pond. The West Quarry is not considered to be a source of groundwater impacts, but is a collection point for surface runoff and a potential source of recharge to the groundwater flow system.

- The discharge pipeline for the Auxiliary Pond, the pond that is currently the active sluice pond for CCR at the site.

- The Main Pond, specifically the existing CCR deposited in an unlined basin behind the cross-valley (eastern) embankment.

The interim remedial measures described below in Section 4.0 were developed specifically to begin addressing these potential source areas.

2.2.4 Potential Receptors and Exposure Routes

The GWAR (AMEC, September 2013) included an initial risk assessment evaluating potential impacts associated with specific elements or compounds. The GWAR referenced a Water User Survey performed as part of the Landfill Application in the summer of 2011. As part of that effort, no potable water users were identified that could potentially be impacted by the groundwater discharges from the plant. Therefore, potential exposure pathways involving drinking water and associated human health impacts are considered incomplete. The pathway involving agricultural supply wells and springs, while potentially complete for the identified receptors (livestock and feed crops), were considered limited or de minimus in comparison to the pathways examined in the risk assessment (i.e., human and ecological exposure via surface water). The human health exposure pathways that were considered potentially complete involved recreational users of surface water. They included incidental ingestion and dermal absorption during swimming, and ingestion of fish obtained from Herrington Lake downstream of the discharges. The most sensitive non-human (ecological) receptors would be aquatic populations in surface water.

2.3 PROCESS MODIFICATIONS

The E.W. Brown Generating Station is a steam-electric power plant, generating electricity in part from turbines driven by steam produced by coal-fired boilers. KU is currently implementing a number of changes to process operations at the plant which will significantly reduce both the amount of water moving through the site and the mass and concentrations of COIs potentially discharged into the environment. As a result, historical data and trends cannot be considered good predictors for future groundwater and surface water quality, and ongoing monitoring will be necessary to assess the new equilibrium that will be established once these changes have been fully implemented. The most significant of these changes are briefly described below.

2.3.1 CCR Handling

Fly ash is one of the residues generated in coal combustion, and comprises the fine particles that rise with the flue gases. Ash that does not rise is called bottom ash. Both types of ash at the E.W. Brown Station are currently transported by water flow to a settling pond. The Main Ash Pond was used until 2008, when the sluicing operation was switched to the Auxiliary Pond.

KU is currently constructing a CCR Treatment (CCRT) area on the northeast corner of the Main Pond, as part of a major reorganization of the facilities for handling CCR at the E.W. Brown Generating Station. Fly ash from Unit #3 will be transported to the CCRT area without water (dry handling) via a pneumatic transfer system. Fly ash from Units 1 & 2 will be sluiced to the Auxiliary Pond pending a decision on the remaining life of these units. At the same time, bottom ash from all three units will be sluiced to the CCRT area via a closed loop system (in which water is re-used). Following construction of the new landfill, the only wastewater generated at the plant will be from the flue gas desulfurization (FGD) system and the Units 1 & 2 fly ash transport systems.

The modifications currently in process will significantly reduce the amount of contact between water and CCR, and therefore reduce the mobilization of CCR constituents into water with the potential to be discharged to the environment. The process of closing the Main Pond, converting to dry CCR storage in that unit, and moving the sluice water transport system for CCR to a lined unit, has already resulted in significant changes to the movement of water through the site, and these changes will continue as water use is further reduced after the new landfill goes into operation and a new hydraulic and geochemical equilibrium establishes itself. The following points describe how the water flow through the Main Ash Pond has been altered since 2008.

- The decision to landfill dry ash in the next phase of plant operation was taken in lieu of expanding the Main Pond vertically, so that water sluicing of CCR at the site could be minimized. The Auxiliary Pond was vertically expanded as a stop-gap measure, to serve as interim storage until the landfill could be constructed and permitted.

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- The Main Pond was taken out of service in late 2008, and measures were taken at that time to decant as much water as possible from the surface of the pond. As a result, the ash deposits in the pond were already substantially dewatered (and therefore more stable) when the landfill application was submitted in 2011, compared to the sluicing phase of pond operation.

- In order to expedite the dewatering process, and to provide cover for dust control, the CCR in the Main Pond were regraded and covered with soil over two thirds of the pond surface between early 2012 and early 2013. Regrading and covering the surface of the Main Pond reduced infiltration of precipitation through the existing CCR deposits, resulting in additional dewatering (strengthening) of the deposits, and reduced circulation through the deposits, thereby reducing associated leaching.

- In addition, during the regrading of the existing CCR and placement of the soil cover over the southern two-thirds of the Main Pond, an underdrain system was installed (between the soil cover and the regraded CCR surface) to allow for rapid dissipation of any pore pressures developed as a result of the load imposed by the new CCR landfill. If needed, the underdrain system will also serve to promote long-term dewatering of the CCR.

- As part of construction of the CCRT area, the landfill, and the associated ponds and roads, the entire surface of the existing CCR in the Main Pond will be capped with low-permeability materials, including a synthetic membrane under the landfill, and associated ponds, ditches and roads, and hardscaping under the CCRT area. The result will be to further limit and ultimately eliminate the potential infiltration of precipitation or surface water into the existing CCR of the Main Pond.

- Some flow of natural groundwater through the existing CCR in the Main Pond is expected to continue over time, as the natural flow of water that existed before the Pond was filled with CCR continues into the buried valley. However, through the combination of the actions described above, the balance of water through the Main Pond has been significantly altered, and the total water content of the existing CCR is expected to continue to subside over time.

2.3.2 Changing Regulatory Conditions

The USEPA proposed new regulations on disposal of coal combustion residuals from electric utilities in June 2010, and issued its final rule on April 17, 2015. These new CCR regulations become effective six months after the publication date.

The USEPA also released its proposed effluent limitation guidelines (ELGs) for the steam-electric power generating point source category on 19 April 2013, and the dates for finalization and implementation of those regulations are not yet established. The proposed ELGs are designed to establish technology-based treatment standards for existing and new sources of wastewater discharges from steam-electric power generating facilities, and to ensure that these standards are consistent nationwide.

The proposed ELG rule proposes best available technology economically achievable (BAT) effluent limitations on various wastewater streams, and proposes specific effluent limits on

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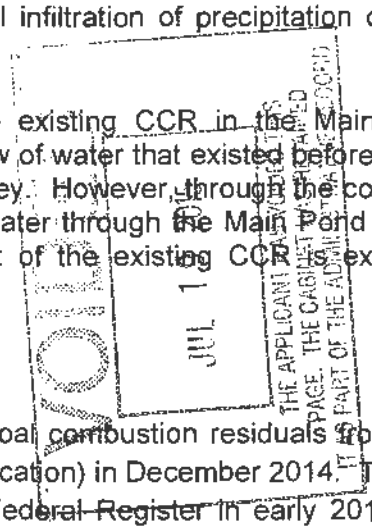

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scrubber wastewater for mercury, arsenic, selenium, and nitrates. Existing facilities are allowed at least three years from the effective date of the final rule to identify compliance plans and schedules for meeting the final ELGs. Specifically, BAT limitations for existing sources would apply as soon as possible after the next NPDES Permit is issued in the permitting cycle beginning July 1, 2007, on a date determined by the state permitting authority. USEPA expects that BAT limitations would become effective at all existing coal-fired units by no later than July 1, 2022. The proposal recognizes that additional time was needed to study available technologies and operational measures for existing facilities, and to design, install, and enhance the technology at each facility before meeting the final BAT limitations.

Although the final form of the ELGs and the date for implementation have not yet been established by the USEPA, KU is actively studying the best means of implementing the proposed rule for the E.W. Brown Generating Station. KU anticipates that the Auxiliary Pond will be phased out of service within the next decade, and replaced with an expanded wastewater treatment unit that is close to or co-located with the Auxiliary Pond. However, the type of treatment systems that may be required and the timeframe for implementing them will depend on the regulatory requirements that are finally adopted. KU understands that future changes in leachate disposal or management facilities, from those specified in the approved Special Waste Landfill Permit, will require a permit modification per 401 KAR 45:040, Section 4.

Groundwater and wastewater discharges from the plant impact the same bodies of water (primarily Curds and HQ Inlets on Herrington Lake), and therefore the same receptors. Through operation of the new wastewater treatment unit, the loading of constituents (including the COIs for groundwater) is expected to be significantly reduced in the wastewater discharges from the plant. As a result, the combined loading into Curds and HQ Inlets from both wastewater and groundwater combined, and the associated impacts on potential receptors, are expected to be appreciably mitigated.

The ELG rule proposes best available technology economically achievable (BAT) effluent limitations on various wastewater streams, and proposes specific effluent limits on scrubber wastewater for mercury, arsenic, selenium, and nitrates. Existing facilities are allowed at least three years from the effective date of the final rule to identify compliance plans and schedules for meeting the final ELGs. Specifically, BAT limitations for existing sources would apply as soon as possible after the next NPDES Permit is issued in the permitting cycle beginning July 1, 2007, on a date determined by the state permitting authority. USEPA expects that BAT limitations would become effective at all existing coal-fired units by no later than July 1, 2022. The proposal recognizes that additional time was needed to study available technologies and operational measures for existing facilities, and to design, install, and enhance the technology at each facility before meeting the final BAT limitations.

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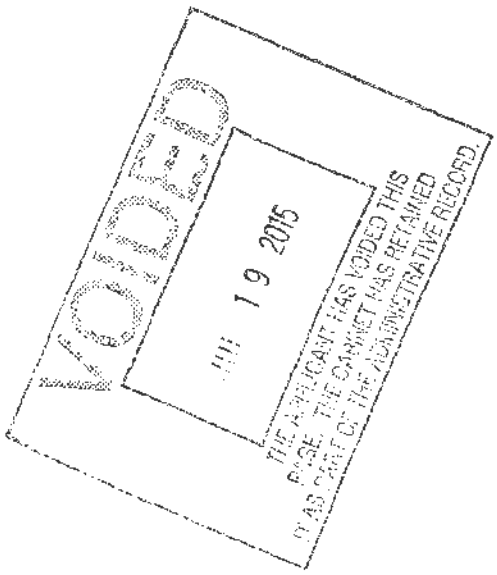

3.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are statements of the general goals of an environmental remediation consisting of multiple remedial actions. The RAOs identified for the remedial actions to be conducted at the E.W. Brown Generating Station are the following:

- Protection of human health and the environment;
- Cleanup consistent with potential land use; and
- Compliance with State and Federal environmental laws.

KU anticipates achieving these goals by both reducing the mass of COIs entering the groundwater flow system from the identified source areas, and reducing the mass of COIs exiting the groundwater flow system into receiving surface water bodies (primarily Herrington Lake). These reductions will be achieved by: reducing the total amount of flow potentially contacting source materials; reducing the transfer of source materials into groundwater flow systems; and intercepting impacted groundwater flow prior to discharge into Herrington Lake.

The following sections provide additional detail on each of the RAOs.

3.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Amec Foster Wheeler has conducted a preliminary human health risk assessment and screening level ecological risk assessment (HHRA/SLERA) to evaluate the initial risks associated with groundwater impacts at the site. The assessment, which was documented in the GWAR (AMEC, September 2013), included:

- An analysis of the exposure pathways and receptors for CCR impacts;
- An assessment of toxicity of the COIs; and
- A preliminary assessment of human health risk and ecological risks.

KU plans to update the initial risk assessment to develop quantitative risk-based threshold concentrations for the site, for use in evaluating the impacts of remedial action. As described above, no users of groundwater have been identified along the flowpaths confirmed to be impacted by source areas at the plant. Furthermore, the surface water bodies receiving groundwater discharges, primarily Herrington Lake via Curds and HQ Inlets, also receive the plant's cooling waterand stormwater discharges. Receptors in Herrington Lake, including aquatic organisms and human recreational users, are impacted by the combined surface water and groundwater discharges from the plant. Therefore, KU will work with the DOW to develop a comprehensive approach to risk management that addresses the totality of surface water impacts from both groundwater and surface water discharges. In the meantime, as described in this plan, KU will pursue a strategy of reducing the total mass of COIs entering the lake via the groundwater flow system.

3.2 CLEANUP CONSISTENT WITH POTENTIAL LAND USE

KU has made a significant commitment to the infrastructure at the E.W. Brown Station, and plans to generate electricity at the Station for the foreseeable future. The presence of CCR in the ponds and in the future landfill will restrict long-term use of the property to non-residential purposes. KU will continue to retain control over the property, and can assure that future land use remains consistent with the remedial objectives and required management controls for the site.

3.3 COMPLIANCE WITH STATE AND FEDERAL ENVIRONMENTAL LAWS

Federal authority to regulate solid waste facilities has been delegated in Kentucky to the DWM, administered by the Solid Waste Branch. State standards for groundwater corrective action are established in 401 KAR 45:160, Section 5, *Groundwater Contamination Assessment and Corrective Action*. Paragraph 12 requires that corrective action be conducted until the owner or operator "demonstrates that concentrations have been reduced to levels below the maximum contaminant level (MCL) or naturally occurring background." Surface water impacts must be addressed as necessary to comply with 401 KAR 30:031 (*Environmental performance standards*), which prohibit surface water impacts that violate KRS Chapter 224, or the surface water standards of 401 KAR Chapters 10 or 8.

Operational changes and remedial actions to be implemented at the plant are anticipated to have significant impacts on infiltration and recharge to the groundwater flow system, as well as transfer of COIs to groundwater. These changes will, in turn, limit the contact of clean water with CCR materials and reduce the overall mass of COIs in the groundwater flow system and in discharges to surface water. However, given the physical configuration and the volume of CCR material in the Main Ash Pond, KU cannot accurately predict when concentrations of COIs in the groundwater system in the vicinity of the plant will achieve the regulatory objectives.

3.4 SUMMARY

The primary source of potential groundwater impacts at the site is the Main Pond, which contains about 6 million cubic yards of CCR in an unlined valley fill. Given this volume of source material, and the ongoing (although reduced) flow of water through this material, the numerical cleanup standards specified in Kentucky's solid waste regulations may not be immediately achievable. In lieu of being able to immediately meet the regulatory objectives, therefore, KU will implement a robust system of engineering and management controls to:

- Continue to eliminate and/or intercept flows contacting waste;
- Reduce the overall risk to environmental receptors; and
- Monitor the impact of these actions to verify that risk reduction is achieved.

4.0 INTERIM REMEDIAL MEASURES

In order to proactively address identified source areas, KU is in the process of implementing significant remedial actions that are designed to prevent the transfer of additional COIs into groundwater to the extent possible, and limit migration of groundwater impacts from identified source areas. These actions are termed Interim Remedial Measures (IRMs) because they can be implemented without extensive evaluation. These IRMs, as they are implemented, become part of the permanent Remedial Action for the site. As part of the ongoing groundwater assessment process, the effectiveness of the IRMs described below will be evaluated through groundwater monitoring, and the result of the evaluation may be incorporated (as needed) into additional remedial action at the site, as described below in Section 5.0.

The IRMs that have previously been or are currently being implemented are described in the following sections.

4.1 GYPSUM PROCESSING PLANT

The Gypsum Processing Plant (GPP, shown in **Figure 3**) was constructed in 2009, to handle the gypsum produced from air emission controls on the coal combustion units. Gypsum is conveyed to the GPP as a wet slurry, by pumping from the generating station. At the GPP, gypsum is dried and processed via a vacuum filter belt.

The GPP includes a pond (known as the Gypsum Pond, or West Collection Pond) which receives stormwater runoff from the surrounding area, runoff from geotextile filter tubes used as part of the gypsum dewatering process, and filtrate from the gypsum vacuum dewatering belt. As originally designed, this pond was excavated into bedrock and was unlined. The outfall from the pond leads to an underground forcemain through which water from the pond is pumped to the Auxiliary Pond.

Based on its location (west of the watershed divide) and the materials handled in this area, the GPP, and more particularly the collection pond associated with it, is considered to have been the most likely source for the COIs (primarily sulfate) detected in Railroad Spring, about 800 feet to the northwest.

In April-May 2014, KU undertook remedial measures to line the pond and the area draining to the pond in order to prevent infiltration of gypsum-impacted water in the area of the GPP. The installed liner system consists of the following, from bottom to top:

- 4 inches minimum of dense graded aggregate (DGA) over grade (rough rock surface), to serve as a cushion under the membrane.
- 60-mil LLDPE flexible membrane liner between two cushion geotextile layers.
- 6-inch fabric form concrete mat.

The total area lined was approximately 55,600 square feet, including the area of the pond and an 18,525 square foot drainage area to the north of the pond, used for the geotextile filter tubes.

Appendix A provides the design drawings and photos showing the liner installation and current appearance of the Gypsum Pond and surrounding area.

The upgrades installed at the GPP are intended as a short-term IRM. In the long term, once the landfill and the CCR Treatment Area are constructed, gypsum processing will be moved to the CCR treatment Area, and dry gypsum will be disposed in the landfill. The current gypsum dewatering system at the GPP will be retained as a backup to the new (redundant) systems in the CCR Treatment Area, but it will only be used in the event of a failure of those systems.

4.2 WEST QUARRY

The West Quarry (also known as Quarry 2 & 3) was excavated along the ridge on the west side of the Main Pond in 2007-2008. It was used as a source of rock for construction of the Auxiliary Pond, and later as temporary storage for bottom ash. The bottom ash was moved to the Main Pond in late 2011, and consolidated with the existing CCR in that pond before it was regraded and covered with soil.

Once emptied, the West Quarry received surface runoff, and may also have a connection to groundwater. The standing water level elevation in the West Quarry in 2014 was approximately 874 feet. In October 2014, KU began dewatering of the quarry, and had lowered the water level elevation to approximately 864 by October 24, 2014. Pumping was discontinued over the weekend during a period without precipitation, and there was no noticeable rise in water level, indicating little to no inflow of groundwater over the two-day period. Based on these observations, the West Quarry appears to act as a collection area for surface runoff, and a potential source of recharge to groundwater immediately upgradient of the Main Pond.

In order to reduce ongoing recharge in this area, KU intends to fill the quarry with inert structural fill (soil and rock), and graded at the surface to shed (rather than infiltrate) precipitation. Design of the fill is currently underway, and filling is planned for 2015. The source of the fill will be borrow generated in previous excavation activities on the property, consisting of mixed soil and rock. The surface of the structural fill will be covered with topsoil and vegetated to minimize erosion.

4.3 AUXILIARY POND DISCHARGE PIPELINE

The relatively high flowrates observed in the springs feeding HQ Stream (HQ Spring and Briar Patch Spring) caused KU to suspect possible leakage from the Auxiliary Pond discharge pipeline. As shown on **Plate 2**, the pipeline exits the Auxiliary Pond on its southwest corner, runs along the southern and eastern perimeters of the pond, and then runs north and northeast,

discharging to the surface at a headwall a short distance above the KPDES 001 monitoring point.

The pipeline is constructed of straight lengths of 30-inch diameter high-density polyethylene (HDPE) pipe, connected through 12 manholes. The manholes are 5-foot diameter concrete cylinders, 6 to 18 feet deep. Based on observations, leaks were suspected of occurring in several manholes at the junctions between the HDPE pipe and the concrete manhole sidewall.

On September 8-10, 2014, Winelco (under subcontract to AMEC) provided testing services to evaluate the integrity of selected lengths of HDPE pipe, and all 12 manholes. The test results for the segments of HDPE line tested indicated no concern. However, the manholes were found to exhibit varying stages of deterioration, including cracking of concrete in the walls and floor, and degradation of the seal round inlet and discharge pipes. In Manholes 8, 9, 10, 11 and 12, cracks were observed all the way through the concrete, and sediment was present in the manholes. In the other manholes, the pipes were sealed and water was introduced to a level 48 inches over the pipe inlets. Manholes 3 and 5 were unable to be tested as the structures were not able to be filled with water. The other manholes tested (1, 2, 6 and 7) all showed substantial water loss (corresponding to water level drops of 36 to 43 inches over one hour of observation) after filling.

Based on these results, the Auxiliary Pond discharge pipeline has been identified as the likely source for most or all of the water quality impacts observed in HQ Stream and the springs feeding it (HQ Spring and Briar Patch Spring). In response to these findings, KU has evaluated options for repairing the existing structures, and has determined that a more effective approach will be to replace the sections of the pipeline and manholes rather than repair it along its entire length. The new structure will most likely be re-routed to the east of the current structure, and will discharge to the same KPDES 001 location. The number of manholes will be reduced, and new manholes will be designed to achieve a durable, water-tight seal with the inlet and outlet lines.

4.4 MAIN POND

Since sluicing of CCR to the Main Pond was discontinued in late 2008, a series of remedial measures have been performed at the Main Pond to limit infiltration, dewater the existing CCR to the extent possible, and ultimately intercept water impacted by the existing CCR so that it can no longer discharge to surface water. These actions are described in the following sections.

4.4.1 Capping of Existing CCR

Between February 2012 and January 2013, the surface of the existing CCR in the Main Pond was regraded to provide drainage for stormwater, and two-thirds of the surface were covered with a clay-mix soil cover (0.5 to 15 feet thick), to prevent dusting from the drying ash and to limit ongoing infiltration. An underdrain system was installed beneath the clay-mix soil, to

capture any free water that might be squeezed upward during future loading from the proposed new landfill. These actions resulted in elimination of standing water from the surface of the existing CCR.

As described in the *Main Ash Pond Closure Plan* (AMEC, April 2014), final capping for closure of the Main Pond will proceed in phases, as the new lined landfill is constructed over the top of the covered existing CCR. This closure approach brings the Main Pond into substantial compliance with EPA's Final Rule on disposal of CCR, issued on April 17, 2015, under which out-of-service ash treatment basins are to be closed by dewatering of the ash, grading to promote runoff, and capping with a low-permeability cover. Placement of the final section of the soil cap is expected to be completed by December 2016.

4.4.2 Abutment Drain Collection

As-built drawings for the last expansion of the Main Pond eastern embankment (dam) showed abutment drains installed in the north and south ends of the dam. The north abutment drain formerly discharged to the ditch carrying plant effluent (Unit #3 cooling tower blowdown) monitored at KPDES 003. This discharge from the abutment drain had been sampled in the monitoring associated with the Groundwater Assessment, and was reported in the GWAR as monitoring point CH-048 (Drain). In March-April 2014 AMEC prepared a design for a pumping station to capture the north abutment drain discharge and transfer it to the Auxiliary Pond. The pump station was installed in June and early July 2014. **Appendix B** provides the design drawings and photos showing the pump station installation.

The south abutment drain was apparently intended to discharge to the outfall channel for the Main Pond discharge, just downstream of the current KPDES 001 monitoring point. However, no flow is observed in the pipe located there. Instead, a seep (shown as "South Abutment Seep" on **Plate 1**) emerges at the ground surface west of KPDES 001, and north of the Main Pond outfall ditch. The seep is thought to represent a break in the south abutment drain line which is diverting all or most of the flow intended to be discharged farther east. A sample has been collected of this seep, and the need for further remedial action to collect the water from the south abutment drain is currently being evaluated.

4.4.3 Toe Drain Collection

Water emerges from the toe of the Main Pond eastern embankment (dam) on a continuous basis, at a rate ranging between 150 and 250 gpm, and possibly higher. Based on as-built drawings for the dam, this water is thought to include at least two components: flow from the internal drainage system for the dam, installed as part of the dam expansion in 1989, emerging as diffuse flow in the area sampled as Dam Toe Middle (CH-041) and Dam Toe Left (CH-042); and flow from a "spring box" that is now buried under the expanded dam. The audible flow noted at the monitoring point referred to as Dam Toe Right (CH-040) is thought to represent flow from this spring box. It is not clear if the spring box had been installed to capture natural

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springs, or was the engineered terminus of a dam drainage system for an earlier phase of the eastern embankment. Most likely, the flow includes a combination of groundwater that underflows the dam through bedrock, and flow through manmade drainage systems. In either case, the flow path from the source (CCR in the Main Pond) to the receiving surface water body (Curds Inlet) is short, and the travel time is relatively fast, leaving little opportunity for attenuation along the way.

Iron staining associated with the discharges is apparent, and samples collected at CH-040 have shown exceedances of the MCL and surface water criteria for arsenic. In response to this finding, KU has made the decision to collect the discharge at the toe of the Main Pond Dam, so that it can be transferred in the short term to the Auxiliary Pond. In the long term, the water pumped from the toe of the dam will be treated with other waste streams at the future enhanced wastewater treatment unit for the plant.

Design and permitting for the planned collection system are currently underway. The current design is provided in **Appendix C**. The first phase will be a cut-off wall constructed across the valley downstream of the toe, to protect the collection system from flood events in Curds Inlet. Construction of the wall is planned for winter 2015, while the lake level is at its lower (wintertime) pool level. Once the cutoff wall is completed, and a temporary water handling system is installed, excavations to locate the drains where the discharges are originating are planned, so that an appropriate collection system can be designed and constructed. Full capture of the toe drain discharges is anticipated to be completed by August 2015.

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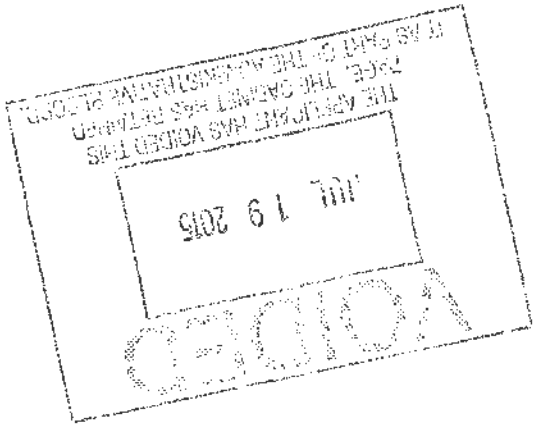

5.0 EVALUATION OF REMEDIAL MEASURES

Remedial measures will be evaluated on an ongoing basis, primarily through groundwater monitoring. Groundwater monitoring will be performed both to evaluate the effectiveness of the IRMs, and to assess the need for additional measures.

5.1 MONITORING EFFECTIVENESS OF INTERIM REMEDIAL MEASURES

A major component of the remedial action process established by this Plan will be to evaluate the effectiveness of the IRMs, as they continue to be implemented.

KU anticipates that the IRMs described in the previous section will result in a significant reduction of mass transfer of COIs into groundwater, and an overall reduction in concentrations of discharges. In combination with the addition of enhanced wastewater treatment that will be implemented over the coming years to meet ELGs in wastewater discharges from the plant, the reduction in groundwater discharges is expected to markedly reduce the transfer of COIs via groundwater to the receiving surface water bodies.

In order to verify and evaluate the impact of the changes that are already in process, KU is committed to ongoing monitoring of groundwater at and near the property. The proposed plan for monitoring is described in the following sections. The plan described below, designed to monitor the effectiveness of the IRMs, also includes the monitoring previously proposed in the landfill Groundwater Monitoring Plan (GWMP) dated October 2013, which has been included in the Landfill Permit.

5.1.1 Monitoring Locations

The locations to be included in ongoing monitoring are described below.

The following springs have been or will be monitored as indicators of background water quality conditions:

- Rockhouse Spring (CH-063)
- Hardin Spring (CH-062)
- Stonewall Spring (CH-052)

The use of Stonewall Spring (CH-052) for background data collection is planned to be phased out, as it is located on property that does not belong to KU. However, it is designated for ongoing monitoring based on the currently approved permit.

The following sampling locations are located east of the Auxiliary Pond on HQ Stream, and will be monitored to verify water quality improvement from replacement of the Auxiliary Pond discharge pipeline:

- HQ Spring (CH-046)
- Briar Patch Spring (CH-057)

The following sampling locations are located east of the Main Pond, at the toe of the dam, and discharge to Curds Inlet:

- Dam Toe Right (CH-040).
- Dam Toe Middle (CH-041) and Dam Toe Left (CH-042).

Collection of these discharges is currently in process, with construction expected to be complete in 2015. Selection of appropriate monitoring points during and after construction will be made based on the final configuration of the collection system. At a minimum, the combined pumped flow from the collection point will be monitored for at least one year, to evaluate the variability in the chemistry of the water emerging from the toe of the Main Pond.

The following sampling locations are located east of the Main Pond, and discharge to (or close to) the Main Pond outfall ditch leading to KPDES 0001:

- Ditch Spring (CH-044)
- Beaver Dam Cave (BDC) Spring (CH-045)
- South Abutment Seep

The water quality at these locations is currently being evaluated, and the need for additional remedial action at these locations (if any) will be assessed based on the results.

The following locations will be monitored to evaluate water quality trends sitewide in response to the remedial actions described in this Plan:

- Railroad Spring (CH-050) – west of the plant
- Webb Spring Complex (CH-028) – north of the plant
- Hardin 2 Spring (CH-065) – south of the plant

5.1.2 Monitoring Parameters

At a minimum, the parameters required to be monitored in groundwater according to the Special Waste Landfill Permit (SW08400010) will be included in all groundwater monitoring. That list (including analytical methods) is presented in the following table:

Analytical Methods

Parameter	Laboratory Method
Flow (for springs)	field measured
Water Level Elevation	

Parameter	Laboratory Method
pH	
Temperature	
Specific Conductance	
Chemical Oxygen Demand (COD)	Method 410.4
Total Organic Carbon (TOC)	Method 9060A
Total Dissolved Solids (TDS)	Method 2540C
Chloride	Method 9056
Sulfate	
Boron	Method 6010B
Arsenic	Method 6020
Calcium	
Copper	
Sodium	

This list represents a minimum list of parameters. Upon completion of the GWAR Update, additional parameters may be identified that will be useful to include in groundwater monitoring in order to better evaluate the effect of the remedial actions.

5.1.3 Monitoring Frequency

The monitoring frequency required by the landfill permit is semi-annual. However, the dynamics of the groundwater systems being monitored are expected to change relatively rapidly over the next one to two years, as the changes discussed in previous sections are implemented. Quarterly monitoring is proposed as the appropriate frequency for groundwater monitoring beginning in the first quarter of 2015. A quarterly frequency should allow for seasonal fluctuations to be distinguished from long-term trends. Once discernible trends become established, a decreased frequency may be recommended.

5.1.4 Data Evaluation and Reporting

Evaluation of background concentrations in groundwater will continue for the parameters on the list that do not have MCLs. The evaluation will be made, as in the GWAR, using pooled data from background monitoring points, and the USEPA software ProUCL to develop a 95% Upper Prediction Limit for each parameter without a MCL. Selection of appropriate data to be included in the statistical analysis of background conditions will be made based on the findings of the GWAR Update (currently in process).

In addition, as sufficient data over time become available, the key parameters at each monitoring location will be reviewed for statistical trends. Trend analyses will be performed using a combination of graphical methods and statistical methods available in ProUCL.

In the long term, as appropriate risk-based screening criteria are developed and approved by the KDEP, KU will introduce those into the evaluation, so that monitoring data can be evaluated in terms of overall environmental risk, rather than solely with regard to background.

A Groundwater Monitoring Report will be prepared semi-annually, beginning with the first half (two first quarters of 2015). The GWMR will be submitted within 60 days from the end of the second and fourth quarters. MCL or statistical exceedances for the permit-required parameters will be reported to the DWM within 48 hours of being identified.

5.1.5 Monitoring Plan Modifications

It is anticipated that modifications to the monitoring plan described above will be appropriate as the results of the Groundwater Assessment Report Update and ongoing monitoring are fully evaluated. The following types of modifications may be proposed by KU, and implemented if approved by the DWM Solid Waste Branch:

- Drop/add monitoring points. Over time, additional monitoring points may be proposed, if discovered or created by new construction or collection procedures. Monitoring points may be proposed to be dropped from the list if they go permanently dry, if they are combined into a collection point, or if long-term trend analysis indicates that relevant data are no longer being generated.

- Drop/add monitoring parameters. The geochemical assessment currently being performed for the Groundwater Assessment Report Update will provide a more complete picture of the parameters that may be COIs with regard to the specific sources at the plant. Long-term, KU may propose modifications to the parameter list so that the appropriate COIs are being monitored, and parameters that are typically not detected over background are eliminated.

- Modify frequency of sampling and/or reporting. Over time, as the rate of dynamic change in the water balance and mass balances in the system decrease, KU may propose a decrease in the frequency of sampling and/or reporting.

It is understood that modifications to permit-required sampling points, parameters or frequency will require submittal and approval of a Permit Modification for the landfill.

5.2 EVALUATION OF ADDITIONAL REMEDIAL MEASURES

The measures described in Section 4.0 have already been implemented, or are in process of being implemented. The need for additional measures will be evaluated on an on-going basis, based on:

- Groundwater monitoring results and trends; and
- Results from ongoing technical evaluations.

It is anticipated that different COIs may respond differently, or distribute differently in groundwater, in response to the planned remedial actions. Therefore, while some concentrations of some COIs may decrease at all locations, concentrations of selected COIs could increase at some locations in the short-term. These increases, if they persist, will be evaluated to determine if additional engineering controls or other actions could be required to further reduce risk.

In parallel with the on-going monitoring described in the previous section, KU proposes to continue the evaluation of the existing CCR in the Main Pond that has been started in 2014. This evaluation is being performed primarily to assess geotechnical and hydraulic response of the CCR to loading from the new landfill, and the studies being performed in 2014-2015 will establish a baseline for comparison to the post-filling data.

It is anticipated that hydraulic evaluation of CCR in the Main Pond will continue through the operational life of the landfill. The instruments installed in the Main Pond in advance of landfilling include:

- Nine settlement monitors anchored into the bedrock just below the CCR.
- Nine sets of vibrating wire piezometers, installed at two levels to monitor water level response in the existing CCR.
- Four wells (three 2-inch and one 4-inch) screened at the bottom of the CCR and equipped with transducers, for comparison to the vibrating wire piezometers, and to evaluate the need and potential to extract water from the CCR.

Locations are shown on **Plate 2**. In addition to the geotechnical and hydraulic evaluations planned for the Main Pond CCR, samples have been retrieved from the newly installed wells in the CCR to evaluate geochemistry of the water within the primary body of waste potentially impacting groundwater at the site. The data generated in the geochemical assessment, which will be reported in the GWAR Update planned for early 2015, will be used for:

- Comparison to concentrations of COIs in groundwater outside the Main Pond.
- Chemical "fingerprinting" of water that has contacted the existing CCR in the Main Pond, for comparison to groundwater samples at other locations.
- Evaluation of the potential for natural attenuation in the groundwater systems.
- Evaluation of potential ex-situ treatment methods, if needed.

In addition, selected monitoring points east of the Main Pond have exhibited concentrations of COIs that could require additional remedial action. These include Ditch Spring and Beaver Dam

Cave Spring (both discharging to the Main Pond outfall ditch), as well as the South Abutment Seep. These points will be specifically targeted in the geochemical assessment as well as the ongoing monitoring to evaluate if they should be captured for transfer to the Auxiliary Pond.

These ongoing studies can be used as the basis for evaluating additional remedial actions, beyond the measures described in Section 4.0, if the results of on-going monitoring indicate they are needed to further reduce risk from groundwater discharges.

6.0 IMPLEMENTATION SCHEDULE

The implementation schedule for the remedial actions described in Section 4 will be integrated with the schedule for and construction of the new landfill and the CCR Treatment area, as well as for the Auxiliary Pond operation. The schedule for each of the IRMs and the monitoring is summarized below.

6.1 GYPSUM PROCESSING PLANT

The IRM described for the Gypsum Processing Plant (lining of the Gypsum Pond and associated drainage area) was completed in May 2014.

6.2 WEST QUARRY

The IRM for the West Quarry involves filling, grading and covering. It is anticipated the design for the planned fill will be completed by mid-2016. Filling will proceed concurrently with construction of Phase 1 of the new landfill, and will be completed as the available fill material is freed up from various stockpiles during construction. It is anticipated that filling and revegetation of the West Quarry area will be completed by late 2016.

6.3 AUXILIARY POND DISCHARGE PIPELINE

The IRM for the Auxiliary Pond discharge pipeline will involve repairing or replacing the manholes and sections of the line. KU is still evaluating alternatives, and anticipates the design for the new pipeline will be completed by the end of June 2015. It is anticipated that the new pipeline will be constructed and in operation within a year, by the end of June 2016.

6.4 MAIN POND

6.4.1 Capping of Existing CCR

A Closure Plan for the Main Pond has been previously submitted (AMEC, April 2014), and provides an overview of how the Main Pond capping will be integrated with construction of the new landfill. According to the schedule proposed in that plan, the following activities will be completed by December 2016:

- Completion of the cover (landfill geomembrane liner) over the Phase 1 area (southern 1/3 of the permitted area for the landfill).
- Completion of the three lined ponds (two for stormwater, one for leachate, in eastern portion of the permitted area, east of the fill).
- Start of construction of the Phase 2 cover (landfill geomembrane liner over middle 1/3 of permitted area).

- Placement of 12-inch interim soil cap over Phase 3 (northern 1/3 of permitted area).
- Hardscaping of the CCR Treatment Area; and paving of the internal roadways between the landfill and the ponds.

By the end of 2016, it is anticipated that the surface of the entire Main Pond area will be graded and covered, so that future infiltration into existing CCR will be minimized.

6.4.2 Abutment Drain Collection

Interception and collection of the flow from the North Abutment Drain on the east embankment of the Main Pond was completed in July 2014. That flow is currently being transferred to the Auxiliary Pond via a pumping station.

Monitoring of the South Abutment Drain seep will continue, along with the nearby springs in the Main Pond outfall ditch (Ditch Spring CH-044, and Beaver Dam Cave CH-045), in order to evaluate if concentrations in the South Abutment Drain seep will attenuate over time, or if interception of that flow may be warranted in the future.

6.4.3 Toe Drain Collection

The toe drain system will consist of a cutoff wall across the valley at the toe of the Main Pond eastern embankment, with a collection and pumping system to transfer all or part of the water that flows into this area to the Auxiliary Pond. Design and permitting are underway, and construction of the wall is planned for winter 2015. Full capture of the toe drain discharges is anticipated to be completed by August 2015.

6.5 MONITORING

The results of the most recent studies and sampling performed in 2014 will be summarized in the GWAR Update, planned for submittal to the DWM by the end of April 2015.

Routine groundwater monitoring will begin at a quarterly frequency in the first quarter of 2015, including the monitoring points and parameters specified above in Section 5.1. Results will be reported semi-annually, within 60 days from the end of the second and fourth quarters.

In addition to the revised groundwater monitoring program, KU will install, monitor, and survey a series of permanent monuments along the lowest bench of the former ash pond dam face (at approximate elevation 800 feet NGVD) to evaluate potential vertical and horizontal movements. The condition of the monuments will be regularly evaluated and the monuments will be surveyed quarterly by a KY-registered professional land surveyor as part of the company's program to evaluate and track berm integrity. Monitoring will be performed and reported to DWM for the duration of the operation of the cutoff wall/toe drain collection system or until remedial measures are completed.

- Placement of 12-inch interim soil cap over Phase 3 (northern 1/3 of permitted area).
- Hardscaping of the CCR Treatment Area; and paving of the internal roadways between the landfill and the ponds.

By the end of 2016, it is anticipated that the surface of the entire Main Pond area will be graded and covered, so that future infiltration into existing CCR will be minimized.

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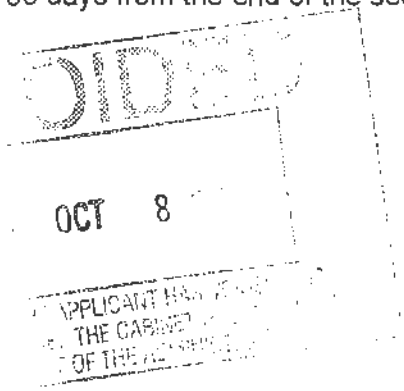


7.0 REFERENCES

AMEC, 2013. *Groundwater Assessment Report, E.W. Brown Generating Station* (GWAR). Report prepared for KU. September 13, 2013.

AMEC, 2014. *Main Ash Pond Closure Plan, E.W. Brown Generating Station* (GWAR). Report prepared for KU. April 25, 2014.

Cressman, E.R. and S.V. Hrabar, 1970. *Geologic Map of the Wilmore Quadrangle, Central, Kentucky.* USGS Geologic Quadrangle Maps of the United States (7.5 Minute, 1:24,000), GQ-847.

Huff, Floyd A. and James R. Angel, 1992. *Rainfall Frequency Atlas of the Midwest.* Midwestern Climate Center and Illinois State Water Survey, Bulletin 71 (MCC Research Report 92-03).

Kentucky Climate Center, 2013. http://www.kyclimate.org/index.html.

Kentucky Mesonet, 2013. http://kymesonet.org/index.html

McDowell, Robert C., ed., 1986. *The Geology of Kentucky – A Text to Accompany the Geologic Map of Kentucky.* USGS Professional Paper 1151-H, Online Version 1.0 available at: http://pubs.usgs.gov/pp/p1151h/contents.html.

Palmquist, W.N., Jr. and F.R. Hall, 1961. *Reconnaissance of Ground-Water Resources in the Blue Grass Region, Kentucky.* USGS, Water-Supply Paper 1533, 39 p.

Sprinkle, C. L., R.W. Davis, and D.S. Mull, 1983. *Evaluation of Ground-Water Quality Data from Kentucky.* USGS Water-Resource Investigation Report 83-4240, 65 p.

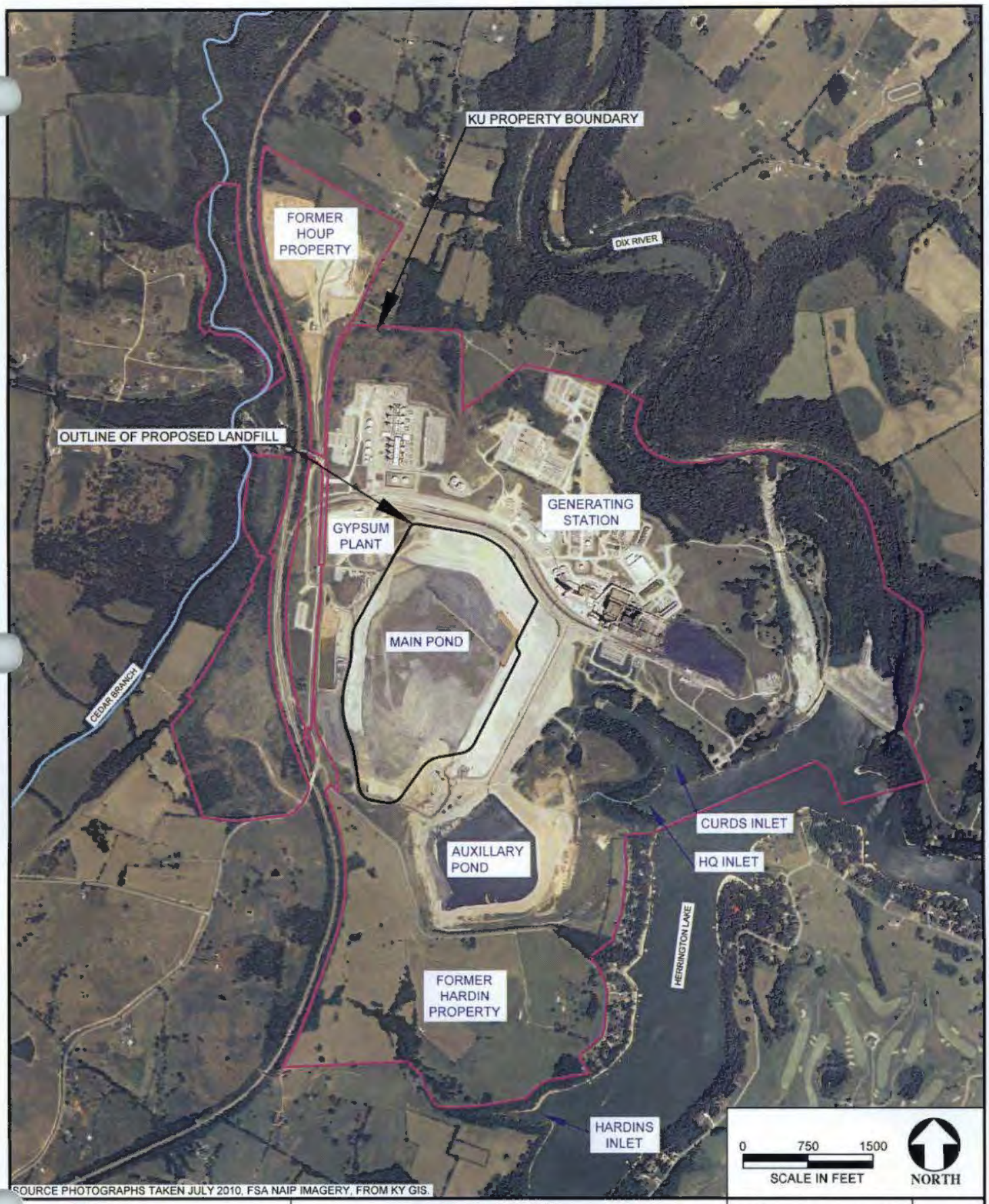
Thrailkill, John, and others, 1982. *Groundwater in the Inner Bluegrass Karst Region.* University of Kentucky Water Resources Research Institute, Research Report No. 136.

Third Rock Consultants, LLC, 2009. *Watershed Monitoring Report, Dix River Watershed, Mercer, Casey, Boyle, Lincoln, Garrard, and Rockcastle Counties, Kentucky.* Report prepared for Kentucky Division of Water. Revised July 15, 2009.

U.S. Department of Agriculture, Soil Conservation Service (USDA-SCS), 1983. *Soil Survey of Boyle and Mercer Counties, Kentucky.* 149 p.

USEPA, 1977. *National Eutrophication Survey, Herrington Lake, Boyle, Garrard and Mercer Counties, Kentucky.* USEPA Working Paper No. 353, 21 p. June 1977.

FIGURES



SOURCE PHOTOGRAPHS TAKEN JULY 2010, FSA NAIP IMAGERY, FROM KY GIS.

amec foster wheeler
Environment & Infrastructure, Inc.
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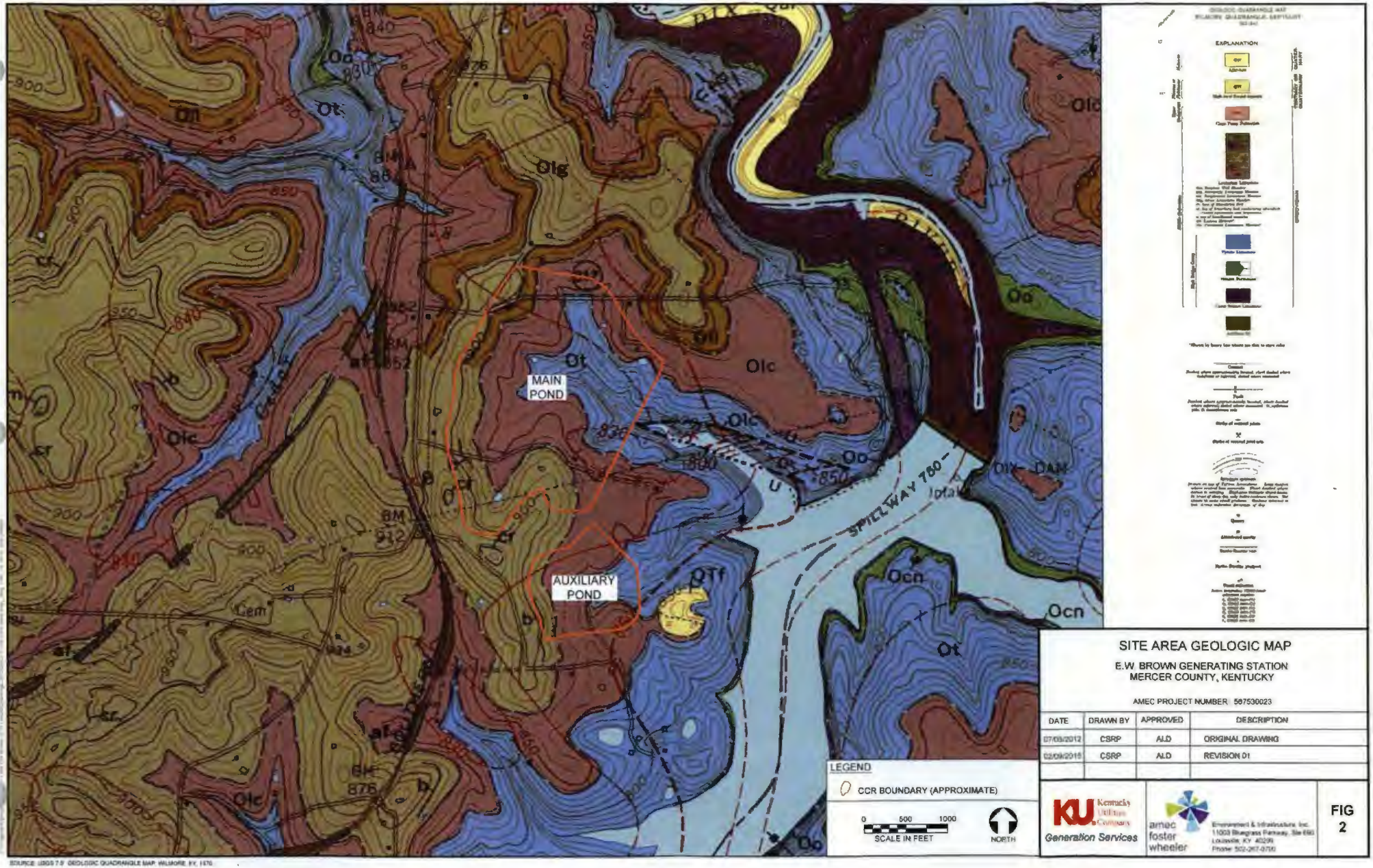
SITE LAYOUT

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY 40330

PROJECT NUMBER: 567530023

SCALE	1" = 1500'
DATE	01/21/2015
DRAWN BY	CSRP
APPROVED BY	ALD

FIG. 1



SITE AREA GEOLOGIC MAP

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY

AMEC PROJECT NUMBER: 587530023

DATE	DRAWN BY	APPROVED	DESCRIPTION
07/09/2012	CSRP	ALD	ORIGINAL DRAWING
12/09/2015	CSRP	ALD	REVISION 01

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Generation Services

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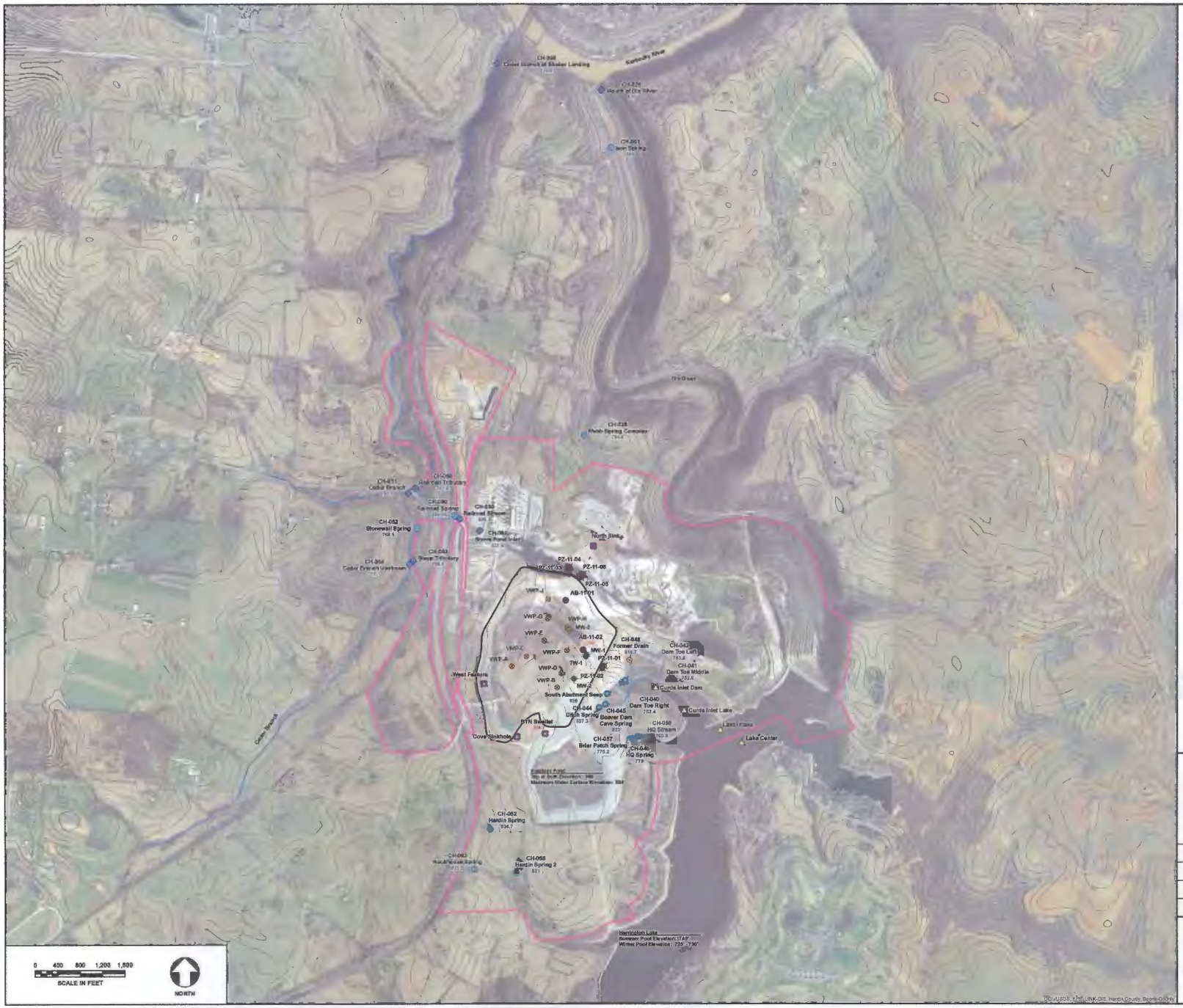
FIG 2

SOURCE: USGS 7.5' GEOLOGIC QUADRANGLE MAP, WILMORE, KY, 1970.

PLATES



Legend

- PROPOSED LANDFILL WASTE BOUNDARY
- KU PROPERTY BOUNDARY
- STREAM / DITCH (INTERMITTENT)
- STREAM / DITCH (PERENNIAL)

MONITORING POINTS AND INVENTORIED SPRINGS

- CCR MONITORING WELL
- CCR TEST WELL
- PIEZOMETER
- VIBRATING WIRE PIEZOMETER
- DRAIN PIPE
- SPRING / SEEP
- SURFACE WATER (STREAM)
- SURFACE WATER (LAKE)
- BORING / TEMPORARY PIEZOMETER
- SINKHOLE / SWALLET
- ELEVATION CONTOUR, IN FEET NGVD29 (MSL)
  CONTOUR INTERVAL: 20 FEET
  SOURCE: USGS National Elevation Dataset (2002)

7/30/15

6/5/2015

HYDROGEOLOGIC STUDY LOCATIONS

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY
PROJECT NUMBER: 567530023

RECEIVED
JUN 19 2015
DIVISION OF WATER MANAGEMENT
SOLID WASTE BRANCH

DATE	DRAWN BY	APPROVED	DESCRIPTION
12/4/2014	TMR	ALD	ORIGINAL DRAWING
12/17/2014	TMR	ALD	UPDATE
8/8/2015	TMR	ALD	UPDATE

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Generation Services

amec foster wheeler
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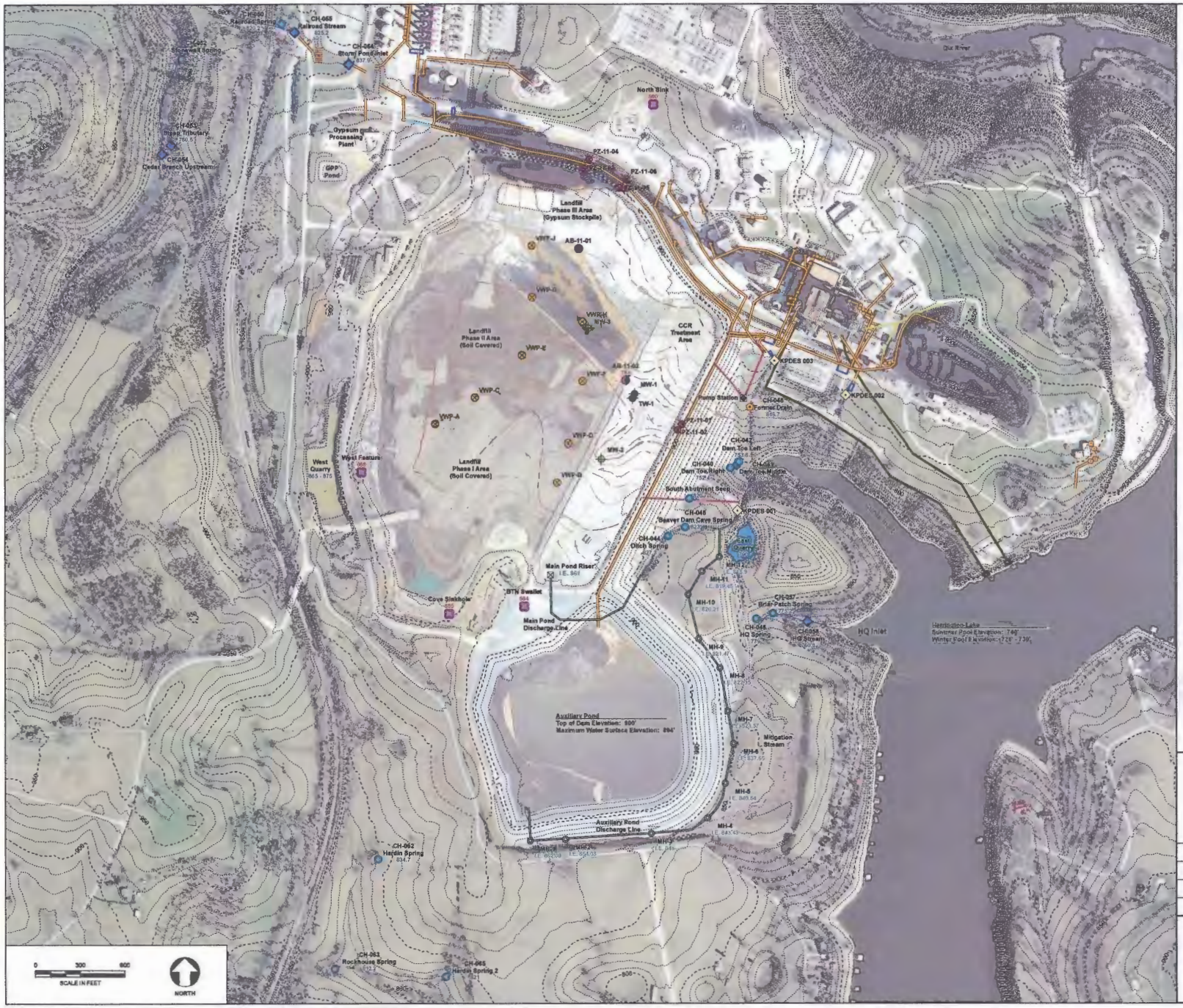
Suite 690
Louisville, KY 40299
Phone: 502-267-0700

PLATE 1

SOURCE: KENTUCKY AERIAL PHOTOGRAPHY & ELEVATION DATA PROGRAM, DATE OF PHOTOGRAPHY: OCTOBER 2012; USDA NAIP, DATE OF PHOTOGRAPHY: 2006



SOURCE: KENTUCKY AERIAL PHOTOGRAPHY & ELEVATION DATA PROGRAM; DATE OF PHOTOGRAPHY: OCTOBER 2012

LEGEND

- VIBRATING WIRE PIEZOMETER

MONITORING POINTS AND INVENTORIED SPRINGS

- CCR TEST WELL - 2 INCH (2014)
- CCR TEST WELL - 4 INCH (2014)
- PIEZOMETER
- DRAIN PIPE
- KPDES OUTFALL
- SPRING / SEEP
- SURFACE WATER (STREAM)
- BORING / TEMPORARY PIEZOMETER
- SINKHOLE / SWALLET USED FOR DYE INJECTION
- PUMP STATION
- MAIN POND RISER
- MANHOLE
- POND UNDERGROUND DISCHARGE LINE
- ESTIMATED STORM SEWER
- INTAKE
- OIL WATER SEPARATOR
- SANITARY SEWER
- STORM SEWER
- TURBINE SEWER
- UNDERGROUND PIPE
- ABUTMENT DRAIN
- STREAM / DITCH (INTERMITTENT)
- STREAM / DITCH (PERENNIAL)
- 684 DYE INJECTION ELEVATION, IN FEET NAVD88 (2011-2012)
- 827 APPROXIMATE WATER LEVEL ELEVATION, IN FEET NAVD88
- I.E. 861 INVERT ELEVATION, IN FEET NAVD88

ELEVATION CONTOURS, IN FEET NAVD88
CONTOUR INTERVAL: 10 FEET
SOURCE: Kentucky Aerial Photography and Elevation Dataset (2012)

- INTERMEDIATE CONTOUR
- INDEX CONTOUR (LABELED)

ORIGINAL TOPOGRAPHIC ELEVATION CONTOURS FOR THE MAIN CCR POND, IN FEET NGVD29 (MSL)
CONTOUR INTERVAL: 10 FEET
SOURCE: USGS National Elevation Dataset (2002)

- INTERMEDIATE CONTOUR
- INDEX CONTOUR (LABELED)

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JUN 19 2015
DIVISION OF WASTE MANAGEMENT SOLID WASTE BRANCH

DRAINAGE MAP
VICINITY OF CCR PONDS

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY

PROJECT NUMBER: 567530023

DATE	DRAWN BY	APPROVED	DESCRIPTION
7/23/2014	TMR	ALD	ORIGINAL DRAWING
1/21/2014	TMR	ALD	UPDATE
6/8/2015	TMR	ALD	UPDATE

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Suite 690
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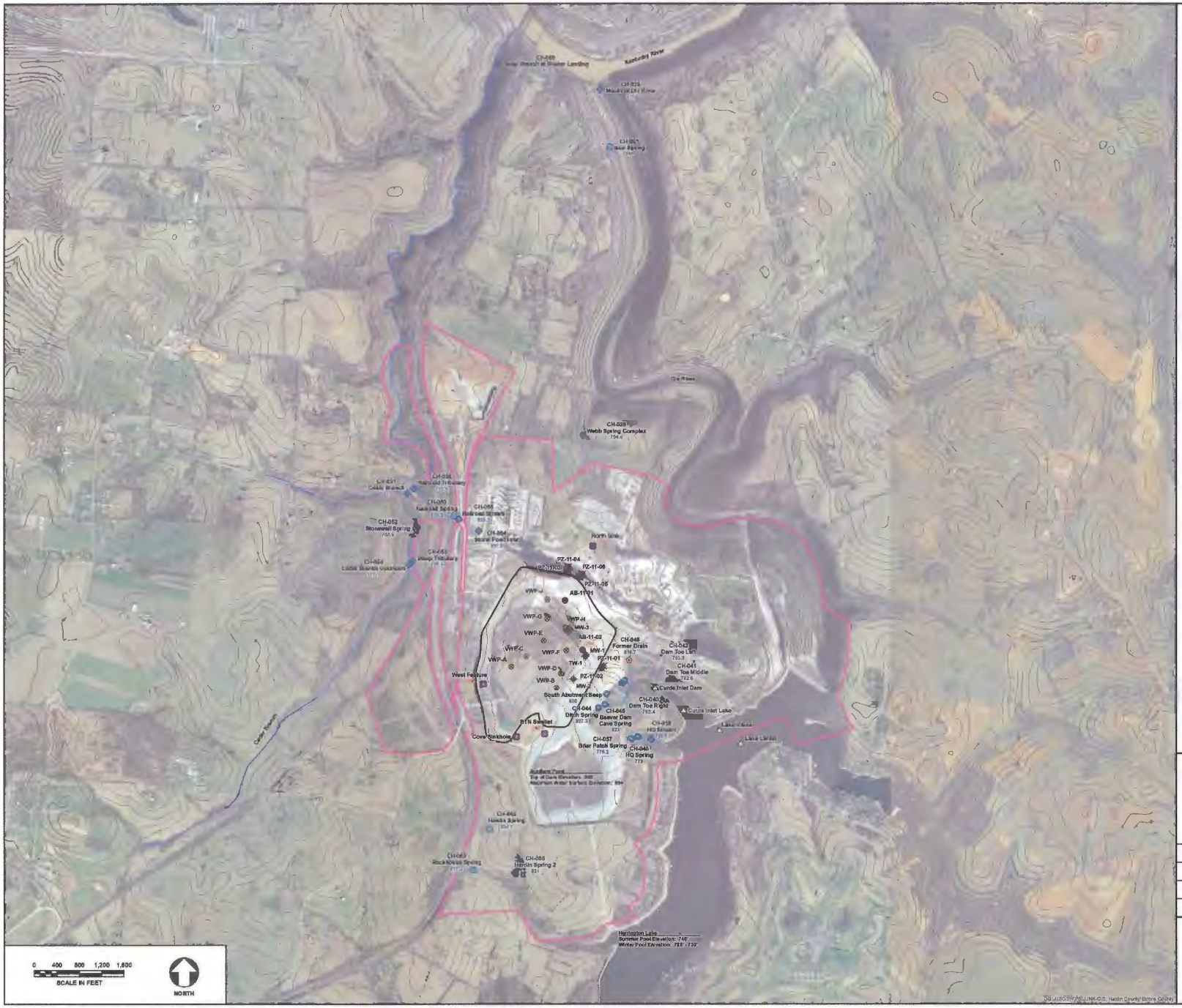
PLATE 2



Legend

- PROPOSED LANDFILL WASTE BOUNDARY
- KU PROPERTY BOUNDARY
- STREAM / DITCH (INTERMITTENT)
- STREAM / DITCH (PERENNIAL)

MONITORING POINTS AND INVENTORIED SPRINGS

- CCR MONITORING WELL
- CCR TEST WELL
- PIEZOMETER
- VIBRATING WIRE PIEZOMETER
- DRAIN PIPE
- SPRING / SEEP
- SURFACE WATER (STREAM)
- SURFACE WATER (LAKE)
- BORING / TEMPORARY PIEZOMETER
- SINKHOLE / SWALLET
- ELEVATION CONTOUR, IN FEET NAVD88
  CONTOUR INTERVAL: 20 FEET
  SOURCE: USGS National Elevation Dataset (2002)

VOIDED
JUN 19 2015

RECEIVED
MAR 11 2015
DIVISION OF WASTE MANAGEMENT
SOLID WASTE BRANCH

HYDROGEOLOGIC STUDY LOCATIONS

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY

AMEC PROJECT NUMBER: 3143101364

DATE	DRAWN BY	APPROVED	DESCRIPTION
12/4/2014	TMR	ALD	ORIGINAL DRAWING
12/17/2014	TMR	ALD	UPDATE
1/21/2015	TMR	ALD	UPDATE

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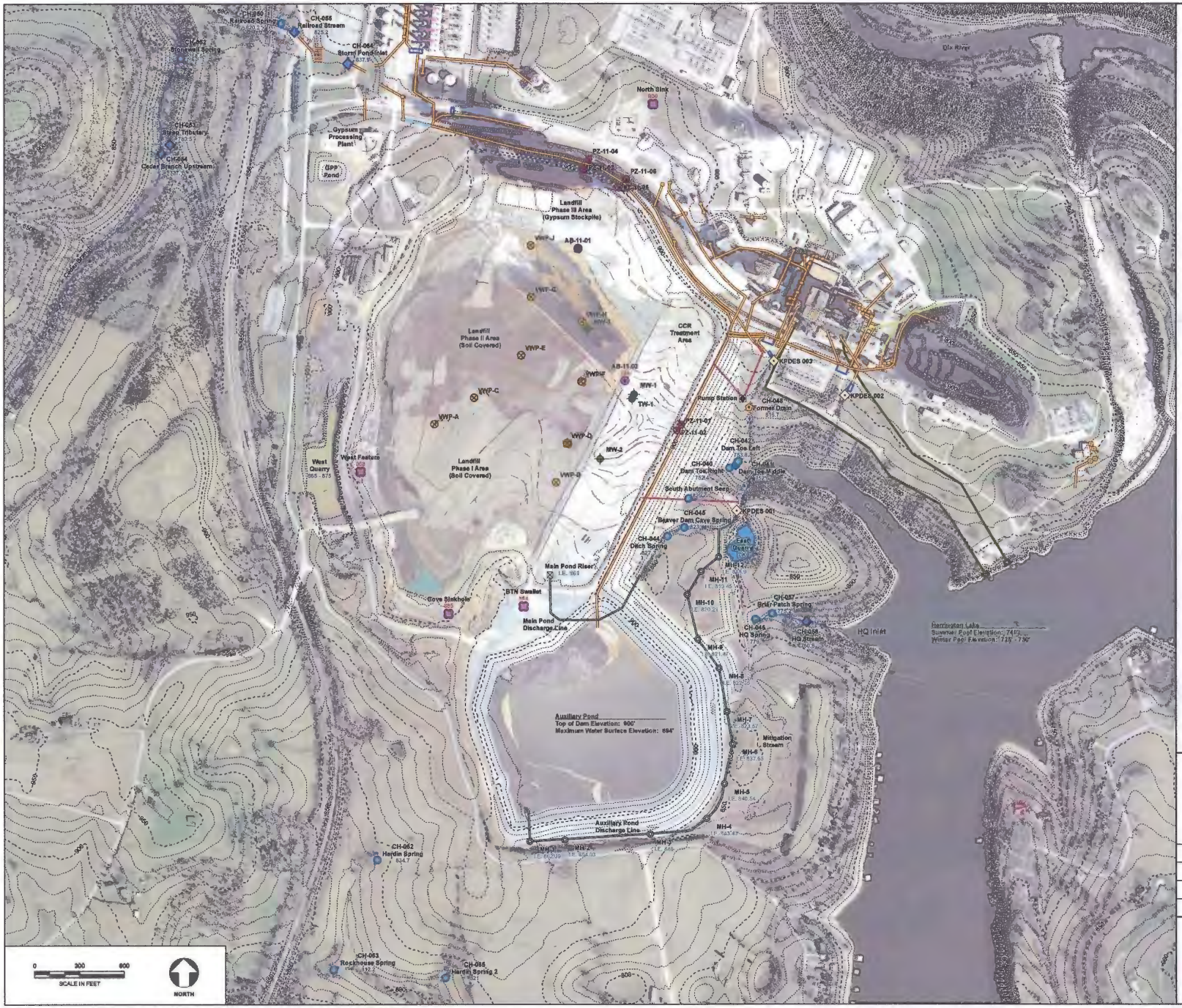
PLATE 1

SOURCE: KENTUCKY AERIAL PHOTOGRAPHY & ELEVATION DATA PROGRAM, DATE OF PHOTOGRAPHY: OCTOBER 2012; USDA NAIP, DATE OF PHOTOGRAPHY: 2006



LEGEND

- VIBRATING WIRE PIEZOMETER

MONITORING POINTS AND INVENTORIED SPRINGS

- CCR TEST WELL - 2 INCH (2014)
- CCR TEST WELL - 4 INCH (2014)
- PIEZOMETER
- DRAIN PIPE
- KPDES OUTFALL
- SPRING / SEEP
- SURFACE WATER (STREAM)
- BORING / TEMPORARY PIEZOMETER
- SINKHOLE / SWALLET USED FOR DYE INJECTION
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- INTAKE
- OIL WATER SEPARATOR
- SANITARY SEWER
- STORM SEWER
- TURBINE SEWER
- UNDERGROUND PIPE
- ABUTMENT DRAIN
- STREAM / DITCH (INTERMITTENT)
- STREAM / DITCH (PERENNIAL)

864 DYE INJECTION ELEVATION, IN FEET NAVD88 (2011-2012)

827 APPROXIMATE WATER LEVEL ELEVATION, IN FEET NAVD88

I.E. 861 INVERT ELEVATION, IN FEET NAVD88

ELEVATION CONTOURS, IN FEET NAVD88
CONTOUR INTERVAL: 10 FEET
SOURCE: Kentucky Aerial Photography and Elevation Dataset (2012)

- INTERMEDIATE CONTOUR
- INDEX CONTOUR (LABELED)

ORIGINAL TOPOGRAPHIC ELEVATION CONTOURS FOR THE MAIN CCR POND, IN FEET NGVD29 (MSL)
CONTOUR INTERVAL: 10 FEET
SOURCE: USGS National Elevation Dataset (2002)

- INTERMEDIATE CONTOUR
- INDEX CONTOUR (LABELED)

RECEIVED
MAR 11 2015
DIVISION OF WASTE MANAGEMENT
SOLID WASTE BRANCH

VOIDED
JUN 19 2015

DRAINAGE MAP
VICINITY OF CCR PONDS

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY
AMEC PROJECT NUMBER: 567530023

DATE	DRAWN BY	APPROVED	DESCRIPTION
7/23/2014	TMR	ALD	ORIGINAL DRAWING
1/21/2014	TMR	ALD	UPDATE
2/19/2014	TMR	ALD	UPDATE

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PLATE 2

SOURCE: KENTUCKY AERIAL PHOTOGRAPHY & ELEVATION DATA PROGRAM; DATE OF PHOTOGRAPHY: OCTOBER 2012

APPENDICES

APPENDIX A

GPP LINER INSTALLATION

SOURCE PHOTOGRAPHS TAKEN 10-09-2013. IMAGERY FROM GOOGLE PRO.

0 65 130
SCALE IN FEET

NORTH

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GYPSUM PROCESSING PLANT
BEFORE INTERIM REMEDIAL ACTION

E.W. BROWN GENERATING STATION
MERCER COUNTY, KENTUCKY 40330

PROJECT NUMBER: 567530023

SCALE	1" = 130'
DATE	01/21/2015
DRAWN BY	CSRP
APPROVED BY	ALD

FIG. A-1

PHOTO 1:

Original gypsum pond, being pumped down prior to lining.

PHOTO 2:

Cushion geotextile is laid across graded surface of pond and in drying area to the north.

PHOTO 3:

Black LLDPE membrane liner is placed over cushion geotextile.

PHOTO 4:

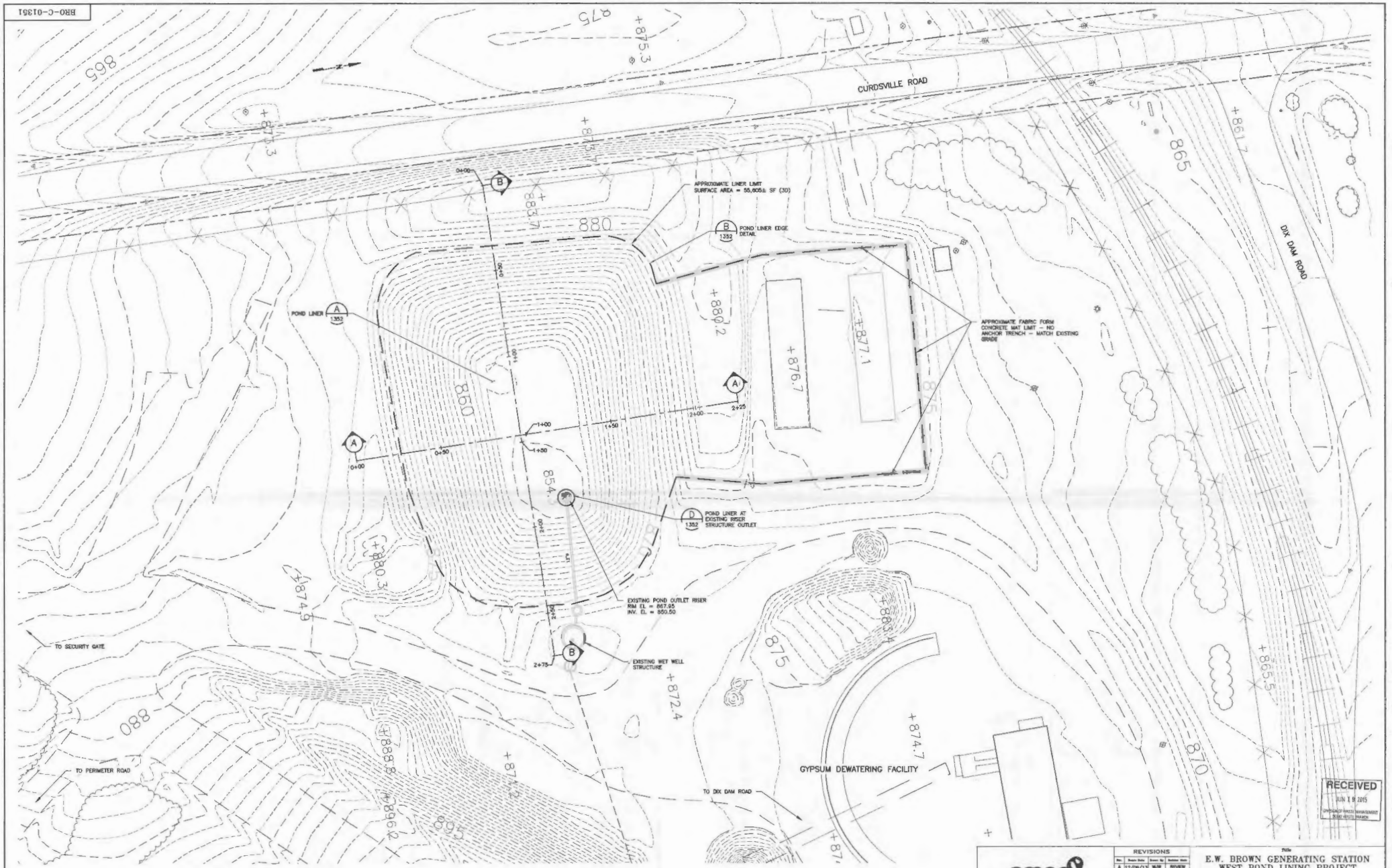
Liner extends past the edges of the pond, under dewatering area to the north.

PHOTO 5:

Another layer of cushion geotextile is placed above liner.

PHOTO 6:

Fabric form concrete mats are used to protect exposed liner under pond and in gypsum drying area.



BRO-C-01351

RECEIVED
JUN 18 2015

NOTE:
SEE DRAWING 01353 FOR NOTES AND SPECIFICATIONS.

0 10 20 40
SCALE IN FEET

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Phone: (502) 267-0700 Fax: (502) 267-5900

Rev.	Issue Date	Issue By	Revision Note
A	12/09/13	WJW	REVIEW
B	12/10/13	WJW	CLIENT
C	4/01/14	WJW	CLIENT

Title
E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
SITE PLAN

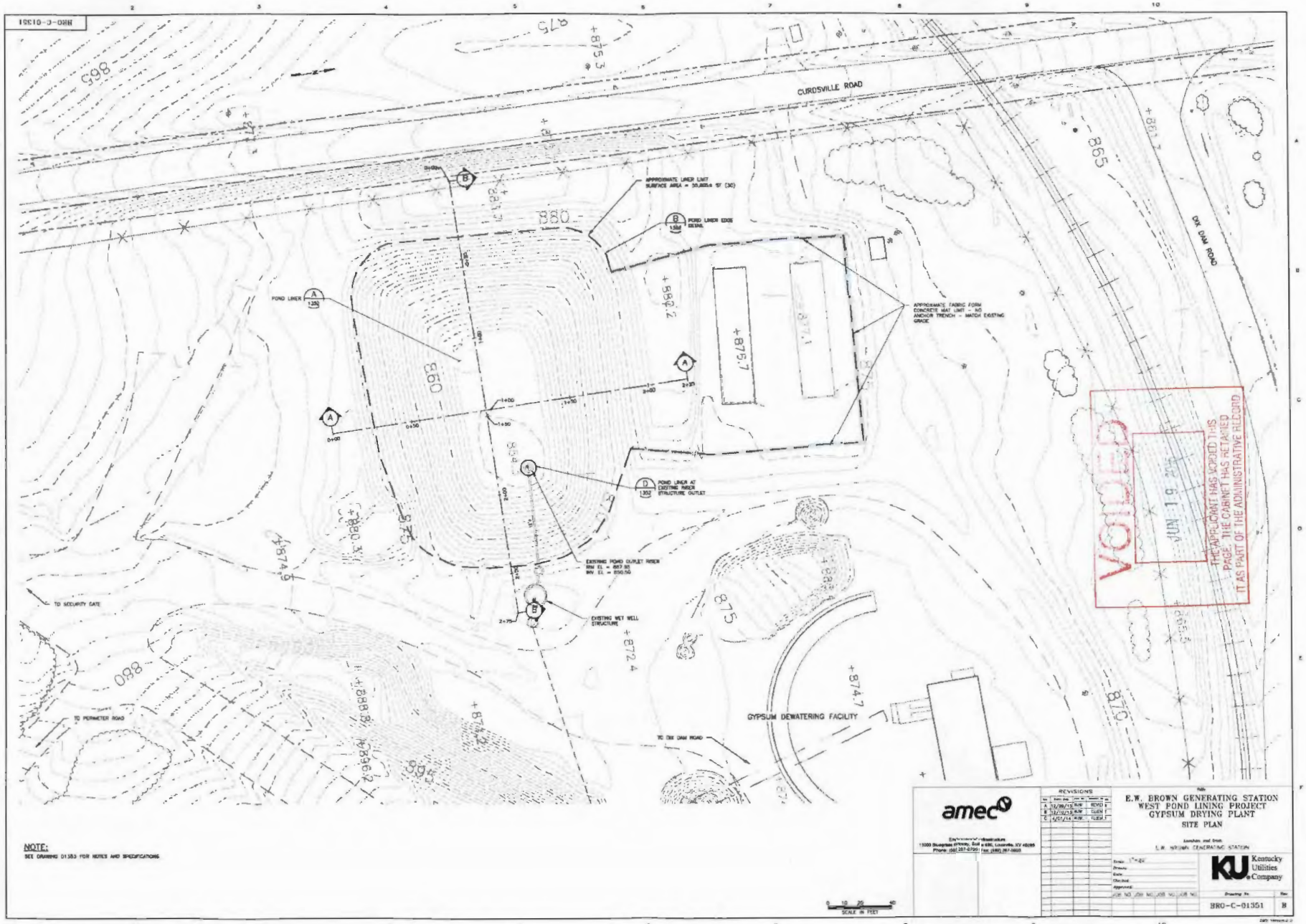
Location and Limit:
E.W. BROWN GENERATING STATION

Scale: 1"=20'
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO. JOB NO.

Kentucky Utilities Company

Drawing No: BRO-C-01351
Rev. B

DGT Version 2.0



NOTE:
SEE DRAWING 01353 FOR NOTES AND SPECIFICATIONS

amec

REVISIONS

A	12/09/13	R/W	REVD F
B	12/16/13	R/W	CLEAR F
C	4/01/14	R/W	CLEAR F

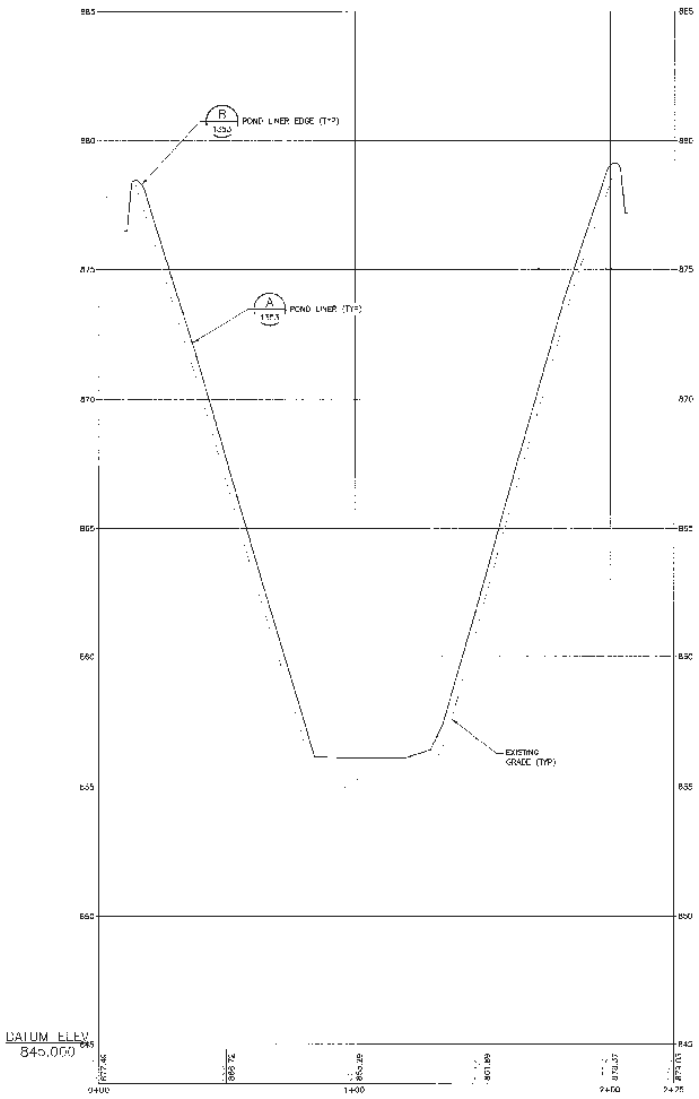
E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
SITE PLAN

Location and Drawn
E.W. BROWN GENERATING STATION

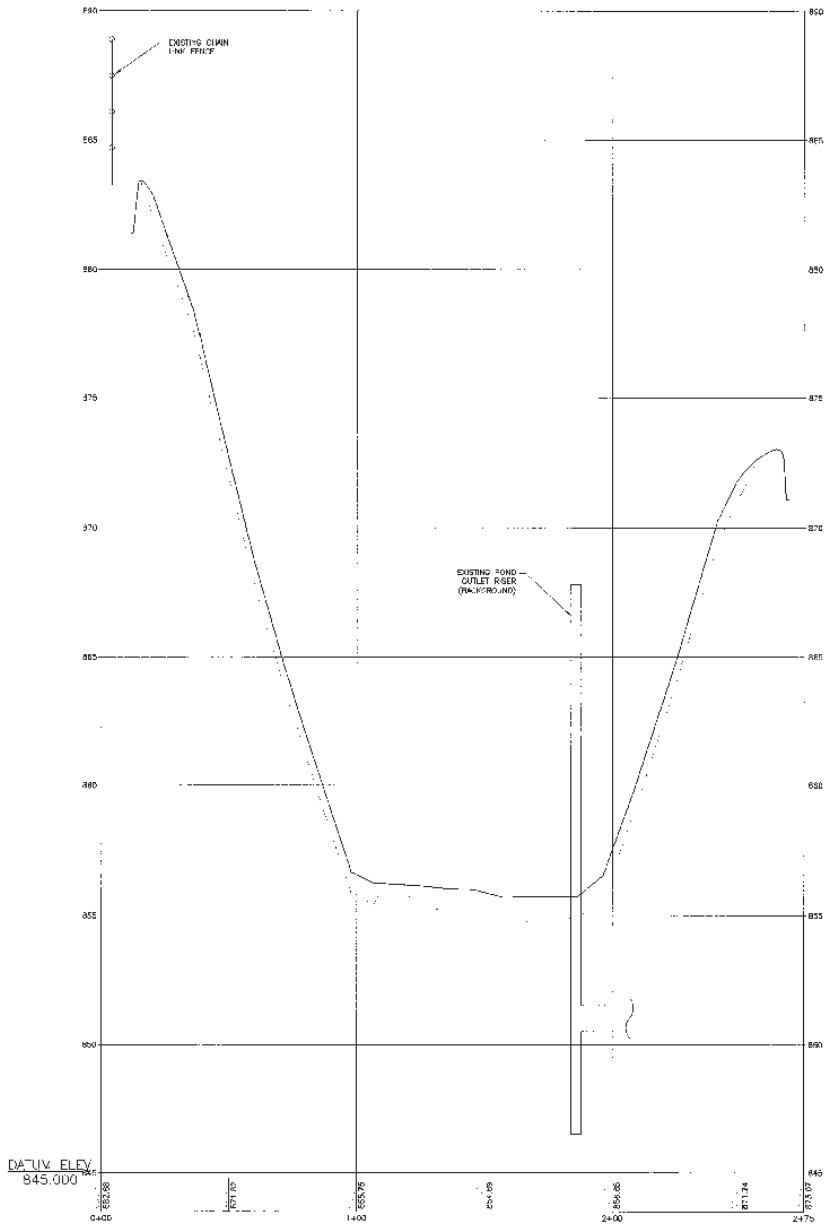
Kentucky Utilities Company

Drawing No. BRO-C-01351 Rev. B

BRO-C-01352



SECTION A



SECTION B

RECEIVED
JUN 18 2015

NOTE:
SEE DRAWING 01253 FOR NOTES AND SPECIFICATIONS.

0 10 20 40
SCALE IN FEET
(HORIZONTAL)

0 5 10
SCALE IN FEET
(VERTICAL)

amec

Environment & Infrastructure
1905 Bellingrath Parkway, Suite 100, Louisville, KY 40213
Phone: (502) 267-6700 Fax: (502) 267-6250

REVISIONS			
No.	DATE	BY	APPROVED
A	12/04/14	MW	MWM
B	12/18/14	MW	CLIENT

Title
E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
SECTIONS

Location and Unit
E.W. BROWN GENERATING STATION

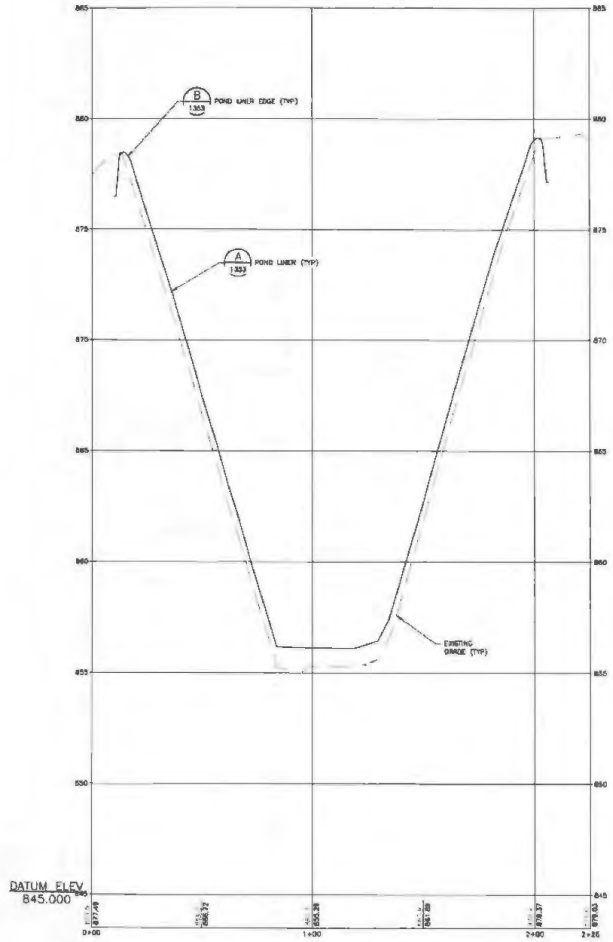
Kentucky Utilities Company

Scale AS SHOWN
Drawn
Date
Checked
Approved
JOB NO. JOB NO. JOB NO. JOB NO.

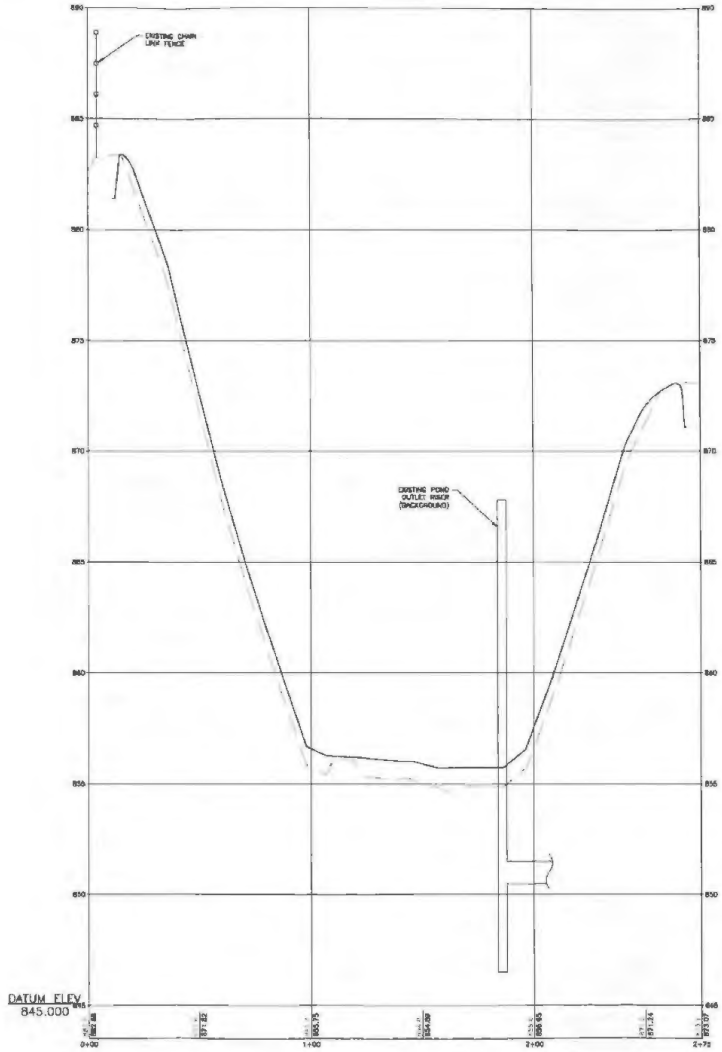
Drawing No. BRO-C-01352 Rev. B

AMEC Revision 2.0

BRO-C-01352



SECTION A



SECTION B

NOTE:
SEE DRAWING 01353 FOR NOTES AND SPECIFICATIONS

SCALE IN FEET (HORIZONTAL)

SCALE IN FEET (VERTICAL)

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Environment & Infrastructure
11000 Bluegrass Parkway, Suite 500, Louisville, KY 40299
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REVISIONS

A	12/19/12	KJW	REVIEW
B	12/21/12	KJW	CLIENT

E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
SECTIONS

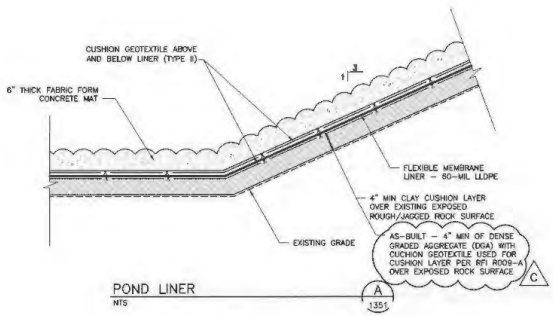
E.W. BROWN GENERATING STATION

Scale: AS SHOWN
Drawn:
Date:
Checked:
Approved:

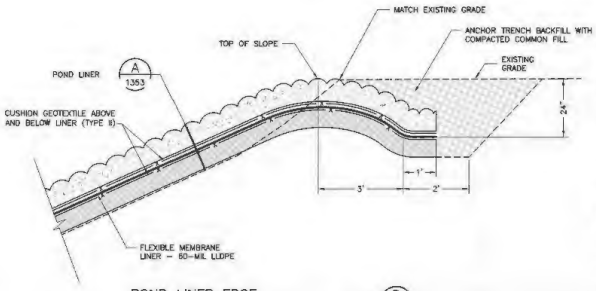
Kentucky Utilities Company

JOB NO.	ADM NO.	LOA NO.	CCB NO.	Drawing No.	Rev.
				BRO-C-01352	B

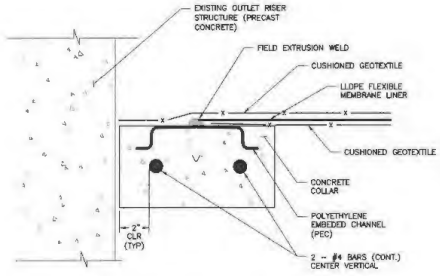
BRO-C-01353



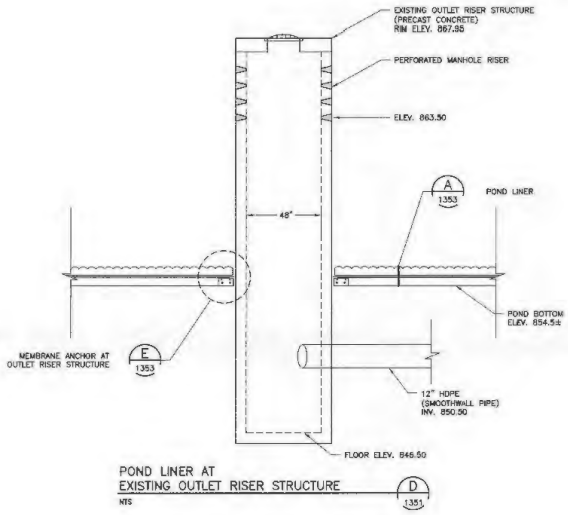
POND LINER
NTS



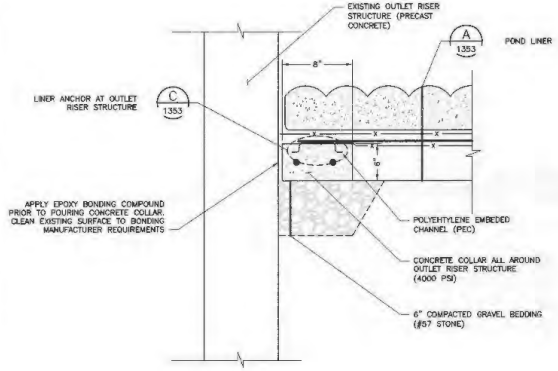
POND LINER EDGE
NTS
B 1351



LINER ANCHOR AT
OUTLET RISER STRUCTURE
NTS
C 1353



POND LINER AT
EXISTING OUTLET RISER STRUCTURE
NTS
D 1351



MEMBRANE ANCHOR AT
EXISTING OUTLET RISER STRUCTURE
NTS
E 1353

NOTES AND SPECIFICATIONS:

GENERAL NOTES:

1. BASE MAP IS BASED ON AN AERIAL TOPOGRAPHIC SURVEY PERFORMED BY GRW AERIAL SURVEYS OF LEXINGTON, KY, ON OCTOBER 15, 2011.

2. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO START OF CONSTRUCTION ACTIVITIES AND PRIOR TO PURCHASING, OBTAINING AND/OR FABRICATING MATERIALS FOR THE NEW WORK.

3. THROUGHOUT THE WORK ACTIVITIES, THE CONTRACTOR SHALL CONDUCT THE WORK THAT ALLOWS OPERATIONS OF THE EXISTING GYPSUM DRYING PLANT TO BE MAINTAINED EXCEPT AS APPROVED BY THE OWNER. THE CONTRACTOR SHALL ALSO MAINTAIN TRAFFIC ON PUBLIC ROADS AND IS RESPONSIBLE FOR PROVIDING ALL NECESSARY TRAFFIC CONTROLS, INCLUDING SIGNAGE, WARNING BARRIERS, AND FLAGGERS.

4. THE CONTRACTOR IS RESPONSIBLE PROPER LAYOUT FOR THE WORK. PROVIDE SURVEY CONTROL AND IDENTIFY REQUIRED LINES, LEVELS, CONTOURS, AND DATUM.

5. THE CONTRACTOR WILL VERIFY THE LOCATION OF ALL EXISTING UTILITIES OR STRUCTURES WITHIN THE LIMITS OF WORK PRIOR TO CONDUCTING CONSTRUCTION ACTIVITIES.

6. OWNER SUPPLIED MATERIALS INCLUDE THE FLEXIBLE MEMBRANE LINER (TEXTURED 60 MIL LINEAR LOW DENSITY POLYETHYLENE (LLDPE)) AND THE CUSHION GEOTEXTILE (16 OUNCE GEOTEXTILE). ALSO, SOIL/CLAY MATERIAL REQUIRED FOR LINER SYSTEM SUBGRADE PREPARATION OVER EXPOSED ROCK SURFACES SHALL BE PROVIDED FROM AN ONSITE STOCKPILE DESIGNATED BY THE OWNER. AS-BUILT – CONTRACTOR SUPPLIED DENSE GRADED AGGREGATE (DGA) WITH CUSHION GEOTEXTILE USED FOR LINER SYSTEM SUBGRADE.

EARTHWORK:

1. EARTHWORK MATERIALS:

– COMMON FILL: REUSE SUITABLE EXCAVATED MATERIAL TO EXTENT PRACTICAL. COMMON FILL SHALL CONSIST OF SOIL/CLAY SUITABLE FOR NORMAL EMBANKMENT CONSTRUCTION. IT SHALL BE FREE FROM FROZEN MATERIALS, PERISHABLE RUBBISH, PEAT, AND OTHER UNSATISFACTORY SOILS/MATERIALS. IT SHALL BE OF SUCH A NATURE AND CHARACTER THAT IT CAN BE COMPACTED TO A FIRM UNYIELDING SURFACE. WHEN PLACED AS SUBGRADE FILL OVER EXPOSED ROCK SURFACES BELOW THE FLEXIBLE MEMBRANE LINER, COMMON FILL SHALL HAVE A MAXIMUM NOMINAL PARTICLE SIZE OF 1– INCH OR LESS ON THE SURFACE OF THE PREPARED SUBGRADE.

2. EXCAVATION:

– EXCAVATE TO LINES AND GRADES INDICATED ON THE CONSTRUCTION DRAWINGS. IF REQUIRED, THE CONTRACTOR MAY MAKE FIELD ADJUSTMENTS WITH THE OWNER'S CONCURRENCE TO THE LINES AND GRADES IF REQUIRED FOR ACTUAL PROJECT SITE CONDITIONS.

– MAINTAIN EXCAVATIONS IN A SAFE CONDITION UNTIL COMPLETION OF CONCRETE CURING AND BACKFILLING OF STRUCTURE OR AS DIRECTED BY THE OWNER.

– UNIFORMLY EXCAVATE AND SHAPE THE SUBGRADE FOR THE LINER TRENCH TO THE DEPTH AND WIDTH INDICATED ON THE CONSTRUCTION DRAWINGS. REMOVE WATER OR MATERIALS THAT INTERFERE WITH WORK.

4. SUBGRADE PREPARATION AND BACKFILL:

– LINER SYSTEM SUBGRADE SHALL BE UNIFORMLY GRADED AND PROOF–ROLLED TO A SMOOTH FIRM SURFACE. FOR AREAS WITH EXPOSED ROCK SURFACES, A MINIMUM 4–INCH LAYER OF SOIL/CLAY COMMON FILL SHALL BE PLACED AND COMPACTED.

– PRIOR TO LINER SYSTEM PLACEMENT, INSPECT THE SUBGRADE FOR EXPOSED ROCK, STONES, AND SOFT AREAS. AND EXCAVATE UNSATISFACTORY MATERIAL AS DIRECTED BY THE OWNER AND BACKFILL WITH SUITABLE COMMON FILL MATERIAL. COMPACT THE FINAL SUBGRADE TO PROVIDE A FIRM UNYIELDING SURFACE.

– UNLESS OTHERWISE NOTED OR DIRECTED, PLACE ALL BACKFILL AND SUBRADE PREPARATION MATERIALS IN LIFTS HAVING A LOOSE THICKNESS SUCH WHEN COMPACTED, THE COMPACTED LIFT SHALL HAVE A NOMINAL THICKNESS OF 6 INCHES.

– REMOVE EXCESS EXCAVATED SOIL NOT INTENDED FOR REUSE AND PROPERLY DISPOSE ON–SITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER.

5. COMPACTION:

– CONDUCT SOIL COMPACTION DURING CONSTRUCTION TO ACHIEVE A FIRM UNYIELDING SURFACE FOR EACH BACKFILL LIFT.

– MAINTAIN PROPER MOISTURE CONTENT OF FILL MATERIALS TO ATTAIN REQUIRED COMPACTION PERFORMANCE.

6. FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION

– INSPECT FINAL PREPARED SUBGRADE SURFACE BELOW LINER SURFACE LIMITS FOR EXPOSED ROCK AND STONES/PARTICLES LARGER THAN 1–INCH. FINAL LINER SYSTEM SUBRADE SHOULD BE PROOF–ROLLED TO A SMOOTH FIRM SURFACE. IN PLACE DENSITY TESTING IS NOT REQUIRED.

FABRIC FORM CONCRETE MAT:

1. FABRIC FORM CONCRETE MAT WILL BE PLACED ABOVE THE INSTALLED FLEXIBLE MEMBRANE LINER AND CUSHION GEOTEXTILE AS SHOWN ON THIS DRAWING.

2. FABRIC FORM MATERIAL:

– FABRIC FORMS SHALL CONSIST OF FACTORY ASSEMBLED PANELS MADE OF A DOUBLE–LAYER WOVEN FABRIC JOINED TOGETHER BY SPACED, INTERWOVEN CORDS OF UNIFORM LENGTH TO FORM A CONCRETE LINING WITH A FINISHED AVERAGE THICKNESS OF 8 INCHES.

– YARNS USED IN THE MANUFACTURE OF THE FABRIC SHALL BE COMPOSED OF NYLON AND/OR POLYESTER. FORMS SHALL BE WOVEN WITH A MINIMUM OF 50% TEXTURED YARNS (BY WEIGHT) TO IMPROVE ADHESION TO FINE AGGREGATE CONCRETE.

– FABRIC FORMS SHALL BE WOVEN IN SUCH A MANNER WITH NYLON SPACER CORDS TO PROVIDE POINTS OF ATTACHMENT ON SPECIFIC CENTERS. THE SPACER CORDS SHALL SERVE TO CONTROL THE THICKNESS OF THE REVETMENT WITHOUT BURSTING THE FABRIC DURING FINE AGGREGATE CONCRETE INJECTION.

– FABRIC FORMS SHALL CONSIST OF HYDROTEX™ UNIFORM SECTION US600 FORMS AS MANUFACTURED BY GEOSTAR CORPORATION, OR FABRIFORM® UNIMAT DESIGNATION STYLE 8" UMNN AS MANUFACTURED BY CONSTRUCTION TECHNIQUES, INC; OR AN OWNER APPROVED EQUIVALENT.

3. FINE AGGREGATE CONCRETE MIX:

– FINE AGGREGATE CONCRETE (GROUT) SHALL CONSIST OF A MIXTURE OF PORTLAND CEMENT, FINE AGGREGATE, AND WATER SO PROPORTIONED AND MIXED AS TO PROVIDE A READILY FLOWABLE GROUT. ADMIXTURES AND/OR A POZZOLAN MAY BE USED WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE. USE OF SUPER PLASTICIZERS REQUIRES SPECIAL PRECAUTIONS. SILICA FUME IS NOT RECOMMENDED. THE HARDENED FINE AGGREGATE CONCRETE SHALL EXHIBIT A COMPRESSIVE STRENGTH OF 2,500 PSI (17 MPA) AT 28 DAYS WHEN SPECIMENS ARE MADE AND TESTED ACCORDING TO THE PROVISIONS OF ASTM C–31 AND C–39. THE AVERAGE COMPRESSIVE STRENGTH OF FABRIC CAST TEST CYLINDERS, AS DESCRIBED IN PARAGRAPH 5 BELOW, SHALL BE AT LEAST 20% HIGHER AT 7 DAYS THAN THAT OF COMPANION TEST CYLINDERS MADE IN ACCORDANCE WITH ASTM C–31, AND NOT LESS THAN 3,000 PSI (21 MPA) AT 28 DAYS. AIR CONTENT OF FINE AGGREGATE MIX SHALL BE 6%±1.5% AND SHALL PROVIDE A FLOW RATE OF 8–12 FT/SEC.

– PORTLAND CEMENT SHALL CONFORM TO ASTM C 150, TYPE I OR TYPE II.

– FINE AGGREGATE SHALL CONFORM TO ASTM C 33, EXCEPT AS TO GRADING. AGGREGATE GRADING SHALL BE REASONABLY CONSISTENT AND SHALL NOT EXCEED THE MAXIMUM SIZE WHICH CAN BE CONVENIENTLY HANDLED WITH AVAILABLE PUMPING EQUIPMENT.

– WATER FOR MIXING SHALL BE CLEAN AND FREE FROM INJURIOUS AMOUNTS OF OIL, ACID, SALT, ALKALI, ORGANIC MATTER OR OTHER DELETERIOUS SUBSTANCES.

– POZZOLAN, IF USED, SHALL CONFORM TO ASTM C 618, CLASS C, F OR N.

– PLASTICIZING AND AIR ENTRAINING ADMIXTURES, IF USED, SHALL CONFORM TO ASTM C 494 AND ASTM C 260, RESPECTIVELY.

4. INSTALLATION:

– FABRIC FORM CONCRETE MAT SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH FABRIC FORM MANUFACTURER INSTRUCTIONS AND AS SPECIFIED HEREIN.

– THE FABRIC FORMS SHALL BE KEPT DRY AND WRAPPED SUCH THAT THEY ARE PROTECTED FROM THE ELEMENTS DURING SHIPPING AND STORAGE. IF STORED OUTDOORS, THEY SHALL BE ELEVATED AND PROTECTED WITH A WATERPROOF COVER THAT IS OPAQUE TO ULTRAVIOLET LIGHT. THE FABRIC FORMS SHALL BE PROPERLY LABELED.
– FABRIC FORMS SHALL BE PLACED WITHIN THE LIMITS SHOWN ON THE DRAWINGS. ANCHORING OF THE FABRIC FORMS SHALL BE ACCOMPLISHED THROUGH THE USE OF ANCHOR TRENCHES.

– ADJACENT FABRIC FORMS SHALL BE JOINED BEFORE FILLING WITH FINE AGGREGATE CONCRETE BY FIELD SEWING OR ZIPPERING THE TWO BOTTOM LAYERS OF FABRIC TOGETHER AND THE TWO TOP LAYERS OF FABRIC TOGETHER. ALL FIELD SEAMS SHALL BE MADE USING TWO LINES OF U.S. FEDERAL STANDARD TYPE 101 STITCHES. ALL SEWN SEAMS SHALL BE DOWNWARD FACING, AND ALL ZIPPER SEAMS SHALL BE FASTENED PER MANUFACTURER RECOMMENDATIONS.

– WHEN CONVENTIONAL JOINING OF FABRIC FORMS IS IMPRACTICAL, ADJACENT FORMS MAY BE OVERLAPPED A MINIMUM OF 3 FEET (1 M) TO FORM A LAP JOINT, PENDING APPROVAL BY THE OWNER'S REPRESENTATIVE. THE DOWNSTREAM EDGE OF THE FORM SHALL OVERLAP THE UPSTREAM EDGE OF THE NEXT FORM. IN NO CASE SHALL SIMPLE BUTT JOINTS BETWEEN FORMS BE PERMITTED.

– IMMEDIATELY PRIOR TO FILLING WITH FINE AGGREGATE CONCRETE, THE ASSEMBLED FABRIC FORMS SHALL BE INSPECTED BY THE OWNER'S REPRESENTATIVE AND NO FINE AGGREGATE CONCRETE SHALL BE PUMPED THEREIN UNTIL THE FABRIC FORM PLACEMENT HAS BEEN APPROVED. AT NO TIME SHALL THE FABRIC FORMS BE EXPOSED TO ULTRAVIOLET LIGHT (INCLUDING DIRECT SUNLIGHT) FOR A PERIOD EXCEEDING FIVE DAYS.

– THE CONTRACTOR MUST MAKE THE APPROPRIATE ALLOWANCE FOR APPROXIMATELY 4% CONTRACTION OF THE FABRIC IN EACH DIRECTION, WHICH WILL OCCUR AS A RESULT OF GROUT INJECTION.

– FOLLOWING THE PLACEMENT OF THE FABRIC FORMS, SMALL SLITS SHALL BE CUT IN THE TOP LAYER OF THE FABRIC FORM TO ALLOW THE INSERTION OF THE FILLING PIPE AT THE END OF THE FINE AGGREGATE CONCRETE PUMP HOSE. THESE SLITS SHALL BE OF THE MINIMUM LENGTH TO ALLOW PROPER INSERTION OF THE FILLING PIPE. FINE AGGREGATE CONCRETE SHALL BE PUMPED BETWEEN THE TOP AND BOTTOM LAYERS OF FABRIC, FILLING THE FORMS TO THE RECOMMENDED THICKNESS AND CONFIGURATION.

– FINE AGGREGATE CONCRETE SHALL BE PUMPED IN SUCH A WAY THAT EXCESSIVE PRESSURE ON THE FABRIC FORMS AND COLD JOINTS ARE AVOIDED. A COLD JOINT IS DEFINED AS ONE IN WHICH THE PUMPING OF THE FINE AGGREGATE CONCRETE INTO A GIVEN FORM IS DISCONTINUED OR INTERRUPTED FOR AN INTERVAL OF FORTY–FIVE OR MORE MINUTES.

– HOLES IN THE FABRIC FORMS LEFT BY THE REMOVAL OF THE FILLING PIPE SHALL BE TEMPORARILY CLOSED BY INSERTING A PIECE OF NONWOVEN FABRIC OR SIMILAR MATERIAL. THE NONWOVEN FABRIC SHALL BE REMOVED WHEN THE CONCRETE IS NO LONGER FLUID AND THE CONCRETE SURFACE AT THE HOLE SHALL BE CLEANED AND SMOOTHED BY HAND.

– FOOT TRAFFIC ON THE FILLED FORM SHALL BE RESTRICTED TO AN ABSOLUTE MINIMUM FOR ONE HOUR AFTER FILLING. FOOT TRAFFIC WILL NOT BE PERMITTED ON THE FRESHLY PUMPED MAT WHEN SUCH TRAFFIC WILL CAUSE PERMANENT INDENTATIONS IN THE MAT SURFACE. WALK BOARDS SHALL BE USED WHERE NECESSARY

– AFTER THE FINE AGGREGATE CONCRETE HAS SET (WHEN CONCRETE CAN SUPPORT FOOT TRAFFIC, APPROXIMATELY 170 LBS, WITHOUT INDENTATION), ALL ANCHOR TRENCHES SHALL BE BACKFILLED AND COMPACTED.

5. CONCRETE TESTING:

– AT THE TIME OF PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE, AND TEMPERATURE OF THE CONCRETE. THE CONCRETE MUST MEET ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT, WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.

– COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S THIRD PARTY TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY SHALL MAKE TWO STANDARD TEST CYLINDERS (IN ACCORDANCE WITH ASTM C 31) AND TWO FABRIC CAST TEST CYLINDERS FOR EACH BATCH (MINIMUM) OR EVERY 40 CUBIC YARDS (MAXIMUM) OF CONCRETE. THE FABRIC CAST CYLINDERS SHALL CONSIST OF FABRIC DESIGN BY INJECTING THE PROPOSED GROUT INTO 5½–INCH DIAMETER SLEEVES. THE SLEEVES SHALL BE CONSTRUCTED OF A SINGLE LAYER OF THE SAME BASIC FABRIC MATERIAL AND SHALL BE PROVIDED BY THE CONTRACTOR. TEST FABRIC CAST CYLINDERS, 12 INCHES LONG, SHALL BE CUT FROM EACH SPECIMEN AND TESTED IN ACCORDANCE WITH ASTM C–39. ONE STANDARD AND ONE FABRIC CAST CYLINDER SHALL BE TESTED AT 7 DAYS AND AT 28 DAYS. AT THE DIRECTION OF THE OWNER REMOVE CONCRETE MAT NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE MAT.

6. SUBMITTALS:

– CONCRETE MIX DESIGN: SIX DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.

– FABRIC FORM MANUFACTURER DATA.

FLEXIBLE MEMBRANE LINER:

1. FLEXIBLE MEMBRANE LINER USED ON THE PROJECT IS PROVIDED BY THE OWNER AND IS CURRENTLY STORED ONSITE. THE FLEXIBLE MEMBRANE LINER IS TEXTURED 60 MIL LINEAR LOW DENSITY POLYETHYLENE GEOMEMBRANE. TYPE II GEOTEXTILE FABRIC SHALL BE USED BELOW AND ABOVE THE FLEXIBLE MEMBRANE LINER AS SHOWN ON THE DRAWINGS.

2. APPLICABLE SPECIFICATION REQUIREMENTS: REFER TO SPECIFICATION SECTION 02372 – FLEXIBLE MEMBRANE LINER PREPARED FOR PHASE I CELL PREPARATION PROJECT.

CUSHION GEOTEXTILE:

1. TYPE II CUSHION GEOTEXTILE USED ON THE PROJECT IS PROVIDED BY THE OWNER AND IS CURRENTLY STORED ONSITE. THE GEOTEXTILE IS A NON–WOVEN 16 OUNCE FABRIC CONSISTING GSE HW16 MATERIAL. TYPE II GEOTEXTILE FABRIC SHALL BE USED BELOW AND ABOVE THE FLEXIBLE MEMBRANE LINER AS SHOWN ON THE DRAWINGS.

2. APPLICABLE SPECIFICATION REQUIREMENTS: REFER TO SPECIFICATION SECTION 02373 – GEOTEXTILES PREPARED FOR PHASE I CELL PREPARATION PROJECT.

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JUN 19 2015
DIVISION OF WASTE MANAGEMENT
SOLID WASTE BRANCH

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Environment & Infrastructure
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No.	Report Date	Drawn By	Revision Made
A	12/06/13	MJW	REVIEW
B	12/10/13	MJW	CLIENT
C	1/21/15	MJW	AS–BUILT

Title
E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
NOTES AND DETAILS

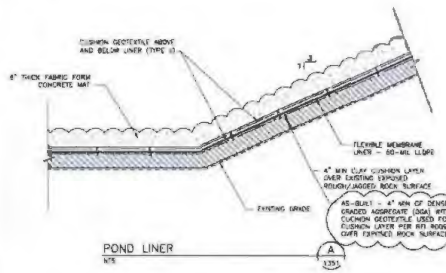
Location and Unit:
E.W. BROWN GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO. JOB NO.

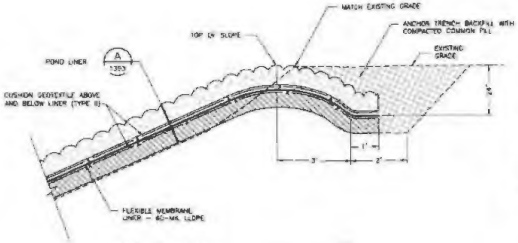
Kentucky Utilities Company

Drawing No: BRO–C–01353
Rev: D

DWG Version 2.0



POND LINER
NTS



POND LINER EDGE
NTS

EARTHWORK

1. EARTHWORK MATERIALS:

– COMMON FILL: REUSE SUITABLE EXCAVATED MATERIAL TO EXTENT PRACTICAL. COMMON FILL SHALL CONSIST OF SOIL/CLAY SUITABLE FOR NORMAL EMBANKMENT CONSTRUCTION. IT SHALL BE FREE FROM FROZEN MATERIALS, PERISHABLE RUBBISH, PEAT, AND OTHER UNSATISFACTORY SOILS/MATERIALS. IT SHALL BE OF SUCH A NATURE AND CHARACTER THAT IT CAN BE COMPACTED TO A FIRM UNYIELDING SURFACE. WHEN PLACED AS SUBGRADE FILL OVER EXPOSED ROCK SURFACES BELOW THE FLEXIBLE MEMBRANE LINER, COMMON FILL SHALL HAVE A MAXIMUM NOMINAL PARTICLE SIZE OF 1-INCH OR LESS ON THE SURFACE OF THE PREPARED SUBGRADE.

2. EXCAVATION:

– EXCAVATE TO LINES AND GRADES INDICATED ON THE CONSTRUCTION DRAWINGS. IF REQUIRED, THE CONTRACTOR MAY MAKE FIELD ADJUSTMENTS WITH THE OWNER'S CONCURRENCE TO THE LINES AND GRADES IF REQUIRED FOR ACTUAL PROJECT SITE CONDITIONS.

– MAINTAIN EXCAVATIONS IN A SAFE CONDITION UNTIL COMPLETION OF CONCRETE CURING AND BACKFILLING OF STRUCTURE OR AS DIRECTED BY THE OWNER.

– UNIFORMLY EXCAVATE AND SHAPE THE SUBGRADE FOR THE LINER TRENCH TO THE DEPTH AND WIDTH INDICATED ON THE CONSTRUCTION DRAWINGS. REMOVE WATER OR MATERIALS THAT INTERFERE WITH WORK.

4. SUBGRADE PREPARATION AND BACKFILL:

– LINER SYSTEM SUBGRADE SHALL BE UNIFORMLY GRADED AND PROOF-ROLLED TO A SMOOTH FIRM SURFACE. FOR AREAS WITH EXPOSED ROCK SURFACES, A MINIMUM 4-INCH LAYER OF SOIL/CLAY COMMON FILL SHALL BE PLACED AND COMPACTED.

– PRIOR TO LINER SYSTEM PLACEMENT, INSPECT THE SUBGRADE FOR EXPOSED ROCK, STONES, AND SOFT AREAS AND EXCAVATE UNSATISFACTORY MATERIAL AS DIRECTED BY THE OWNER AND BACKFILL WITH SUITABLE COMMON FILL MATERIAL. COMPACT THE FINAL SUBGRADE TO PROVIDE A FIRM UNYIELDING SURFACE.

– UNLESS OTHERWISE NOTED OR DIRECTED, PLACE ALL BACKFILL AND SUBGRADE PREPARATION MATERIALS IN LIFTS HAVING A LOOSE THICKNESS SUCH WHEN COMPACTED, THE COMPACTED LIFT SHALL HAVE A NOMINAL THICKNESS OF 6 INCHES.

– REMOVE EXCESS EXCAVATED SOIL NOT INTENDED FOR REUSE AND PROPERLY DISPOSE ON-SITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER.

3. COMPACTION:

– CONDUCT SOIL COMPACTION DURING CONSTRUCTION TO ACHIEVE A FIRM UNYIELDING SURFACE FOR EACH BACKFILL LIFT.

– MAINTAIN PROPER MOISTURE CONTENT OF FILL MATERIALS TO ATTAIN REQUIRED COMPACTION PERFORMANCE.

8. FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION

– INSPECT FINAL PREPARED SUBGRADE SURFACE BELOW LINER SURFACE LIMITS FOR EXPOSED ROCK AND STONES/PARTICLES LARGER THAN 1-INCH. FINAL LINER SYSTEM SUBGRADE SHOULD BE PROOF-ROLLED TO A SMOOTH FIRM SURFACE. IN PLACE DENSITY TESTING IS NOT REQUIRED.

FABRIC FORM CONCRETE MAT:

1. FABRIC FORM CONCRETE MAT WILL BE PLACED ABOVE THE INSTALLED FLEXIBLE MEMBRANE LINER AND CUSHION GEOTEXTILE AS SHOWN ON THIS DRAWING.

2. FABRIC FORM MATERIAL:

– FABRIC FORMS SHALL CONSIST OF FACTORY ASSEMBLED PANELS MADE UP A DOUBLE-LAYER WOVEN FABRIC JOINED TOGETHER BY SPACED, INTERWOVEN CORDS OF UNIFORM LENGTH TO FORM A CONCRETE LINING WITH A FINISHED AVERAGE THICKNESS OF 6 INCHES.

– YARNS USED IN THE MANUFACTURE OF THE FABRIC SHALL BE COMPOSED OF NYLON AND/OR POLYESTER FORMS SHALL BE WOVEN WITH A MINIMUM OF 50% TEXTURED YARNS (BY WEIGHT) TO IMPROVE ADHESION TO FINE AGGREGATE CONCRETE.

– FABRIC FORMS SHALL BE WOVEN IN SUCH A MANNER WITH NYLON SPACER CORDS TO PROVIDE POINTS OF ATTACHMENT ON SPECIFIC CENTERS. THE SPACER CORDS SHALL SERVE TO CONTROL THE THICKNESS OF THE NEWCRETE WITHOUT BURSTING THE FABRIC DURING FINE AGGREGATE CONCRETE INJECTION.

– FABRIC FORMS SHALL CONSIST OF HYDROTEX® UNIFORM SECTION US600 FORMS AS MANUFACTURED BY GEOSTAR CORPORATION, OR FABRITORM® UNIMAT DESIGNATION STYLE 6" UNIMAT AS MANUFACTURED BY CONSTRUCTION TECHNIQUES, INC. OR AN OWNER APPROVED EQUIVALENT.

3. FINE AGGREGATE CONCRETE MIX:

– FINE AGGREGATE CONCRETE (GROUT) SHALL CONSIST OF A MIXTURE OF PORTLAND CEMENT, FINE AGGREGATE, AND WATER SO PROPORTIONED AND MIXED AS TO PROVIDE A READILY FLOWABLE GROUT. ADMIXTURES AND/OR A POZZOLAN MAY BE USED WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE. USE OF SILICA FUME REQUIRES SPECIAL PRECAUTIONS. SILICA FUME IS NOT RECOMMENDED. THE HARDENED FINE AGGREGATE CONCRETE SHALL EXHIBIT A COMPRESSIVE STRENGTH OF 2,500 PSI (17 MPA) AT 28 DAYS WHEN SPECIMENS ARE MADE AND TESTED ACCORDING TO THE PROVISIONS OF ASTM C-31 AND C-39. THE AVERAGE COMPRESSIVE STRENGTH OF FABRIC CAST TEST CYLINDERS, AS DESCRIBED IN PARAGRAPH 5 BELOW, SHALL BE AT LEAST 20% HIGHER AT 7 DAYS THAN THAT OF CONFIRMATION TEST CYLINDERS MADE IN ACCORDANCE WITH ASTM C-31 AND NOT LESS THAN 3,000 PSI (21 MPA) AT 28 DAYS. AIR CONTENT OF FINE AGGREGATE MIX SHALL BE 6±1.5% AND SHALL PROVIDE A FLOW RATE OF 8-12 FT/SEC.

– PORTLAND CEMENT SHALL CONFORM TO ASTM C 150, TYPE I OR TYPE II.

– FINE AGGREGATE SHALL CONFORM TO ASTM C 33 EXCEPT AS TO GRADING. AGGREGATE GRADING SHALL BE REASONABLY CONSISTENT AND SHALL NOT EXCEED THE MAXIMUM SIZE WHICH CAN BE CONVENIENTLY HANDLED WITH AVAILABLE PUMPING EQUIPMENT.

– WATER FOR MIXING SHALL BE CLEAN AND FREE FROM INJURIOUS AMOUNTS OF OIL, ACID, SALT, ALKALI, ORGANIC MATTER OR OTHER DELETERIOUS SUBSTANCES.

– POZZOLAN, IF USED, SHALL CONFORM TO ASTM C 618, CLASS C, F OR N.

– PLASTICIZING AND AIR ENTRAINING ADMIXTURES, IF USED, SHALL CONFORM TO ASTM C 494 AND ASTM C 260, RESPECTIVELY.

4. INSTALLATION:

– FABRIC FORM CONCRETE MAT SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH FABRIC FORM MANUFACTURERS INSTRUCTIONS AND AS SPECIFIED HEREIN.

– THE FABRIC FORMS SHALL BE KEPT DRY AND WRAPPED SUCH THAT THEY ARE PROTECTED FROM THE ELEMENTS DURING SHIPPING AND STORAGE. IF STORED OUTDOORS, THEY SHALL BE ELEVATED AND PROTECTED WITH A WATERPROOF COVER THAT IS OPAQUE TO ULTRAVIOLET LIGHT. THE FABRIC FORMS SHALL BE PROPERLY LABELED.

– FABRIC FORMS SHALL BE PLACED WITHIN THE LIMITS SHOWN ON THE DRAWINGS. ANCHORING OF THE FABRIC FORMS SHALL BE ACCOMPLISHED THROUGH THE USE OF ANCHOR TRENCHES.

– ADJACENT FABRIC FORMS SHALL BE JOINED BEFORE FILLING WITH FINE AGGREGATE CONCRETE BY FIELD SEWING OR OPENING THE TWO BOTTOM LAYERS OF FABRIC TOGETHER AND THE TWO TOP LAYERS OF FABRIC TOGETHER. ALL FIELD SEAMS SHALL BE MADE USING TWO LINES OF U.S. FEDERAL STANDARD TYPE 101 STITCHES. ALL SEAM SEAMS SHALL BE DOWNWARD FACING AND ALL ZIPPER SEAMS SHALL BE FASTENED PER MANUFACTURER RECOMMENDATIONS.

– WHEN CONVENTIONAL JOINING OF FABRIC FORMS IS IMPRACTICAL, ADJACENT FORMS MAY BE OVERLAPPED A MINIMUM OF 3 FEET (1 M) TO FORM A LAP JOINT, PENDING APPROVAL BY THE OWNER'S REPRESENTATIVE. THE DOWNSTREAM EDGE OF THE FORM SHALL OVERLAP THE UPSTREAM EDGE OF THE NEXT FORM. IN NO CASE SHALL SIMPLE BUTT JOINTS BETWEEN FORMS BE PERMITTED.

– IMMEDIATELY PRIOR TO FILLING WITH FINE AGGREGATE CONCRETE, THE ASSEMBLED FABRIC FORMS SHALL BE INSPECTED BY THE OWNER'S REPRESENTATIVE AND NO FINE AGGREGATE CONCRETE SHALL BE PUMPED THEREIN UNTIL THE FABRIC FORM PLACEMENT HAS BEEN APPROVED. AT NO TIME SHALL THE FABRIC FORMS BE EXPOSED TO ULTRAVIOLET LIGHT (INCLUDING DIRECT SUNLIGHT) FOR A PERIOD EXCEEDING FIVE DAYS.

– THE CONTRACTOR MUST MAKE THE APPROPRIATE ALLOWANCE FOR APPROXIMATELY 4% DIMINUTION OF THE FABRIC IN EACH DIRECTION, WHICH WILL OCCUR AS A RESULT OF GROUT INJECTION.

– FOLLOWING THE PLACEMENT OF THE FABRIC FORMS, SMALL SLITS SHALL BE CUT IN THE TOP LAYER OF THE FABRIC FORM TO ALLOW THE INSERTION OF THE FILLING PIPE AT THE END OF THE FINE AGGREGATE CONCRETE PUMP HOSE. THESE SLITS SHALL BE OF THE MINIMUM LENGTH TO ALLOW PROPER INSERTION OF THE FILLING PIPE. FINE AGGREGATE CONCRETE SHALL BE PUMPED BETWEEN THE TOP AND BOTTOM LAYERS OF FABRIC, FILLING THE FORMS TO THE RECOMMENDED THICKNESS AND CONFIGURATION.

– FINE AGGREGATE CONCRETE SHALL BE PUMPED IN SUCH A WAY THAT EXCESSIVE PRESSURE ON THE FABRIC FORMS AND COLD JOINTS ARE AVOIDED. A COLD JOINT IS DEFINED AS ONE IN WHICH THE PUMPING OF THE FINE AGGREGATE CONCRETE INTO A GIVEN FORM IS DISCONTINUED OR INTERRUPTED FOR AN INTERVAL OF FORTY-FIVE OR MORE MINUTES.

– HOLES IN THE FABRIC FORMS LEFT BY PIN REMOVAL OR THE FILLING PIPE SHALL BE TEMPORARILY CLOSED BY INSERTING A PIECE OF NONWOVEN FABRIC OR SIMILAR MATERIAL. THE NONWOVEN FABRIC SHALL BE REMOVED WHEN THE CONCRETE IS NO LONGER FLUID AND THE CONCRETE SURFACE AT THE HOLE SHALL BE CLEANED AND SMOOTHED BY HAND.

– FOOT TRAFFIC ON THE FILLED FORM SHALL BE RESTRICTED TO AN ABSOLUTE MINIMUM FOR THE HOUR AFTER FILLING. FOOT TRAFFIC WILL NOT BE PERMITTED ON THE FRESHLY PUMPED MAT WHEN SLOW TRAFFIC WILL CAUSE PERMANENT INDENTATIONS IN THE MAT SURFACE. WALK BOARDS SHALL BE USED WHERE NECESSARY.

– AFTER THE FINE AGGREGATE CONCRETE HAS SET (WHEN CONCRETE CAN SUPPORT FOOT TRAFFIC, APPROXIMATELY 170 LBS, WITHOUT INDENTATION), ALL ANCHOR TRENCHES SHALL BE BACKFILLED AND COMPACTED.

5. CONCRETE TESTING:

– AT THE TIME OF PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE, AND TEMPERATURE OF THE CONCRETE. THE CONCRETE MUST MEET ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT, WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.

– COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S THIRD PARTY TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY SHALL MAKE TWO STANDARD TEST CYLINDERS (IN ACCORDANCE WITH ASTM C 31) AND TWO FABRIC CAST TEST CYLINDERS FOR EACH BATCH (MINIMUM) OR EVERY 40 CUBIC YARDS (MAXIMUM) OF CONCRETE. THE FABRIC CAST CYLINDERS SHALL CONSIST OF FABRIC FORMED BY INJECTING THE PROPOSED GROUT INTO 3/8-INCH DIAMETER SLEEVES. THE SLEEVES SHALL BE CONSTRUCTED OF A SINGLE LAYER OF THE SAME BASIC FABRIC MATERIAL AND SHALL BE PROVIDED BY THE CONTRACTOR. TEST FABRIC CAST CYLINDERS, 12 INCHES LONG, SHALL BE CUT FROM EACH SPECIMEN AND TESTED IN ACCORDANCE WITH ASTM C-39. ONE STANDARD AND ONE FABRIC CAST CYLINDER SHALL BE TESTED AT 7 DAYS AND AT 28 DAYS. AT THE DIRECTION OF THE OWNER REMOVE CONCRETE MAT NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE MAT.

6. SUBMITTALS:

– CONCRETE MIX DESIGN: 5(N DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.

– FABRIC FORM MANUFACTURER DATA.

FLEXIBLE MEMBRANE LINER:

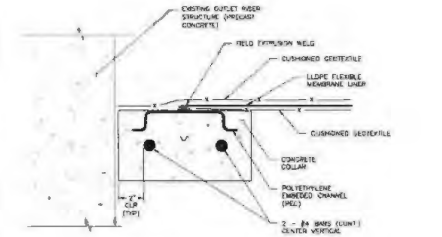
1. FLEXIBLE MEMBRANE LINER USED ON THE PROJECT IS PROVIDED BY THE OWNER AND IS CURRENTLY STORED ONSITE. THE FLEXIBLE MEMBRANE LINER IS TEXTURED 60 MIL LINEAR LOW DENSITY POLYETHYLENE GEOMEMBRANE. TYPE II GEOTEXTILE FABRIC SHALL BE USED BELOW AND ABOVE THE FLEXIBLE MEMBRANE LINER AS SHOWN ON THE DRAWINGS.

2. APPLICABLE SPECIFICATION REQUIREMENTS: REFER TO SPECIFICATION SECTION 02372 – FLEXIBLE MEMBRANE LINER PREPARED FOR PHASE 1 CELL PREPARATION PROJECT.

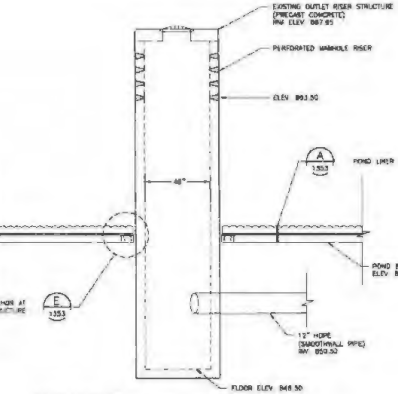
CUSHION GEOTEXTILE

1. TYPE II CUSHION GEOTEXTILE USED ON THE PROJECT IS PROVIDED BY THE OWNER AND IS CURRENTLY STORED ONSITE. THE GEOTEXTILE IS A NON-WOVEN 16 OUNCE FABRIC CONSISTING ONE WHITE MATERIAL. TYPE II GEOTEXTILE FABRIC SHALL BE USED BELOW AND ABOVE THE FLEXIBLE MEMBRANE LINER AS SHOWN ON THE DRAWINGS.

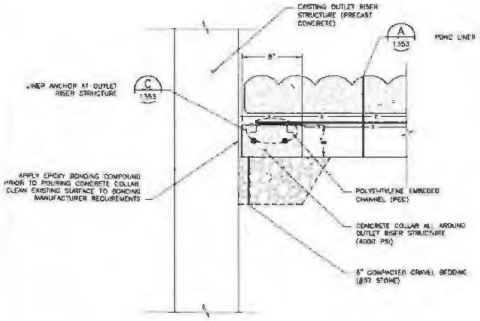
2. APPLICABLE SPECIFICATION REQUIREMENTS: REFER TO SPECIFICATION SECTION 02373 – GEOTEXTILES PREPARED FOR PHASE 1 CELL PREPARATION PROJECT.



LINER ANCHOR AT OUTLET RISER STRUCTURE
NTS



POND LINER AT EXISTING OUTLET RISER STRUCTURE
NTS



MEMBRANE ANCHOR AT EXISTING OUTLET RISER STRUCTURE
NTS

amec

Environment & Infrastructure
11002 Bluegrass Parkway, Suite 500, Louisville, KY 40299
Phone: (502) 267-6700 Fax: (502) 267-0600

REVISIONS			
No.	Date	Drawn By	Description
A	12/08/14	NJM	REVIEW
B	12/22/14	NJM	SUBMIT
C	1/31/15	NJM	AS-BUILT

Title
E.W. BROWN GENERATING STATION
WEST POND LINING PROJECT
GYPSUM DRYING PLANT
NOTES AND DETAILS

Location and Area
E.W. BROWN GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:
JOB NO. 60 NO. FOR NO. JOB NO.

Kentucky Utilities Company

Drawing No. BRO-C-01353
Rev. B

APPENDIX B

NORTH ABUTMENT DRAIN
PUMP STATION INSTALLATION

PHOTO 1:

Sampling Point CH-048, discharge from north abutment drain prior to collection.

PHOTO 2:

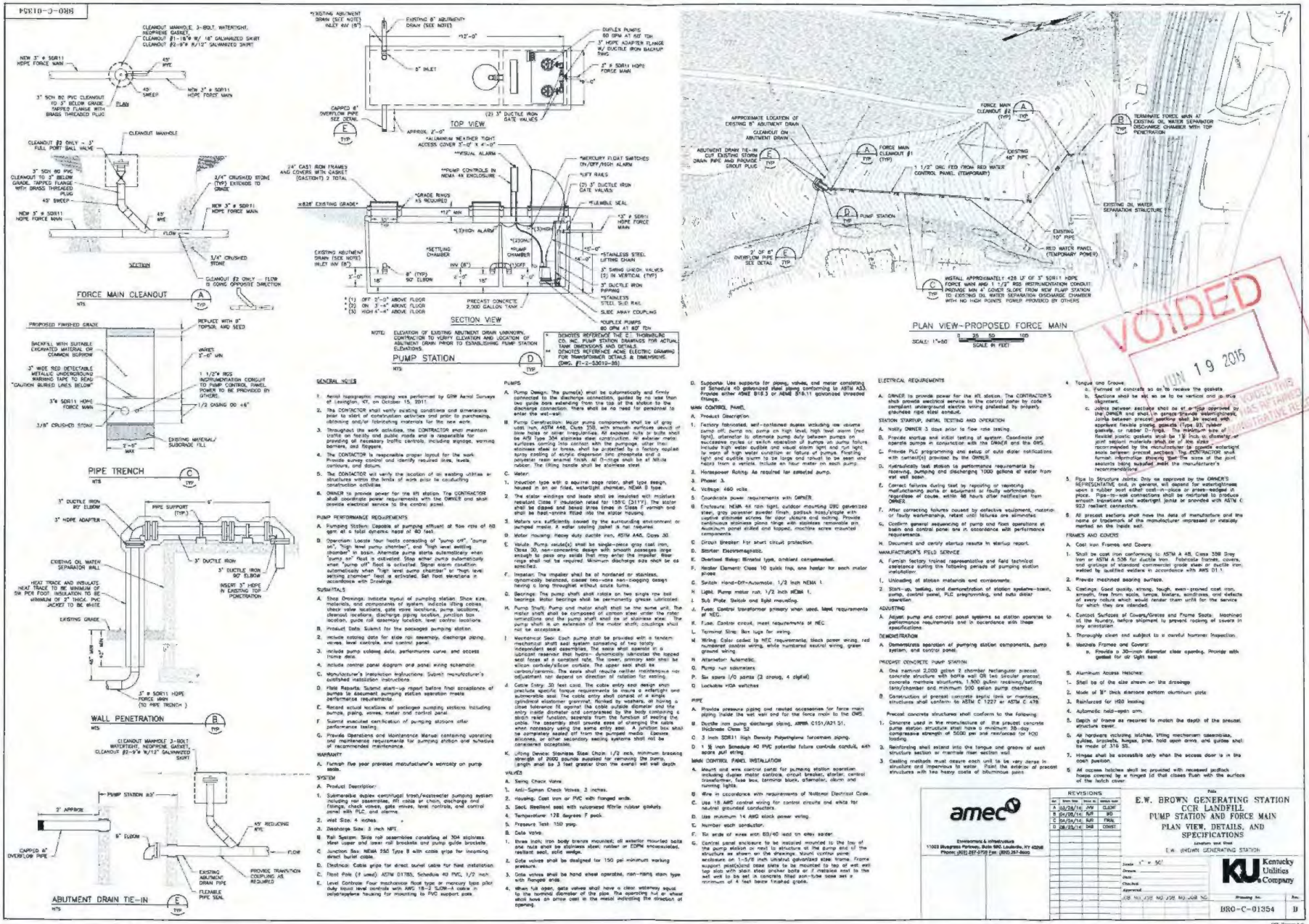
New pumping station installed to capture the north abutment drain discharge and transfer it to the Auxiliary Pond. The former discharge point (CH-048) is downslope to the left (southeast)

PHOTO 3:

New pumping station, view from the south, Main Pond embankment (dam) to the left (west).

PHOTO 4:

Interior of the pump station.



GENERAL NOTES

1. Aerial topographic mapping was performed by GRW Aerial Surveys of Lexington, KY, on October 15, 2011.
2. The CONTACTOR shall verify existing conditions and dimensions prior to start of construction activities and prior to purchasing, obtaining and/or fabricating materials for the new work.
3. Throughout the work activities, the CONTRACTOR shall maintain traffic on facility and public roads and is responsible for providing all necessary traffic controls, including signage, warning barriers, and flaggers.
4. The CONTACTOR is responsible proper layout for the work. Provide survey control and identify required lines, levels, contours, and datum.
5. The CONTACTOR will verify the location of all existing utilities or structures within the limits of work prior to conducting excavation activities.
6. OWNER to provide power for the lift station. The CONTRACTOR shall coordinate power requirements with the OWNER and shall provide electrical service to the control panel.

PUMP PERFORMANCE REQUIREMENTS

A. Pumping System: Capable of pumping effluent at flow rate of 60 gpm at a total dynamic head of 60 feet.

B. Operation: Locate four floats consisting of "pump off", "pump on", "high level pump chamber", and "high level existing chamber" in basin. Alternate pump starts automatically when "pump on" float is raised. Stop either pump automatically when "pump off" float is activated. Signal alarm condition automatically when "high level pump chamber" or "high level existing chamber" float is activated. Set float elevations in accordance with Drawings.

SUBMITTALS

A. Shop Drawings: Indicate layout of pumping station. Show size, materials, and components of system. Indicate lifting cables, check valve locations, gate valve locations, pump locations, cleanout locations, discharge piping location, junction box location, guide rail assembly location, level control locations.

B. Product Data: Submit for the packaged pumping station.

C. Include rotating data for slide rail assembly, discharge piping, valves, level controls, and control panel.

D. Include pump catalog data, performance curve, and access frame data.

E. Include control panel diagram and panel wiring schematic.

F. Manufacturer's Instruction Instructions: Submit manufacturer's published installation instructions.

G. Field Reports: Submit start-up report before final acceptance of pumps to document pumping station separation meets performance requirements.

H. Submit executed certification of pumping stations after performance testing.

I. Provide Operations and Maintenance Manual containing operating and maintenance requirements for pumping station and schedule of recommended maintenance.

WARRANTY

A. Furnish five year prorated manufacturer's warranty on pump system.

SYSTEM

A. Product Description:

1. Submersible duplex centrifugal treat/wastewater pumping system including rail assemblies, lift cable or chain, discharge and fittings, check valves, gate valves, level controls, and control panel with PLC and alarms.
2. Inlet Size: 4 inches.
3. Discharge Size: 3 inch NPT.
4. Rail System: Slide rail assemblies consisting of 304 stainless steel upper and lower rail brackets and pump guide brackets.
5. Junction Box: NEMA 250 Type 8 with cable grips for incoming direct burial cable.
6. Electrical: Cable grips for direct burial cable for field installation.
7. Float Pink (if used): ASTM D1785, Schedule 40 PVC, 1/2 inch.
8. Level Controls: Four mechanical float type or mercury type pilot duty liquid level controls with AWG 18-2 SJOW-A cable in polypropylene housing for mounting to PVC support pole.

PUMPS

A. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connections, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

B. Pump Construction: Major pump components shall be of gray cast iron, ASTM A48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All exterior metal surfaces coming into contact with the pumpage, other than stainless steel or bronze, shall be protected by a factory applied epoxy coating of epoxic dispersion into phosphate and a polyester resin enamel finish. All O-rings shall be of Nitrile rubber. The lifting handle shall be stainless steel.

C. Motor:

1. Induction type with a squirrel cage rotor, shaft type design, housed in an air filled, watertight chamber, NEMA B type.
2. The stator windings and leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing.
3. Motors are sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket is not required.

D. Motor Housing: Heavy duty ductile iron, ASTM A48, Class 30.

E. Volute: Pump volute(s) shall be single-piece gray cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Wear rings shall not be required. Minimum discharge size shall be as specified.

F. Impeller: The impeller shall be of hardened or stainless, dynamically balanced, closed two-vane non-clogging design having a long throughlet without scale turns.

G. Bearings: The pump shaft shall rotate on two single row ball bearings. Motor bearings shall be permanently grease lubricated.

H. Pump Shaft: Pump and motor shaft shall be the same unit. The motor shaft shall be composed of carbon steel under the rotor lamentations and the pump shaft shall be of stainless steel. The pump shaft is an extension of the motor shaft; couplings shall not be acceptable.

I. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro- dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal shall be silicon carbide/silicon carbide. The upper seal shall be carbon/ceramic. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

J. Cable Entry: 30 feet cord. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. A junction box shall be completely sealed off from the pumped media. Epoxies, elastomers, or other secondary sealants systems shall not be considered acceptable.

K. Lifting Device: Stainless Steel Chain: 1/2 inch, minimum breaking strength of 2000 pounds supplied for removing the pump, length shall be 3 feet greater than the overall wet well depth.

VALVES

A. Swing Check Valve:

1. Anti-Siphon Check Valves, 2 inches.
2. Housing: Cast iron or PVC with flanged ends.
3. Seat: Resilient seal with vulcanized Nitrile rubber gaskets.
4. Temperature: 120 degrees F peak.
5. Pressure Test: 150 psig.

B. Gate Valves:

1. Brass inch iron body bronze mounted; all exterior mounted bolts and nuts shall be stainless steel; rubber or EDPM encapsulated, resilient seat, solid wedge.
2. Gate valves shall be designed for 150 psi minimum working pressure.
3. Gate valves shall be hand wheel operated, non-rising stem type with flanged ends.
4. When full open, gate valves shall have a clear waterway equal to the nominal diameter of the pipe. The operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening.

D. Supports: Use supports for piping, valves, and meter consisting of Schedule 40 galvanized steel piping conforming to ASTM A53. Provide either ASME B16.3 or ANSI B16.11 galvanized threaded fittings.

MAIN CONTROL PANEL

A. Product Description:

1. Factory fabricated, self-contained duplex including one volume pump off, pump on, pump on high level, high level alarm (red light), alternator to alternate pump duty between pumps on successive cycles or switch operation of pumps on pump failure. Include high water audible and visual alarm light and run light to warn of high water condition or failure of pumps. Floating light and audible alarm to be large and robust to be seen and heard from a vehicle. Include an hour meter on each pump.
2. Horsepower Rating: As required for selected pump.
3. Phase: 3.
4. Voltage: 480 volts.
5. Coordinate power requirements with OWNER.

B. Enclosure: NEMA 4X rain tight, outdoor mounting 090 galvanized steel, gray polyester powder finish, padlock hasp/staple with captive stainless screws for door closure and locking. Provide continuous stainless piano hinge with stainless removable pin. Aluminum panel slotted and tapped, machine screw mounted components.

C. Circuit Breaker: For short circuit protection.

D. Starter: Electromagnetic.

E. Overload Relay: Ambient type, ambient compensated.

F. Heater Elements: Class 10 quick trip, one heater for each motor phase.

G. Switch: Hand-Off-Automatic, 1/2 inch NEMA 1.

H. Light: Pump motor run, 1/2 inch NEMA 1.

I. Sub Plate: Sketch and light mounting.

J. Fuses: Control transformer primary when used, input requirements of NEC.

K. Fuse: Control circuit, meet requirements of NEC.

L. Terminal Strip: Box lugs for wiring.

M. Wiring: Color coded to NEC requirements, black power wiring, red numbered control wiring, white numbered neutral wiring, green grounding.

N. Alternator: Automatic.

O. Pump run volumeters.

P. Six spare I/O points (2 analog, 4 digital).

Q. Lockable HOA switches.

PIPE

A. Provide pressure piping and related accessories for force main piping inside the wet well and for the force main to the GWS.

B. Ductile iron pump discharge piping, ANSI A 0151/A21.51, Thickness Class 52.

C. 3 inch SDR11 High Density Polyethylene forcemain piping.

D. 1 ½ inch Schedule 40 PVC potential failure controls conduit, with spare pull string.

MAIN CONTROL PANEL INSTALLATION

A. Mount and wire control panel for pumping station operation including duplex motor controls, circuit breaker, starter, control transformer, fuse box, terminal block, alternator, alarm and running lights.

B. Wire in accordance with requirements of National Electrical Code.

C. Use 18 AWG control wiring for control circuits and white for neutral grounded conductors.

D. Use minimum 14 AWG stock power wiring.

E. Number each conductor.

F. Tin ends of wires with 63/40 lead tin alloy solder.

G. Control panel enclosure to be installed mounted to the top of the pump station or next to structure at the pump and of the structure as shown on the drawings. Mount control panel enclosure on 1-5/8 inch UNistrut galvanized steel frame. Frame support post(s)and base plate to be mounted to top of wet well top slab with steel shear bolts or if installed next to the wet well to be set in concrete filled non-tube base set a minimum of 4 feet below finished grade.

ELECTRICAL REQUIREMENTS

A. OWNER to provide power for the lift station. The CONTRACTOR'S shall provide electrical service to the control panel by code compliant underground electric wiring protected by properly grounded rigid steel conduit.

STATION STARTUP, INITIAL TESTING AND OPERATION

A. Notify OWNER 3 days prior to flow rate testing.

B. Provide startup and initial testing of system. Coordinate and operate pumps in conjunction with the OWNER and the GWS.

C. Provide PLC programming and setup of auto dialer notifications with contact(s) provided by the OWNER.

D. Hydraulically test station to performance requirements by receiving, pumping and discharging 1000 gallons of water from wet well basin.

E. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty watertightness, regardless of cause, within 48 hours after notification from OWNER.

F. After correcting failures caused by defective equipment, material or faulty workmanship, retest until failures are eliminated.

G. Confirm general sequencing of pump and float operations at basin and control panel are in accordance with performance requirements.

H. Document and certify startup results in startup report.

MANUFACTURER'S FIELD SERVICE

A. Furnish factory trained representative and field technical assistance during the following periods of pumping station installation:

1. Unloading of station materials and components.
2. Start-up, testing, and demonstration of station systems--basin, pump, control panel, PLC programming, and auto dialer operation.

ADJUSTING

A. Adjust pump and control panel systems so station operates to performance requirements and in accordance with these specifications.

DEMONSTRATION

A. Demonstrate operation of pumping station components, pump system, and control panel.

PRECAST CONCRETE PUMP STATION

A. One nominal 2,000 gallon 2 chamber rectangular precast concrete structure with bolt-a wall OR two circular precast concrete manhole structures, 1,500 gallon receiving/settling tank/chamber and minimum 500 gallon pump chamber.

B. Construction of precast concrete septic tank or manholes, structures shall conform to ASTM C 1227 or ASTM C 478.

Precast concrete structures shall conform to the following:

1. Concrete used in the manufacture of the precast concrete pump station structure shall have a minimum 28-day compressive strength of 5000 psi and reinforced for H20 loading.
2. Reinforcing shall extend into the tongue and groove of each structure section so it matches that section wall.
3. Casting methods must assure each unit to be very dense in structure and impervious to water. Point the exterior of precast structures with two heavy coats of bituminous paint.
4. Tongue and Groove:
   a. Formed of concrete so as to receive the gaskets.
   b. Sections shall be set so as to be vertical and provide alignment.
   c. Joints between sections shall be of a type approved by the OWNER and shall, in garage/grade watertightness. Joints between precast sections shall be sealed with a preformed flexible plastic gaskets (Type 63), rubber gaskets, or rubber O-rings. The minimum size of flexible plastic gaskets shall be 1" thick by diameter of joint sealant materials shall be of size sizes recommended by the manufacturer to provide watertight seals between precast sections. The CONTRACTOR shall furnish information showing that the sizes of the joint sealants being supplied meet the manufacturer's recommendations.
5. Pipe to Structure Joints: Only as approved by the OWNER'S REPRESENTATIVE and, in general, will depend for watertightness upon a rubber boot either cast-in-place or press-wedged in place. Pipe-to-wall connections shall be mortared to produce smooth transitions and watertight joints be provided with ASTM C 923 resilient connectors.
6. All precast sections shall have the date of manufacture and the name or trademark of the manufacturer impressed or indelibly marked on the inside wall.

FRAMES AND COVERS

A. Cast Iron Frames and Covers:

1. Shall be cast iron conforming to ASTM A 48, Class 35B Gray Iron or ASTM A 536 for ductile iron. Fabricate frames, covers, and gratings of standard commercial grade steel or ductile iron; welded by qualified welders in accordance with AWS D1.1.
2. Provide machined bearing surfaces.
3. Castings: Good quality, strong, tough, even-grained cast iron, smooth, free from scabs, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended.
4. Contact Surfaces of Covers/Gratings and Frame Seats: Machined all the foundry, before shipment to prevent rocking of covers in any orientation.
5. Thoroughly clean and subject to a careful hammer inspection.

B. Watertight Frames and Covers:

a. Provide a 30-inch diameter clear opening. Provide with gasket for air tight seal.

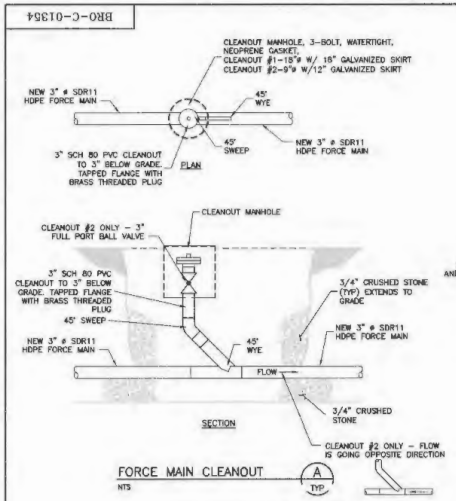
5. Aluminum Access Hatches:
   1. Shall be of the size shown on the drawings.
   2. Made of 1/4" thick stainless pattern aluminum plate.
   3. Reinforced for H20 loading.
   4. Automatic hold-open arm.
   5. Depth of frame as required to match the depth of the precast structure cover.
   6. All hardware including latches, lifting mechanism assemblies, guides, brackets, hinges, pins, hold open arms, and guides shall be made of 316 SS.
   7. Hinges shall be accessible only when the access door is in the open position.
   8. All access hatches shall be provided with recessed padlock hasps covered by a hinged lid that closes flush with the surface of the hatch cover.

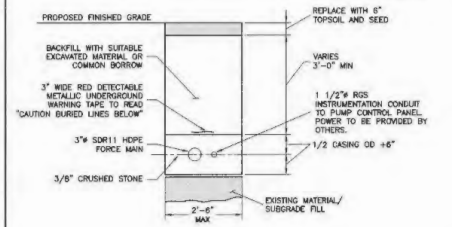
REVISIONS			
No.	Date	By	Description
A	10/28/14	JAW	CLIENT
B	04/28/14	RJP	PD
C	04/24/14	RJP	FINAL
D	08/25/14	DAB	CONST

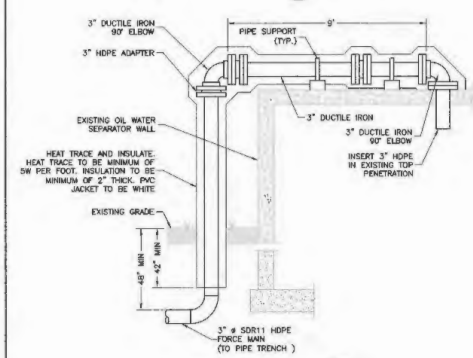
E.W. BROWN GENERATING STATION
CCR LANDFILL
PUMP STATION AND FORCE MAIN
PLAN VIEW, DETAILS, AND SPECIFICATIONS
Location: E.W. BROWN GENERATING STATION

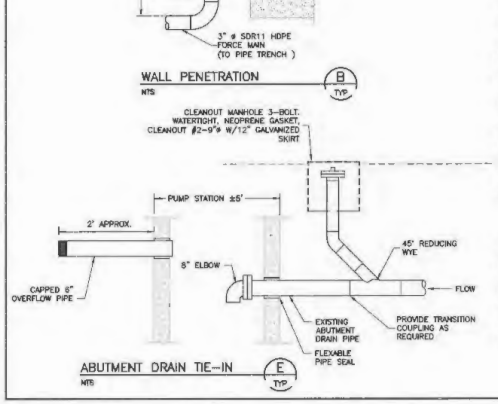
Scale: 1" = 50'
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO.
Drawing No.: BRO-C-01354
Rev.: D

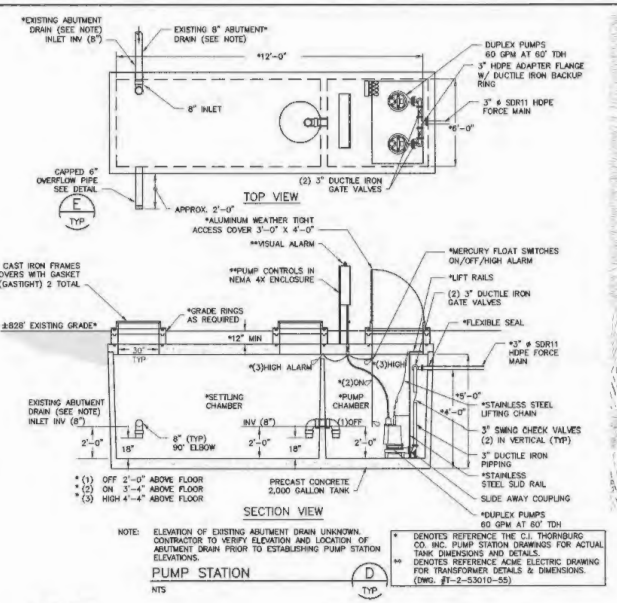
BRO-C-01354

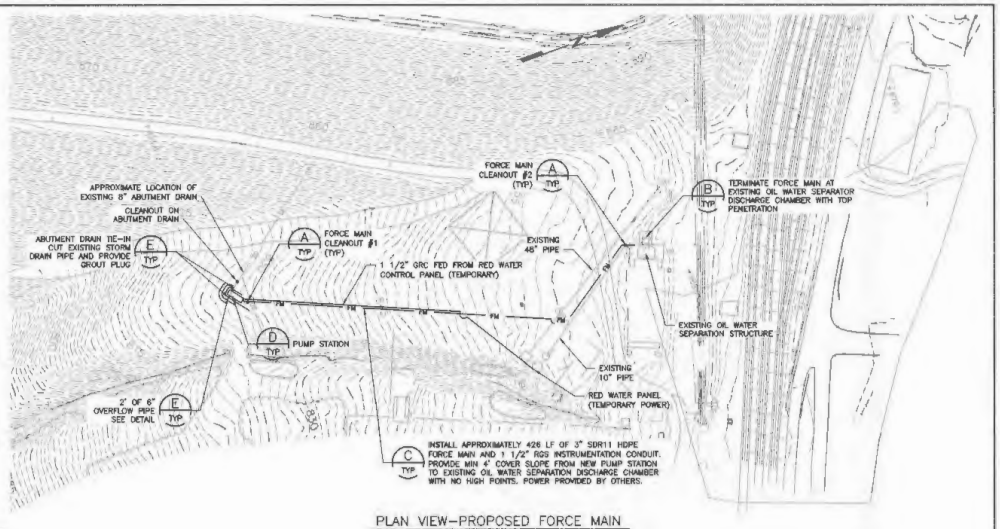












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4. The CONTACTOR is responsible proper layout for the work. Provide survey control and identify required lines, levels, contours, and datum.
5. The CONTACTOR will verify the location of all existing utilities or structures within the limits of work prior to conducting construction activities.
6. OWNER to provide power for the lift station. The CONTRACTOR shall coordinate power requirements with the OWNER and shall provide electrical service to the control panel.

PUMP PERFORMANCE REQUIREMENTS

A. Pumping Station: Capable of pumping effluent at flow rate of 60 gpm at a total dynamic head of 80 feet.
B. Operation: Locate four floats consisting of "pump off", "pump on", "high level pump chamber", and "high level settling chamber" in basin. Alternate pump starts automatically when "pump on" float is activated. Stop either pump automatically when "pump off" float is activated. Signal alarm condition automatically when "high level pump chamber" or "high level settling chamber" float is activated. Set float elevations in accordance with Drawings.

SUBMITTALS

A. Shop Drawings: Indicate layout of pumping station. Show size, materials, and components of system. Indicate lifting cables, check valve locations, gate valve locations, pump locations, cleanout locations, discharge piping location, junction box location, guide rail assembly location, level control locations.
B. Product Data: Submit for the packaged pumping station.
2. Include catalog data for lift assembly, discharge piping, valves, level controls, and control panel.
3. Include pump catalog data, performance curve, and access frame data.
4. Include control panel diagram and panel wiring schematic.
C. Manufacturer's Installation Instructions: Submit manufacturer's published installation instructions.
D. Field Reports: Submit start-up report before final acceptance of pumps to document pumping station operation meets performance requirements.
E. Record actual locations of packaged pumping stations including pumps, piping, valves, meter and control panel.
F. Submit executed certification of pumping stations after performance testing.
G. Provide Operations and Maintenance Manual containing operating and maintenance requirements for pumping station and schedule of recommended maintenance.

WARRANTY

A. Furnish five year prorated manufacturer's warranty on pump seals.

SYSTEM

A. Product Description:
1. Submersible duplex centrifugal trash/wastewater pumping system including rail assemblies, lift cable or chain, discharge and fittings, check valves, gate valves, level controls, and control panel with PLC, and alarms.
2. Inlet Size: 4 inches.
3. Discharge Size: 3 inch NPT.
B. Rail System: Slide rail assemblies consisting of 304 stainless steel upper and lower rail brackets and pump guide brackets.
C. Junction Box: NEMA 250 Type 6 with cable grips for incoming direct burial cable.
D. Electrical: Cable grips for direct burial cable for field installation.
C. Float Pole (if used): ASTM D1785, Schedule 40 PVC, 1/2 inch.
E. Level Controls: Four mechanical float type or mercury type pilot duty liquid level controls with AWG 18-2 SJOW-A cable in polypropylene housing for mounting to PVC support pole.

PUMPS

A. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.
B. Pump Construction: Major pump components shall be of gray cast iron, ASTM A48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI Type 304 stainless steel construction. All exterior metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate and a polyester resin enamel finish. All O-rings shall be of Nitrile rubber. The lifting handle shall be stainless steel.
C. Motor:
1. Induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type.
2. The stator windings and leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing.
3. Motors are sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket is not required.
D. Motor Housing: Heavy duty ductile iron, ASTM A48, Class 30.
E. Volute: Pump volute(s) shall be single-piece gray cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Wear rings shall not be required. Minimum discharge size shall be as specified.
F. Impeller: The impeller shall be of hardened or stainless, dynamically balanced, closed two-vane non-clogging design having a long throughlet without acute turns.
G. Bearings: The pump shaft shall rotate on two single row ball bearings. Motor bearings shall be permanently grease lubricated.
H. Pump Shaft: Pump and motor shaft shall be the same unit. The motor shaft shall be composed of carbon steel under the rotor laminations and the pump shaft shall be of stainless steel. The pump shaft is an extension of the motor shaft; couplings shall not be acceptable.
I. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydra- dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal shall be silicon carbide/silicon carbide. The upper seal shall be carbon/ceramic. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.
J. Cable Entry: 30 feet cord. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. A junction box shall be completely sealed off from the pumped media. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
K. Lifting Device: Stainless Steel Chain: 1/2 inch, minimum breaking strength of 2000 pounds supplied for removing the pump. Length shall be 3 feet greater than the overall wet well depth.

VALVES

A. Swing Check Valve:
1. Anti-Siphon Check Valves, 3 inches.
2. Housing: Cast iron or PVC with flanged ends.
3. Seat: Resilient seat with vulcanized Nitrile rubber gaskets.
4. Temperature: 176 degrees F peak.
5. Pressure Test: 150 psig.
B. Gate Valve:
1. three inch; iron body bronze mounted; all exterior mounted bolts and nuts shall be stainless steel; rubber or EDPM encapsulated, resilient seat, solid wedge.
2. Gate valves shall be designed for 150 psi minimum working pressure.
3. Gate valves shall be hand wheel operated, non-rising stem type with flanged ends.
4. When full open, gate valves shall have a clear waterway equal to the nominal diameter of the pipe. The operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening.
D. Supports: Use supports for piping, valves, and meter consisting of Schedule 40 galvanized steel piping conforming to ASTM A53. Provide either ASME B16.3 or ASME B16.11 galvanized threaded fittings.

MAIN CONTROL PANEL

A. Product Description.
1. Factory fabricated, self-contained duplex including low volume pump off; pump on; pump on high level; high level alarm (red light), alternator to alternate pump duty between pumps on successive cycles or switch operation of pumps on pump failure. Include high water audible and visual alarm light and run light to warn of high water condition or failure of pumps. Flashing light and audible alarm to be large and robust to be seen and heard from a vehicle. Include an hour meter on each pump.
2. Horsepower Rating: As required for selected pump.
3. Phase: 3.
4. Voltage: 460 volts.
5. Coordinate power requirements with OWNER.
B. Enclosure: NEMA 4X rain tight, outdoor mounting G90 galvanized steel, gray polyester powder finish, padlock hasp/staple with captive stainless screws for door closure and locking. Provide continuous stainless piano hinge with stainless removable pin. Aluminum panel drilled and tapped, machine screw mounted components.
C. Circuit Breaker: For short circuit protection.
D. Starter: Electromagnetic.
E. Overload Relay: Bimetal type, ambient compensated.
F. Heater Element: Class 10 quick trip, one heater for each motor phase.
G. Switch: Hand-Off-Automatic, 1/2 inch NEMA 1.
H. Light: Pump motor run, 1/2 inch NEMA 1.
I. Sub Plate: Switch and light mounting.
J. Fuse: Control transformer primary when used. Meet requirements of NEC.
K. Fuse: Control circuit, meet requirements of NEC.
L. Terminal Strip: Box lugs for wiring.
M. Wiring: Color coded to NEC requirements; black power wiring, red numbered control wiring, white numbered neutral wiring, green ground wiring.
N. Alternator: Automatic.
O. Pump run odometers.
P. Six spare I/O points (2 analog, 4 digital)
Q. Lockable HOA switches

PIPE

A. Provide pressure piping and related accessories for force main piping inside the wet well and for the force main to the OWS.
B. Ductile iron pump discharge piping, AWWA C151/A21.51, thickness Class 52
C. 3 inch SDR11 High Density Polyethylene forcemain piping.
D. 1 ½ inch Schedule 40 PVC potential future controls conduit, with spare pull string.

MAIN CONTROL PANEL INSTALLATION

A. Mount and wire control panel for pumping station operation including duplex motor controls, circuit breaker, starter, control transformer, fuse box, terminal block, alternator, alarm and running lights.
B. Wire in accordance with requirements of National Electrical Code.
C. Use 18 AWG control wiring for control circuits and white for neutral grounded conductors.
D. Use minimum 14 AWG black power wiring.
E. Number each conductor.
F. Tin ends of wires with 60/40 lead tin alloy solder.
G. Control panel enclosure to be installed mounted to the top of the pump station or next to structure at the pump end of the structure as shown on the drawings. Mount control panel enclosure on 1-5/8 inch Unistrut galvanized steel frame. Frame support post(s)and base plate to be mounted to top of wet well top slab with stain steel anchor bolts or if installed next to the wet well to be set in concrete filled son-tube base set a minimum of 4 feet below finished grade.

ELECTRICAL REQUIREMENTS

A. OWNER to provide power for the lift station. The CONTRACTOR'S shall provide electrical service to the control panel by code compliant underground electric wiring protected by properly grounded rigid steel conduit.

STATION STARTUP, INITIAL TESTING AND OPERATION

A. Notify OWNER 3 days prior to flow rate testing.
B. Provide startup and initial testing of system. Coordinate and operate pumps in conjunction with the OWNER and the OWS.
C. Provide PLC programming and setup of auto dialer notifications with contact(s) provided by the OWNER.
D. Hydraulically test station to performance requirements by receiving, pumping and discharging 1000 gallons of water from wet well basin.
E. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty workmanship, regardless of cause, within 48 hours after notification from OWNER.
F. After correcting failures caused by defective equipment, material, or faulty workmanship, retest until failures are eliminated.
G. Confirm general sequencing of pump and float operations at basin and control panel are in accordance with performance requirements.
H. Document and certify startup results in startup report.

MANUFACTURER'S FIELD SERVICE

A. Furnish factory trained representative and field technical assistance during the following periods of pumping station installation:
1. Unloading of station materials and components.
2. Start-up, testing, and demonstration of station systems-basin, pump, control panel, PLC programming, and auto dialer operation.

ADJUSTING

A. Adjust pump and control panel systems so station operates to performance requirements and in accordance with these specifications.

DEMONSTRATION

A. Demonstrate operation of pumping station components, pump system, and control panel.

PRECAST CONCRETE PUMP STATION

A. One nominal 2,000 gallon 2 chamber rectangular precast concrete structure with baffle wall OR two circular precast concrete manhole structures, 1,500 gallon receiving/settling tank/chamber and minimum 500 gallon pump chamber.
B. Construction of precast concrete septic tank or manholes, structures shall conform to ASTM C 1227 or ASTM C 478.

Precast concrete structures shall conform to the following:

1. Concrete used in the manufacture of the precast concrete pump station structure shall have a minimum 28-day compressive strength of 5000 psi and reinforced for H20 loading.
2. Reinforcing shall extend into the tongue and groove of each structure section or manhole riser section wall.
3. Casting methods must assure each unit to be very dense in structure and impervious to water. Paint the exterior of precast structures with two heavy coats of bituminous paint.
4. Tongue and Groove:
   a. Formed of concrete so as to receive the gaskets.
   b. Sections shall be set so as to be vertical and in true alignment.
   c. Joints between sections shall be of a type approved by the OWNER and shall, in general provide watertightness. Joints between precast sections shall be sealed with approved flexible plastic gaskets (Type B), rubber gaskets, or rubber O-rings. The minimum size of flexible plastic gaskets shall be 1⅛ inch in diameter or joint sealant materials shall be of the sizes recommended by the manufacturer to provide watertight seals between precast sections. The CONTRACTOR shall furnish information showing that the sizes of the joint sealants being supplied meet the manufacturer's recommendations.
5. Pipe to Structure Joints: Only as approved by the OWNER'S REPRESENTATIVE and, in general, will depend for watertightness upon a rubber boot either cast-in-place or press-wedged in place. Pipe-to-wall connections shall be mortared to produce smooth transitions and watertight joints or provided with ASTM C 923 resilient connectors.
6. All precast sections shall have the date of manufacture and the name or trademark of the manufacturer impressed or indelibly marked on the inside wall.

FRAMES AND COVERS

A. Cast Iron Frames and Covers:
1. Shall be cast iron conforming to ASTM A 48, Class 35B Gray Iron or ASTM A 536 for ductile iron. Fabricate frames, covers, and gratings of standard commercial grade steel or ductile iron, welded by qualified welders in accordance with AWS D1.1.
2. Provide machined bearing surface.
3. Castings: Good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended.
4. Contact Surfaces of Covers/Grates and Frame Seats: Machined at the foundry, before shipment to prevent rocking of covers in any orientation.
5. Thoroughly clean and subject to a careful hammer inspection.
6. Manhole Frames and Covers:
   a. Provide a 30-inch diameter clear opening. Provide with gasket for air tight seal.
B. Aluminum Access Hatches:
1. Shall be of the size shown on the drawings.
2. Made of ¼" thick diamond pattern aluminum plate.
3. Reinforced for H20 loading.
4. Automatic hold-open arm.
5. Depth of frame as required to match the depth of the precast structure cover.
6. All hardware including latches, lifting mechanism assemblies, guides, brackets, hinges, pins, hold open arms, and guides shall be made of 316 SS.
7. Hinges shall be accessible only when the access door is in the open position.
8. All access hatches shall be provided with recessed padlock hasps covered by a hinged lid that closes flush with the surface of the hatch cover.

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Rev.	Issue Date	Issue By	Revision Item
A	03/28/14	JVM	CLIENT
B	04/08/14	RJR	BID
C	04/24/14	RJR	FINAL
D	08/20/14	DAB	CONST.

Title
E.W. BROWN GENERATING STATION
CCR LANDFILL
PUMP STATION AND FORCE MAIN
PLAN VIEW, DETAILS, AND SPECIFICATIONS
Location and Unit:
E.W. BROWN GENERATING STATION

Scale: 1" = 50'
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO.

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Drawing No: BRO-C-01354
Rev: B

DWG Version 2.0

APPENDIX C

MAIN POND TOE DRAIN
COLLECTION SYSTEM DESIGN

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A	11/25/14	JVM	CLIENT
B	12/19/14	BJB	CLIENT
C	1/19/15	BJB	IFC
D	2/19/15	MJW	CLIENT
E	3/05/15	BJB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM – PHASE 1A
EXISTING CONDITIONS (FOR PHASE 1B)
SITE PLAN
Location and Detail
E.W. BROWN GENERATING STATION

Scale: 1"=10'
Drawn:
Date:
Checked:
Approved:
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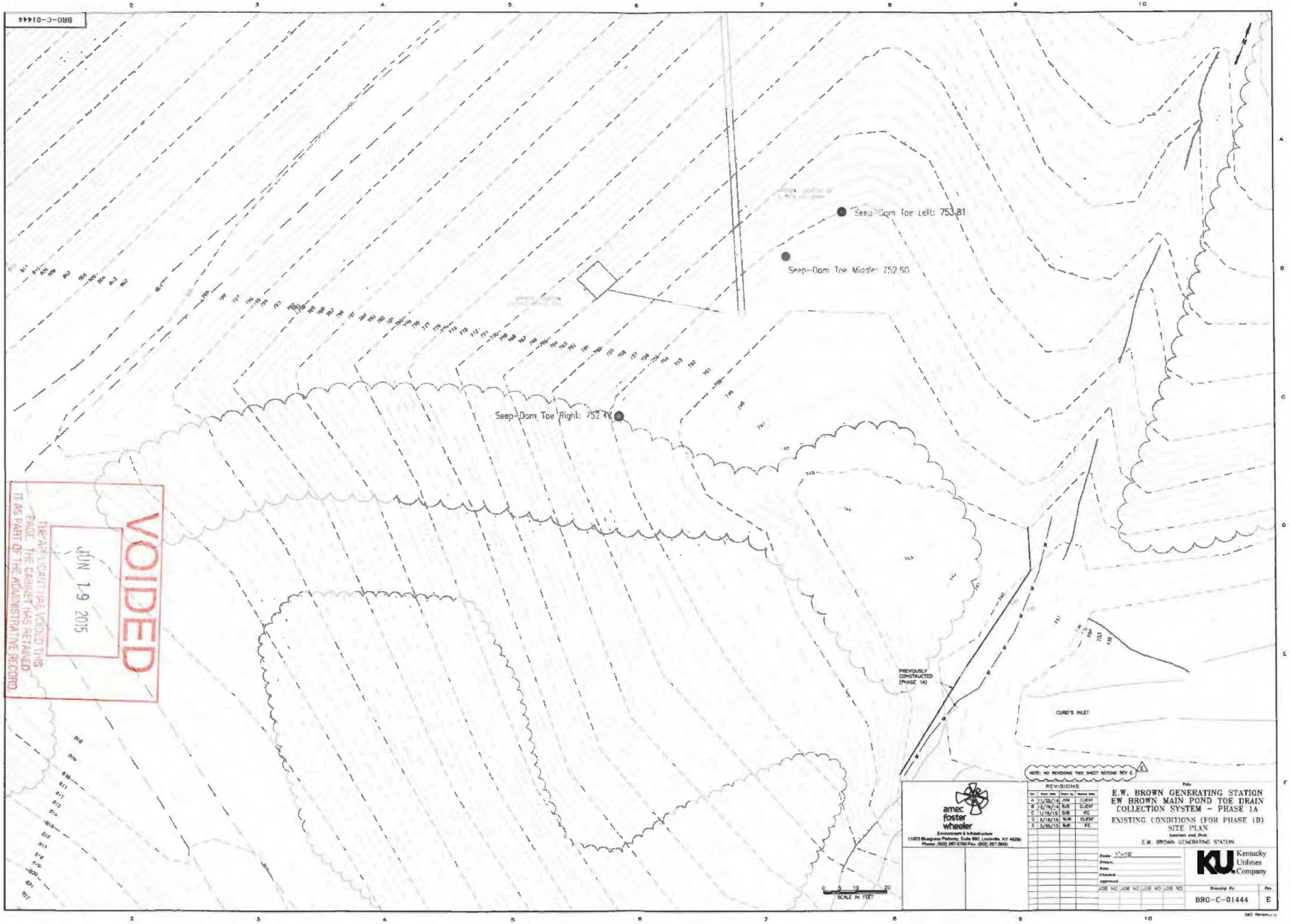
Drawing No: BRO-C-01444
Rev. E

ISSUE Version 2.0



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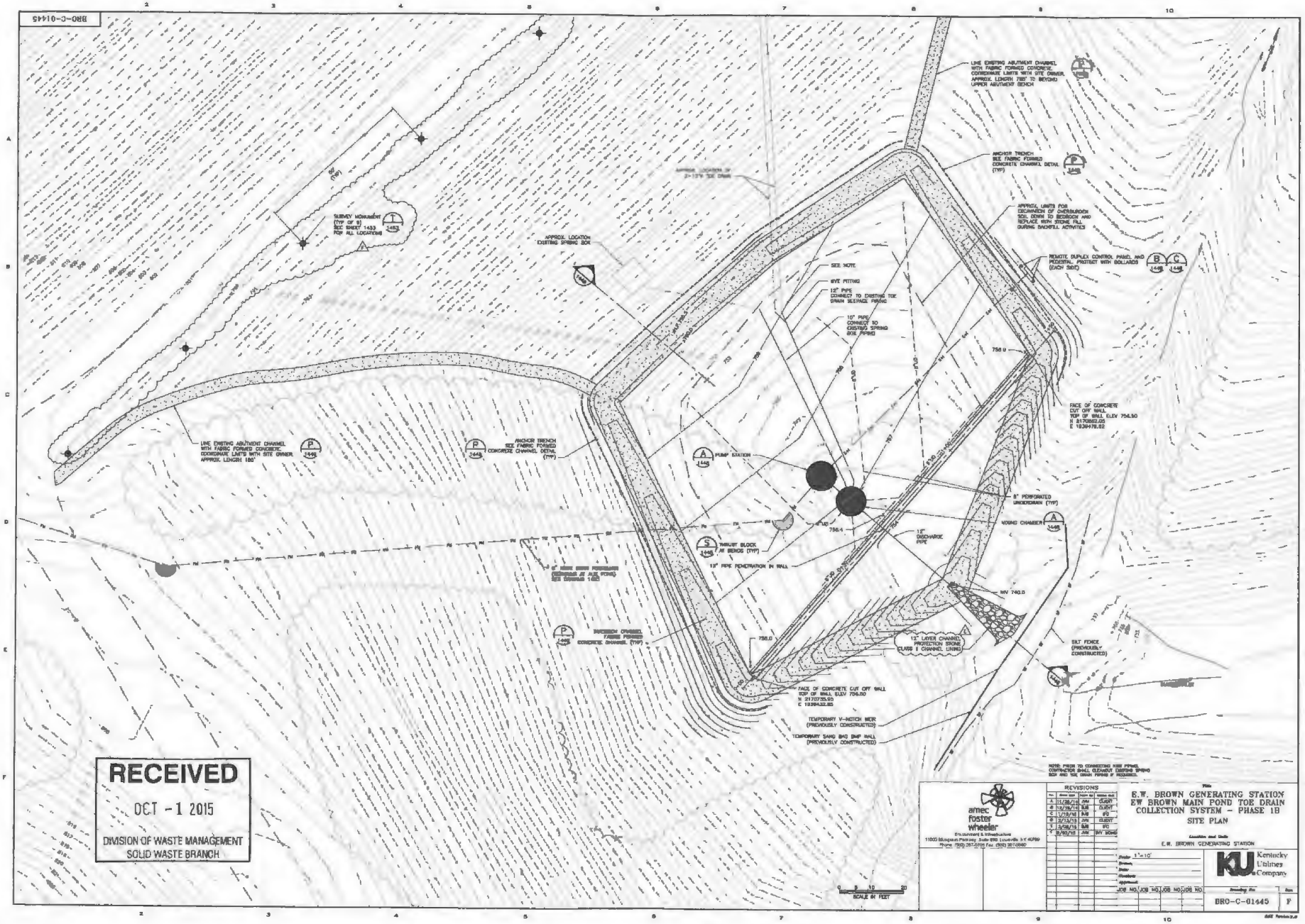

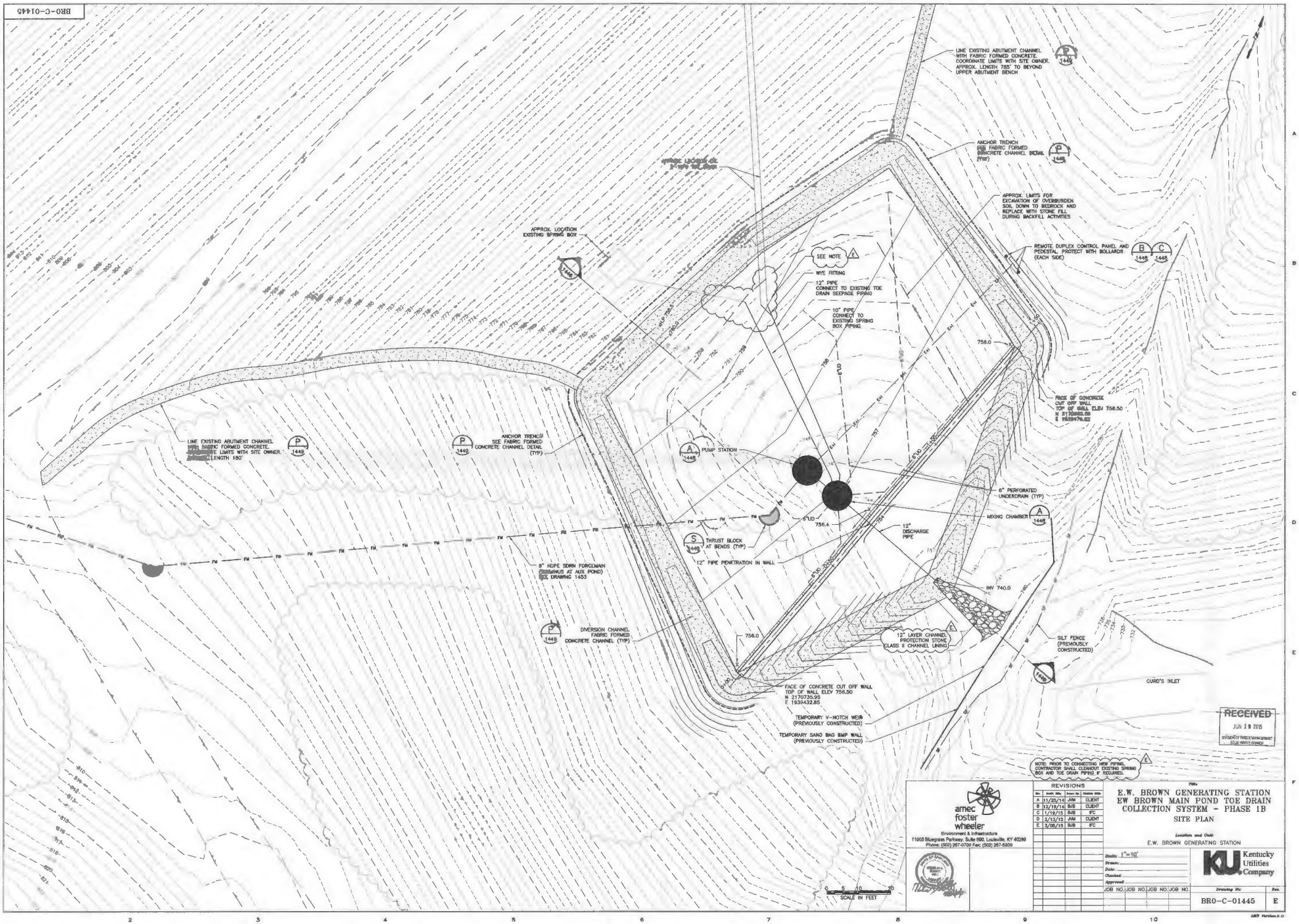

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C	1/19/15	BJB	IFC
D	2/13/15	JWM	CLIENT
E	5/06/15	BJB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
SITE PLAN

Location and Unit:
E.W. BROWN GENERATING STATION

Scale: 1"=10'
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO. JOB NO.

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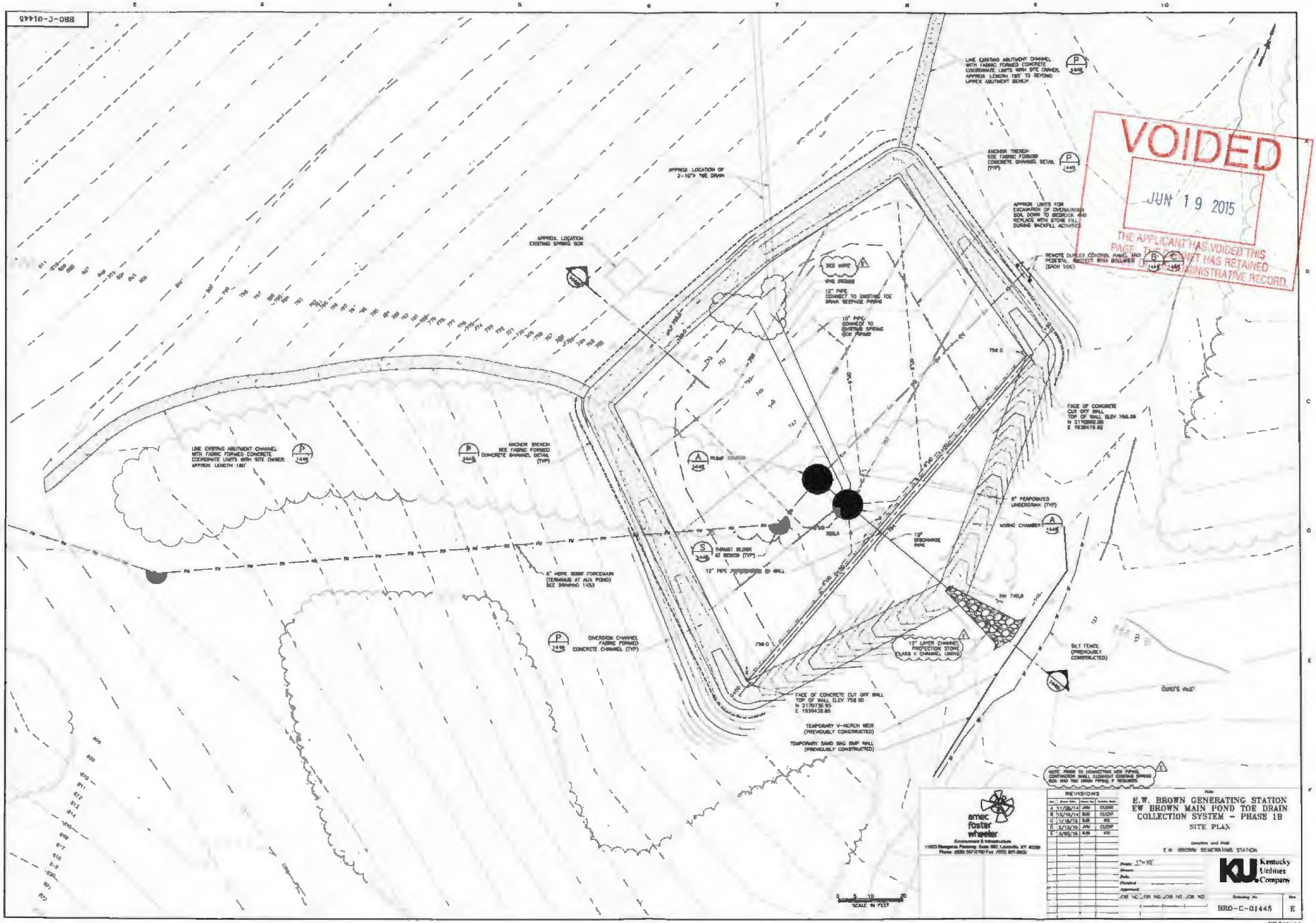
Drawing No: BR0-C-01445
Rev. E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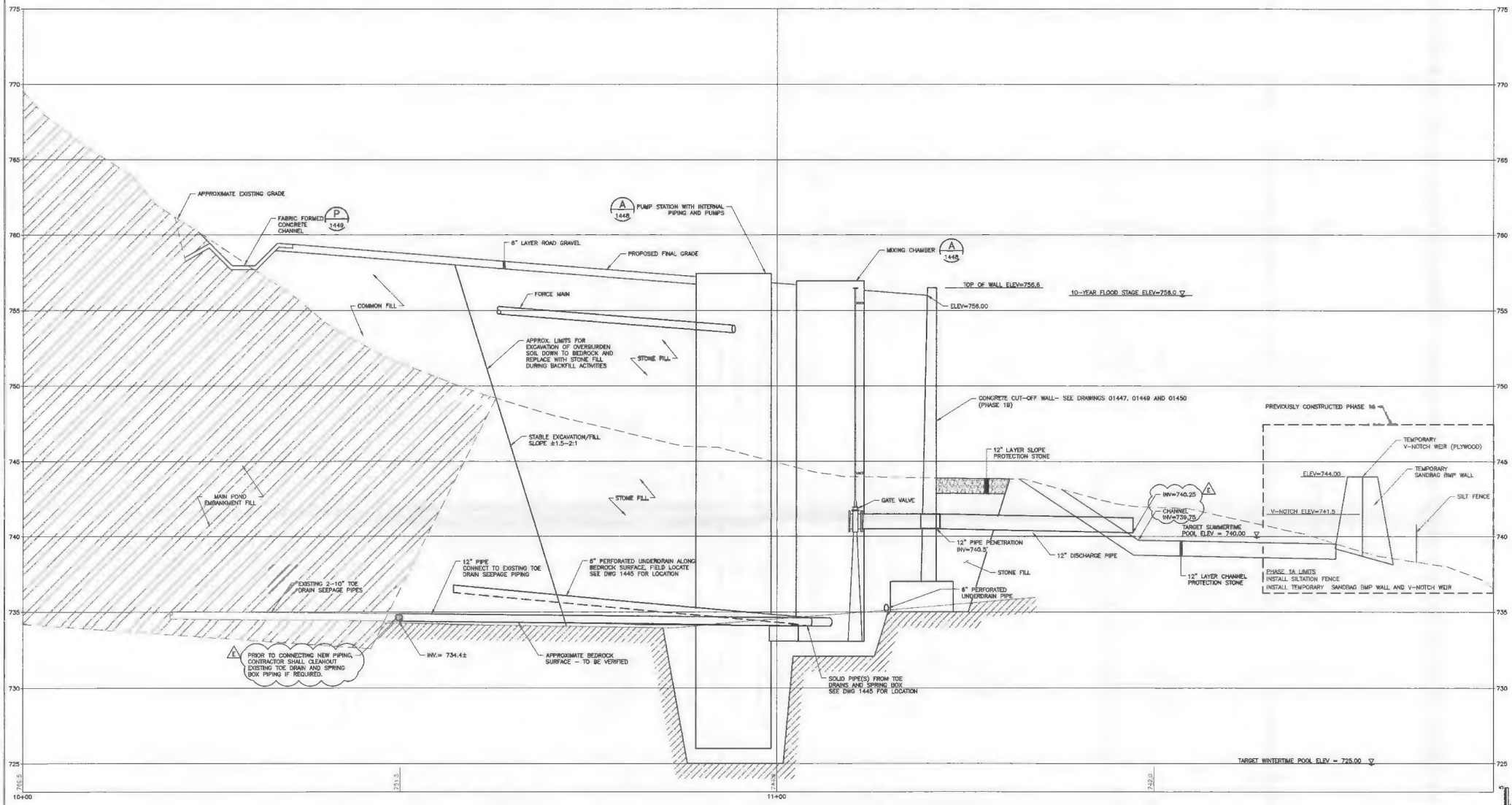
THE APPLICANT HAS VOIDED THIS PAGE. THE DEPARTMENT HAS RETAINED IT FOR THE ADMINISTRATIVE RECORD.
BRO-C-01445
LINE EXISTING ABUTMENT CHANNEL WITH FABRIC FORMED CONCRETE COORDINATE LIMITS WITH SITE OWNER APPROX LENGTH 180'
ANCHOR TRENCH SEE FABRIC FORMED CONCRETE CHANNEL DETAIL (TYP)
APPROX LOCATION OF 2-10"ø TVE DRAIN
APPROX LOCATION EXISTING SPRING BOX
12" PIPE CONNECT TO EXISTING TOE DRAIN SEEPAGE PIPING
10" PIPE CONNECT TO EXISTING SPRING BOX REPAIR
8" HDPE SDR17 FORCEMAIN (TERMINATE AT AUX POND) SEE DRAWING 1453
DIVERSION CHANNEL FABRIC FORMED CONCRETE CHANNEL (TYP)
FACE OF CONCRETE CUT OFF WALL TOP OF WALL ELEV 758.50 N 2170735.55 E 1939438.86
TEMPORARY V-NOTCH WEIR (PREVIOUSLY CONSTRUCTED)
TEMPORARY SAND BAG BMP WALL (PREVIOUSLY CONSTRUCTED)
LINE EXISTING ABUTMENT CHANNEL WITH FABRIC FORMED CONCRETE COORDINATE LIMITS WITH SITE OWNER APPROX LENGTH 785' TO BEYOND UPPER ABUTMENT BENCH
APPROX LIMITS FOR EXCAVATION OF OVERBURDEN SOIL DOWN TO BEDROCK AND REPLACE WITH STONE FILL DURING BACKFILL ACTIVITIES
REMOTE DUPLEX CONTROL PANEL AND PEDESTAL MOUNTED WITH BOLLARDS (EACH SIDE)
FACE OF CONCRETE CUT OFF WALL TOP OF WALL ELEV 758.35 N 2170882.20 E 1939478.82
6" PERFORATED UNDERDRAIN (TYP)
MIXING CHAMBER
18" STORMPIPE
12" LAYER CHANNEL PROTECTION STONE CLASS II CHANNEL LINING
SILT FENCE (PREVIOUSLY CONSTRUCTED)
NOTE PRIOR TO CONNECTING HDR PIPING CONTRACTOR SHALL CLEANOUT EXISTING SPRING BOX AND TOE DRAIN PIPING IF NECESSARY
REVISIONS
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
SITE PLAN
EW BROWN GENERATING STATION
Kentucky Utilities Company
BRO-C-01445
E

BRO-C-01446



TOE DRAIN COLLECTION SYSTEM - PROFILE A

1"=5' HORIZ. 1"=2.5' VERT.

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A	11/25/14	JVM	CLIENT
B	12/18/14	SJB	CLIENT
C	1/19/15	SJB	IFC
D	2/13/15	JVM	CLIENT
E	3/19/15	SJB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
PROFILE A

Location and Unit:
E.W. BROWN GENERATING STATION

Scale: 1"=5'H, 1=2.5V
Drawn:
Date:
Checked:
Approved:

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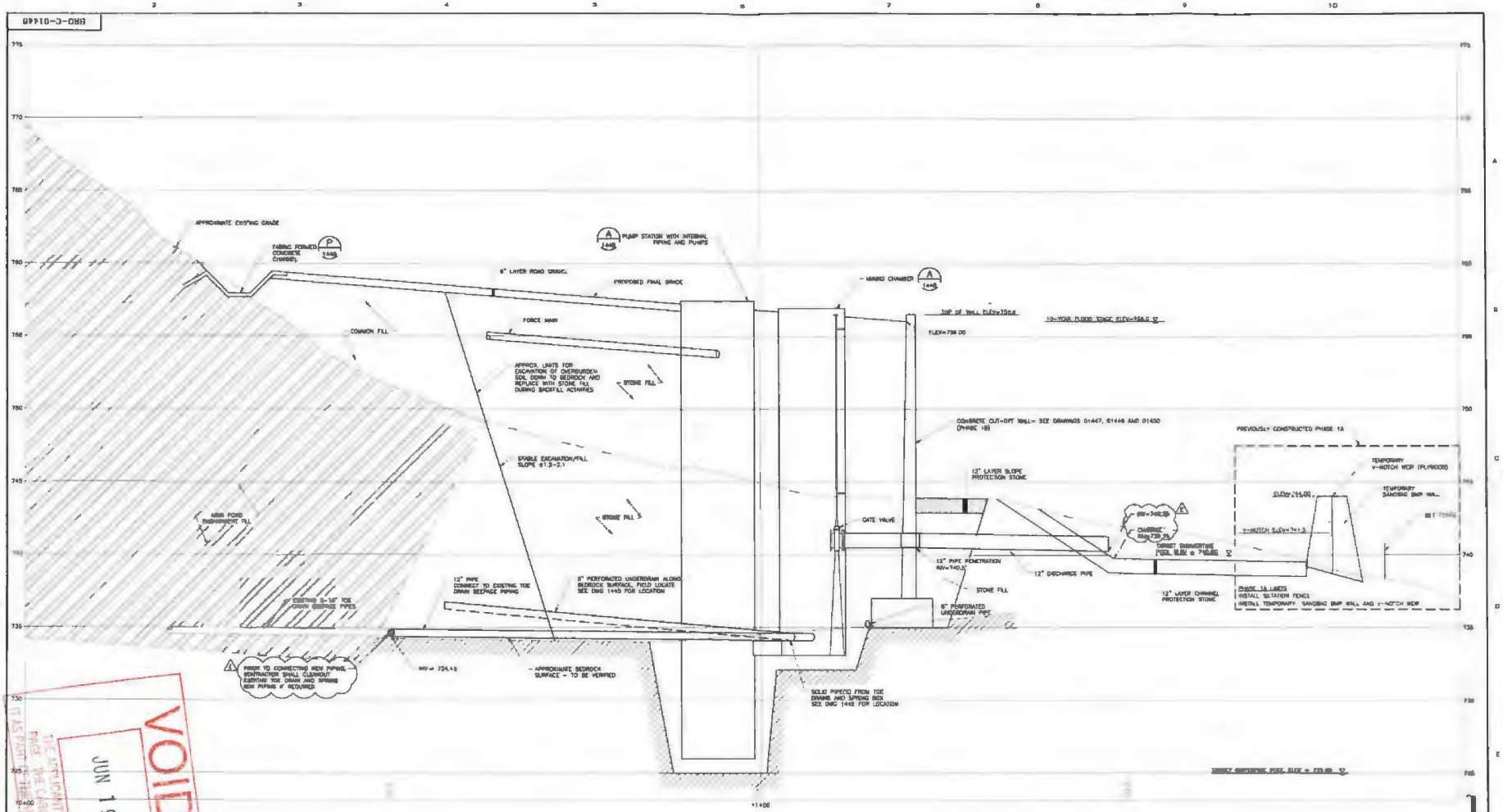
JOB NO. JOB NO. JOB NO. JOB NO.

Drawing No. BRO-C-01446

Rev. E



TOE DRAIN COLLECTION SYSTEM – PROFILE A
1"=5' HORZ 1"=15' VERT

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REVISIONS			
A	11/25/14	JW	CLIENT
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E	3/09/15	BJF	FC

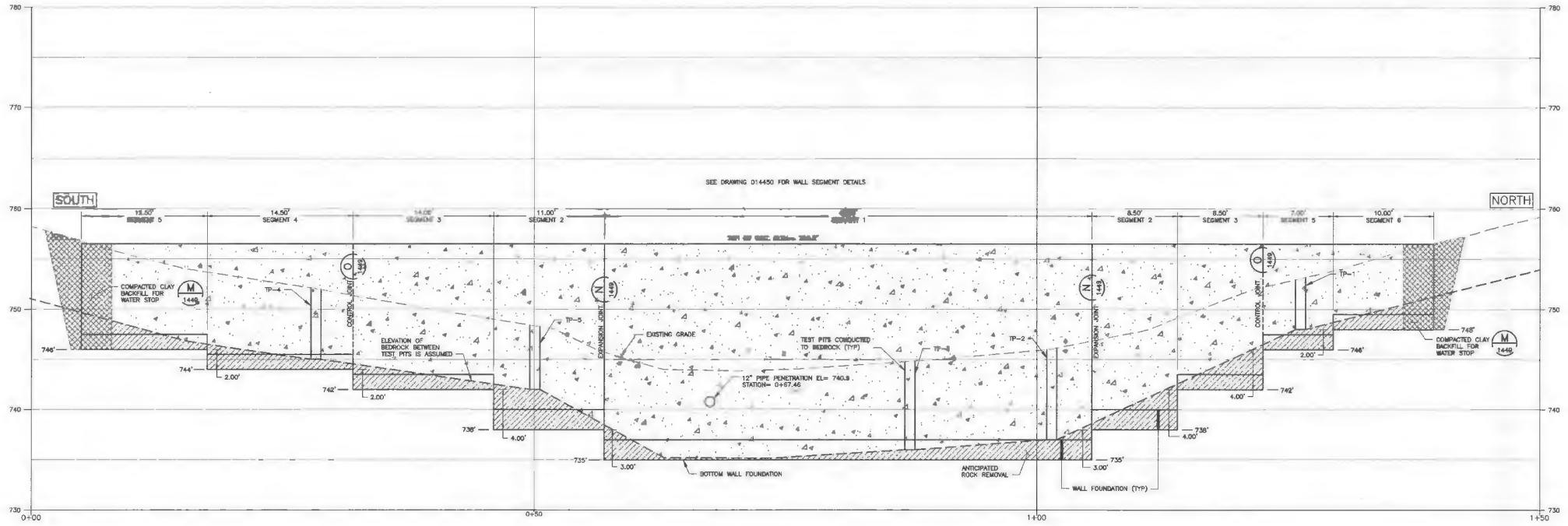
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM – PHASE 1B
PROFILE A

E.W. BROWN GENERATING STATION

Kentucky Utilities Company

BRD-C-01448 E

BR0-C-01447



CUT-OFF WALL PROFILE

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HORIZONTAL SCALE: 1" = 4'
0 2 4 8
SCALE IN FEET

VERTICAL SCALE: 1" = 4'
0 2 4 8
SCALE IN FEET

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No.	Date	Issued By	Status
A	10/17/14	JVM	PERMIT
B	12/19/14	BJB	CLIENT
C	1/19/15	BJB	IFC
D	2/19/15	MJW	CLIENT
E	3/06/15	BJB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
CUT-OFF WALL PROFILE

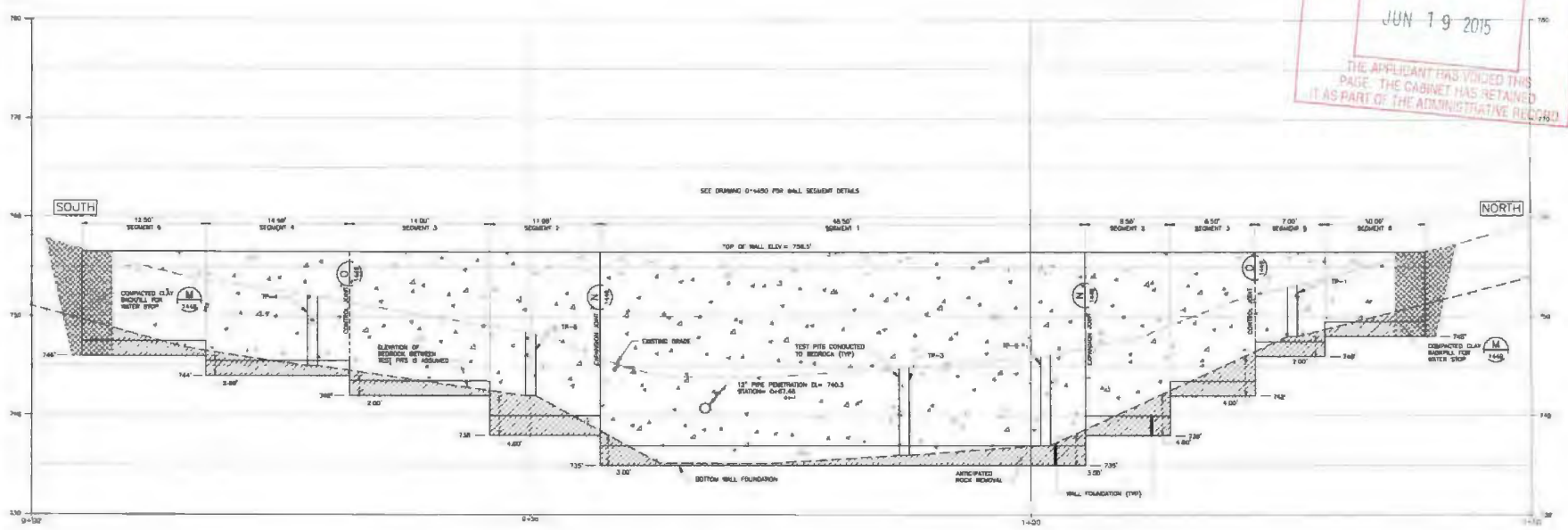
Location and Detail:
E.W. BROWN GENERATING STATION

Scale: 1"=4'
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO. JOB NO.

Kentucky Utilities Company

Drawing No: BR0-C-01447
Rev. E

DMS Version 2.0



CUT-OFF WALL PROFILE

NOTE: NO REVISIONS THIS SHEET BEYOND REV C

REVISIONS				
No.	Date	Description	By	Check
A	05/17/14	JOB	PCRatt	
B	08/04/14	BID	CLARK	
C	12/18/13	BID	PC	
D	3/19/15	BID	S.RATT	
E	5/08/15	BID	YC	

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HORIZONTAL SCALE: 1" = 4'
SCALE IN FEET
VERTICAL SCALE: 1" = 4'
SCALE IN FEET

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
CUT-OFF WALL PROFILE

Location and Plant
E.W. BROWN GENERATING STATION

Project 1"=4
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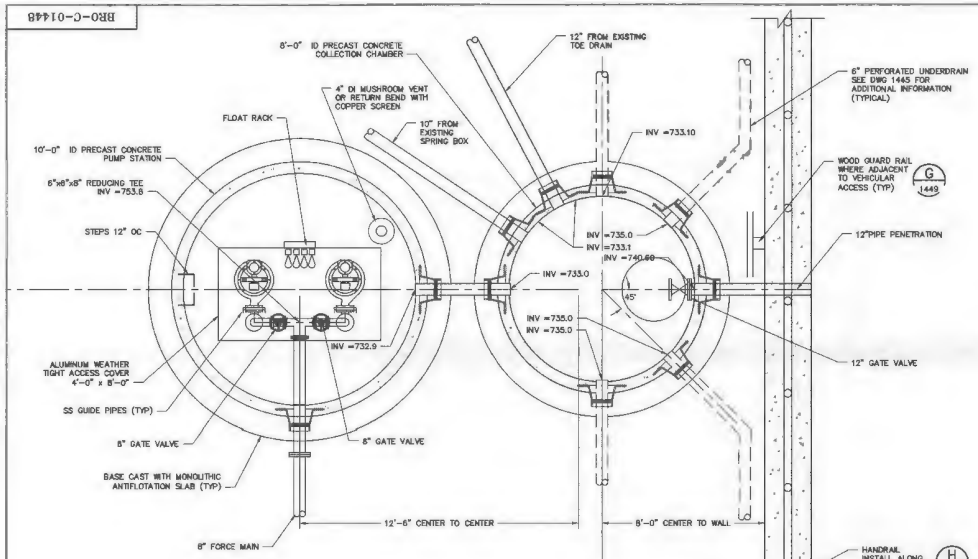
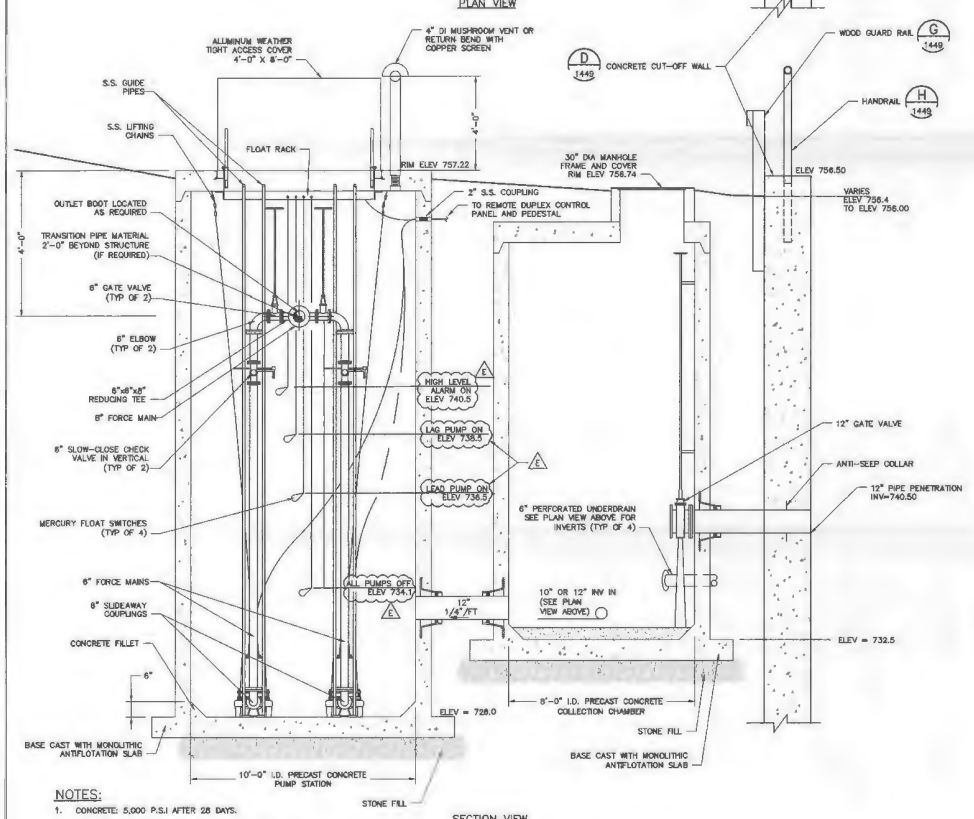


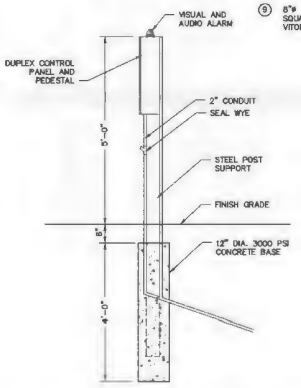
PLAN VIEW



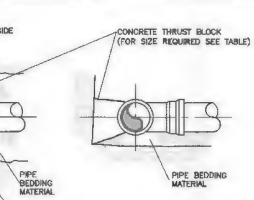
SECTION VIEW

NOTES:
1. CONCRETE: 5,000 P.S.I AFTER 28 DAYS.
2. JOINTS SEALED WITH BUTYL RUBBER SEALANT.

PUMP STATION AND MIXING CHAMBER A 1448 NTS



REMOTE DUPLEX CONTROL PANEL AND PEDESTAL B 1448 NTS



TYPICAL THRUST BLOCK PLACEMENT ON BENDS

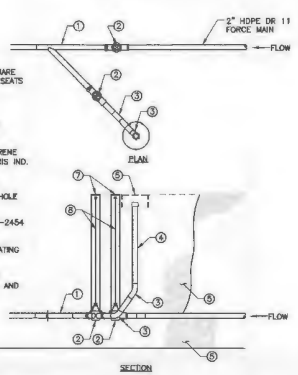
CONCRETE THRUST BLOCK SIZE REQUIREMENTS

FITTINGS		SQUARE FEET OF BEARING ON UNDISTURBED SOIL		
		45° BENDS	22.5° BENDS	11.25° BENDS
PIPE SIZE (IN)	B	3.0	2.5	1.8

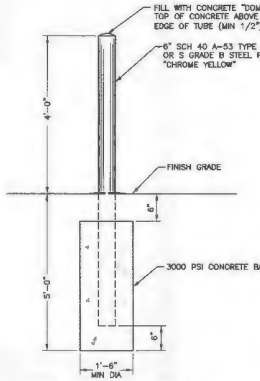
NOTES:
1. FOR TRENCHES IN ROCK WHERE THE TOP OF THE ROCK FACE IS AT OR ABOVE THE PIPE CROWN, CONCRETE SHALL BE PLACED BETWEEN THE PIPE AND THE ROCK FACE.
2. THE THRUST BLOCK BEARING AREAS ARE BASED ON A RESULTANT THRUST AT FITTINGS OFF 100 PSI WATER PRESSURE AND A SOIL WITH A BEARING CAPACITY OF 2000 POUNDS PER SQUARE FOOT. DIFFERENT SOIL CONDITIONS MAY REQUIRE DIFFERENT BEARING AREAS AT THE DIRECTION OF THE ENGINEER.
3. THE MAXIMUM HEIGHT OF EACH THRUST BLOCK SHALL BE EQUAL TO 1/2 THE DISTANCE BETWEEN THE GROUND SURFACE AND THE BOTTOM OF THAT THRUST BLOCK.
4. JOINTS SHALL NOT BE ENCASED IN CONCRETE.

THRUST BLOCK S 1448 NTS

FORCEMAIN CLEANOUT AND PLUG VALVE NOTES:
1. 8" x 2" WYE HDPE SDR 11.
2. HDPE SDR-11 GATE VALVE. FLANGE ENDS, SQUARE NUT OPERATED WITH EXTENSION STEM, VITON SEATS AND O-RINGS.
3. 45° SWEEP - HDPE SDR-11
4. HDPE SDR-11 CLEANOUT TO 2" BELOW GRADE. TAPPED FLANGE WITH BRASS THREADED PLUG.
5. MANHOLE - 12"ø, 3-BOLT, WATERTIGHT, NEOPRENE GASKET, 12" GALVANIZED SKIRT MADE BY MORRIS IND.
6. PIPE BEDDING MATERIAL. GRANULAR MATERIAL, INSTALLED IN MINIMUM OF 12-INCH LIFTS AND COMPACTED TO 90%, EXTENDS TO GRADE - WHOLE EXCAVATION.
7. CLOW, SCREW TYPE ADJUSTABLE VALVE BOX, F-2454 WITH 5-1/4" LID OR APPROVED EQUAL.
8. CLOW EXTENSION STEM WITH 2" BRONZE OPERATING NUT
9. 8"ø DI PLUG VALVE, MECHANICAL JOINT ENDS, SQUARE NUT OPERATED WITH EXTENSION STEM, AND VITON SEATS AND O-RINGS



FORCEMAIN CLEANOUT Q 1448 NTS



NOTE: TWO BOLLARDS LOCATED AT PUMP STATION CONTROL. SEE SHEET BRO-C-01445 FOR LAYOUT.

BOLLARD C 1448 NTS

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SOLID WASTE BRANCH

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Environment & Infrastructure
11005 Bluegrass Parkway, Suite 650, Louisville, KY 40299
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REVISIONS				
No.	Issue Date	Drawn By	Submitted By	Submitted To
A	11/25/14	JVM	CLIENT	
B	12/15/14	SJB	CLIENT	
C	1/19/15	MAP	PC	
D	2/13/15	JVM	CLIENT	
E	5/06/15	SJB	PC	

Title: E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
DETAILS 1

Location and Unit: E.W. BROWN GENERATING STATION

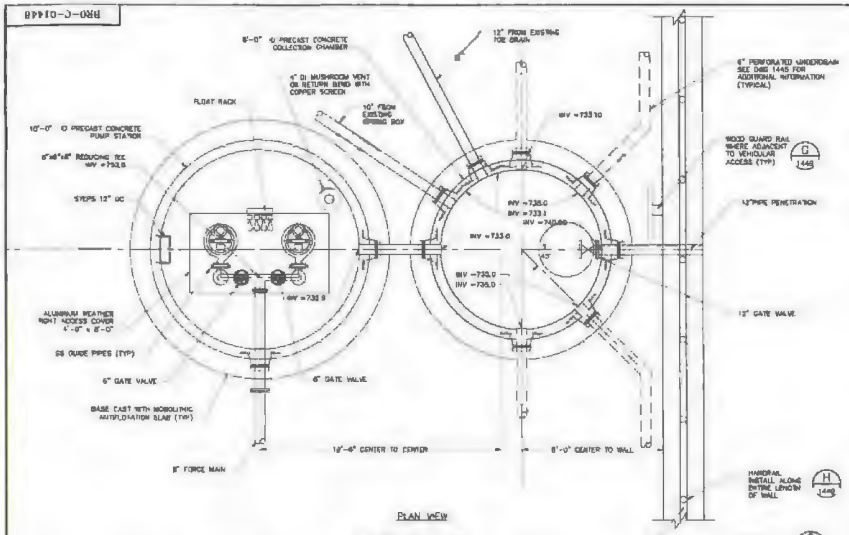
Similar: None
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO.

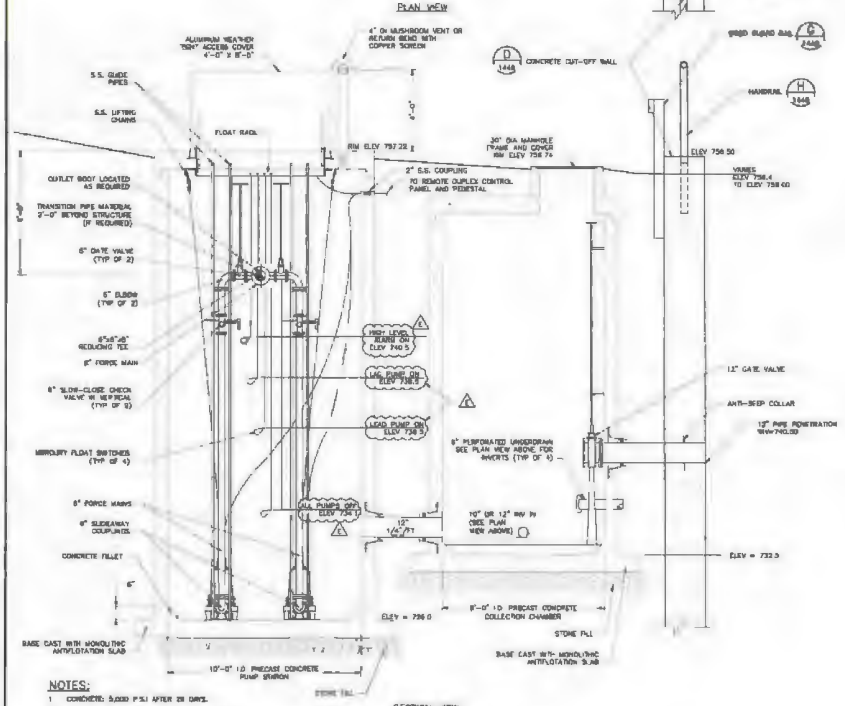
Kentucky Utilities Company

Drawing No: BRO-C-01448
Rev: E

DEP Version 2.0

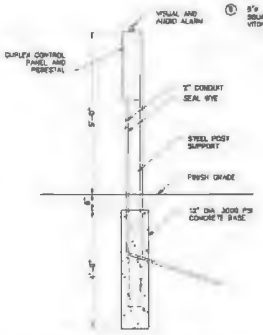
BRD-C-01448



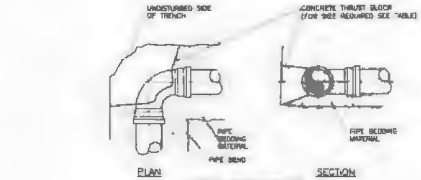


NOTES:
1. CONCRETE: 5,000 P.S.I AFTER 28 DAYS.
2. JOINTS SEALED WITH BUTYL RUBBER SEALANT

PUMP STATION AND WIDING CHAMBER (A)



REMOTE DUPLEX CONTROL PANEL AND PEDESTAL (B)



TYPICAL THRUST BLOCK PLACEMENT ON BENDS

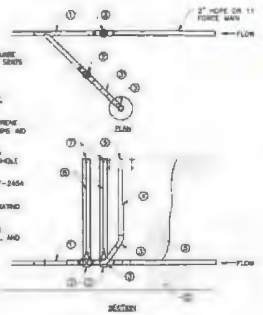
CONCRETE THRUST BLOCK SIZE REQUIREMENTS

		SQUARE FEET OF BEARING ON UNDISTURBED SOIL		
FITTINGS		90° BENDS	22.5° BENDS	11.25° BENDS
PIPE SIZE (IN.)	B	L.S	L.S	1.0

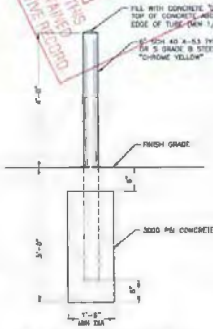
NOTES
1. FOR TRENCHES IN ROCK WHERE THE TOP OF THE ROCK FACE IS AT OR ABOVE THE PIPE CROWN, CONCRETE SHALL BE PLACED BETWEEN THE PIPE AND THE ROCK FACE.
2. THE THRUST BLOCK BEARING AREAS ARE BASED ON A RESULTANT THRUST AT FITTINGS OFF 100 PSI WATER PRESSURE AND A SOIL WITH A BEARING CAPACITY OF 2000 POUNDS PER SQUARE FOOT. DIFFERENT SOIL CONDITIONS MAY REQUIRE DIFFERENT BEARING AREAS AT THE DIRECTION OF THE ENGINEER.
3. THE MAXIMUM HEIGHT OF EACH THRUST BLOCK SHALL BE EQUAL TO 1/2 THE DISTANCE BETWEEN THE GROUND SURFACE AND THE BOTTOM OF THAT THRUST BLOCK.
4. JOINTS SHALL NOT BE ENCASED IN CONCRETE.

THRUST BLOCK (S) 1448

FORCEMAIN CLEANOUT AND PLUG VALVE NOTES:
1. 8" x 3" RYE HDPE SDR 11.
2. 8"x8"x3" GATE VALVE FLANGE ENDS, SQUARE NUT OPERATED WITH EXTENSION STEM, WHEEL SERVES AND O-RINGS.
3. 45° SWEEP - 8"x8"x3"
4. 8"x8"x3" CLEANOUT TO 3" BELOW GRADE, SWEEP ELBOW WITH GRADE THREADED PLUG.
5. MANHOLE - 12"ø, 3-BOLT, WATERTIGHT, NEOPRENE GASKET, 18" GALVANIZED SHAFT MADE BY NEENAH NO
6. PIPE BEDDING MATERIAL, GRANULAR MATERIAL INSTALLED IN MINIMUM OF 12" LIFTS AND COMPACTED TO 90% BETWEEN TO GRADE - 90% EXCAVATION
7. CLOW, SCREW TYPE ADJUSTABLE VALVE BOX F-2454 WITH 5-1/4" LID OR APPROVED EQUAL
8. CLOW EXTENSION STEM WITH 2" BRONZE, OPERATING NUT
9. 8"x 3" PLUG VALVE, MECHANICAL JOINT ENDS SQUARE NUT OPERATED WITH EXTENSION STEM, AND VITON SEATS AND O-RINGS



FORCEMAIN CLEANOUT (Q) 1448



NOTE: TWO BOLLARDS LOCATED AT PUMP STATION CONTROL. SEE SHEET BRD-C-01446 FOR LAYOUT

BOLLARD (C) 1448

amec foster wheeler
Environment & Infrastructure
11079 Bluegrass Parkway Suite 600 Louisville KY 40299
Phone (502) 267-0100 Fax (502) 267-0600

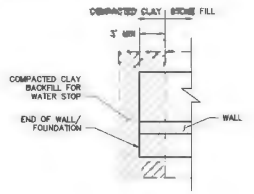
REVISIONS			
A	5/13/2014	JMM	CLIENT
B	12/19/2014	BJG	CLIENT
C	2/26/2015	MRP	EPC
D	5/14/2015	JMM	CLIENT
E	6/08/2015	BJG	EPC

E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
DETAILS 1

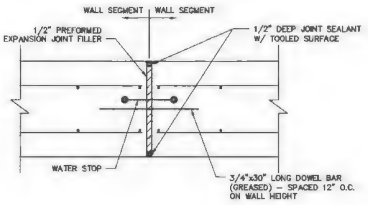
Kentucky Utilities Company

BRD-C-01448 E

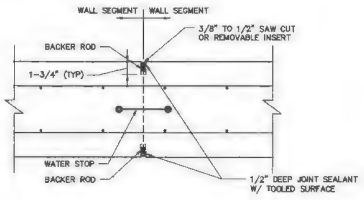
BRO-C-01449



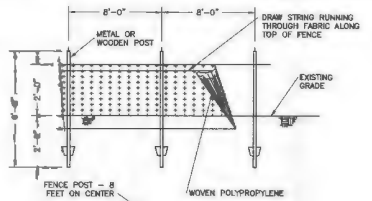
PLAN

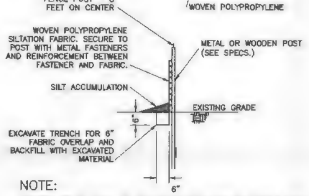


EXPANSION JOINT N 1449
NTS



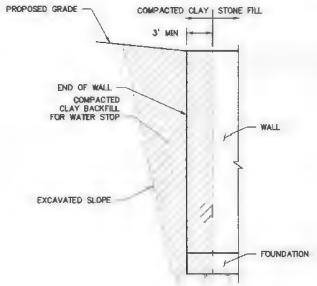
CONTROL JOINT O 1449
NTS



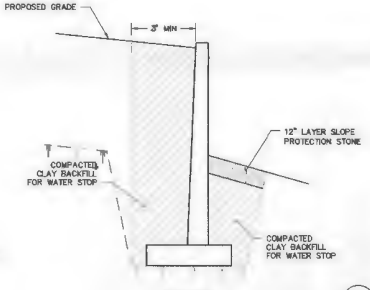


NOTE:
SILTATION FENCE SHALL BE REINFORCED WITH HOG OR CHICKEN WIRE OR INTEGRAL PLASTIC MESH REINFORCING.

SILT FENCE L 1449
NTS

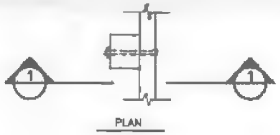


ELEVATION

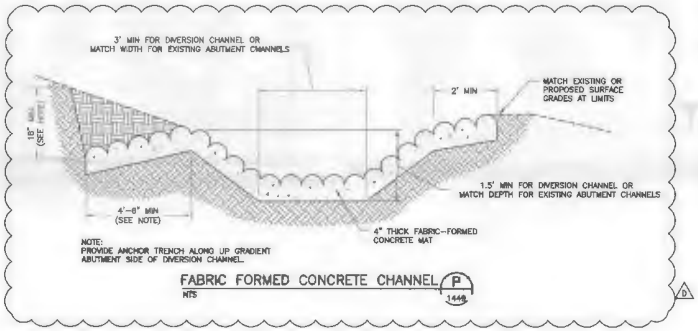


SECTION

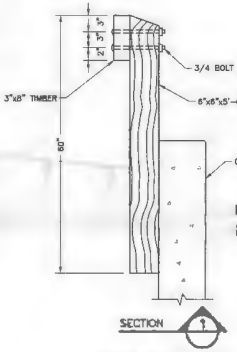
TYPICAL CLAY BACKFILL WATER STOP M 1449
NTS



PLAN

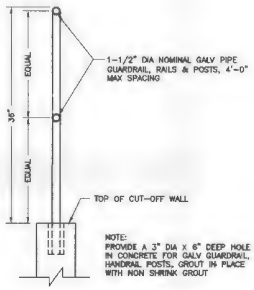


FABRIC FORMED CONCRETE CHANNEL P 1449
NTS

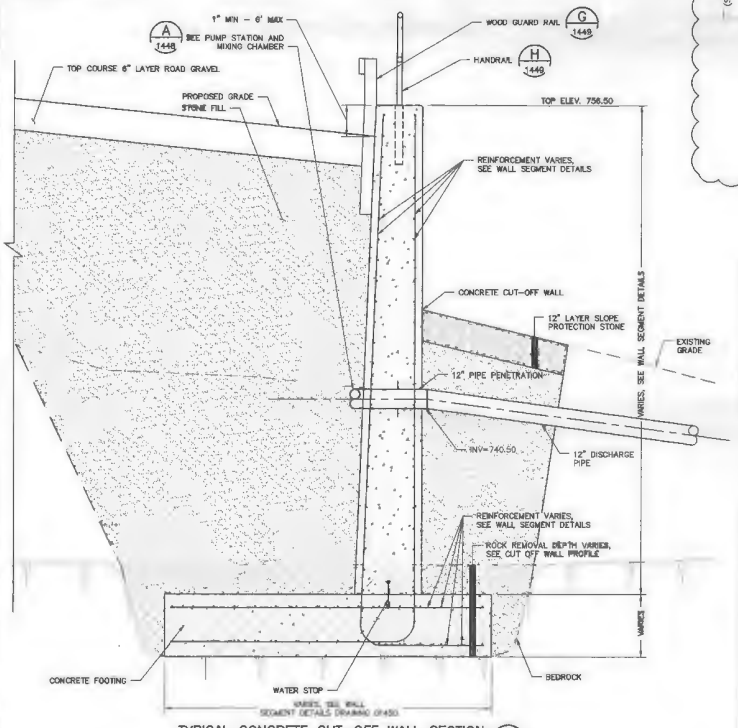


NOTE:
ALL TIMBERS TO BE PRESSURE TREATED.

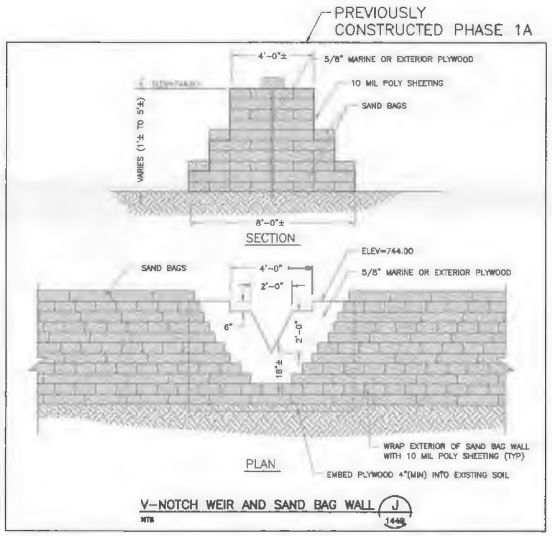
WOOD GUARD RAIL G 1449
NTS



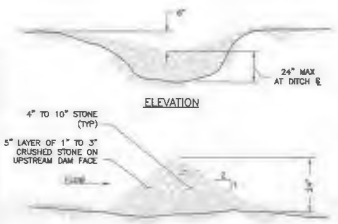
HANDRAIL H 1449
NTS



TYPICAL CONCRETE CUT-OFF WALL SECTION D 1449
NTS

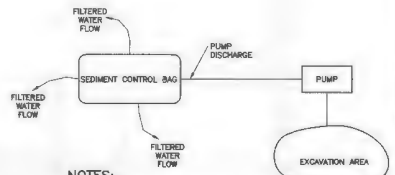


V-NOTCH WEIR AND SAND BAG WALL J 1449
NTS



NOTE:
ONCE DISTURBED AREA IS STABILIZED, INCORPORATE STONE FROM CHECK DAM INTO CORRESPONDING RIPRAP SWALE LINING.

ROCK CHECK F 1449
NTS



NOTES:
1. BAG MUST BE LOCATED AWAY FROM RECEIVING WATERS AND/OR CONSTRUCTION ACTIVITIES.
2. BAGS MUST BE DISPOSED OF ACCORDING TO MANUFACTURER'S INSTRUCTIONS. BAGS MAY NOT BE REUSED.

RECEIVED
JUN 1 9 2015
DIVISION OF WASTE MANAGEMENT SOLID WASTE BRANCH

SEDIMENT CONTROL BAG FOR DEWATERING K 1449
NTS

amec foster wheeler
Environment & Infrastructure
11003 Bluegrass Parkway, Suite 600, Louisville, KY 40299
Phone: (502) 267-0700 Fax: (502) 267-6900

REVISIONS

No.	Revision Date	Drawn By	Revision Made
A	11/25/14	JVM	CLIENT
B	12/18/14	SJB	CLIENT
C	1/19/15	SJB	IFC
D	3/13/15	JVM	CLIENT
E	3/06/15	SJB	IFC

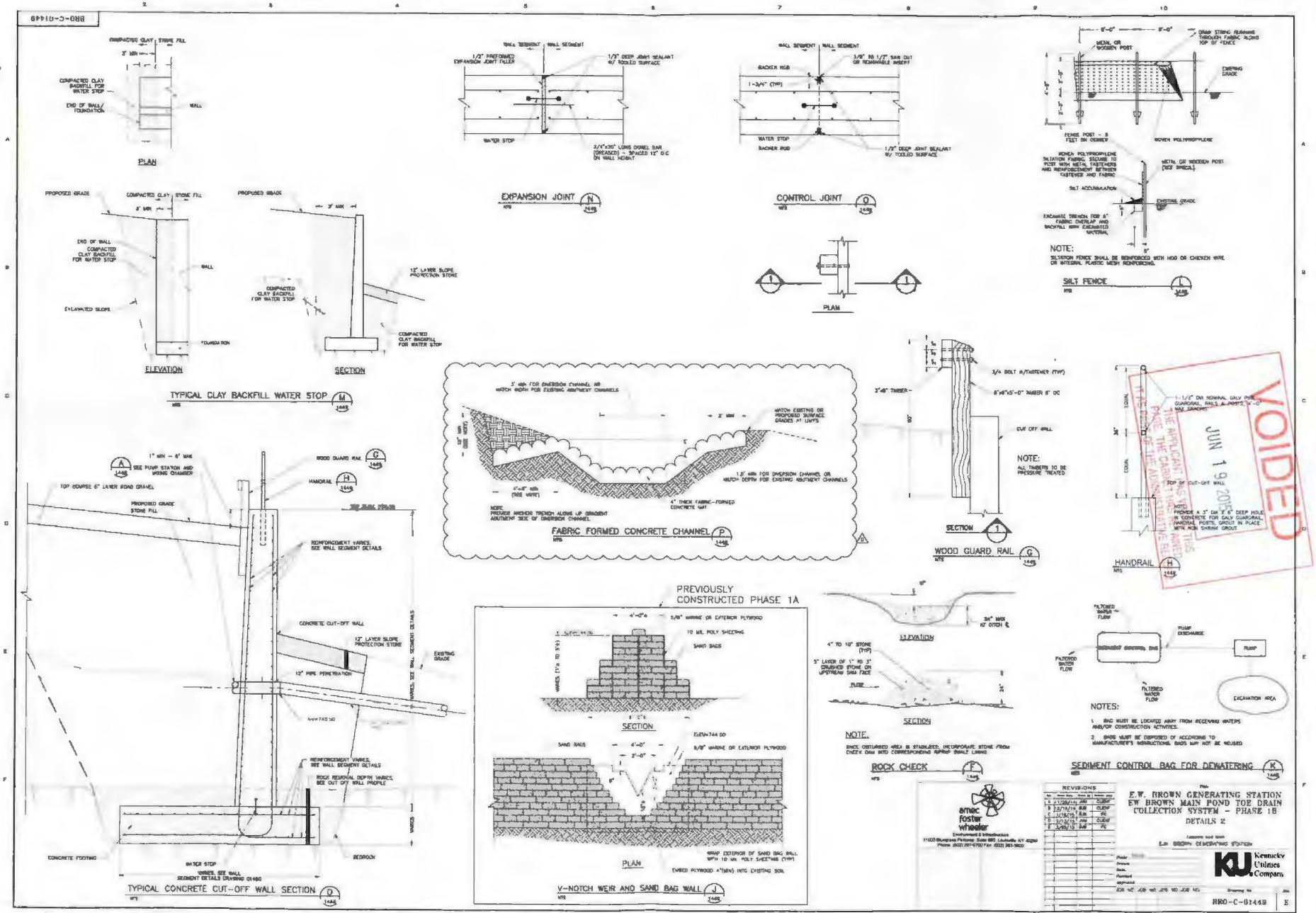
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
DETAILS 2

Location and Unit:
E.W. BROWN GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO.

Kentucky Utilities Company

Drawing No: BRO-C-01449
Rev: E



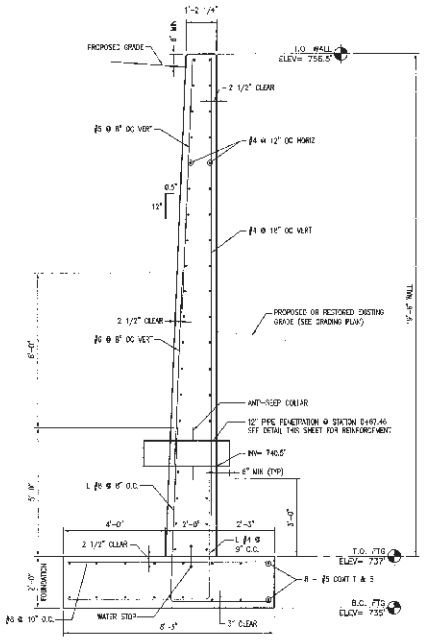
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
DETAILS 2

amec foster wheeler

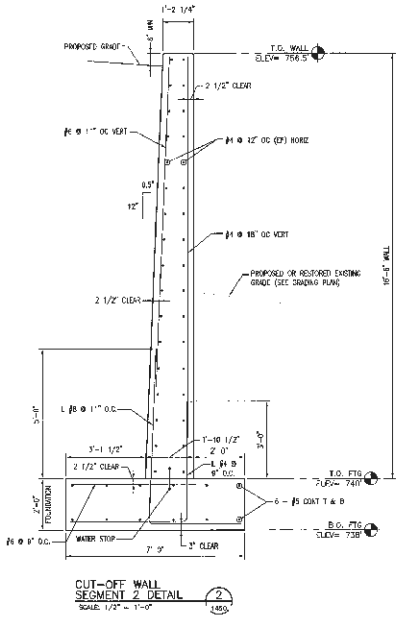
Kentucky Utilities Company

HRO-C-01449 E

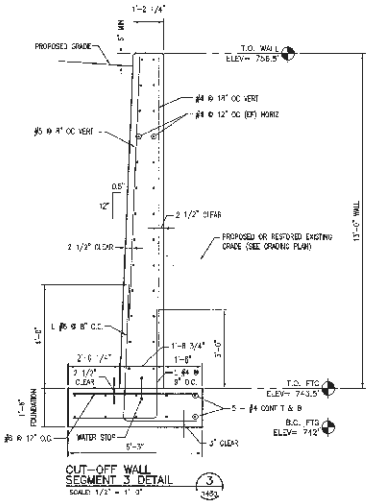
BRO-C-01450



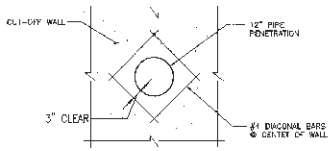
CUT-OFF WALL SEGMENT 1 DETAIL 1 (1450)
SCALE: 1/2" = 1'-0"



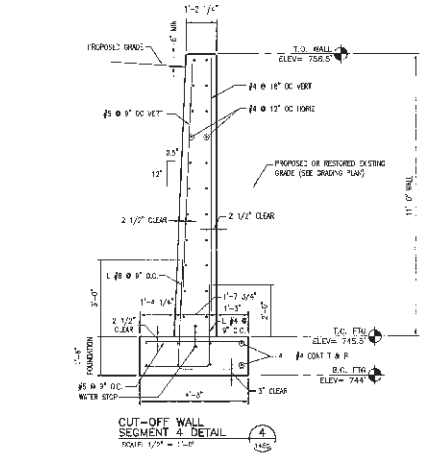
CUT-OFF WALL SEGMENT 2 DETAIL 2 (1450)
SCALE: 1/2" = 1'-0"



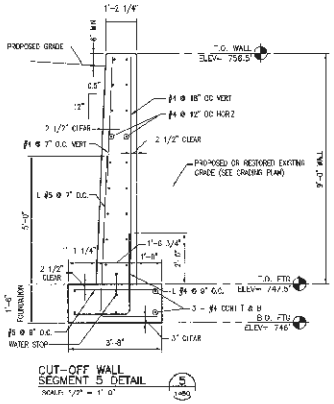
CUT-OFF WALL SEGMENT 3 DETAIL 3 (1450)
SCALE: 1/2" = 1'-0"



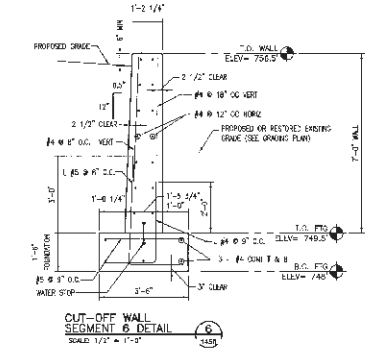
CUT-OFF WALL PIPE PENETRATION DETAIL 7 (1450)
SCALE: 3/4" = 1'-0"



CUT-OFF WALL SEGMENT 4 DETAIL 4 (1450)
SCALE: 1/2" = 1'-0"



CUT-OFF WALL SEGMENT 5 DETAIL 5 (1450)
SCALE: 1/2" = 1'-0"



CUT-OFF WALL SEGMENT 6 DETAIL 6 (1450)
SCALE: 1/2" = 1'-0"

RECEIVED

0 1'-0" 2'-0" 4'-0"
SCALE IN FEET

NOTE: NO REVISIONS THIS SHEET BEYOND REV C 4

REVISIONS

No.	Date (M/D/Y)	By	Reason for Revision
A	11/25/14	AKM	CLIENT
B	12/19/14	KMM	CLIENT
C	1/19/15	BJB	PC
D	5/29/15	KMM	CLIENT
E	9/09/15	BJB	PC

amec foster wheeler
Environment & Infrastructure
11005 Bluegrass Parkway, Suite 600, Louisville, KY 40299
Phone: (502) 267-0700 Fax: (502) 267-6600

PREPARED FOR
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
CUT-OFF WALL DETAILS

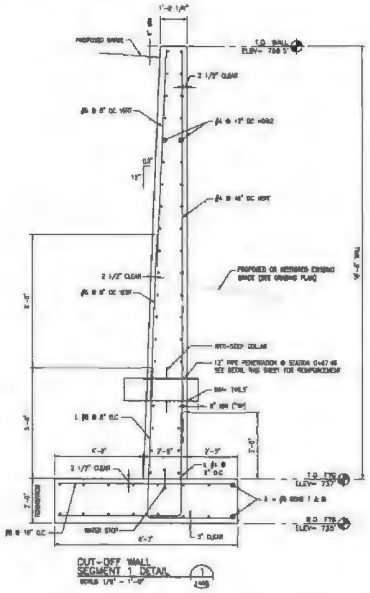
Location and Unit:
E.W. BROWN GENERATING STATION

Scale: As Noted
Designed:
Drawn:
Date:
Checked:
Approved:

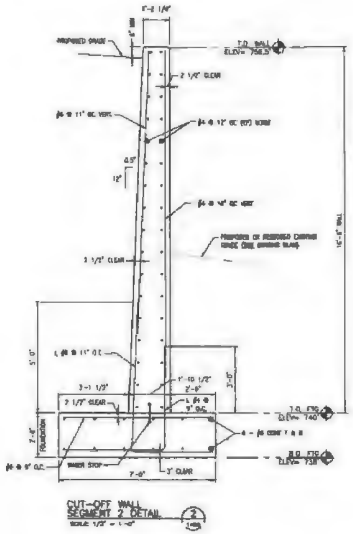
Kentucky Utilities Company

JOB NO. LOC NO. XREF NO. SUB NO. Existing No.: BRO-C-01450 Rev. E

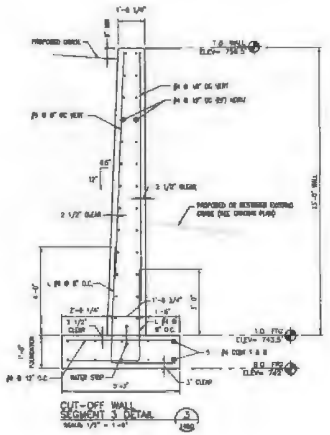
DMS Version 2.0



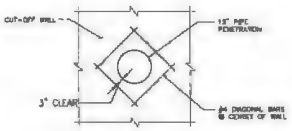
CUT-OFF WALL SEGMENT 1 DETAIL 1 1455



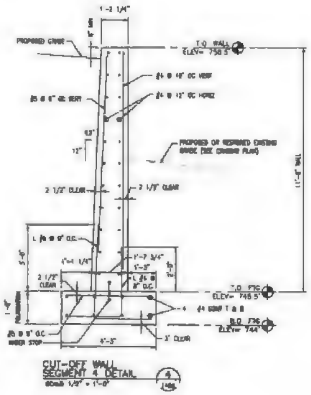
CUT-OFF WALL SEGMENT 2 DETAIL 2 1455



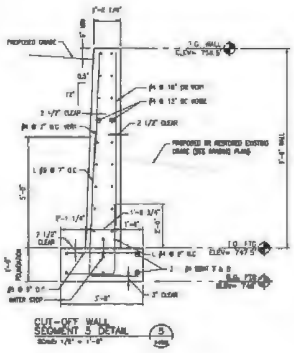
CUT-OFF WALL SEGMENT 3 DETAIL 3 1455



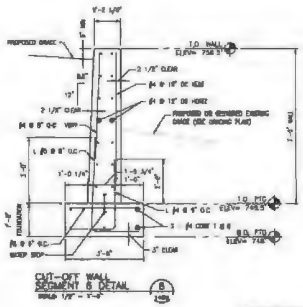
CUT-OFF WALL PIPE PENETRATION DETAIL 7 1455



CUT-OFF WALL SEGMENT 4 DETAIL 4 1455



CUT-OFF WALL SEGMENT 5 DETAIL 5 1455



CUT-OFF WALL SEGMENT 6 DETAIL 6 1455

NOTE: NO REVISIONS THIS SHEET BEYOND REV C

SCALE IN FEET

amec foster wheeler
Environment & Infrastructure
11800 Rangeview Parkway, Suite 600, Louisville, KY 40299
Phone: (502) 267-0700 Fax: (502) 267-0500

REVISIONS

NO.	DESCRIPTION	DATE	BY	CHECKED
A	11/20/14	JMV	CHRIST	
B	12/18/14	BJB	CLIENT	
C	7/15/15	BJB	PC	
D	9/15/15	BJB	CLIENT	
E	10/09/15	BJB	PC	

E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
CUT-OFF WALL DETAILS

E.W. BROWN GENERATING STATION

Kentucky Utilities Company

BRO-C-01450 E

BRO-C-01451

GENERAL NOTES:

1. SOURCE OF BASE MAP: EXISTING SITE CONDITIONS SHOWN ON THE DRAWINGS ARE BASED ON AN AERIAL LIDAR SURVEY CONDUCTED IN 2012 AND PROVIDED BY LG&E AND KU ENERGY, LLC (OWNER). THE SURVEY COORDINATES AND ELEVATIONS SHOWN ARE BASED THE FOLLOWING: HORIZONTAL = NAD 83 KY. S.P.C.S. SOUTH ZONE – U.S. FEET AND VERTICAL = NAVD 88(GPS) – U.S. FEET.
2. THE CONTRACTOR IS RESPONSIBLE PROPER LAYOUT FOR THE WORK. THE CONTRACTOR SHALL PROVIDE REQUIRED SURVEY CONTROL AND IDENTIFY REQUIRED LINES, LEVELS, CONTOURS, AND DATUM AT THE WORK AREA
3. COORDINATE THE USE OF THE SITE WITH THE OWNER FOR ACCESS, STAGING AND STORING OF EQUIPMENT, SOIL STOCKPILES AND THE USE OF AVAILABLE ONSITE SOIL MATERIALS
4. THE CONTRACTOR SHALL VERIFY DIMENSIONS FOR WORK ITEMS PRIOR TO START OF CONSTRUCTION ACTIVITIES AND PRIOR TO PURCHASING, OBTAINING AND/OR FABRICATING MATERIALS FOR THE NEW WORK.
5. THE CONTRACTOR WILL VERIFY THE LOCATION OF ALL EXISTING UTILITIES OR STRUCTURES WITHIN THE LIMITS OF WORK PRIOR TO CONDUCTING EXCAVATION ACTIVITIES.
6. KNOWN EXISTING UNDERGROUND UTILITIES AND UNDERGROUND STRUCTURES ARE SHOWN ON THE DRAWINGS. THE LOCATIONS (BOTH HORIZONTAL AND VERTICAL) OF UNDERGROUND UTILITIES/STRUCTURES SHOWN ON THE DRAWINGS ARE APPROXIMATE. PRIOR TO EXCAVATION ACTIVITIES, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES/STRUCTURES IN THE AREA. THE CONTRACTOR IS WARNED THAT ADDITIONAL UTILITIES/STRUCTURES MAY EXIST AND SPECIAL CARE SHOULD BE TAKEN WHILE CONDUCTING WORK BELOW GRADE. THE CONTRACTOR IS REQUIRED TO PROTECT EXISTING UTILITIES AND STRUCTURES FROM DAMAGE.
7. SHOULD UNCHARTED, OR INCORRECTLY CHARTED, PIPING, OTHER UTILITIES, OR UNDERGROUND STRUCTURES BE ENCOUNTERED DURING EXCAVATION, CONSULT THE OWNER IMMEDIATELY FOR DIRECTIONS. COOPERATE WITH THE OWNER IN KEEPING RESPECTIVE FACILITIES IN OPERATION. THE CONTRACTOR SHALL REPAIR DAMAGED UTILITIES OR UNDERGROUND STRUCTURES TO SATISFACTION OF THE OWNER.
8. THE CONTRACTOR SHALL CONDUCT EXCAVATIONS IN ACCORDANCE WITH SAFETY REQUIREMENTS OF THE U.S. DEPARTMENT OF LABOR'S CONSTRUCTIONS SAFETY ACT DESIGNATED AS TITLE 29 CFR PART 1926 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION, SUBPART P, SECTIONS 1926.650 THROUGH 652, AND ALL OTHER APPLICABLE LAWS AND REGULATIONS.
9. THROUGHOUT THE WORK ACTIVITIES, THE CONTRACTOR SHALL MAINTAIN TRAFFIC ON FACILITY ROADS AND IS RESPONSIBLE FOR PROVIDING ALL NECESSARY TRAFFIC CONTROLS INCLUDING SIGNAGE, WARNING BARRIERS, AND SIGNAGE.
10. RESTORE AREAS DISTURBED BY THE WORK TO THE OWNER'S SATISFACTION AND LEAVE AREA NEAT AND CLEAN UPON COMPLETION OF THE WORK.

SPECIFICATIONS:

PREPARATION:

1. CLEARING:
   - CLEARING INCLUDES CUTTING AT THE GROUND SURFACE TREES AND GENERAL WOODY GROWTH INCLUDING SHRUBS, BUSHES, VINES, AND GENERAL BRUSH.
   - COORDINATE CLEARING LIMITS AND EXISTING PLANT LIFE TO REMAIN WITH THE OWNER AND CLEARLY FLAG FOR PROTECTION. PROTECT TREES, PLANT GROWTH, AND FEATURES DESIGNATED TO REMAIN. PERFORM CLEARING WITHIN THE LIMIT OF WORK AS SHOWN ON THESE DRAWINGS. CLEARING PERFORMED OUTSIDE THE DEFINED LIMIT OF WORK SHALL NOT BE PERMITTED WITHOUT PERMISSION OF THE OWNER.
   - SEGREGATE CLEARING DEBRIS, AS REQUIRED IF ONSITE CHIPPING IS PROPOSED.
   - CLEARED VEGETATION MAY BE STOCKPILED WITHIN THE LIMIT OF WORK UNTIL PROPERLY DISPOSED ONSITE AT A LOCATION AND IN A MANNER AS DIRECTED BY THE OWNER OR OFFSITE DISPOSAL IS CONDUCTED.
   - CLEARED MATERIAL MAY BE CHIPPED AND USED AS MULCH OR DISPOSED ONSITE IN A LOCATION APPROVED BY THE OWNER.
   - BURNING OF MATERIALS: IF APPROVED BY THE OWNER, BURNING OF REMOVED VEGETATION SHALL BE ALLOWED PROVIDED REQUIRED PERMITS ARE OBTAINED AND IS CONDUCTED IN ACCORDANCE WITH PERMIT AND LOCAL AUTHORITY REQUIREMENTS.
2. GRUBBING:
   - GRUBBING INCLUDES REMOVAL OF VEGETATIVE COVER WITH ROOT SYSTEMS, STUMPS WITH ROOT SYSTEMS, AND OTHER ORGANIC MATTER SURFICIAL OR BURIED WITHIN THE TOP LAYER OF SOIL (TOPSOIL).
   - COORDINATE WITH THE OWNER FOR THE LOCATION OF ONSITE TEMPORARY STOCKPILES FOR SALVAGED TOPSOIL STOCKPILES. STRIPPED TOPSOIL SHALL BE USED FOR RESTORATION OF VEGETATION OF DISTURBED AREAS.
   - REMOVE ALL STUMPS, ROOTS OVER 2 INCHES IN DIAMETER, MATTED ROOTS, AND VEGETATIVE MATTER INCLUDING GRASSES AND WEEDS WITHIN THE LIMIT OF GRADING. SEGREGATE GRUBBINGS (E.G. STUMPS) GREATER THAN 6 INCHES IN DIAMETER FROM OTHER GRUBBED MATERIALS.
   - GRUBBED MATERIAL MAY BE STOCKPILED WITHIN THE LIMIT OF WORK UNTIL AND SHALL BE COVERED IF NECESSARY TO PREVENT WIND-BLOWN DUST UNTIL PROPERLY DISPOSED ONSITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER OR IS DISPOSED OFFSITE. DO NOT BURY MATERIALS ON SITE UNLESS APPROVED BY OWNER. LEAVE SITE IN CLEAN CONDITION.
3. DEWATERING:
   - THE WORK REQUIRES EXCAVATION AND TRENCHING IN CLOSE PROXIMITY TO HARRINGTON LAKE (CURD'S INLET) AND IS LOCATED IN AN AREA SUBJECT TO TOE SEEPAGE FROM THE EXISTING MAIN POND EMBANKMENT. WORK FOR THIS CONTRACT INCLUDES PROVIDING LABOR, MATERIALS, AND EQUIPMENT TO SUPPLY, OPERATE AND MAINTAIN STORMWATER AND GROUNDWATER SEEPAGE DIVERSION AND DEWATERING SYSTEMS DURING THE INSTALLATION OF THE CUT-OFF WALL. EARTHWORK SHALL NOT BE CONDUCTED IN CONDITIONS THAT PROVIDES A WATER ELEVATION WITHIN LESS THAN 1 FOOT BELOW THE BOTTOM OF EXCAVATIONS OR FILL AREAS WHERE THE SUBGRADE CONSISTS OF SOIL MATERIALS. CAST-IN-PLACE CONCRETE ACTIVITIES MAY BE CONDUCTED IN WET CONDITIONS BUT SHALL NOT BE CONDUCTED IN PONDED WATER, UNLESS APPROVED BY OWNER.
   - THE CONTRACTOR WILL PROVIDE, OPERATE, AND MAINTAIN DIVERSION AND/OR DEWATERING SYSTEMS TO REMOVE WATER AS REQUIRED FROM EXCAVATIONS AND TRENCHES USING DIVERSIONS, SUMPS AND PUMPS, DRAINS OR OTHER FACILITIES NECESSARY TO KEEP EXCAVATIONS AND TRENCHES FREE OF WATER TO THE EXTENT THAT IS REQUIRED TO FACILITATE AND COMPLETE CONSTRUCTION.
   - COORDINATE THE TRENCH DEWATERING ACTIVITIES WITH THE OWNER PRIOR TO CONDUCTING DEWATERING OPERATIONS. THE DEWATERING SYSTEM CAN BE DISCHARGED/PUMPED TO THE EXISTING OLD PRINCIPAL SPILLWAY DITCH IN A MANNER THAT PREVENTS EROSION. PROVIDE APPROPRIATE OUTLET PROTECTION FOR PUMP DISCHARGE LINES TO PREVENT SCOUR AND EROSION OF EXISTING DRAINAGE CHANNELS. AS REQUIRED FOR SEDIMENT REMOVAL, DEWATERING FILTER BAGS SHALL BE USED PRIOR TO DISCHARGE TO SPILLWAY DITCH. ALSO, IF DEWATERING FLUIDS ARE DETERMINED TO BE CONTAMINATED BASED ON SAMPLING CONDUCTED BY THE OWNER'S REPRESENTATIVE, WATER FROM DEWATERING OPERATIONS SHALL BE COLLECTED IN FRAC TANKS FOR TRANSPORT TO AND/OR PUMPED TO THE AUXILIARY POND FOR DISPOSAL OR AS DIRECTED BY THE OWNER.
   - THE OBJECTIVE IS TO MAINTAIN THE GROUNDWATER AT A MINIMUM OF 1 FOOT BELOW THE BASE OF THE EXCAVATIONS AND TRENCHES WHERE THE SUBGRADE CONSISTS OF SOIL MATERIALS TO ALLOW FOR PLACEMENT AND COMPACTION OF THE BACKFILL IN ADEQUATELY DRY CONDITIONS AND TO CONDUCT CAST-IN-PLACE CONCRETE WORK WITHOUT PONDED WATER.

EARTHWORK:

1. EARTHWORK MATERIALS:
   - ROAD GRAVEL: FOR TRAFFIC AREAS AS SHOWN ON THE DRAWINGS, PROVIDE AGGREGATE MATERIAL MEETING THE REQUIREMENTS OF KENTUCKY TRANSPORTATION CABINET (KTC) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 805.06 – DENSE GRADED AGGREGATE OR SECTION 805.14 – AGGREGATE SURFACING, TRAFFIC-BOUND BASE AND MAINTENANCE, AGGREGATE SIZE 610 OR 710.
   - SLOPE AND CHANNEL PROTECTION STONE: SOUND, DURABLE WELL GRADED ANGULAR ROCK MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND ~~BRIDGE CONSTRUCTION SECTION 805.13.02 – CRUSHED~~ AGGREGATE SLOPE PROTECTION OR SECTION 805.13.04 – CLASS II CHANNEL LINING. E
   - COMMON FILL: AT THE DIRECTION OF THE OWNER'S REPRESENTATIVE, REUSE SUITABLE EXCAVATED MATERIAL. COMMON FILL SHALL CONSIST OF SOIL SUITABLE FOR EMBANKMENT CONSTRUCTION. IT SHALL BE FREE FROM FROZEN MATERIALS, PERISHABLE RUBBISH, PEAT, AND OTHER UNSATISFACTORY SOILS/MATERIALS. IT SHALL BE OF SUCH A NATURE AND CHARACTER THAT IT CAN BE COMPACTED TO A FIRM UN-YIELDING SURFACE.
   - STONE FILL: STONE FILL MATERIAL FOR BACKFILL AROUND AND BEHIND THE CUT-OFF WALL AND ACCESS ROAD CONSTRUCTION AS SHOWN ON THE DRAWINGS SHALL CONSIST OF STONE MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 805.03 – GRADATION SIZE NO 2.
   - COMPACTED CLAY: MATERIAL FOR COMPACTED CLAY BACKFILL MATERIAL FOR WATER STOPS AT BOTH ENDS OF THE CUT-OFF WALL AS SHOWN ON THESE DRAWINGS SHALL CONSIST OF SOIL MATERIAL CLASSIFIED AS CH OR CL IN ACCORDANCE WITH ASTM D 2487 (UNIFIED SOIL CLASSIFICATION SYSTEM). THE CLAY MATERIAL SHALL NOT CONTAIN STONES LARGER THAN 3 INCHES AND SHALL BE FREE OF TRASH, ICE, SNOW, TREE STUMPS, AND OTHER ORGANIC AND DELETERIOUS MATERIALS.
2. BORROW SOURCE TESTING
   - BORROW SOURCE TESTING SHALL BE CONDUCTED BY THE CONTRACTOR ON ALL SOIL MATERIALS PROPOSED FOR CONSTRUCTION. TESTING REQUIREMENTS AND FREQUENCY SHALL BE AS PROVIDED BELOW.
   - ROAD GRAVEL AND COMMON FILL:

TEST	METHODOLOGY	FREQUENCY
GRAIN SIZE	ASTM D 422	2 TESTS/SOURCE/MATERIAL
MOISTURE DENSITY CURVE	ASTM D 1557	2 TESTS/SOURCE/MATERIAL

   - STONE FILL AND SLOPE AND CHANNEL PROTECTION STONE:

TEST	METHODOLOGY	FREQUENCY
PARTICLE SIZE	ASTM D 5519	2 TESTS/SOURCE/MATERIAL

   - COMPACTED CLAY:

TEST	METHODOLOGY	FREQUENCY
GRADATION	ASTM D 422	2 TEST PER SOURCE MATERIAL
PERCENT FINER NO. 200 SIEVE	ASTM D 1140	2 TEST PER SOURCE MATERIAL
ATTERBERG LIMITS	ASTM D 4318	2 TEST PER SOURCE MATERIAL
MOISTURE DENSITY CURVE	ASTM D 698	2 TEST PER SOURCE/MATERIAL

3. EXCAVATION:
   - UNIFORMLY EXCAVATE TO LINES, GRADES, AND SHAPES INDICATED ON THE CONSTRUCTION DRAWINGS. REMOVE WATER OR MATERIALS THAT INTERFERE WITH WORK. THE OWNER RESERVES RIGHT TO MAKE CHANGES IN LINES AND GRADES IF REQUIRED FOR ACTUAL PROJECT SITE CONDITIONS.
   - MAINTAIN EXCAVATIONS IN A SAFE CONDITION UNTIL COMPLETION OF BACKFILLING ACTIVITIES OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
   - ON THE UPGRADIENT SIDE OF THE CUT-OFF WALL, EXISTING OVERBURDEN SOIL MATERIALS SHALL BE EXCAVATED DOWN TO BEDROCK TO THE LIMITS AS SHOWN ON THE DRAWINGS AND REPLACED WITH STONE FILL DURING BACKFILL ACTIVITIES.
   - REMOVE EXCESS EXCAVATED SOIL NOT INTENDED FOR REUSE AND PROPERLY DISPOSE ONSITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER.
4. ROCK REMOVAL AND EXCAVATION

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NOTE: Where rock excavation is planned, foundation section details or typical grading or trench cross sections on plans should show the required limits of rock excavation and any special refill or bedding requirements.

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   - ROCK: SOLID HOMOGENEOUS INTERLOCKING CRYSTALLINE MATERIAL WITH FIRMLY CEMENTED, LAMINATED, OR FOLIATED MASSES OR CONGLOMERATE DEPOSITS, NEITHER OF WHICH CAN BE REMOVED WITHOUT SYSTEMATIC DRILLING AND BLASTING, DRILLING AND THE USE OF EXPANSION JACKS OR FEATHER WEDGES, OR THE USE OF BACKHOE-MOUNTED PNEUMATIC HOLE PUNCHERS OR ROCK BREAKERS. COMMON EXCAVATION SHALL CONSIST OF ALL EXCAVATION NOT CLASSIFIED AS ROCK EXCAVATION.
   - REMOVE ROCK TO ELEVATIONS OR DETAILS INDICATED ON THE DRAWINGS IN A MANNER THAT WILL LEAVE FOUNDATION MATERIAL IN AN UN-SHATTERED AND SOLID CONDITION. REMOVAL OF ROCK BEYOND LINES AND GRADES INDICATED WILL NOT BE GROUNDS FOR A CLAIM FOR ADDITIONAL PAYMENT UNLESS PREVIOUSLY AUTHORIZED BY THE OWNER.
   - ROCK SHALL BE REMOVED BY DRILLING AND THE USE OF EXPANSION JACKS OR FEATHER WEDGES OR THE USE OF BACKHOE-MOUNTED PNEUMATIC HOLE PUNCHERS OR ROCK BREAKERS. REMOVAL OF ROCK OR HARD MATERIAL WILL NOT BE CONDUCTED BY DRILLING AND BLASTING UNLESS APPROVED BY THE OWNER IN WRITING. IF ALLOWED, ROCK REMOVAL BY DRILLING AND BLASTING METHODS WILL REQUIRE PREPARATION AND APPROVAL OF A BLASTING PLAN.
   - REMOVED ROCK MAY BE USED AS INITIAL STONE FILL BEHIND THE CUT-OFF WALL BUT SHALL NOT BE PLACED WITHIN 5 FEET OF THE WALL, PIPING, AND PRECAST STRUCTURES.
   - PRIOR TO FORMWORK FOR CAST-IN-PLACE CONCRETE STRUCTURES, THE OWNER'S REPRESENTATIVE SHALL INSPECT THE PREPARED ROCK SURFACE. PROVIDE ADDITIONAL ROCK PREPARATION AND/OR REMOVAL AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
5. BACKFILL:
   - GENERAL: PLACE SPECIFIED BACKFILL SOIL MATERIALS IN LAYERS TO REQUIRED SUBGRADE ELEVATIONS. DO NOT PLACE BACKFILL OR FILL MATERIAL ON SURFACES THAT ARE MUDDY, FROZEN, OR CONTAIN FROST OR ICE.
   - UNLESS OTHERWISE NOTED OR DIRECTED, PLACE BACKFILL AND FILL MATERIALS IN LOOSE DEPTH LAYERS NOT MORE THAN AS INDICATED FOR EACH TYPE OF MATERIAL, UNLESS OTHERWISE DIRECTED OR SPECIFIED:
     COMMON FILL – 12 INCHES
     STONE BACKFILL – 12 INCHES
     ROAD GRAVEL – 8 INCHES
     COMPACTED CLAY MATERIAL – 6 INCHES
   - PLACE BACKFILL AND FILL MATERIALS EVENLY ADJACENT TO STRUCTURES, TO REQUIRED ELEVATIONS. TAKE CARE TO PREVENT WEDGING ACTION OF BACKFILL AGAINST STRUCTURES BY CARRYING THE MATERIAL UNIFORMLY AROUND AND ALONG STRUCTURES TO APPROXIMATELY SAME ELEVATION IN EACH LIFT.
6. COMPACTION:
   - AT THE TIME OF STONE AND SOIL PLACEMENT AND COMPACTION, THE OWNER'S REPRESENTATIVE WILL INSPECT AND PROVIDE IN-PLACE SOIL MATERIAL TESTING. THE CONTRACTOR SHALL PROVIDE THE REQUIRED SOIL COMPACTION DURING CONSTRUCTION TO ACHIEVE MINIMUM PERCENT/DEGREE OF COMPACTION OR A FIRM UN-YIELDING SURFACE AS SPECIFIED HEREIN.
   - ROAD GRAVEL MATERIAL SHALL BE COMPACTED TO MINIMUM OF 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 1557 AS TESTED BY THE OWNER'S REPRESENTATIVE.
   - CLAY MATERIAL SHALL BE COMPACTED TO MINIMUM OF 93% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 698 AS TESTED BY THE OWNER'S REPRESENTATIVE.
   - PROVIDE STONE FILL COMPACTION DURING CONSTRUCTION TO ACHIEVE A FIRM UNYIELDING SURFACE FOR EACH BACKFILL LIFT.
   - MAINTAIN OPTIMUM MOISTURE CONTENT OF FILL MATERIALS TO ATTAIN REQUIRED COMPACTION DENSITY.
7. FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION
   - THE OWNER'S REPRESENTATIVE WILL PERFORM FIELD DENSITY TESTS ON ROAD GRAVEL COMPACTED CLAY MATERIALS IN ACCORDANCE WITH ASTM D 6938.
   - THE OWNER'S REPRESENTATIVE WILL CONDUCT IN-PLACE DENSITY AND MOISTURE TESTS AT A FREQUENCY OF 1 TEST PER 500 SQUARE FEET OF PLACED LAYER OF COMPACTED ROAD GRAVEL AND CLAY MATERIAL OR A MINIMUM OF 2 TESTS PER LIFT. THE CONTRACTOR KEEP THE OWNER'S REPRESENTATIVE NOTIFIED OF THE BACKFILL AND COMPACTION ACTIVITIES IN ORDER TO ALLOW FOR INSPECTION AND IN-PLACE DENSITY TO OCCUR IN TIMELY MANNER. COOPERATE AND ASSIST THE OWNER'S REPRESENTATIVE AS NEEDED DURING INSPECTION AND TESTING OF BACKFILL MATERIALS.
   - THE OWNER'S REPRESENTATIVE WILL INSPECT EACH STONE FILL LIFT PLACED FOR A SUITABLE FIRM UNYIELDING SURFACE. IN PLACE DENSITY TESTING WILL NOT BE CONDUCTED.
8. SUBMITTALS:
   - SOIL MATERIAL TESTING RESULTS:
   - BORROW SOURCE SOIL MATERIAL TESTING RESULTS.

CONCRETE WORK:

1. CONCRETE SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND IN ACCORDANCE WITH ACI 318 LATEST EDITION, EXCEPT AS SPECIFIED HEREIN.
2. ALL SPLICES IN REINFORCEMENT SHALL BE CLASS B SPLICES AS PER ACI 318.
3. CONCRETE MATERIALS:
   - CEMENT: ASTM C 150 AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 801 FOR CEMENT.
   - AGGREGATES: KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 804 FOR FINE AGGREGATE AND SECTION 805 FOR COARSE AGGREGATE. AGGREGATES SHALL NOT CONTAIN ANY SUBSTANCE WHICH MAY BE DELETERIOUSLY REACTIVE WITH THE ALKALIES IN THE CEMENT.
   - REINFORCING BARS: ASTM A 615 AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 811.02, GRADE 60, DEFORMED, EPOXY COATED.
   - EPOXY BONDING COMPOUND: ASTM C 881AND AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 826. PROVIDE TYPE V FOR BONDING PLASTIC CONCRETE TO HARDENED CONCRETE. PROVIDE GRADE 3 FOR VERTICAL SURFACES.
   - NON-SHRINK GROUT: ASTM C 1107.
   - AIR-ENTRAINING: ASTM C 260.
   - HIGH RANGE WATER REDUCER (HRWR) (SUPERPLASTICIZERS): ASTM C 494, TYPE F OR G AND ASTM C 1017.
   - FORMS FOR FORMED FINISHED CONCRETE: PLYWOOD, LUMBER, METAL, OR ANOTHER APPROVED MATERIAL. PROVIDE LUMBER DRESSED ON AT LEAST TWO EDGES AND ONE SIDE FOR TIGHT FIT.
   - LIQUID CHEMICAL SEALER-HARDENER COMPOUND: COMPOUND SHALL BE MAGNESIUM FLUOSILICATE WHICH WHEN MIXED WITH WATER SEALS AND HARDENS THE SURFACE OF THE CONCRETE.
   - WATERSTOP: PVC, MINIMUM 4 INCHES WIDE. USE DUMBELL WITH CENTER BULB OR RIBBED WITH CENTER BULB FOR EXPANSION JOINTS. ALL OTHER JOINTS USE RIBBED OR DUMBELL TYPE.
4. CONCRETE MIX:
   - CONTACTOR-FURNISHED MIX DESIGN: PROVIDE A CONCRETE MIX CONFORMING TO APPLICABLE MATERIAL SECTIONS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION FOR CLASS AA CONCRETE (MINIMUM COMPRESSIVE STRENGTH (F'C) OF 4000 PSI; SLUMP RANGE 3-5INCHES; MAXIMUM WATER/CEMENT RATIO 0.42; AIR-ENTRAINMENT 6 (± 2) PERCENT). DO NOT CHANGE THE SELECTED OPTION DURING THE COURSE OF THE WORK.
   - SLUMP MAY BE INCREASED TO 8 INCHES MAXIMUM PROVIDED THE WATER/CEMENT RATIO DOES NOT EXCEED 0.4 AND A HIGH RANGE WATER REDUCER (SUPERPLASTICIZERS) TYPE F OR G IS USED. PROVIDE AIR ENTRAINMENT USING AIR-ENTRAINING ADMIXTURE.
5. PLACING:
   - PLACE CONCRETE IN ACCORDANCE WITH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 601.03.09. SECTION 601.03.09(D) SPECIFICALLY ADDRESSES WEATHER LIMITATIONS DURING CONCRETE MIXING, PLACING, AND FINISHING, INCLUDING DURING COLD WEATHER.
   - OBTAIN THE OWNER'S REPRESENTATIVE APPROVAL OF THE CONDITION OF THE PREPARED ROCK SURFACE BEFORE FORMWORK INSTALLATION AND PLACING ANY CONCRETE.
   - DEPOSIT THE CONCRETE IN FORMWORK TO REQUIRE AS LITTLE RE-HANDLING AS POSSIBLE. UNLESS HAULING EQUIPMENT IS EQUIPPED WITH MEANS FOR DISCHARGE OF CONCRETE WITHOUT SEGREGATION OF THE MATERIALS, UNLOAD THE CONCRETE INTO AN APPROVED SPREADING DEVICE AND MECHANICALLY SPREAD IT ON THE GRADE IN A MANNER TO PREVENT SEGREGATION OF THE MATERIALS.
   - DO NOT DROP CONCRETE IN EXCESS OF 5 FEET WITHOUT USING PIPE OR TREMIES, AND DO NOT DEPOSIT A LARGE QUANTITY AT ANY POINT AND RUN OR WORK IT ALONG THE FORMS. WHEN PUMPING, EQUIP THE DELIVERY PIPE WITH A NOZZLE, HAVING A MINIMUM OF 2RIGHT ANGLES, AT THE DISCHARGE END. MAINTAIN THE DISCHARGE END OF THE PIPE AS CLOSE TO THE POINT OF DEPOSIT AS FEASIBLE. PLACE CONCRETE TO ENTIRELY FILL BUT NOT BULGE OR DISTORT THE FORMS OR TO DISTURB THEIR ALIGNMENT. FILL EACH PART OF THE FORMS BY DEPOSITING CONCRETE AS NEAR ITS FINAL POSITION AS POSSIBLE, TO WORK THE COARSER AGGREGATE BACK FROM THE FACE, AND TO FORCE CONCRETE UNDER AND AROUND REINFORCING BARS WITHOUT DISPLACING THEM. AFTER CONCRETE HAS TAKEN ITS INITIAL SET, AVOID JARRING THE FORMS OR PLACING ANY STRAIN ON ENDS OF PROJECTING REINFORCEMENT.
   - PROVIDE VIBRATION OF SUFFICIENT INTENSITY AND DURATION TO CAUSE FLOW OR SETTLEMENT OF THE CONCRETE AND COMPLETE CONSOLIDATION, BUT ENSURE THAT VIBRATION IS NOT USED TO CAUSE CONCRETE TO FLOW OVER LONG DISTANCES IN THE FORMS OR IS UNDULY PROLONGED TO CAUSE SEGREGATION OR UNDESIRABLE LAITANCE AT THE SURFACE OF THE LIFT BEING CONSOLIDATED. USE PLASTIC COATED VIBRATORS, WHEN NECESSARY, TO PREVENT DAMAGE TO THE EPOXY COATING OF THE STEEL. PROVIDE AND USE A SUFFICIENT NUMBER OF MECHANICAL VIBRATORS TO ENSURE THAT CONSOLIDATION CAN BE STARTED IMMEDIATELY AFTER CONCRETE HAS BEEN DEPOSITED IN THE FORMS. DO NOT ATTACH THE MECHANICAL VIBRATOR TO THE FORMS OR REINFORCING STEEL OR APPLY TO THE SURFACE OF THE CONCRETE. APPLY THE VIBRATOR TO THE CONCRETE IMMEDIATELY AFTER DEPOSITING THE CONCRETE AND MOVE IT THROUGHOUT THE MASS, THOROUGHLY WORKING THE CONCRETE AROUND THE REINFORCEMENT, EMBEDDED FIXTURES, AND INTO ANGLES AND CORNERS OF THE FORMS. DESIGN FORMS TO PROVIDE FOR REQUIREMENTS OF VIBRATION.
   - PLACE CONCRETE IN CONTINUOUS HORIZONTAL LAYERS NOT EXCEEDING A THICKNESS OF ONE FOOT. IN ANY GIVEN LAYER, PLACE AND CONSOLIDATE CONSECUTIVE BATCHES BEFORE THE PRECEDING BATCH HAS TAKEN ITS INITIAL SET. ENSURE THAT EACH LAYER OF CONCRETE RETAINS A ROUGH SURFACE TO SECURE EFFICIENT BONDING WITH THE NEXT LAYER. CONSOLIDATE A SUCCEEDING LAYER PLACED BEFORE THE UNDERLYING LAYER HAS SET IN A MANNER THAT WILL ENTIRELY BREAK UP AND ELIMINATE THE TENDENCY TO PRODUCE A COLD JOINT BETWEEN LAYERS.
   - DURING ANY TEMPORARY SHUTDOWN OF LESS THAN 30 MINUTES, COVER THE CONCRETE AT THE UNFINISHED END OF THE WALL WITH WET BURLAP. WHEN AN INTERRUPTION OF THE WORK EXCEEDS 30 MINUTES DURATION, THE OWNER'S REPRESENTATIVE MAY REQUIRE THAT A CONSTRUCTION JOINT BE INSTALLED. WHEN TEMPORARILY DISCONTINUING PLACING, CLEAN THE PLACED CONCRETE, AFTER IT BECOMES FIRM ENOUGH TO RETAIN ITS FORM, OF LAITANCE AND OTHER OBJECTIONABLE MATERIAL TO A SUFFICIENT DEPTH TO EXPOSE SOUND CONCRETE PRIOR TO NEW CONCRETE PLACEMENT. MAKE CONSTRUCTION JOINTS ACCORDING TO KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 601.03.10.
6. JOINTS:
   - PROVIDE CONTRACTION JOINTS AND EXPANSION JOINTS AT THE LOCATIONS SHOWN ON THE DRAWINGS. ALL JOINTS SHALL OCCUR AT THE JUNCTION OF DIFFERENT WALL SEGMENTS.
   - PROVIDE 1/2-INCH JOINT MATERIAL IN ALL EXPANSION JOINTS. PLACE 30-INCH LONG, 3/4-INCH DIAMETER, COMMERCIAL GRADE GREASED STEEL DOWELS AT 12-INCH INTERVALS ALONG THE CENTERLINE OF THE OF THE WALL STEM. DO NOT PASS WALL REINFORCING STEEL THROUGH EITHER JOINT. SEAL JOINTS FROM TOP TO BOTTOM WITH JOINT SEALANT.
   - EXPANSION JOINT FILLER: FURNISH PREFORMED SPONGE RUBBER JOINT FILLERS THAT CONFORM TO AASHTO M 153 FOR TYPE I (SPONGE RUBBER), 1/2-INCH THICK. FURNISH PREFORMED FILLERS IN A SINGLE PIECE FOR THE FULL DEPTH AND WIDTH REQUIRED FOR THE JOINT UNLESS OTHERWISE AUTHORIZED.
   - JOINT SEALANTS – USE RAPID-CURE SILICONE SEALANT CONFORMING TO WITH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 807.03.05 (B). USE SEALANT THAT IS: (1) FURNISHED AS A TWO-PART, RAPID-CURE, COLD-APPLIED, ULTRA-LOW-MODULUS SUITABLE FOR VERTICAL APPLICATION, 100-PERCENT SILICONE RUBBER SEALANT; (2) FLEXIBLE OVER A WIDE TEMPERATURE RANGE; AND (3) SUITABLE FOR USE IN CONCRETE-TO-CONCRETE.
   - BACKER ROD – USE A CLOSED-CELL POLYETHYLENE FOAM, BACK-UP ROD THAT IS COMPATIBLE WITH THE SEALANT. ENSURE NO BOND OR REACTION OCCURS BETWEEN THE BACK-UP ROD AND SEALANT.
7. CURING AND PROTECTION:
   - CONDUCT CURING IN ACCORDANCE WITH THESE NOTES AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 601.
   - IMMEDIATELY AFTER PLACEMENT, PROTECT CONCRETE FROM PREMATURE DRYING, EXCESSIVELY HOT OR COLD TEMPERATURES, AND MECHANICAL INJURY. MAINTAIN CONCRETE WITH MINIMAL MOISTURE LOSS AT RELATIVELY CONSTANT TEMPERATURE FOR PERIOD NECESSARY FOR HYDRATION OF CEMENT AND HARDENING OF CONCRETE.
   - FOLLOWING CONCRETE PLACEMENT AND FINISHING, IMMEDIATELY BEGIN PROPER CURING. PLASTIC SHRINKAGE CRACKS CAN OCCUR WHEN CURING PRACTICES ARE INEFFECTIVE.
   - USE WETTED BURLAP OR A CURING COMPOUND. CURING SHALL CONTINUE FOR AT LEAST 7 DAYS. FORM REMOVAL SHALL BE AVOIDED FOR THE 7 DAY CURING PERIOD AND WALL BACKFILL SHALL NOT OCCUR FOR AT LEAST 14 DAYS.
   - IF BURLAP IS USED, MONITOR WETTING/RE-WETTING OF THE BURLAP. AVOID OVERSPRAY THAT ADDS WATER TO THE NEWLY FINISHED 'GREEN' PAVEMENT SURFACE.
   - IF USED, CURING COMPOUND SHALL INCLUDE WHITE PIGMENT TO REDUCE HEAT AT THE SURFACE FROM SOLAR RADIATION AND THE FOLLOWING REQUIREMENTS. VISUALLY INSPECT FOR COMPLETE AND UNIFORM COVERAGE; THE SURFACE SHOULD BE SIMILAR IN APPEARANCE TO A WHITE SHEET OF PAPER (NO GRAY STREAKS). TIMELY APPLICATION OF AN ADEQUATE QUANTITY OF CURING COMPOUND IS THE OBJECTIVE. CURING COMPOUND SHOULD BE APPLIED BEFORE ANY SURFACE DRYING CAN OCCUR AND SHOULD NOT BE APPLIED UNTIL BLEED WATER IS GONE AND APPLICATION SHALL FOLLOW THE MANUFACTURER INSTRUCTIONS.
8. FINISH:
   - FORMED FINISH: AS-CAST CONCRETE TEXTURE IMPARTED BY FORM-FACING MATERIAL WITH TIE HOLES AND DEFECTS REPAIRED AND PATCHED.
9. CONCRETE TESTING:
   - AT THE TIME OF PLACEMENT, THE OWNER'S REPRESENTATIVE WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE, AND TEMPERATURE OF THE CONCRETE. THE CONCRETE MUST MEET ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE MAXIMUM SLUMP MAY BE INCREASED AS SPECIFIED WITH THE ADDITION OF AN APPROVED ADMIXTURE PROVIDED THAT THE WATER-CEMENT RATIO IS NOT EXCEEDED. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT, WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.
   - COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S REPRESENTATIVE TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT, THE OWNER'S REPRESENTATIVE'S TESTING AGENCY SHALL MAKE FOUR TEST CYLINDERS IN ACCORDANCE WITH ASTM C 31. ONE CYLINDER SHALL BE TESTED AT 7 DAYS, TWO CYLINDERS AT 28 DAYS, AND ONE CYLINDER HELD IN RESERVE. IF THE AVERAGE OF THE TWO 28 DAY STRENGTH TEST RESULTS IS LESS THAN F'C OR IF ANY STRENGTH TEST RESULT FALLS BELOW F'C BY MORE THAN 300 PSI, THEN THE RESERVE CYLINDER SHALL BE TESTED.
   - AT THE DIRECTION OF THE OWNER REMOVE CONCRETE NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE.
10. SUBMITTALS:
   - CONCRETE MIX DESIGN: SIX DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.
   - STEEL REINFORCEMENT SHOP DRAWINGS: PLACEMENT DRAWINGS THAT DETAIL FABRICATION, BENDING, AND PLACEMENT, INCLUDING BAR SIZES, LENGTHS, MATERIAL, GRADE, BAR SCHEDULES, BENT BAR DIAGRAMS, BAR ARRANGEMENT, AND SPLICES AND LAPS.

PRECAST CONCRETE STRUCTURES:

1. PROVIDE PRECAST CONCRETE STRUCTURES FOR PUMP STATION, AND SEEPAGE MIXING CHAMBER TO THE DIMENSIONS AS SHOWN ON THESE DRAWINGS.
2. PRECAST CONCRETE:
   - PRECAST CONCRETE STRUCTURES MANUFACTURED IN ACCORDANCE WITH ASTM C 478 FOR H-20 LOADING WITH CONCRETE DESIGNED TO OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI AFTER 28 DAYS.
   - PROVIDE SHIPLAP JOINTS FOR STRUCTURES BETWEEN RISERS AND COVERS SEALED WITH O-RING GASKET OR A MINIMUM 1-INCH STRIP OF BUTYL RUBBER SEALANT.
3. PIPE TO STRUCTURE CONNECTION:
   - FLEXIBLE PIPE BOOT, USING KOR-N-SEAL® FLEXIBLE PIPE BOOT CONNECTOR OR APPROVED EQUAL.
4. FRAMES AND COVERS:
   - HEAVY DUTY CAST IRON CONFORMING TO ASTM A 48, CLASS 35B GRAY IRON OR ASTM A 536 FOR DUCTILE IRON. FABRICATE FRAMES, COVERS, AND GRATINGS OF STANDARD COMMERCIAL GRADE STEEL OR DUCTILE IRON, WELDED BY QUALIFIED WELDERS IN ACCORDANCE WITH AWS D1.1.
   - CONTACT SURFACES OF COVERS AND FRAME SEATS: MACHINED AT THE FOUNDRY, BEFORE SHIPMENT TO PREVENT ROCKING OF COVERS IN ANY ORIENTATION.
   - PROVIDE FRAMES WITH COVERS WITH CLEAR OPENINGS AS SHOWN ON THE DRAWINGS.
   - CASTINGS: GOOD QUALITY, STRONG, TOUGH, EVEN-GRAINED CAST IRON, SMOOTH, FREE FROM SCALE, LUMPS, BLISTERS, SANDHOLES, AND DEFECTS OF EVERY NATURE WHICH WOULD RENDER THEM UNFIT FOR THE SERVICE FOR WHICH THEY ARE INTENDED. CASTINGS SHALL BE THOROUGHLY CLEAN AND SUBJECT TO A CAREFUL HAMMER INSPECTION.
5. ALUMINUM ACCESS HATCHES:
   - SHALL BE OF THE SIZE SHOWN ON THE DRAWINGS.
   - MADE OF ¼" THICK DIAMOND PATTERN ALUMINUM PLATE.
   - REINFORCED FOR H20 LOADING.
   - AUTOMATIC HOLD-OPEN ARM.
   - DEPTH OF FRAME AS REQUIRED TO MATCH THE DEPTH OF THE PRECAST STRUCTURE COVER.
   - ALL HARDWARE INCLUDING LATCHES, LIFTING MECHANISM ASSEMBLIES, GUIDES, BRACKETS, HINGES, PINS, HOLD OPEN ARMS, AND GUIDES SHALL BE MADE OF 316 SS.
   - HINGES SHALL BE ACCESSIBLE ONLY WHEN THE ACCESS DOOR IS IN THE OPEN POSITION.
   - ACCESS HATCH SHALL BE PROVIDED WITH RECESSED PADLOCK HASPS COVERED BY A HINGED LID THAT CLOSES FLUSH WITH THE SURFACE OF THE HATCH COVER.
6. SUBMITTALS:
   - VENDOR DRAWINGS FOR PRECAST CONCRETE STRUCTURES.
   - MANUFACTURER DATA ON FRAMES AND COVERS.
   - MANUFACTURER DATA ON ALUMINUM ACCESS HATCH.

HANDRAIL:

1. PROVIDE AND INSTALL A HANDRAIL ALONG THE TOP OF THE CUT-OFF WALL PER THE DIMENSIONS AND DETAILS SHOWN ON THESE DRAWINGS.
2. PROVIDE HANDRAIL MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 813.12.01 TYPE B.
3. SUBMITTALS:
   - VENDOR DATA ON HANDRAIL MATERIALS.

GUARD RAIL:

1. PROVIDE AND INSTALL A GUARD RAIL ALONG THE FRONT OF THE TOP OF THE CUT-OFF WALL PER THE DIMENSIONS AND DETAILS SHOWN ON THESE DRAWINGS..
2. PROVIDE GUARD RAIL MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 814.04.02 TIMBER GUARDRAIL POSTS, EXCEPT MATERIAL SHALL ALSO APPLY TO RAIL SECTIONS.
3. FURNISH SQUARE SAWN TIMBER GUARDRAIL POSTS AND RAILS. CONFORM TO THE NOMINAL DIMENSIONS SHOWN ON THESE DRAWINGS. SAW THE BUTTS OF ALL POSTS AND RAILS SQUARE. BORE BOLT HOLES TO A DRIVING FIT FOR THE BOLTS. FRAME, BORE, AND TRIM, AS MUCH AS IS PRACTICAL, BEFORE GIVING THE POSTS A PRESERVATIVE TREATMENT. WHEN IT IS NECESSARY TO BORE OR CUT THE POSTS AND RAILS AFTER TREATMENT, OR WHEN ANY TREATED SURFACE HAS BEEN BADLY SCARRED, TREAT THE CUT OR SCARRED SURFACE ACCORDING TO AWPA M4. TREAT THE POSTS AND RAILS WITH PRESERVATIVE ACCORDING TO AWPA C 14 AS APPLICABLE FOR GUARDRAIL POSTS.
4. SUBMITTALS:
   - VENDOR DATA ON GUARD RAIL MATERIALS.

PIPE:

1. PVC PIPE: ASTM D 1785, SCHEDULE 80, POLY (VINYL CHLORIDE) (PVC) MATERIAL; BELL AND SPIGOT STYLE SOLVENT WELDED JOINT ENDS.
2. HDPE PIPE: USE HDPE (PE 3408) PIPING CONFORMING TO ASTM D 3350 CELL CLASSIFICATION 345434C WITH A STANDARD DIMENSION RATIO (SDR) 17 IN ACCORDANCE WITH ASTM D 2513 WITH WELDED JOINTS.
3. PERFORATED PIPE: WATER INLET AREA SHALL BE A MINIMUM OF 1.5 SQUARE INCH PER LINEAR FOOT. MANUFACTURER'S STANDARD PERFORATED (3/8-INCH TO ½-INCH DIAMETER HOLES) OR SLOTTED (1/32 TO 1/8 INCH WIDE SLOTS) PIPE WHICH MEETS THESE REQUIREMENTS IS ACCEPTABLE.
4. GATE VALVES: 6-INCH GATE VALVE ON BURIED PIPING: AWWA C500 OR UL 262. VALVES, AWWA C500, NON-RISING STEM TYPE WITH DOUBLE-DISC GATES. VALVES, UL 262, INSIDE-SCREW TYPE WITH OPERATING NUT, SPLIT WEDGE OR DOUBLE DISC TYPE GATE. MATERIALS FOR UL 262 VALVES CONFORMING TO THE REFERENCE STANDARDS SPECIFIED IN AWWA C500. VALVES SHALL OPEN BY COUNTERCLOCKWISE ROTATION OF THE VALVE STEM. STUFFING BOXES SHALL HAVE O-RING STEM SEALS AND SHALL BE BOLTED AND CONSTRUCTED SO AS TO PERMIT EASY REMOVAL OF PARTS FOR REPAIR. PIPE ENDS SHALL HAVE MECHANICAL FITTINGS SUITABLE FOR JOINING TO THE PIPE TO THE VALVE. VALVE TO BE INSTALLED IN MIXING CHAMBER, PROVIDE VALVE SUPPORTS AS REQUIRED.
5. SUBMITTALS:
   - MANUFACTURER DATA ON PIPING, VALVE, AND VALVE BOX.

BOLLARDS:

1. BOLLARDS FOR PROTECTION OF PRECAST STRUCTURES: SCHEDULE 40 ASTM A 53 TYPE E OR S GRADE B STEEL PIPE, CONCRETE FILLED, CROWNED CAP, 6-INCH DIAMETER, LENGTH AS INDICATED ON DRAWINGS; PRIME YELLOW PAINT, ONE COAT.
2. CONCRETE FILL: 3,000 PSI COMPRESSIVE STRENGTH.

RECEIVED
JUN 19 2015
DIVISION OF WASTE MANAGEMENT
SOLID WASTE BRANCH

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REVISIONS

A	11/25/14	JVM	CLIENT
B	12/19/14	BJB	CLIENT
C	1/19/15	BJB	IFC
D	2/13/15	JVM	CLIENT
E	3/05/15	BJB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM – PHASE 1B
NOTES AND SPECIFICATIONS – 1

Location and Unit:
E.W. BROWN GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:

KU Kentucky Utilities Company

JOB NO. | JOB NO. | JOB NO. | JOB NO.

Drawing No: BRO-C-01451 Rev. E

DBW Version 2.0

BRD-C-01451

GENERAL NOTES:

1. SOURCE OF BASE MAP: EXISTING SITE CONDITIONS SHOWN ON THE DRAWINGS ARE BASED ON AN AERIAL LIDAR SURVEY CONDUCTED IN 2012 AND PROVIDED BY LG&E AND KU ENERGY LLC (OWNER). THE SURVEY COORDINATES AND ELEVATIONS SHOWN ARE BASED THE FOLLOWING: HORIZONTAL – NAD 83 KY S.P.C.S. SOUTH ZONE – U.S. FEET AND VERTICAL – NAVD 88(GPS) – U.S. FEET
2. THE CONTRACTOR IS RESPONSIBLE FOR PROPER LAYOUT FOR THE WORK. THE CONTRACTOR SHALL PROVIDE REQUIRED SURVEY CONTROL AND IDENTIFY REQUIRED LINES, LEVELS, CONTOURS, AND DATUM AT THE WORK AREA.
3. COORDINATE THE USE OF THE SITE WITH THE OWNER FOR ACCESS, STAGING AND STORING OF EQUIPMENT, SOIL STOCKPILES AND THE USE OF AVAILABLE ONSITE SOIL MATERIALS.
4. THE CONTRACTOR SHALL VERIFY DIMENSIONS FOR WORK ITEMS PRIOR TO START OF CONSTRUCTION ACTIVITIES AND PRIOR TO PURCHASING, ORDERING AND/OR FABRICATING MATERIALS FOR THE NEW WORK.
5. THE CONTRACTOR WILL VERIFY THE LOCATION OF ALL EXISTING UTILITIES OR STRUCTURES WITHIN THE LIMITS OF WORK PRIOR TO CONDUCTING EXCAVATION ACTIVITIES.
6. KNOWN EXISTING UNDERGROUND UTILITIES AND UNDERGROUND STRUCTURES ARE SHOWN ON THE DRAWINGS. THE LOCATIONS (BOTH HORIZONTAL AND VERTICAL) OF UNDERGROUND UTILITIES/STRUCTURES SHOWN ON THE DRAWINGS ARE APPROXIMATE. PRIOR TO EXCAVATION ACTIVITIES, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES/STRUCTURES IN THE AREA. THE CONTRACTOR IS WARNED THAT ADDITIONAL UTILITIES/STRUCTURES MAY EXIST AND SPECIAL CARE SHOULD BE TAKEN WHILE CONDUCTING WORK BELOW GRADE. THE CONTRACTOR IS REQUIRED TO PROTECT EXISTING UTILITIES AND STRUCTURES FROM DAMAGE.
7. SHOULD UNCHARTED, OR INCORRECTLY CHARTED, PIPING, OTHER UTILITIES, OR UNDERGROUND STRUCTURES BE ENCOUNTERED DURING EXCAVATION, CONSULT THE OWNER IMMEDIATELY FOR DIRECTIONS. COOPERATE WITH THE OWNER IN KEEPING RESPECTIVE FACILITIES IN OPERATION. THE CONTRACTOR SHALL REPAIR DAMAGED UTILITIES OR UNDERGROUND STRUCTURES TO SATISFACTION OF THE OWNER.
8. THE CONTRACTOR SHALL CONDUCT EXCAVATIONS IN ACCORDANCE WITH SAFETY REQUIREMENTS OF THE U.S. DEPARTMENT OF LABOR'S CONSTRUCTIONS SAFETY ACT DESIGNATED AS TITLE 29 CFR PART 1926 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION, SUBPART P, SECTIONS 1926.650 THROUGH 652, AND ALL OTHER APPLICABLE LAWS AND REGULATIONS.
9. THROUGHOUT THE WORK ACTIVITIES, THE CONTRACTOR SHALL MAINTAIN TRAFFIC ON FACILITY ROADS AND IS RESPONSIBLE FOR PROVIDING ALL NECESSARY TRAFFIC CONTROLS INCLUDING SIGNAGE, WARNING BARRIERS, AND [illegible].
10. RESTORE AREAS DISTURBED BY THE WORK TO THE OWNER'S SATISFACTION AND LEAVE AREA NEAT AND CLEAN UPON COMPLETION OF THE WORK.

SPECIFICATIONS

PREPARATION

1. CLEARING
   - CLEARING INCLUDES CUTTING AT THE GROUND SURFACE TREES AND GENERAL WOODY GROWTH INCLUDING SHRUBS, BUSHES, VINES, AND GENERAL BRUSH.
   - COORDINATE CLEARING LIMITS AND EXISTING PLANT LIFE TO REMAIN WITH THE OWNER AND CLEARLY FLAG FOR PROTECTION. PROTECT TREES, PLANT GROWTH, AND FEATURES DESIGNATED TO REMAIN. PERFORM CLEARING WITHIN THE LIMIT OF WORK AS SHOWN ON THESE DRAWINGS. CLEARING PERFORMED OUTSIDE THE DEFINED LIMIT OF WORK SHALL NOT BE PERMITTED WITHOUT PERMISSION OF THE OWNER.
   - SEGREGATE CLEARING DEBRIS, AS REQUIRED IF ONSITE CHIPPING IS PROPOSED.
   - CLEARED VEGETATION MAY BE STOCKPILED WITHIN THE LIMIT OF WORK UNTIL PROPERLY DISPOSED ONSITE AT A LOCATION AND IN A MANNER AS DIRECTED BY THE OWNER OR OFFSITE DISPOSAL IS CONDUCTED.
   - CLEARED MATERIAL MAY BE CHIPPED AND USED AS MULCH OR DISPOSED ONSITE IN A LOCATION APPROVED BY THE OWNER.
   - BURNING OF MATERIALS: IF APPROVED BY THE OWNER, BURNING OF REMOVED VEGETATION SHALL BE ALLOWED PROVIDED REQUIRED PERMITS ARE OBTAINED AND IS CONDUCTED IN ACCORDANCE WITH PERMIT AND LOCAL AUTHORITY REQUIREMENTS.
2. GRUBBING
   - GRUBBING INCLUDES REMOVAL OF VEGETATIVE COVER WITH ROOT SYSTEMS, STUMPS WITH ROOT SYSTEMS, AND OTHER ORGANIC MATTER SURFICIAL OR BURIED WITHIN THE TOP LAYER OF SOIL (TOPSOIL).
   - COORDINATE WITH THE OWNER FOR THE LOCATION OF ONSITE TEMPORARY STOCKPILES FOR SALVAGED TOPSOIL STOCKPILES. STRIPPED TOPSOIL SHALL BE USED FOR RESTORATION OF VEGETATION OF DISTURBED AREAS.
   - REMOVE ALL STUMPS, ROOTS OVER 2 INCHES IN DIAMETER, MATTED ROOTS, AND VEGETATIVE MATTER INCLUDING GRASSES AND WEEDS WITHIN THE LIMIT OF GRADING. SEGREGATE GRUBBINGS (E.G. STUMPS) GREATER THAN 6 INCHES IN DIAMETER FROM OTHER GRUBBED MATERIALS.
   - GRUBBED MATERIAL MAY BE STOCKPILED WITHIN THE LIMIT OF WORK UNTIL AND SHALL BE COVERED IF NECESSARY TO PREVENT WIND-BLOWN DUST UNTIL PROPERLY DISPOSED ONSITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER OR IS DISPOSED OFFSITE. DO NOT BURY MATERIALS ON SITE UNLESS APPROVED BY OWNER. LEAVE SITE IN CLEAN CONDITION.
3. DEWATERING
   - THE WORK REQUIRES EXCAVATION AND TRENCHING IN CLOSE PROXIMITY TO HARRODSBURG LAKE (GUARD'S INLET) AND IS LOCATED IN AN AREA SUBJECT TO THE SEEPAGE FROM THE EXISTING MAIN POND EMBANKMENT. WORK FOR THIS CONTRACT INCLUDES PROVIDING LABOR, MATERIALS, AND EQUIPMENT TO SUPPLY, OPERATE AND MAINTAIN STORMWATER AND GROUNDWATER SEEPAGE DIVERSION AND DEWATERING SYSTEMS DURING THE INSTALLATION OF THE CUT-OFF WALL. EARTHWORK SHALL NOT BE CONDUCTED IN CONDITIONS THAT PROVIDES A WATER ELEVATION WITHIN LESS THAN 1 FOOT BELOW THE BOTTOM OF EXCAVATIONS OR FILL AREAS WHERE THE SUBGRADE CONSISTS OF SOIL MATERIALS. CAST-IN-PLACE CONCRETE ACTIVITIES MAY BE CONDUCTED IN WET CONDITIONS BUT SHALL NOT BE CONDUCTED IN PONDED WATER, UNLESS APPROVED BY OWNER.
   - THE CONTRACTOR WILL PROVIDE, OPERATE, AND MAINTAIN DIVERSION AND/OR DEWATERING SYSTEMS TO REMOVE WATER AS REQUIRED FROM EXCAVATIONS AND TRENCHES USING DIVERSIONS, SUMPS AND PUMPS, DRAINS OR OTHER FACILITIES NECESSARY TO KEEP EXCAVATIONS AND TRENCHES FREE OF WATER TO THE EXTENT THAT IS REQUIRED TO FACILITATE AND COMPLETE CONSTRUCTION.
   - COORDINATE THE TRENCH DEWATERING ACTIVITIES WITH THE OWNER PRIOR TO CONDUCTING DEWATERING OPERATIONS. THE DEWATERING SYSTEM CAN BE DISCHARGED/PUMPED TO THE EXISTING OLD PRINCIPAL SPILLWAY DITCH IN A MANNER THAT PREVENTS EROSION. PROVIDE APPROPRIATE OUTLET PROTECTION FOR PUMP DISCHARGE LINES TO PREVENT SCOUR AND EROSION OF EXISTING DRAINAGE CHANNELS. AS REQUIRED FOR SEDIMENT REMOVAL, DEWATERING FILTER BAGS SHALL BE USED PRIOR TO DISCHARGE TO SPILLWAY DITCH. ALSO, IF DEWATERING FLUIDS ARE DETERMINED TO BE CONTAMINATED BASED ON SAMPLING CONDUCTED BY THE OWNER'S REPRESENTATIVE, WATER FROM DEWATERING OPERATIONS SHALL BE COLLECTED IN FRAC TANKS FOR TRANSPORT TO AND/OR PUMPED TO THE AUXILIARY POND FOR DISPOSAL OR AS DIRECTED BY THE OWNER.
   - THE OBJECTIVE IS TO MAINTAIN THE GROUNDWATER AT A MINIMUM OF 1 FOOT BELOW THE BASE OF THE EXCAVATIONS AND TRENCHES WHERE THE SUBGRADE CONSISTS OF SOIL MATERIALS TO ALLOW FOR PLACEMENT AND COMPACTION OF THE BACKFILL IN ADEQUATELY DRY CONDITIONS AND TO CONDUCT CAST-IN-PLACE CONCRETE WORK WITHOUT PONDED WATER.

EARTHWORK

1. EARTHWORK MATERIALS
   - ROAD GRAVEL: FOR TRAFFIC AREAS AS SHOWN ON THE DRAWINGS PROVIDE AGGREGATE MATERIAL MEETING THE REQUIREMENTS OF KENTUCKY TRANSPORTATION CABINET (KTC) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 805.08 – DENSE GRADED AGGREGATE OR SECTION 805.14 – AGGREGATE SURFACING, TRAFFIC-BOUND BASE AND MAINTENANCE, AGGREGATE SIZE 610 OR 710.
   - SLOPE AND CHANNEL PROTECTION STONE: SOUND, DURABLE WELL GRADED ANGULAR ROCK MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 805.11.02 – CRUSHED AGGREGATE SLOPE PROTECTION OR SECTION 805.11.04 – CLASS II CHANNEL LINING. (E)
   - COMMON FILL: AT THE DIRECTION OF THE OWNER'S REPRESENTATIVE, REUSE SUITABLE EXCAVATED MATERIAL. COMMON FILL SHALL CONSIST OF SOIL SUITABLE FOR ENGINEERING CONSTRUCTION. IT SHALL BE FREE FROM FROZEN MATERIALS, PERISHABLE RUBBISH, PEAT, AND OTHER UNSATISFACTORY SOILS/MATERIALS. IT SHALL BE OF SUCH A NATURE AND CHARACTER THAT IT CAN BE COMPACTED TO A FIRM UN-YIELDING SURFACE.
   - STONE FILL: STONE FILL MATERIAL FOR BACKFILL AROUND AND BEHIND THE CUT-OFF WALL AND ACCESS ROAD CONSTRUCTION AS SHOWN ON THE DRAWINGS SHALL CONSIST OF STONE MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 805.05 – GRADATION SIZE NO. 2.
   - COMPACTED CLAY: MATERIAL FOR COMPACTED CLAY BACKFILL MATERIAL FOR WATER STOPS AT BOTH ENDS OF THE CUT-OFF WALL AS SHOWN ON THESE DRAWINGS SHALL CONSIST OF SOIL MATERIAL CLASSIFIED AS CH OR CL IN ACCORDANCE WITH ASTM D 2487 (UNIFIED SOIL CLASSIFICATION SYSTEM). THE CLAY MATERIAL SHALL NOT CONTAIN STONES LARGER THAN 3 INCHES AND SHALL BE FREE OF TRASH, ICE, SNOW, TREE STUMPS, AND OTHER ORGANIC AND DELETERIOUS MATERIALS.
2. BORROW SOURCE TESTING
   - BORROW SOURCE TESTING SHALL BE CONDUCTED BY THE CONTRACTOR ON ALL SOIL MATERIALS PROPOSED FOR CONSTRUCTION. TESTING REQUIREMENTS AND FREQUENCY SHALL BE AS PROVIDED BELOW.
   - ROAD GRAVEL AND COMMON FILL:

TEST	METHODOLOGY	FREQUENCY
GRAIN SIZE	ASTM D 422	2 TESTS/SOURCE/MATERIAL
MOISTURE DENSITY CURVE	ASTM D 1557	2 TESTS/SOURCE/MATERIAL

   - STONE FILL AND SLOPE AND CHANNEL PROTECTION STONE

TEST	METHODOLOGY	FREQUENCY
PARTICLE SIZE	ASTM D 5519	2 TESTS/SOURCE/MATERIAL

   - COMPACTED CLAY

TEST	METHODOLOGY	FREQUENCY
GRADATION	ASTM D 422	2 TEST PER SOURCE MATERIAL
PERCENT FINER NO. 200 SIEVE	ASTM D 1140	2 TEST PER SOURCE MATERIAL
ATTERBERG LIMITS	ASTM D 4318	2 TEST PER SOURCE MATERIAL
MOISTURE DENSITY CURVE	ASTM D 698	2 TEST PER SOURCE/MATERIAL

3. EXCAVATION
   - UNIFORMLY EXCAVATE TO LINES, GRADES, AND SHAPES INDICATED ON THE CONSTRUCTION DRAWINGS. REMOVE WATER OR MATERIALS THAT INTERFERE WITH WORK. THE OWNER RESERVES RIGHT TO MAKE CHANGES IN LINES AND GRADES IF REQUIRED FOR ACTUAL PROJECT SITE CONDITIONS.
   - MAINTAIN EXCAVATIONS IN A SAFE CONDITION UNTIL COMPLETION OF BACKFILLING ACTIVITIES OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
   - ON THE UPGRADIENT SIDE OF THE CUT-OFF WALL, EXISTING OVERBURDEN SOIL MATERIALS SHALL BE EXCAVATED DOWN TO BEDROCK TO THE LIMITS AS SHOWN ON THE DRAWINGS AND REPLACED WITH STONE FILL DURING BACKFILL ACTIVITIES.
   - REMOVE EXCESS EXCAVATED SOIL NOT INTENDED FOR REUSE AND PROPERLY DISPOSE ONSITE AT A LOCATION AND A MANNER AS DIRECTED BY THE OWNER.
4. ROCK REMOVAL AND EXCAVATION

   NOTE: Where rock excavation is planned, foundation section details or typical grading or trench cross sections on plans should show the required angle of rock excavation and any special refill or bedding requirements.

   - ROCK: SOLID HOMOGENEOUS INTERLOCKING CRYSTALLINE MATERIAL WITH FIRMLY CEMENTED, LAMINATED, OR FOLIATED MASSES OR CONGLOMERATE DEPOSITS, NEITHER OF WHICH CAN BE REMOVED WITHOUT SYSTEMATIC DRILLING AND BLASTING, DRILLING AND THE USE OF EXPANSION JACKS OR FEATHER WEDGES, OR THE USE OF BACKHOE-MOUNTED PNEUMATIC HOLE PUNCHERS OR ROCK BREAKERS. COMMON EXCAVATION SHALL CONSIST OF ALL EXCAVATION NOT CLASSIFIED AS ROCK EXCAVATION.
   - REMOVE ROCK TO ELEVATIONS OR DETAILS INDICATED ON THE DRAWINGS IN A MANNER THAT WILL LEAVE FOUNDATION MATERIAL IN AN UN-SHATTERED AND SOLID CONDITION. REMOVAL OF ROCK BEYOND LINES AND GRADES INDICATED WILL NOT BE GROUNDS FOR A CLAIM FOR ADDITIONAL PAYMENT UNLESS PREVIOUSLY AUTHORIZED BY THE OWNER.
   - ROCK SHALL BE REMOVED BY DRILLING AND THE USE OF EXPANSION JACKS OR FEATHER WEDGES OR THE USE OF BACKHOE-MOUNTED PNEUMATIC HOLE PUNCHERS OR ROCK BREAKERS. REMOVAL OF ROCK OR HARD MATERIAL WILL NOT BE CONDUCTED BY DRILLING AND BLASTING UNLESS APPROVED BY THE OWNER IN WRITING. IF ALLOWED, ROCK REMOVAL BY DRILLING AND BLASTING METHODS WILL REQUIRE PREPARATION AND APPROVAL OF A BLASTING PLAN.
   - REMOVED ROCK MAY BE USED AS INITIAL STONE FILL BEHIND THE CUT-OFF WALL BUT SHALL NOT BE PLACED WITHIN 5 FEET OF THE WALL, PIPING, AND PRECAST STRUCTURES.
   - PRIOR TO FORMWORK FOR CAST-IN-PLACE CONCRETE STRUCTURES, THE OWNER'S REPRESENTATIVE SHALL INSPECT THE PREPARED ROCK SURFACE. PROVIDE ADDITIONAL ROCK PREPARATION AND/OR REMOVAL AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
5. BACKFILL
   - GENERAL: PLACE SPECIFIED BACKFILL SOIL MATERIALS IN LAYERS TO REQUIRED SUBGRADE ELEVATIONS. DO NOT PLACE BACKFILL OR FILL MATERIAL ON SURFACES THAT ARE MUDDY, FROZEN, OR CONTAIN FROST OR ICE.
   - UNLESS OTHERWISE NOTED OR DIRECTED, PLACE BACKFILL AND FILL MATERIALS IN LOOSE DEPTH LAYERS NOT MORE THAN AS INDICATED FOR EACH TYPE OF MATERIAL, UNLESS OTHERWISE DIRECTED OR SPECIFIED:
     COMMON FILL – 12 INCHES
     STONE BACKFILL – 12 INCHES
     ROAD GRAVEL – 8 INCHES
     COMPACTED CLAY MATERIAL – 8 INCHES
   - PLACE BACKFILL AND FILL MATERIALS EVENLY ADJACENT TO STRUCTURES, TO REQUIRED ELEVATIONS. TAKE CARE TO PREVENT WEDGING ACTION OF BACKFILL AGAINST STRUCTURES BY CARRYING THE MATERIAL UNIFORMLY AROUND AND ALONG STRUCTURES TO APPROXIMATELY SAME ELEVATION IN EACH LIFT.
6. COMPACTION
   - AT THE TIME OF STONE AND SOIL PLACEMENT AND COMPACTION, THE OWNER'S REPRESENTATIVE WILL INSPECT AND PROVIDE IN-PLACE SOIL MATERIAL TESTING. THE CONTRACTOR SHALL PROVIDE THE REQUIRED SOIL COMPACTION DURING CONSTRUCTION TO ACHIEVE MINIMUM PERCENT/DEGREE OF COMPACTION OR A FIRM UN-YIELDING SURFACE AS SPECIFIED HEREIN.
   - ROAD GRAVEL MATERIAL SHALL BE COMPACTED TO MINIMUM OF 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 1557 AS TESTED BY THE OWNER'S REPRESENTATIVE.
   - CLAY MATERIAL SHALL BE COMPACTED TO MINIMUM OF 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 698 AS TESTED BY THE OWNER'S REPRESENTATIVE.
   - PROVIDE STONE FILL COMPACTION DURING CONSTRUCTION TO ACHIEVE A FIRM UNYIELDING SURFACE FOR EACH BACKFILL LIFT.
   - MAINTAIN OPTIMUM MOISTURE CONTENT OF FILL MATERIALS TO ATTAIN REQUIRED COMPACTION DENSITY.
7. FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION
   - THE OWNER'S REPRESENTATIVE WILL PERFORM FIELD DENSITY TESTS ON ROAD GRAVEL COMPACTED CLAY MATERIALS IN ACCORDANCE WITH ASTM D 6938.

     THE OWNER'S REPRESENTATIVE WILL CONDUCT IN-PLACE DENSITY AND MOISTURE TESTS AT A FREQUENCY OF 1 TEST PER 800 SQUARE FEET OF PLACED LAYER OF COMPACTED ROAD GRAVEL AND CLAY MATERIAL OR A MINIMUM OF 2 TESTS PER LIFT. THE CONTRACTOR KEEP THE OWNER'S REPRESENTATIVE NOTIFIED OF THE BACKFILL AND COMPACTION ACTIVITIES IN ORDER TO ALLOW FOR INSPECTION AND IN PLACE DENSITY TO OCCUR IN TIMELY MANNER. COOPERATE AND ASSIST THE OWNER'S REPRESENTATIVE AS NEEDED DURING INSPECTION AND TESTING OF BACKFILL MATERIALS.
   - THE OWNER'S REPRESENTATIVE WILL INSPECT EACH STONE FILL LIFT PLACED FOR A SUITABLE FIRM UNYIELDING SURFACE. IN PLACE DENSITY TESTING WILL NOT BE CONDUCTED.
8. SUBMITTALS:
   - SOIL MATERIAL TESTING RESULTS
   - BORROW SOURCE SOIL MATERIAL TESTING RESULTS

CONCRETE WORK

1. CONCRETE SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND IN ACCORDANCE WITH ACI 318 LATEST EDITION, EXCEPT AS SPECIFIED HEREIN.
2. ALL SPLICES IN REINFORCEMENT SHALL BE CLASS B SPLICES AS PER ACI 318.
3. CONCRETE MATERIALS.
   - CEMENT: ASTM C 150 AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 801 FOR CEMENT.
   - AGGREGATES: KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 804 FOR FINE AGGREGATE AND SECTION 805 FOR COARSE AGGREGATE. AGGREGATES SHALL NOT CONTAIN ANY SUBSTANCE WHICH MAY BE DELETERIOUSLY REACTIVE WITH THE ALKALIES IN THE CEMENT.
   - REINFORCING BARS: ASTM A 615 AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 811.02, GRADE 60, DEFORMED, EPOXY COATED.
   - EPOXY BONDING COMPOUND: ASTM C 881 AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 826. PROVIDE TYPE V FOR BONDING PLASTIC CONCRETE TO HARDENED CONCRETE. PROVIDE GRADE 3 FOR VERTICAL SURFACES.
   - NON-SHRINK GROUT: ASTM C 1107
   - AIR-ENTRAINING: ASTM C 260
   - HIGH RANGE WATER REDUCER (HRWR) (SUPERPLASTICIZERS): ASTM C 494, TYPE F OR G AND ASTM C 1017
   - FORMS FOR FORMED FINISHED CONCRETE: PLYWOOD, LUMBER, METAL, OR ANOTHER APPROVED MATERIAL. PROVIDE LUMBER DRESSED ON AT LEAST TWO EDGES AND ONE SIDE FOR TIGHT FIT.
   - LIQUID CHEMICAL SEALER-HARDENER COMPOUND: COMPOUND SHALL BE MAGNESIUM FLUOSILICATE WHICH WHEN MIXED WITH WATER SEALS AND HARDENS THE SURFACE OF THE CONCRETE.
   - WATERSTOP: PVC, MINIMUM 4 INCHES WIDE. USE DUMBELL WITH CENTER BULB OR RIBBED WITH CENTER BULB FOR EXPANSION JOINTS. ALL OTHER JOINTS USE RIBBED OR DUMBELL TYPE.
4. CONCRETE MIX
   - CONTRACTOR-FURNISHED MIX DESIGN: PROVIDE A CONCRETE MIX CONFORMING TO APPLICABLE MATERIAL SECTIONS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION FOR CLASS AA CONCRETE (MINIMUM COMPRESSIVE STRENGTH (f'C) OF 4000 PSI; SLUMP RANGE 3-5 INCHES; MAXIMUM WATER/CEMENT RATIO 0.42; AIR-ENTRAINMENT 6 (± 2) PERCENT). DO NOT CHANGE THE SELECTED OPTION DURING THE COURSE OF THE WORK.
   - SLUMP MAY BE INCREASED TO 8 INCHES MAXIMUM PROVIDED THE WATER/CEMENT RATIO DOES NOT EXCEED 0.4 AND A HIGH RANGE WATER REDUCER (SUPERPLASTICIZERS) TYPE F OR G IS USED. PROVIDE AIR ENTRAINMENT USING AIR-ENTRAINING ADMIXTURE.
5. PLACING
   - PLACE CONCRETE IN ACCORDANCE WITH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 601.03.08. SECTION 601.03.09(B) SPECIFICALLY ADDRESSES WEATHER LIMITATIONS DURING CONCRETE MIXING, PLACING, AND FINISHING, INCLUDING DURING COLD WEATHER.
   - OBTAIN THE OWNER'S REPRESENTATIVE APPROVAL OF THE CONDITION OF THE PREPARED ROCK SURFACE BEFORE FORMWORK INSTALLATION AND PLACING ANY CONCRETE.
   - DEPOSIT THE CONCRETE IN FORMWORK TO REQUIRE AS LITTLE RE-HANDLING AS POSSIBLE UNLESS HAULING EQUIPMENT IS EQUIPPED WITH MEANS FOR DISCHARGE OF CONCRETE WITHOUT SEGREGATION OF THE MATERIALS. UNLOAD THE CONCRETE INTO AN APPROVED SPREADING DEVICE AND MECHANICALLY SPREAD IT ON THE GRADE IN A MANNER TO PREVENT SEGREGATION OF THE MATERIALS.
   - DO NOT DROP CONCRETE IN EXCESS OF 5 FEET WITHOUT USING PIPE OR TREMIES, AND DO NOT DEPOSIT A LARGE QUANTITY AT ANY POINT AND RUN OR WORK IT ALONG THE FORMS. WHEN PUMPING, EQUIP THE DELIVERY PIPE WITH A NOZZLE, HAVING A MINIMUM OF 3 RIGHT ANGLES, AT THE DISCHARGE END. MAINTAIN THE DISCHARGE END OF THE PIPE AS CLOSE TO THE POINT OF DEPOSIT AS FEASIBLE. PLACE CONCRETE TO ENTIRELY FILL BUT NOT BULGE OR DISTORT THE FORMS OR TO DISTURB THEIR ALIGNMENT. FILL EACH PART OF THE FORMS BY DEPOSITING CONCRETE AS NEAR ITS FINAL POSITION AS POSSIBLE. TO WORK THE COARSER AGGREGATE BACK FROM THE FACE, AND TO FORCE CONCRETE UNDER AND AROUND REINFORCING BARS WITHOUT DISPLACING THEM. AFTER CONCRETE HAS TAKEN ITS INITIAL SET, AVOID JARRING THE FORMS OR PLACING ANY STRAIN ON ENDS OF PROJECTING REINFORCEMENT.
   - PROVIDE VIBRATION OF SUFFICIENT INTENSITY AND DURATION TO CAUSE FLOW OR SETTLEMENT OF THE CONCRETE AND COMPLETE CONSOLIDATION, BUT ENSURE THAT VIBRATION IS NOT USED TO CAUSE CONCRETE TO FLOW OVER LONG DISTANCES IN THE FORMS OR IS UNDULY PROLONGED TO CAUSE SEGREGATION OR UNDESIRABLE LAITANCE AT THE SURFACE OF THE LIFT BEING CONSOLIDATED. USE PLASTIC COATED VIBRATORS, WHEN NECESSARY TO PREVENT DAMAGE TO THE EPOXY COATING OF THE STEEL. PROVIDE AND USE A SUFFICIENT NUMBER OF MECHANICAL VIBRATORS TO ENSURE THAT CONSOLIDATION CAN BE STARTED IMMEDIATELY AFTER CONCRETE HAS BEEN DEPOSITED IN THE FORMS. DO NOT ATTACH THE MECHANICAL VIBRATOR TO THE FORMS OR REINFORCING STEEL OR APPLY TO THE SURFACE OF THE CONCRETE. APPLY THE VIBRATOR TO THE CONCRETE IMMEDIATELY AFTER DEPOSITING THE CONCRETE AND MOVE IT THROUGHOUT THE MASS, THOROUGHLY WORKING THE CONCRETE AROUND THE REINFORCEMENT, EMBEDDED FIXTURES, AND INTO ANGLES AND CORNERS OF THE FORMS. DESIGN FORMS TO PROVIDE FOR REQUIREMENTS OF VIBRATION.
   - PLACE CONCRETE IN CONTINUOUS HORIZONTAL LAYERS NOT EXCEEDING A THICKNESS OF ONE FOOT IN ANY GIVEN LAYER. PLACE AND CONSOLIDATE CONSECUTIVE BATCHES BEFORE THE PRECEDING BATCH HAS TAKEN ITS INITIAL SET. ENSURE THAT EACH LAYER OF CONCRETE RETAINS A ROUGH SURFACE TO SECURE EFFICIENT BONDING WITH THE NEXT LAYER. CONSOLIDATE A SUCCEEDING LAYER PLACED BEFORE THE UNDERLYING LAYER HAS SET IN A MANNER THAT WILL ENTIRELY BREAK UP AND ELIMINATE THE TENDENCY TO PRODUCE A COLD JOINT BETWEEN LAYERS.
   - DURING ANY TEMPORARY SHUTDOWN OF LESS THAN 30 MINUTES, COVER THE CONCRETE AT THE UNFINISHED END OF THE WALL WITH WET BURLAP. WHEN AN INTERRUPTION OF THE WORK EXCEEDS 30 MINUTES DURATION, THE OWNER'S REPRESENTATIVE MAY REQUIRE THAT A CONSTRUCTION JOINT BE INSTALLED. WHEN TEMPORARILY DISCONTINUING PLACING, CLEAN THE PLACED CONCRETE, AFTER IT BECOMES FIRM ENOUGH TO RETAIN ITS FORM, OF LAITANCE AND OTHER OBJECTIONABLE MATERIAL TO A SUFFICIENT DEPTH TO EXPOSE SOUND CONCRETE PRIOR TO NEW CONCRETE PLACEMENT. MAKE CONSTRUCTION JOINTS ACCORDING TO KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 601.03.10.
6. JOINTS
   - PROVIDE CONTRACTION JOINTS AND EXPANSION JOINTS AT THE LOCATIONS SHOWN ON THE DRAWINGS. ALL JOINTS SHALL OCCUR AT THE JUNCTION OF DIFFERENT WALL SEGMENTS.
   - PROVIDE 1/2-INCH JOINT MATERIAL IN ALL EXPANSION JOINTS. PLACE 20-INCH LONG, 3/4-INCH DIAMETER, COMMERCIAL GRADE GREASED STEEL DOWELS AT 12-INCH INTERVALS ALONG THE CENTERLINE OF THE OF THE WALL STEM. DO NOT PASS WALL REINFORCING STEEL THROUGH EITHER JOINT. SEAL JOINTS FROM TOP TO BOTTOM WITH JOINT SEALANT.
   - EXPANSION JOINT FILLER: FURNISH PREFORMED SPONGE RUBBER JOINT FILLERS THAT CONFORM TO AASHTO M 153 FOR TYPE I (SPONGE RUBBER), 1/2-INCH THICK. FURNISH PREFORMED FILLERS IN A SINGLE PIECE FOR THE FULL DEPTH AND WIDTH REQUIRED FOR THE JOINT UNLESS OTHERWISE AUTHORIZED.
   - JOINT SEALANTS – USE RAPID-CURE SILICONE SEALANT CONFORMING TO BOTH KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 807.03.05 OR USE SEALANT THAT IS (1) FURNISHED AS A TWO-PART, RAPID-CURE, COLD-APPLIED, ULTRA-LOW-MODULUS SUITABLE FOR VERTICAL APPLICATION. 100-PERCENT SILICONE RUBBER SEALANT, (2) FLEXIBLE OVER A WIDE TEMPERATURE RANGE, AND (3) SUITABLE FOR USE IN CONCRETE-TO-CONCRETE.
   - BACKER ROD – USE A CLOSED-CELL, POLYETHYLENE FOAM, BACK-UP ROD THAT IS COMPATIBLE WITH THE SEALANT. ENSURE NO BOND OR REACTION OCCURS BETWEEN THE BACK-UP ROD AND SEALANT.
7. CURING AND PROTECTION
   - CONDUCT CURING IN ACCORDANCE WITH THESE NOTES AND KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 601.
   - IMMEDIATELY AFTER PLACEMENT, PROTECT CONCRETE FROM PREMATURE DRYING, EXCESSIVELY HOT OR COLD TEMPERATURES, AND MECHANICAL INJURY. MAINTAIN CONCRETE WITH MINIMAL MOISTURE LOSS AT RELATIVELY CONSTANT TEMPERATURE FOR PERIOD NECESSARY FOR HYDRATION OF CEMENT AND HARDENING OF CONCRETE.
   - FOLLOWING CONCRETE PLACEMENT AND FINISHING, IMMEDIATELY BEGIN PROPER CURING. PLASTIC SHRINKAGE CRACKS CAN OCCUR WHEN CURING PRACTICES ARE INEFFECTIVE.
   - USE WETTED BURLAP OR A CURING COMPOUND. CURING SHALL CONTINUE FOR AT LEAST 7 DAYS. FORM REMOVAL SHALL BE AVOIDED FOR THE 7 DAY CURING PERIOD AND WALL BACKFILL SHALL NOT OCCUR FOR AT LEAST 14 DAYS.
   - IF BURLAP IS USED, MONITOR WETTING/RE-WETTING OF THE BURLAP. AVOID OVERSPRAY THAT ADDS WATER TO THE NEWLY FINISHED "GREEN" PAVEMENT SURFACE.
   - IF USED, CURING COMPOUND SHALL INCLUDE WHITE PIGMENT TO REDUCE HEAT AT THE SURFACE FROM SOLAR RADIATION AND THE FOLLOWING REQUIREMENTS: VISUALLY INSPECT FOR COMPLETE AND UNIFORM COVERAGE. THE SURFACE SHOULD BE SIMILAR IN APPEARANCE TO A WHITE SHEET OF PAPER (NO GRAY STREAKS). TIMELY APPLICATION OF AN ADEQUATE QUANTITY OF CURING COMPOUND IS THE OBJECTIVE. CURING COMPOUND SHOULD BE APPLIED BEFORE ANY SURFACE DRYING CAN OCCUR AND SHOULD NOT BE APPLIED UNTIL BLEED WATER IS GONE AND APPLICATION SHALL FOLLOW THE MANUFACTURER INSTRUCTIONS.
8. FINISH
   - FORMED FINISH: AS-CAST CONCRETE TEXTURE IMPARTED BY FORM FACING MATERIAL WITH TIE HOLES AND DEFECTS REPAIRED AND PATCHED.
9. CONCRETE TESTING
   - AT THE TIME OF PLACEMENT, THE OWNER'S REPRESENTATIVE WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE, AND TEMPERATURE OF THE CONCRETE. THE CONCRETE MUST MEET ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE MAXIMUM SLUMP MAY BE INCREASED AS SPECIFIED WITH THE ADDITION OF AN APPROVED ADMIXTURE PROVIDED THAT THE WATER-CEMENT RATIO IS NOT EXCEEDED. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.
   - COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S REPRESENTATIVE TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT, THE OWNER'S REPRESENTATIVE'S TESTING AGENCY SHALL MAKE FOUR TEST CYLINDERS IN ACCORDANCE WITH ASTM C 31. ONE CYLINDER SHALL BE TESTED AT 7 DAYS, TWO CYLINDERS AT 28 DAYS, AND ONE CYLINDER HELD IN RESERVE. IF THE AVERAGE OF THE TWO 28 DAY STRENGTH TEST RESULTS IS LESS THAN f'C OR IF ANY STRENGTH TEST RESULT FALLS BELOW f'C BY MORE THAN 500 PSI, THEN THE RESERVE CYLINDER SHALL BE TESTED.
   - AT THE DIRECTION OF THE OWNER REMOVE CONCRETE NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE.
10. SUBMITTALS
   - CONCRETE MIX DESIGN: SIX DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.
   - STEEL REINFORCEMENT SHOP DRAWINGS: PLACEMENT DRAWINGS THAT DETAIL FABRICATION, BENDING, AND PLACEMENT INCLUDING BAR SIZES, LENGTHS, MATERIAL, GRADE, BAR SCHEDULES, BENT BAR DIAGRAMS, BAR ARRANGEMENT AND SPLICES AND LAPS.

PRECAST CONCRETE STRUCTURES

1. PROVIDE PRECAST CONCRETE STRUCTURES FOR PUMP STATION, AND SEEPAGE MIXING CHAMBER TO THE DIMENSIONS AS SHOWN ON THESE DRAWINGS.
2. PRECAST CONCRETE
   - PRECAST CONCRETE STRUCTURES MANUFACTURED IN ACCORDANCE WITH ASTM C 478 FOR H-20 LOADING WITH CONCRETE DESIGNED TO OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI AFTER 28 DAYS.
   - PROVIDE SHIPLAP JOINTS FOR STRUCTURES BETWEEN RISERS AND COVERS SEALED WITH O-RING GASKET OR A MINIMUM 1 INCH STRIP OF BUTYL RUBBER SEALANT.
3. PIPE TO STRUCTURE CONNECTION
   - FLEXIBLE PIPE BOOT, USING NOR-N-SEAL® FLEXIBLE PIPE BOOT CONNECTOR OR APPROVED EQUAL.
4. FRAMES AND COVERS
   - HEAVY DUTY CAST IRON CONFORMING TO ASTM A 48, CLASS 35B GRAY IRON OR ASTM A 536 FOR DUCTILE IRON. FABRICATE FRAMES, COVERS, AND GRATINGS OF STANDARD COMMERCIAL GRADE STEEL OR DUCTILE IRON WELDED BY QUALIFIED WELDERS IN ACCORDANCE WITH AWS D1.1.
   - CONTACT SURFACES OF COVERS AND FRAME SEATS: MACHINED AT THE FOUNDRY BEFORE SHIPMENT TO PREVENT ROCKING OF COVERS IN ANY ORIENTATION.
   - PROVIDE FRAMES WITH COVERS WITH CLEAR OPENINGS AS SHOWN ON THE DRAWINGS.
   - CASTINGS: GOOD QUALITY, STRONG, TOUGH, EVEN-GRAINED CAST IRON, SMOOTH, FREE FROM SCALE, LUMPS, BLISTERS, SANDHOLES, AND DEFECTS OF EVERY NATURE WHICH WOULD RENDER THEM UNFIT FOR THE SERVICE FOR WHICH THEY ARE INTENDED. CASTINGS SHALL BE THOROUGHLY CLEAN AND SUBJECT TO A CAREFUL HAMMER INSPECTION.
5. ALUMINUM ACCESS HATCHES
   - SHALL BE OF THE SIZE SHOWN ON THE DRAWINGS.
   - MADE OF ¼" THICK DIAMOND PATTERN ALUMINUM PLATE.
   - REINFORCED FOR H20 LOADING.
   - AUTOMATIC HOLD-OPEN ARM.
   - DEPTH OF FRAME AS REQUIRED TO MATCH THE DEPTH OF THE PRECAST STRUCTURE COVER.
   - ALL HARDWARE INCLUDING LATCHES, LIFTING MECHANISM ASSEMBLIES, GUIDES, BRACKETS, HINGES, PINS, HOLD OPEN ARMS, AND GUIDES SHALL BE MADE OF 316 SS.
   - HINGES SHALL BE ACCESSIBLE ONLY WHEN THE ACCESS DOOR IS IN THE OPEN POSITION.
   - ACCESS HATCH SHALL BE PROVIDED WITH RECESSED PADLOCK HASPS COVERED BY A HINGED LID THAT CLOSES FLUSH WITH THE SURFACE OF THE HATCH COVER.
6. SUBMITTALS
   - VENDOR DRAWINGS FOR PRECAST CONCRETE STRUCTURES
   - MANUFACTURER DATA ON FRAMES AND COVERS
   - MANUFACTURER DATA ON ALUMINUM ACCESS HATCH

HANDRAIL

1. PROVIDE AND INSTALL A HANDRAIL ALONG THE TOP OF THE CUT-OFF WALL PER THE DIMENSIONS AND DETAILS SHOWN ON THESE DRAWINGS.
2. PROVIDE HANDRAIL MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 813.12.01 TYPE B.
3. SUBMITTALS
   - VENDOR DATA ON HANDRAIL MATERIALS

GUARD RAIL

1. PROVIDE AND INSTALL A GUARD RAIL ALONG THE FRONT OF THE TOP OF THE CUT-OFF WALL PER THE DIMENSIONS AND DETAILS SHOWN ON THESE DRAWINGS.
2. PROVIDE GUARD RAIL MEETING THE REQUIREMENTS OF KTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 814.04.08 TIMBER GUARDRAIL POSTS, EXCEPT MATERIAL SHALL ALSO APPLY TO RAIL SECTIONS.
3. FURNISH SQUARE SAWN TIMBER GUARDRAIL POSTS AND RAILS. CONFORM TO THE NOMINAL DIMENSIONS SHOWN ON THESE DRAWINGS. SAW THE BUTTS OF ALL POSTS AND RAILS SQUARE. BORE BOLT HOLES TO A DRIVING FIT FOR THE BOLTS. FRAME, BORE, AND TRIM, AS MUCH AS IS PRACTICAL, BEFORE GIVING THE POSTS A PRESERVATIVE TREATMENT. WHEN IT IS NECESSARY TO BORE OR CUT THE POSTS AND RAILS AFTER TREATMENT, OR WHEN ANY TREATED SURFACE HAS BEEN BADLY SCARRED, TREAT THE CUT OR SCARRED SURFACE ACCORDING TO AWPA M4. TREAT THE POSTS AND RAILS WITH PRESERVATIVE ACCORDING TO AWPA C 14 AS APPLICABLE FOR GUARDRAIL POSTS.
4. SUBMITTALS
   - VENDOR DATA ON GUARD RAIL MATERIALS.

PIPE

1. PVC PIPE: ASTM D 1785, SCHEDULE 80, POLY (VINYL CHLORIDE) (PVC) MATERIAL, BELL AND SPIGOT STYLE SOLVENT WELDED JOINT ENDS.
2. HDPE PIPE: USE HDPE (PE 3408) PIPING CONFORMING TO ASTM D 3350 CELL CLASSIFICATION 345434C WITH A STANDARD DIMENSION RATIO (SDR) 17 IN ACCORDANCE WITH ASTM D 2513 WITH WELDED JOINTS.
3. PERFORATED PIPE: WATER INLET AREA SHALL BE A MINIMUM OF 1.5 SQUARE INCH PER LINEAR FOOT. MANUFACTURER'S STANDARD PERFORATED (3/8-INCH TO ½-INCH DIAMETER HOLES) OR SLOTTED (1/32 TO 1/8 INCH WIDE SLOTS) PIPE WHICH MEETS THESE REQUIREMENTS IS ACCEPTABLE.
4. GATE VALVES: 6-INCH GATE VALVE ON BURIED PIPING: AWWA C509 OR UL 262. VALVES, AWWA C509, NON-RISING STEM TYPE WITH DOUBLE-DISC GATES. VALVES, UL 262, WEDGE-BODY TYPE WITH OPERATING NUT, SPLIT WEDGE OR DOUBLE DISC TYPE GATE. MATERIALS FOR UL 262 VALVES CONFORMING TO THE REFERENCE STANDARDS SPECIFIED IN AWWA C509. VALVES SHALL OPEN BY COUNTERCLOCKWISE ROTATION OF THE VALVE STEM. STUFFING BOXES SHALL HAVE O-RING STEM SEALS AND SHALL BE BOLTED AND CONSTRUCTED SO AS TO PERMIT EASY REMOVAL OF PARTS FOR REPAIR. PIPE ENDS SHALL HAVE MECHANICAL FITTINGS SUITABLE FOR JOINING TO THE PIPE TO THE VALVE. VALVE TO BE INSTALLED IN MIXING CHAMBER. PROVIDE VALVE SUPPORTS AS REQUIRED.
5. SUBMITTALS
   - MANUFACTURER DATA ON PIPING, VALVE, AND VALVE BOX

BOLLARDS

1. BOLLARDS FOR PROTECTION OF PRECAST STRUCTURES: SCHEDULE 40 ASTM A 53 TYPE E OR S GRADE B STEEL PIPE, CONCRETE FILLED, CROWNED CAP, 6-INCH DIAMETER, LENGTH AS INDICATED ON DRAWINGS; PRIME YELLOW PAINT, ONE COAT.
2. CONCRETE FILL: 3,000 PSI COMPRESSIVE STRENGTH

VOIDED

JUN 19 2015

THE APPLICANT HAS VOIDED THIS PAGE. THE CABINET HAS RETAINED IT AS PART OF THE ADMINISTRATIVE RECORD.

REVISIONS

No.	Date	By	Checked
A	3/25/14	[illegible]	CJ/DF
B	12/18/14	[illegible]	CJ/DF
C	1/29/15	[illegible]	DC
D	2/13/15	[illegible]	CJ/DF
E	[illegible]/15	[illegible]	DC

E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM – PHASE 1B
NOTES AND SPECIFICATIONS – 1

E.W. BROWN GENERATING STATION

Kentucky Utilities Company

BRD-C-01451 | E

SPECIFICATIONS (CONTINUED)

FABRIC FORM CONCRETE MAT:

1. FABRIC FORM CONCRETE MAT WILL BE PLACED TO LINE THE CONSTRUCTED DIVERSION CHANNEL AS WELL AS EXISTING ABUTMENT CHANNELS AS SHOWN ON THESE DRAWINGS.

2. FABRIC FORM MATERIAL:
   - FABRIC FORMS SHALL CONSIST OF FACTORY ASSEMBLED PANELS MADE OF A DOUBLE-LAYER WOVEN FABRIC JOINED TOGETHER BY SPACED, INTERWOVEN CORDS OF UNIFORM LENGTH TO FORM A CONCRETE LINING WITH A FINISHED AVERAGE THICKNESS OF 4 INCHES.
   - YARNS USED IN THE MANUFACTURE OF THE FABRIC SHALL BE COMPOSED OF NYLON AND/OR POLYESTER. FORMS SHALL BE WOVEN WITH A MINIMUM OF 50% TEXTURED YARNS (BY WEIGHT) TO IMPROVE ADHESION TO FINE AGGREGATE CONCRETE.
   - FABRIC FORMS SHALL BE WOVEN IN SUCH A MANNER WITH NYLON SPACER CORDS TO PROVIDE POINTS OF ATTACHMENT ON SPECIFIC CENTERS. THE SPACER CORDS SHALL SERVE TO CONTROL THE THICKNESS OF THE REVETMENT WITHOUT BURSTING THE FABRIC DURING FINE AGGREGATE CONCRETE INJECTION.
   - FABRIC FORMS SHALL CONSIST OF HYDROTEX™ UNIFORM SECTION US400 FORMS AS MANUFACTURED BY GEOSTAR CORPORATION, OR FABRIFORM® UNIMAT DESIGNATION STYLE 4" UNMN AS MANUFACTURED BY CONSTRUCTION TECHNIQUES, INC; OR AN OWNER APPROVED EQUIVALENT.

3. FINE AGGREGATE CONCRETE MIX:
   - FINE AGGREGATE CONCRETE (GROUT) SHALL CONSIST OF A MIXTURE OF PORTLAND CEMENT, FINE AGGREGATE, AND WATER SO PROPORTIONED AND MIXED AS TO PROVIDE A READILY FLOWABLE GROUT. ADMIXTURES AND/OR A POZZOLAN MAY BE USED WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE. USE OF SUPER PLASTICIZERS REQUIRES SPECIAL PRECAUTIONS; SILICA FUME IS NOT RECOMMENDED. THE HARDENED FINE AGGREGATE CONCRETE SHALL EXHIBIT A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI (17 MPA) AT 28 DAYS WHEN SPECIMENS ARE MADE AND TESTED ACCORDING TO THE PROVISIONS OF ASTM C-31 AND C-39.
   - PORTLAND CEMENT SHALL CONFORM TO ASTM C 150, TYPE I OR TYPE II.
   - FINE AGGREGATE SHALL CONFORM TO ASTM C 33, EXCEPT AS TO GRADING. AGGREGATE GRADING SHALL BE REASONABLY CONSISTENT AND SHALL NOT EXCEED THE MAXIMUM SIZE WHICH CAN BE CONVENIENTLY HANDLED WITH AVAILABLE PUMPING EQUIPMENT.
   - WATER FOR MIXING SHALL BE CLEAN AND FREE FROM INJURIOUS AMOUNTS OF OIL, ACID, SALT, ALKALI, ORGANIC MATTER OR OTHER DELETERIOUS SUBSTANCES.
   - POZZOLAN, IF USED, SHALL CONFORM TO ASTM C 618, CLASS C, F OR N.
   - PLASTICIZING AND AIR ENTRAINING ADMIXTURES, IF USED, SHALL CONFORM TO ASTM C 494 AND ASTM C 260, RESPECTIVELY.

4. INSTALLATION:
   - FABRIC FORM CONCRETE MAT SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH FABRIC FORM MANUFACTURER INSTRUCTIONS AND AS SPECIFIED HEREIN.
   - THE FABRIC FORMS SHALL BE KEPT DRY AND WRAPPED SUCH THAT THEY ARE PROTECTED FROM THE ELEMENTS DURING SHIPPING AND STORAGE. IF STORED OUTDOORS, THEY SHALL BE ELEVATED AND PROTECTED WITH A WATERPROOF COVER THAT IS OPAQUE TO ULTRAVIOLET LIGHT. THE FABRIC FORMS SHALL BE PROPERLY LABELED.
   - FABRIC FORMS SHALL BE PLACED WITHIN THE LIMITS SHOWN ON THE DRAWINGS. ANCHORING OF THE FABRIC FORMS SHALL BE ACCOMPLISHED THROUGH THE USE OF ANCHOR TRENCHES.
   - ADJACENT FABRIC FORMS SHALL BE JOINED BEFORE FILLING WITH FINE AGGREGATE CONCRETE BY FIELD SEWING OR ZIPPERING THE TWO BOTTOM LAYERS OF FABRIC TOGETHER AND THE TWO TOP LAYERS OF FABRIC TOGETHER. ALL FIELD SEAMS SHALL BE MADE USING TWO LINES OF U.S. FEDERAL STANDARD TYPE 101 STITCHES. ALL SEWN SEAMS SHALL BE DOWNWARD FACING, AND ALL ZIPPER SEAMS SHALL BE FASTENED PER MANUFACTURER RECOMMENDATIONS.
   - WHEN CONVENTIONAL JOINING OF FABRIC FORMS IS IMPRACTICAL, ADJACENT FORMS MAY BE OVERLAPPED A MINIMUM OF 3 FEET TO FORM A LAP JOINT, PENDING APPROVAL BY THE OWNER'S REPRESENTATIVE. THE DOWNSTREAM EDGE OF THE FORM SHALL OVERLAP THE UPSTREAM EDGE OF THE NEXT FORM. IN NO CASE SHALL SIMPLE BUTT JOINTS BETWEEN FORMS BE PERMITTED.
   - IMMEDIATELY PRIOR TO FILLING WITH FINE AGGREGATE CONCRETE, THE ASSEMBLED FABRIC FORMS SHALL BE INSPECTED BY THE OWNER'S REPRESENTATIVE AND NO FINE AGGREGATE CONCRETE SHALL BE PUMPED THEREIN UNTIL THE FABRIC FORM PLACEMENT HAS BEEN APPROVED. AT NO TIME SHALL THE FABRIC FORMS BE EXPOSED TO ULTRAVIOLET LIGHT (INCLUDING DIRECT SUNLIGHT) FOR A PERIOD EXCEEDING FIVE DAYS.
   - THE CONTRACTOR MUST MAKE THE APPROPRIATE ALLOWANCE FOR APPROXIMATELY 4% CONTRACTION OF THE FABRIC IN EACH DIRECTION, WHICH WILL OCCUR AS A RESULT OF GROUT INJECTION.
   - FOLLOWING THE PLACEMENT OF THE FABRIC FORMS, SMALL SLITS SHALL BE CUT IN THE TOP LAYER OF THE FABRIC FORM TO ALLOW THE INSERTION OF THE FILLING PIPE AT THE END OF THE FINE AGGREGATE CONCRETE PUMP HOSE. THESE SLITS SHALL BE OF THE MINIMUM LENGTH TO ALLOW PROPER INSERTION OF THE FILLING PIPE. FINE AGGREGATE CONCRETE SHALL BE PUMPED BETWEEN THE TOP AND BOTTOM LAYERS OF FABRIC, FILLING THE FORMS TO THE RECOMMENDED THICKNESS AND CONFIGURATION.
   - FINE AGGREGATE CONCRETE SHALL BE PUMPED IN SUCH A WAY THAT EXCESSIVE PRESSURE ON THE FABRIC FORMS AND COLD JOINTS ARE AVOIDED. A COLD JOINT IS DEFINED AS ONE IN WHICH THE PUMPING OF THE FINE AGGREGATE CONCRETE INTO A GIVEN FORM IS DISCONTINUED OR INTERRUPTED FOR AN INTERVAL OF FORTY-FIVE OR MORE MINUTES.
   - HOLES IN THE FABRIC FORMS LEFT BY THE REMOVAL OF THE FILLING PIPE SHALL BE TEMPORARILY CLOSED BY INSERTING A PIECE OF NONWOVEN FABRIC OR SIMILAR MATERIAL. THE NONWOVEN FABRIC SHALL BE REMOVED WHEN THE CONCRETE IS NO LONGER FLUID AND THE CONCRETE SURFACE AT THE HOLE SHALL BE CLEANED AND SMOOTHED BY HAND.
   - FOOT TRAFFIC ON THE FILLED FORM SHALL BE RESTRICTED TO AN ABSOLUTE MINIMUM FOR ONE HOUR AFTER FILLING. FOOT TRAFFIC WILL NOT BE PERMITTED ON THE FRESHLY PUMPED MAT WHEN SUCH TRAFFIC WILL CAUSE PERMANENT INDENTATIONS IN THE MAT SURFACE. WALK BOARDS SHALL BE USED WHERE NECESSARY.

5. CONCRETE TESTING:
   - AT THE TIME OF PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE OF THE APPROVED MIX DESIGN, AND TEMPERATURE OF THE CONCRETE. THE CONCRETE MUST MEET ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT. WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.
   - COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S THIRD PARTY TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY SHALL MAKE THREE STANDARD TEST CYLINDERS (IN ACCORDANCE WITH ASTM C 31) FOR EACH BATCH (MINIMUM) OR EVERY 40 CUBIC YARDS (MAXIMUM) OF CONCRETE. ONE STANDARD CYLINDER SHALL BE TESTED AT 7 DAYS AND AT 28 DAYS, WITH ONE HELD IN RESERVE. AT THE DIRECTION OF THE OWNER REMOVE CONCRETE MAT NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE MAT.

6. SUBMITTALS:
   - CONCRETE MIX DESIGN: SIX DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.
   - FABRIC FORM MANUFACTURER DATA.

PUMP STATION AND FORCEMAIN:

1. PERFORMANCE REQUIREMENTS
   - PUMPING STATION: WITH ONE PUMP OPERATING, CAPABLE OF PUMPING EFFLUENT AT FLOW RATE OF 350 GPM AT A TOTAL DYNAMIC HEAD OF 200 FEET. (E)
   - OPERATION: LOCATE FOUR FLOATS CONSISTING OF "PUMPS OFF", "LEAD PUMP ON", "LAG PUMP ON", AND "HIGH LEVEL" IN BASIN. START LEAD PUMP AUTOMATICALLY WHEN "LEAD PUMP ON" FLOAT IS ACTIVATED. START LAG PUMP AUTOMATICALLY WHEN "LAG PUMP ON" FLOAT IS ACTIVATED. STOP EITHER OR BOTH PUMPS AUTOMATICALLY WHEN "PUMP OFF" FLOAT IS ACTIVATED. SIGNAL ALARM CONDITION AUTOMATICALLY WHEN "HIGH LEVEL" FLOAT IS ACTIVATED. SET FLOAT ELEVATIONS IN ACCORDANCE WITH DRAWINGS. PUMPS SHALL BE PROGRAMMED TO ALTERNATE AUTOMATICALLY.

2. SUBMITTALS
   - SHOP DRAWINGS: INDICATE LAYOUT OF PUMPING STATION. SHOW SIZE, MATERIALS, AND COMPONENTS OF SYSTEM. INDICATE LIFTING CABLES, CHECK VALVE LOCATIONS, GATE VALVE LOCATIONS, PUMP LOCATIONS, DISCHARGE PIPING LOCATION, JUNCTION BOX LOCATION, SLIDE RAIL / AUTO COUPLING ASSEMBLY LOCATION, LEVEL CONTROL LOCATIONS.
   - PRODUCT DATA: SUBMIT FOR THE PACKAGED PUMPING STATION.
     - INCLUDE CATALOG DATA FOR SLIDE RAIL / AUTO COUPLING ASSEMBLY, DISCHARGE PIPING, VALVES, LEVEL CONTROLS, AND CONTROL PANEL.
     - INCLUDE PUMP CATALOG DATA, PERFORMANCE CURVE, BREAKAWAY FITTINGS DATA, AND ACCESS FRAME DATA.
     - INCLUDE CONTROL PANEL DIAGRAM AND PANEL WIRING SCHEMATIC.
   - MANUFACTURER'S INSTALLATION INSTRUCTIONS: SUBMIT MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS.
   - FIELD REPORTS: SUBMIT START-UP REPORT BEFORE FINAL ACCEPTANCE OF PUMPS TO DOCUMENT PUMPING STATION OPERATION MEETS PERFORMANCE REQUIREMENTS.
   - RECORD ACTUAL LOCATIONS OF PACKAGED PUMPING STATIONS INCLUDING PUMPS, PIPING, VALVES, METER AND CONTROL PANEL.
   - SUBMIT EXECUTED CERTIFICATION OF PUMPING STATIONS AFTER PERFORMANCE TESTING.
   - PROVIDE OPERATIONS AND MAINTENANCE MANUAL CONTAINING OPERATING AND MAINTENANCE REQUIREMENTS FOR PUMPING STATION AND SCHEDULE OF RECOMMENDED MAINTENANCE.

3. WARRANTY
   - FURNISH FIVE YEAR PRORATED MANUFACTURER'S WARRANTY ON PUMP SEALS.

4. SYSTEM
   - PRODUCT DESCRIPTION:
     - SUBMERSIBLE DUPLEX CENTRIFUGAL TRASH/WASTEWATER PUMPING SYSTEM INCLUDING SLIDE RAIL / AUTO COUPLING ASSEMBLY, LIFT CABLE OR CHAIN, DISCHARGE AND FITTINGS, CHECK VALVES, GATE VALVES, LEVEL CONTROLS, AND CONTROL PANEL WITH PLC, AND ALARMS.
     - DISCHARGE SIZE: 5 INCH NPT.
   - RAIL SYSTEM: SLIDE RAIL / AUTO COUPLING ASSEMBLY CONSISTING OF 304 STAINLESS STEEL UPPER AND LOWER RAIL BRACKETS AND PUMP GUIDE BRACKETS.
   - JUNCTION BOX: NEMA 250 TYPE 6 WITH CABLE GRIPS FOR INCOMING DIRECT BURIAL CABLE.
   - ELECTRICAL: CABLE GRIPS FOR DIRECT BURIAL CABLE FOR FIELD INSTALLATION.
   - FLOAT POLE (IF USED): ASTM D1785, SCHEDULE 40 PVC, 1/2 INCH.
   - LEVEL CONTROLS: FOUR MECHANICAL FLOAT TYPE OR MERCURY TYPE PILOT DUTY LIQUID LEVEL CONTROLS WITH AWG 18-2 SJOW-A CABLE IN POLYPROPYLENE HOUSING FOR MOUNTING TO PVC SUPPORT POLE.

5. PUMPS
   - PUMP DESIGN: THE PUMP(S) SHALL BE AUTOMATICALLY AND FIRMLY CONNECTED TO THE DISCHARGE CONNECTION, GUIDED BY NO LESS THAN TWO GUIDE BARS EXTENDING FROM THE TOP OF THE STATION TO THE DISCHARGE CONNECTION. THERE SHALL BE NO NEED FOR PERSONNEL TO ENTER THE WET-WELL.
   - PUMP CONSTRUCTION: MAJOR PUMP COMPONENTS SHALL BE OF GRAY CAST IRON, ASTM A48, CLASS 35B, WITH SMOOTH SURFACES DEVOID OF BLOW HOLES OR OTHER IRREGULARITIES. ALL EXPOSED NUTS OR BOLTS SHALL BE AISI TYPE 304 STAINLESS STEEL CONSTRUCTION. ALL EXTERIOR METAL SURFACES COMING INTO CONTACT WITH THE PUMPAGE, OTHER THAN STAINLESS STEEL OR BRASS, SHALL BE PROTECTED BY A FACTORY APPLIED SPRAY COATING OF ACRYLIC DISPERSION ZINC PHOSPHATE AND A POLYESTER RESIN ENAMEL FINISH. ALL O-RINGS SHALL BE OF NITRILE RUBBER. THE LIFTING HANDLE SHALL BE STAINLESS STEEL.
   - MOTOR:
     - INDUCTION TYPE WITH A SQUIRREL CAGE ROTOR, SHELL TYPE DESIGN, HOUSED IN AN AIR FILLED, WATERTIGHT CHAMBER, NEMA B TYPE.
     - THE STATOR WINDINGS AND LEADS SHALL BE INSULATED WITH MOISTURE RESISTANT CLASS F INSULATION RATED FOR 155°C (311°F). THE STATOR SHALL BE DIPPED AND BAKED THREE TIMES IN CLASS F VARNISH AND SHALL BE HEAT-SHRINK FITTED INTO THE STATOR HOUSING.
     - MOTORS ARE SUFFICIENTLY COOLED BY THE SURROUNDING ENVIRONMENT OR PUMPED MEDIA. A WATER COOLING JACKET IS NOT REQUIRED.
   - MOTOR HOUSING: HEAVY DUTY DUCTILE IRON, ASTM A48, CLASS 30.
   - VOLUTE: PUMP VOLUTE(S) SHALL BE SINGLE-PIECE GRAY CAST IRON, CLASS 30, NON-CONCENTRIC DESIGN WITH SMOOTH PASSAGES LARGE ENOUGH TO PASS ANY SOLIDS THAT MAY ENTER THE IMPELLER. WEAR RINGS SHALL NOT BE REQUIRED. MINIMUM DISCHARGE SIZE SHALL BE AS SPECIFIED.
   - IMPELLER: THE IMPELLER SHALL BE OF HARDENED OR STAINLESS, DYNAMICALLY BALANCED, CLOSED TWO-VANE NON-CLOGGING DESIGN HAVING A LONG THROUGHLET WITHOUT ACUTE TURNS.
   - BEARINGS: THE PUMP SHAFT SHALL ROTATE ON TWO SINGLE ROW BALL BEARINGS. MOTOR BEARINGS SHALL BE PERMANENTLY GREASE LUBRICATED.
   - PUMP SHAFT: PUMP AND MOTOR SHAFT SHALL BE THE SAME UNIT. THE MOTOR SHAFT SHALL BE COMPOSED OF CARBON STEEL UNDER THE ROTOR LAMINATIONS AND THE PUMP SHAFT SHALL BE OF STAINLESS STEEL. THE PUMP SHAFT IS AN EXTENSION OF THE MOTOR SHAFT; COUPLINGS SHALL NOT BE ACCEPTABLE.
   - MECHANICAL SEAL: EACH PUMP SHALL BE PROVIDED WITH A TANDEM MECHANICAL SHAFT SEAL SYSTEM CONSISTING OF TWO TOTALLY INDEPENDENT SEAL ASSEMBLIES. THE SEALS SHALL OPERATE IN A LUBRICANT RESERVOIR THAT HYDRO- DYNAMICALLY LUBRICATES THE LAPPED SEAL FACES AT A CONSTANT RATE. THE LOWER, PRIMARY SEAL SHALL BE SILICON CARBIDE/SILICON CARBIDE. THE UPPER SEAL SHALL BE CARBON/CERAMIC. THE SEALS SHALL REQUIRE NEITHER MAINTENANCE NOR ADJUSTMENT NOR DEPEND ON DIRECTION OF ROTATION FOR SEALING.
   - CABLE ENTRY: 32 FEET CORD. THE CABLE ENTRY SEAL DESIGN SHALL PRECLUDE SPECIFIC TORQUE REQUIREMENTS TO INSURE A WATERTIGHT AND SUBMERSIBLE SEAL. THE CABLE ENTRY SHALL CONSIST OF A SINGLE CYLINDRICAL ELASTOMER GROMMET, FLANKED BY WASHERS, ALL HAVING A CLOSE TOLERANCE FIT AGAINST THE CABLE OUTSIDE DIAMETER AND THE ENTRY INSIDE DIAMETER AND COMPRESSED BY THE BODY CONTAINING A STRAIN RELIEF FUNCTION, SEPARATE FROM THE FUNCTION OF SEALING THE CABLE. THE ASSEMBLY SHALL PROVIDE EASE OF CHANGING THE CABLE WHEN NECESSARY USING THE SAME ENTRY SEAL. A JUNCTION BOX SHALL BE COMPLETELY SEALED OFF FROM THE PUMPED MEDIA. EPOXIES, SILICONES, OR OTHER SECONDARY SEALING SYSTEMS SHALL NOT BE CONSIDERED ACCEPTABLE.
   - LIFTING DEVICE: STAINLESS STEEL CHAIN: 1/2 INCH, MINIMUM BREAKING STRENGTH OF 2500 POUNDS SUPPLIED FOR REMOVING THE PUMP. LENGTH SHALL BE 3 FEET GREATER THAN THE OVERALL WET WELL DEPTH.

6. VALVES
   - SWING CHECK VALVE:
     - AVR CUSHIONED SIDE MOUNTED CHECK VALVE, FIELD CONVERTIBLE.
     - HOUSING: CAST IRON WITH FLANGED ENDS.
     - COUNTERWEIGHTED LEVER ARM.
     - TEMPERATURE: 176 DEGREES F PEAK.
   - GATE VALVE:
     - IRON BODY BRONZE MOUNTED; ALL EXTERIOR MOUNTED BOLTS AND NUTS SHALL BE STAINLESS STEEL; RUBBER OR EDPM ENCAPSULATED, RESILIENT SEAT, SOLID WEDGE.
     - GATE VALVES SHALL BE DESIGNED FOR 150 PSI MINIMUM WORKING PRESSURE.
     - GATE VALVES SHALL BE HAND WHEEL OPERATED, NON-RISING STEM TYPE WITH FLANGED ENDS.
     - WHEN FULL OPEN, GATE VALVES SHALL HAVE A CLEAR WATERWAY EQUAL TO THE NOMINAL DIAMETER OF THE PIPE. THE OPERATING NUT OR WHEEL SHALL HAVE AN ARROW CAST IN THE METAL INDICATING THE DIRECTION OF OPENING.
   - SUPPORTS: USE SUPPORTS FOR PIPING, VALVES, AND METER CONSISTING OF SCHEDULE 40 GALVANIZED STEEL PIPING CONFORMING TO ASTM A53. PROVIDE EITHER ASME B16.3 OR ASME B16.11 GALVANIZED THREADED FITTINGS.

7. MAIN CONTROL PANEL
   - PRODUCT DESCRIPTION.
     - FACTORY FABRICATED, SELF-CONTAINED DUPLEX INCLUDING LOW VOLUME PUMP OFF; PUMP ON; PUMP ON HIGH LEVEL; HIGH LEVEL ALARM (RED LIGHT), ALTERNATOR TO ALTERNATE PUMP DUTY BETWEEN PUMPS ON SUCCESSIVE CYCLES OR SWITCH OPERATION OF PUMPS ON PUMP FAILURE. INCLUDE HIGH WATER AUDIBLE AND VISUAL ALARM LIGHT AND RUN LIGHT TO WARN OF HIGH WATER CONDITION OR FAILURE OF PUMPS.
     - HORSEPOWER RATING: AS REQUIRED FOR SELECTED PUMP.
     - PHASE: 3 (E)
     - VOLTAGE: 480 VOLTS (E)
     - COORDINATE POWER REQUIREMENTS WITH OWNER.
   - ENCLOSURE: NEMA 4X RAIN TIGHT, OUTDOOR MOUNTING G60 GALVANIZED STEEL, GRAY POLYESTER POWDER FINISH, PADLOCK HASP/STAPLE WITH CAPTIVE STAINLESS SCREWS FOR DOOR CLOSURE AND LOCKING. PROVIDE CONTINUOUS STAINLESS PIANO HINGE WITH STAINLESS REMOVABLE PIN. ALUMINUM PANEL DRILLED AND TAPPED, MACHINE SCREW MOUNTED COMPONENTS.
   - ALARM LIGHT: LARGE RED STROBE LIGHT THAT CAN BE SEEN DURING DAYLIGHT HOURS. (E)
   - CIRCUIT BREAKER: FOR SHORT CIRCUIT PROTECTION.
   - STARTER: ELECTROMAGNETIC, SOFT START.
   - OVERLOAD RELAY: BIMETAL TYPE, AMBIENT COMPENSATED.
   - HEATER ELEMENT: CLASS 10 QUICK TRIP, ONE HEATER FOR EACH MOTOR PHASE.
   - SWITCH: HAND-OFF-AUTOMATIC, 1/2 INCH NEMA 1.
   - LIGHT: PUMP MOTOR RUN, 1/2 INCH NEMA 1.
   - SUB PLATE: SWITCH AND LIGHT MOUNTING.
   - FUSE: CONTROL TRANSFORMER PRIMARY WHEN USED. MEET REQUIREMENTS OF NEC.
   - FUSE: CONTROL CIRCUIT, MEET REQUIREMENTS OF NEC.
   - TERMINAL STRIP: BOX LUGS FOR WIRING.
   - WIRING: COLOR CODED TO NEC REQUIREMENTS; BLACK POWER WIRING, RED NUMBERED CONTROL WIRING, WHITE NUMBERED NEUTRAL WIRING, GREEN GROUND WIRING.
   - ALTERNATOR: AUTOMATIC.
   - PUMP RUN ODOMETERS/HOUR METERS TO TRACK EACH PUMP SEPARATELY. (E)
   - SIX SPARE I/O POINTS (2 ANALOG, 4 DIGITAL) PROVIDE THE ABILITY TO TRACE THE ALARMS BACK TO THE POINT FOR A PUMP FAILURE AND THE HIGH ALARM (E)
   - LOCKABLE HOA SWITCHES
   - PROGRAMMABLE LOGIC COMPUTER (PLC) CONTROLLER
     - ALL INPUTS SHALL TERMINATE AT PLC IN PUMP MAIN CONTROL PANEL. PLC SHALL ACTIVATE ALL OUTPUT NOTIFICATION DEVICES
     - MINIMUM MEMORY: 16 KILOBYTES OF PROGRAMMABLE RAM MEMORY AND 8K OF DATA STORAGE WITH EEPROM BACKUP.
     - POWER: 110/220 VAC POWER SUPPLY. THE PLC SHALL BE CONNECTED TO AN UNINTERRUPTIBLE POWER SUPPLY (UPS).
     - UL LISTED (UL 508), CSA CERTIFIED (CSA 142).
     - EXTERNAL COMMUNICATIONS VIA RS232/485/ETHERNET PORTS.
     - PROGRAMMING AND DIAGNOSTIC SOFTWARE SHALL BE WINDOWS BASED VIA RELAY LADDER LOGIC (RLL), BASIC, AND CUSTOM PROGRAMMING TOOLS FOR THE PLC. PROVIDE TO THE OWNER A LICENSED COPY OF ALL PROGRAMMING SOFTWARE USED TO CONFIGURE AND PROGRAM THE PLC PC. THE SOFTWARE SHALL INCLUDE BOTH THE SOFTWARE AND HARDWARE (I.E. CABLES, INTERFACE BOX, ETC.) REQUIRED FOR DIRECT PLC-TO-PC COMMUNICATIONS FOR PLC PROGRAMMING. ALL SOFTWARE SHALL BE PROVIDED ON CD ROM.
     - THE CONTRACTOR SHALL PROVIDE PROGRAMMING TIME REQUIRED TO CONFIGURE PLC TO PROVIDE COMPLETE CONTROL AND COMMUNICATION/NOTIFICATION FUNCTIONS AS DESCRIBED HEREIN.
     - THE FOLLOWING CONDITIONS SHALL INITIATE THE PLC SEQUENCE FOR ALARM CONDITION AND NOTIFICATION: LEAD PUMP DOES NOT GO ON; LAG PUMP DOES NOT GO ON; HIGH LEVEL SWITCH IS ACTIVATED; PUMP(S) DO NOT TURN OFF.
     - ACCEPTABLE PLC MANUFACTURER: ALLEN-BRADLEY MICROLOGIX 1100 OR APPROVED EQUAL.

8. PIPE
   - PROVIDE PRESSURE PIPING AND RELATED ACCESSORIES FOR FORCE MAIN PIPING INSIDE THE WET WELL AND VALVE VAULT FOR THE FORCE MAIN TO THE AUXILIARY POND.
   - DUCTILE IRON PUMP DISCHARGE PIPING, AWWA C151/A21.51, THICKNESS CLASS 52
   - PUMP STATION INTERNAL PIPING -- DUCTILE IRON, AWWA C151/A21.51, THICKNESS CLASS 52.
   - PUMP STATION EXTERNAL PIPING – 8 INCH SDR11 HIGH DENSITY POLYETHYLENE FORCEMAIN.
   - 1 ¼ INCH SCHEDULE 40 PVC POTENTIAL FUTURE CONTROLS CONDUIT, WITH SPARE PULL STRING.

9. MAIN CONTROL PANEL INSTALLATION
   - MOUNT AND WIRE CONTROL PANEL FOR PUMPING STATION OPERATION INCLUDING DUPLEX MOTOR CONTROLS, CIRCUIT BREAKER, STARTER, CONTROL TRANSFORMER, FUSE BOX, TERMINAL BLOCK, ALTERNATOR, ALARM AND RUNNING LIGHTS.
   - WIRE IN ACCORDANCE WITH REQUIREMENTS OF NATIONAL ELECTRICAL CODE.
   - USE 16 AWG CONTROL WIRING FOR CONTROL CIRCUITS AND WHITE FOR NEUTRAL GROUNDED CONDUCTORS.
   - USE MINIMUM 14 AWG BLACK POWER WIRING.
   - NUMBER EACH CONDUCTOR.
   - TIN ENDS OF WIRES WITH 60/40 LEAD TIN ALLOY SOLDER.
   - LOCATE AND CONNECT DIRECT BURIAL CABLE FROM CONTROL PANEL TO BASIN JUNCTION BOX.
   - CONTROL PANEL ENCLOSURE TO BE INSTALLED AT A REMOTE LOCATION TO THE PUMP STATION AS SHOWN ON THE DRAWINGS. MOUNT CONTROL PANEL ENCLOSURE ON 1-5/8 INCH DIAMETER GALVANIZED STEEL FRAME. FRAME SUPPORT POST(S)AND BASE PLATE TO BE MOUNTED TO TOP OF WET WELL TOP SLAB WITH STAIN STEEL ANCHOR BOLTS OR IF INSTALLED NEXT TO THE WET WELL TO BE SET IN CONCRETE FILLED SCH-80 PIPE BASE SET A MINIMUM OF 4 FEET BELOW FINISHED GRADE. (E)
   - ALL PENETRATIONS IN THE CONTROL PANEL SHALL BE ON THE SIDE OR BOTTOM AND NO PENETRATIONS ON THE TOP. (E)

10. ELECTRICAL REQUIREMENTS
    - OWNER TO PROVIDE POWER AND WILL BRING POWER INTO THE CONTRACTOR SUPPLIED CONTROL PANEL. THE CONTRACTOR SHALL PROVIDE ELECTRICAL SERVICE TO THE LIFT STATION PER CODE COMPLIANT UNDERGROUND ELECTRIC WIRING PROTECTED BY PROPERLY GROUNDED RIGID STEEL CONDUIT. (E)

11. STATION STARTUP, INITIAL TESTING AND OPERATION
    - NOTIFY OWNER 3 DAYS PRIOR TO FLOW RATE TESTING.
    - PROVIDE STARTUP AND INITIAL TESTING OF SYSTEM. COORDINATE AND OPERATE PUMPS IN CONJUNCTION WITH THE OWNER AND THE OWS.
    - PROVIDE PLC PROGRAMMING AND SETUP OF AUTO DIALER NOTIFICATIONS WITH CONTACT(S) PROVIDED BY THE OWNER.
    - HYDRAULICALLY TEST STATION TO PERFORMANCE REQUIREMENTS BY RECEIVING, PUMPING AND DISCHARGING 1000 GALLONS OF WATER FROM WET WELL BASIN.
    - CORRECT FAILURES DURING TEST BY REPAIRING OR REPLACING MALFUNCTIONING PARTS OR EQUIPMENT OR FAULTY WORKMANSHIP, REGARDLESS OF CAUSE, WITHIN 48 HOURS AFTER NOTIFICATION FROM OWNER.
    - AFTER CORRECTING FAILURES CAUSED BY DEFECTIVE EQUIPMENT, MATERIAL OR OR FAULTY WORKMANSHIP, RETEST UNTIL FAILURES ARE ELIMINATED.
    - CONFIRM GENERAL SEQUENCING OF PUMP AND FLOAT OPERATIONS AT BASIN AND CONTROL PANEL ARE IN ACCORDANCE WITH PERFORMANCE REQUIREMENTS.
    - DOCUMENT AND CERTIFY STARTUP RESULTS IN STARTUP REPORT.

12. MANUFACTURER'S FIELD SERVICE
    - FURNISH FACTORY TRAINED REPRESENTATIVE AND FIELD TECHNICAL ASSISTANCE DURING THE FOLLOWING PERIODS OF PUMPING STATION INSTALLATION:
      - UNLOADING OF STATION MATERIALS AND COMPONENTS.
      - START-UP, TESTING, AND DEMONSTRATION OF STATION SYSTEMS--BASIN, PUMP, CONTROL PANEL, PLC PROGRAMMING, AND AUTO DIALER OPERATION.

13. ADJUSTING
    - ADJUST PUMP AND CONTROL PANEL SYSTEMS SO STATION OPERATES TO PERFORMANCE REQUIREMENTS AND IN ACCORDANCE WITH THESE SPECIFICATIONS.

14. DEMONSTRATION
    - DEMONSTRATE OPERATION OF PUMPING STATION COMPONENTS, PUMP SYSTEM, AND CONTROL PANEL.

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0 1'-0" 2'-0" 4'-0"
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REVISIONS			
No.	Date	Issued By	Review Code
A	2/13/15	JVM	CLIENT
B	2/19/15	NJW	CLIENT
C		NOT	USED
D		NOT	USED
E	3/05/15	SVB	IFC

Title
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1B
NOTES AND SPECIFICATIONS - 2

Location and Unit:
E.W. BROWN GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:
JOB NO. JOB NO. JOB NO. JOB NO.

Kentucky Utilities Company

Drawing No: BRO-C-01452 Rev. E

BRO Version 2.0

SPECIFICATIONS (CONTINUED)

FABRIC FORM CONCRETE MAT

1 FABRIC FORM CONCRETE MAT SHALL BE PLACED TO LINE THE CONSTRUCTED OVERFLOW CHANNEL AS WELL AS EXISTING ADJACENT CHANNELS AS SHOWN ON THESE DRAWINGS.

2 FABRIC FORM MATERIAL

- FABRIC FORMS SHALL CONSIST OF FACTORY ASSEMBLED PANELS MADE OF A DOUBLE-LAYER WOVEN FABRIC JOINED TOGETHER BY WOVEN OR ANTI-WICKING CORDS OF UNIFORM LENGTH TO FORM A CONCRETE LINED WITH A FINISHED ANCHOR THICKNESS OF 4 INCHES.
- YARNS USED IN THE MANUFACTURE OF THE FABRIC SHALL BE ECHAPPED OF NYLON AND/OR POLYESTER FIBERS SHALL BE WOVEN WITH A MINIMUM OF SIXS RETAINED YARNS (OR WEAVES) TO IMPROVE ADHESION TO THE AGGREGATE CONCRETE.
- FABRIC FORMS SHALL BE WOVEN IN SUCH A MANNER WITH WOVEN SPACER CORDS TO PREVENT POINTS OF DETACHMENT OR EXCESSIVE BOWING. THE SPACER CORDS SHALL EXIST TO CONTROL THE THICKNESS OF THE REINFORCEMENT WITHOUT RESTRICTING THE FABRIC DURING FINE AGGREGATE CONCRETE INJECTION.
- FABRIC FORMS SHALL CONSIST OF MORATEX™ UNIFORM SECTION USAGE FORMS AS MANUFACTURED BY SEDEFLEX CORPORATION, OR FABRIFORMA UNIBAR DESIGNARCH STYLE 4 UNIBAR AS MANUFACTURED BY REINFORCATION TECHNOLOGY INC, OR AN OWNER APPROVED EQUIVALENT

3 FINE AGGREGATE CONCRETE MIX

- FINE AGGREGATE CONCRETE (GROUT) SHALL CONSIST OF A MIXTURE OF PORTLAND CEMENT, FINE AGGREGATE, AND WATER SO PROPORTIONED AND MIXED AS TO PROVIDE A READILY FLOWABLE GROUT ADMIXTURES ARE ALLOWED A PUMPABLE MIX BY USED WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE. USE OF SUPER PLASTICIZERS REQUIRES SPECIAL PRECAUTIONS. SILICA FUME IS NOT RECOMMENDED THE MINIMUM FINE AGGREGATE CONCRETE SHALL EXHIBIT A MINIMUM COMPRESSIVE STRENGTH OF 2,000 PSI (17 MPA) AT 28 DAYS WHEN SPECIMENS ARE MADE AND TESTED ACCORDING TO THE PROVISIONS OF ASTM C-31 AND C-39.
- PORTLAND CEMENT SHALL CONFORM TO ASTM C 150, TYPE I OR TYPE
- FINE AGGREGATE SHALL CONFORM TO ASTM C 33 EXCEPT AS TO GRADING, AGGREGATE GRADING SHALL BE REASONABLY UNIFORM AND SHALL NOT EXCEED THE MAXIMUM SIZE WHICH CAN BE CONVENIENTLY HANDLED WITH AVAILABLE PUMPING EQUIPMENT
- WATER FOR MIXING SHALL BE CLEAN AND FREE FROM INJURIOUS AMOUNTS OF OIL, ACID, SALT, ALKALI, ORGANIC MATTER OR OTHER DELETERIOUS SUBSTANCES
- POZZOLAN, IF USED, SHALL CONFORM TO ASTM C 618, CLASS C, F OR N.
- PLASTICIZING AND AIR ENTRAINING ADMIXTURES, IF USED, SHALL CONFORM TO ASTM C 494 AND ASTM C 260, RESPECTIVELY.

4 INSTALLATION:

- FABRIC FORM CONCRETE MAT SHALL BE PREPARED, PLACED AND CURED IN ACCORDANCE WITH FABRIC FORM MANUFACTURER INSTRUCTIONS AND AS SPECIFIED HEREIN
- THE FABRIC FORMS SHALL BE KEPT DRY AND UNWRAPPED SUCH THAT THEY ARE PROTECTED FROM THE ELEMENTS DURING SHIPPING AND STORAGE. 4 WOVEN OVERHEADS THEY SHALL BE ELEVATED AND PROTECTED WITH A WATERPROOF COVER THAT IS OPAQUE TO ULTRAVIOLET LIGHT THE FABRIC FORMS SHALL BE PROPERLY LABELED.
- FABRIC FORMS SHALL BE PLACED WITHIN THE LIMITS SHOWN ON THE DRAWINGS. ANCHORING OF THE FABRIC FORMS SHALL BE ACCOMPLISHED THROUGH THE USE OF ANCHOR TRENCHES.
- ADJACENT FABRIC FORMS SHALL BE JOINED BEFORE FILLING WITH FINE AGGREGATE CONCRETE BY FIELD SEWING OR EMPLOYING ANY OTHER APPROVED LAYERS OF FABRIC TOGETHER AND THE TIED TOP LAYERS OF FABRIC TOGETHER. ALL FIELD SEWING SHALL BE DONE USING TWO LINES OF U.S. FEDERAL STANDARD TYPE 401 STITCHES. ALL SEWN SEAMS SHALL BE DOWNWARD FACING, AND ALL EXPOSED SEAMS SHALL BE FASTENED PER MANUFACTURER RECOMMENDATIONS.
- WHEN CIRCUMFERENTIAL JOININGS OF FABRIC FORMS IS MECHANICAL, ADJACENT FORMS MAY BE OVERLAPPED A MINIMUM OF 3 FEET TO FORM A LAP JOINT, PENDING APPROVAL BY THE OWNER'S REPRESENTATIVE. THE DOWNSTREAM EDGE OF THE FORM SHALL OVERLAP THE UPSTREAM EDGE OF THE NEXT FORM. IN NO CASE SHALL SIMPLE BUTT JOINTS BETWEEN FORMS BE PERMITTED.
- IMMEDIATELY PRIOR TO FILLING WITH FINE AGGREGATE CONCRETE THE ASSEMBLED FABRIC FORMS SHALL BE INSPECTED BY THE OWNER'S REPRESENTATIVE AND NO FINE AGGREGATE CONCRETE SHALL BE PUMPED THEREIN UNTIL THE FABRIC FORM PLACEMENT HAS BEEN APPROVED. AT NO TIME SHALL THE FABRIC FORMS BE EXPOSED TO ULTRAVIOLET LIGHT (INCLUDING DIRECT SUNLIGHT) FOR A PERIOD EXCEEDING FIVE DAYS.
- THE CONTRACTOR MUST MAKE THE APPROPRIATE ALLOWANCE FOR APPROXIMATELY 8% CONTRACTION OF THE FORMS IN EACH DIRECTION WHICH WILL OCCUR AS A RESULT OF GROUT INJECTION.
- FOLLOWING THE PLACEMENT OF THE FABRIC FORMS, EMPTY SLIT SHALL BE CUT IN THE TOP LAYER OF THE FABRIC FORM TO ALLOW THE EMERSION OF THE FILLING PIPE AT THE END OF THE FINE AGGREGATE CONCRETE PUMP HOSE. THESE SLITS SHALL BE OF THE MINIMUM LENGTH TO ALLOW PROPER EMERSION OF THE FILLING PIPE. FINE AGGREGATE CONCRETE SHALL BE PUMPED BETWEEN THE TOP AND BOTTOM LAYERS OF FABRIC, FILLING THE FORMS TO THE RECOMMENDED THICKNESS AND REINFORCEMENTS.
- FINE AGGREGATE CONCRETE SHALL BE PUMPED IN SUCH A WAY THAT EXCESSIVE PRESSURE ON THE FABRIC FORMS AND COLD JOINTS ARE AVOIDED. A COLD JOINT IS DEFINED AS ONE IN WHICH THE TIME BETWEEN TIP THE FINE AGGREGATE CONCRETE AND A SIMILAR FORM IS SUFFICIENT TO BE ENCOMPASSED FOR AN INTERVAL OF FORTY-FIVE OR MORE MINUTES.
- HOLES IN THE FABRIC FORMS LEFT BY THE REMOVAL OF THE FILLING PIPE SHALL BE TEMPORARILY CLOSED BY INSERTING A PIECE OF NONWOVEN FABRIC OR SIMILAR MATERIAL. THE NONWOVEN FABRIC SHALL BE REMOVED WHEN THE CONCRETE IS NO LONGER FLUID AND THE CONCRETE SURFACE AT THE HOLE SHALL BE CLEANED AND SMOOTHED BY HAND.
- FOOT TRAFFIC ON THE FILLED FORM SHALL BE RESTRICTED TO AN ABSOLUTE MINIMUM FOR ONE HOUR AFTER FILLING. FOOT TRAFFIC SHALL NOT BE PERMITTED ON THE FRESHLY PUMPED MAT WHEN SUCH TRAFFIC WILL CAUSE PERMANENT INDENTATIONS IN THE MAT SURFACE. WALK BOARDS SHALL BE USED WHERE NECESSARY.

5 CONCRETE TESTING:

- AT THE TIME OF PLACEMENT, THE OWNER'S THIRD PARTY TESTING AGENCY WILL INSPECT THE CONCRETE BEING PLACED FOR THE REQUIRED SLUMP, AIR PERCENTAGE OF THE APPROVED MIX DESIGN AND SUFFICIENCY OF THE COMPONENTS. THE DESIGNATED YEAR MUST ALL REQUIREMENTS BEFORE AND DURING FIELD PLACEMENT. THE TESTS WILL BE CONDUCTED DURING CONCRETE PLACEMENT, WHEN TEST CYLINDERS ARE MADE FOR THE TRUCK LOAD OF CONCRETE.
- COMPRESSIVE STRENGTH TESTS SHALL ALSO BE CONDUCTED BY THE OWNER'S THIRD PARTY TESTING AGENCY IN ACCORDANCE WITH ASTM C 39. DURING CONCRETE PLACEMENT THE OWNER'S THIRD PARTY TESTING AGENCY SHALL MAKE THREE STANDARD TEST CYLINDERS ON ADDITIONAL WITH ASTM C 31) FOR EACH BATCH (MINIMUM) OR EVERY 50 CUBIC YARDS (MINIMUM) OF CONCRETE. ONE STANDARD CYLINDER SHALL BE TESTED AT 7 DAYS AND AT 28 DAYS, WITH ONE HELD IN RESERVE AT THE DIRECTION OF THE OWNER'S REVIEW CONCRETE MAT NOT MEETING STRENGTH CRITERIA AND PROVIDE NEW ACCEPTABLE CONCRETE MAT

6 SUBMITTALS

- CONCRETE MIX DESIGN. TEN DAYS PRIOR TO CONCRETE PLACEMENT SUBMIT THE MIX DESIGN TO THE OWNER FOR APPROVAL.
- FABRIC FORM MANUFACTURER DATA.

PUMP STATION AND FORCEMAIN

7. PERFORMANCE REQUIREMENTS

- PUMPING STATION WITH ONE PUMP OPERATING, CAPABLE OF PUMPING EFFLUENT AT FLOW RATE OF 350 GPM AT A TOTAL DYNAMIC HEAD OF 208 FEET
- OPERATION: LOCATE FOUR FLOATS CONSISTING OF "PUMPS OFF" "LEAD PUMP ON" "LAG PUMP ON" AND "HIGH LEVEL" IN BASIN. START LEAD PUMP AUTOMATICALLY WHEN "LEAD PUMP ON" FLOAT IS ACTIVATED. START LAG PUMP AUTOMATICALLY WHEN "LAG PUMP ON" FLOAT IS ACTIVATED. STOP EITHER OR BOTH PUMPS AUTOMATICALLY WHEN "PUMP OFF" FLOAT IS ACTIVATED. SIGNAL ALARM CONDITION AUTOMATICALLY WHEN "HIGH LEVEL" FLOAT IS ACTIVATED. SET FLOAT ELEVATIONS AS ACCORDANCE WITH DRAWINGS. PUMPS SHALL BE PROGRAMMED TO ALTERNATE AUTOMATICALLY

8. SUBMITTALS

- SHOP DRAWINGS WITHDRAWN LAYOUT OF PUMPING STATION SHOWING SIZE, MATERIALS, AND CHARACTERISTICS OF SYSTEM, INDICATE WIRING CABLES, CHECK VALVE LOCATIONS, GATE VALVE LOCATIONS, PUMP LOCATIONS, DISCHARGE PIPING LOCATIONS, JUNCTION BOX LOCATION, SLIDE RAIL / AUTO COUPLING ASSEMBLY LOCATION, LEVEL CONTROL LOCATIONS.
- PRODUCT DATA, SUBMIT FOR THE PACKAGED PUMPING STATION
  - PACKAGE CABLEGE DATA FOR SLIDE RAIL / AUTO COUPLING ASSEMBLY, DISCHARGE PIPING, VALVES, LEVEL CONTROLS, AND CONTROL PANEL.
  - INCLUDE PUMP CATALOG DATA, PERFORMANCE CURVE, DIFFERENT INTAKES DATA, AND MOTOR FRAME DATA.
  - INCLUDE CONTROL PANEL DIAGRAM AND PANEL WIRING SCHEMATIC.
- MANUFACTURER'S INSTALLATION INSTRUCTIONS. SUBMIT MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS.
- FIELD REPORTS SUBMIT START-UP REPORT BEFORE FINAL ACCEPTANCE OF PLANTS TO DOCUMENT PUMPING STATION OPERATION MEETS PERFORMANCE REQUIREMENTS.
- RECORD ACTUAL LOCATIONS OF PACKAGED PUMPING STATIONS, INCLUDING PIPING, VALVES, METER AND CONTROL PANEL.
- SUBMIT COMPLETED COMPARISON OF PUMPING STATIONS AFTER PERFORMANCE TESTING
- PROVIDE OPERATIONS AND MAINTENANCE MANUAL CONTAINING OPERATIONS AND MAINTENANCE REQUIREMENTS FOR PUMPING STATION AND SCHEDULE OF RECOMMENDED MAINTENANCE.

9. WARRANTY

- FURNISH FIVE YEAR PRORATED MANUFACTURER'S WARRANTY ON PUMP SEALS.

A SYSTEM

- PRODUCT DESCRIPTION
  - SUBMERSIBLE DUPLEX GRINDER/SUMP, TRASH-MASTER-PUMPING SYSTEM INCLUDING SLIDE RAIL / AUTO COUPLING ASSEMBLY, WET CABLE OR CHAIN, BRACKETS AND FITTINGS, CHECK VALVES, GATE VALVES, LEVEL CONTROLS AND CONTROL PANEL WITH PLC AND ALARMS
  - DISCHARGE SIZE: 5 INCH NPT
- RAIL SYSTEM: SLIDE RAIL / AUTO COUPLING ASSEMBLY CONSISTING OF 304 STAINLESS STEEL UPPER AND LOWER RAIL BRACKETS AND PUMP GUIDE BRACKETS
- JUNCTION BOX: NEMA 250 TYPE 6 WITH CABLE GRIPS FOR INCOMING DIRECT BURIAL CABLE
- ELECTRICAL CABLE GRIPS FOR DIRECT BURIAL CABLE FOR FIELD INSTALLATION
- FLOAT ROLE (IF USED): ASTM DITRO, SCHEDULE 80 PVC 1/2 INCH
- LEVEL CONTROLS: FOUR MECHANICAL FLOAT TYPE OR MERCURY TYPE HEAVY DUTY LIQUID LEVEL CONTROLS WITH 18-2 ELEVATION CABLE IN POLYPROPYLENE HOUSING FOR MOUNTING TO PVC SUPPORT POLE

B PUMPS

- PUMP DESIGN: THE PUMP(S) SHALL BE AUTOMATICALLY AND FIRMLY CONNECTED TO THE DISCHARGE CONNECTION BY MEANS OF NO LESS THAN TWO GUIDE RAILS EXTENDING FROM THE TOP OF THE STATION TO THE DISCHARGE CONNECTION. THERE SHALL BE NO NEED FOR PERSONNEL TO ENTER THE WET WELL.
- PUMP CONSTRUCTION: GRINDER PUMP CONSISTING SHALL BE OF GRAY CAST IRON, ASTM A48, CLASS 35B, WITH SMOOTH SURFACES DEVOID OF BLOW HOLES OR OTHER IMPERFECTIONS. ALL EXPOSED NUTS OR BOLTS SHALL BE AISI TYPE 304 STAINLESS STEEL CONSTRUCTION AS EXTERIOR METAL SURFACES DAMAGED AND CORRECT WITH THE PURPOSE, OTHER THAN STAINLESS STEEL OR BRASS, SHALL BE PROTECTED BY A FACTORY APPLIED COATING OF AN ACRYLIC EPOXY/POLYAMIDE SEMI PHOSPHATE AND A POLYESTER RESIN ENAMEL FINISH. ALL O-RINGS SHALL BE OF NITRILE RUBBER THE LIFTING HANDLE SHALL BE STAINLESS STEEL.
- MOTOR
  - INDUCTION TYPE WITH A SQUIRREL CAGE ROTOR, SHELL TYPE DESIGN, HOUSED IN AN AIR FILLED, WATERTIGHT CHAMBER, NEMA B TYPE.
  - THE STATOR WINDINGS AND LEADS SHALL BE INSULATED WITH MOISTURE RESISTANT CLASS F INSULATION RATED FOR 155°F (311°F). THE STATOR SHALL BE DIPPED AND BAKED THREE TIMES IN CLASS F VARNISH. ARE SHALL BE HEAT-SHRINK FITTED WITH THE STATOR HOUSINGS
  - MOTORS ARE SUFFICIENTLY COOLED BY THE SURROUNDING MEDIUM IN WHICH THEY ARE SUBMERGED. A WATER COOLING JACKET IS NOT REQUIRED
- MOTOR HOUSING: HEAVY DUTY DUCTILE IRON, 45SH 448, CLASS 30
- IMPELLER: IMPELLER(S) SHALL BE SINGLE-VANE GRAY CAST IRON, CLASS 30, NON-CORROSIVE DESIGN WITH SMOOTH PASSAGES LARGE ENOUGH TO PASS ANY SOLIDS THAT MAY ENTER THE IMPELLER. VANE EDGES SHALL NOT BE SHARPENED. MINIMUM CLEARANCE BUT SHALL BE AS SPECIFIED.
- IMPELLER: THE IMPELLER SHALL BE OF HARDENED 316 STAINLESS, DYNAMICALLY BALANCED, CLOSED TWO-VANE NON-CLOGGING DESIGN, HAVING A LARGE UNOBSTRUCTED MINIMUM SOLIDS HANDLING
- BEARINGS: THE PUMP SHAFT SHALL ROTATE ON TWO SINGLE ROW BALL BEARINGS. MOTOR BEARINGS SHALL BE PERMANENTLY GREASE LUBRICATED.
- PUMP SHAFT: PUMP AND MOTOR SHAFT SHALL BE THE SAME UNIT THE MOTOR SHAFT SHALL BE COMPOSED OF CHROMIUM STEEL, UNDER THE MOTOR LUBRICATIONS AND THE PUMP SHAFT SHALL BE OF STAINLESS STEEL. THE PUMP SHAFT IS AN EXTENSION OF THE MOTOR SHAFT, COUPLINGS SHALL NOT BE ACCEPTABLE
- MECHANICAL SEAL: EACH PUMP SHALL BE PROVIDED WITH A HANDLE MECHANICAL SHAFT SEAL SYSTEM CONSISTING OF TWO METALLY INDEPENDENT SEAL ASSEMBLIES. THE SEALS SHALL OPERATE IN A LUBRICANT RESERVOIR THAT HYDRO- DYNAMICALLY LUBRICATES THE LAPPED SEAL FACES AT A CONSTANT RATE. THE LOWER PRIMARY SEAL SHALL BE SILICON CARBIDE/SILICON CARBIDE. THE UPPER SEAL SHALL BE CARBON/CERAMIC. THE SEALS SHALL REQUIRE NEGATIVE MAINTENANCE NOR ADJUSTMENT NOR DEPEND ON DIRECTION OF ROTATION FOR SEALING
- CABLE ENTRY: 50 FOOT LONG THY CABLE ENTRY SEAL DESIGN SHALL PREVENT SPECIFIC TORQUE REQUIREMENTS TO ENSURE A WATERTIGHT AND SUBMERSIBLE SEAL. THE CABLE ENTRY SHALL CONSIST OF A SINGLE CYLINDRICAL ELASTOMER GROMMET, FLANKED BY WASHERS, ALL HAVING A CLOSE TOLERANCE FIT AGAINST THE CABLE OUTER DIAMETER AND THE ENTRY INSIDE DIAMETER AND COMPRESSED BY THE BODY CONTAINING A STRAIN RELIEF FUNCTION. SEPARATE FROM THE FUNCTION OF SEALING THE CABLE, THE ASSEMBLY SHALL PROVIDE EASE OF CHANGING THE CABLE WHEN NECESSARY USING THE SAME ENTRY SEAL. A JUNCTION BOX SHALL BE COMPLETELY WATER DRY FROM THE HUMIDITY MEDIA. CHEMICALS, SULFIDES, OR OTHER SUCCESSFUL SEALING SYSTEM SHALL NOT BE CONSIDERED ACCEPTABLE
- LIFTING DEVICE: STAINLESS STEEL CHAIN 1/2 INCH, MINIMUM BREAKING STRENGTH OF EIGHT POUNDS SUPPLIED FOR REMOVING THE PUMP. LENGTH SHALL BE 3 FEET GREATER THAN THE OVERALL WET WELL DEPTH

C VALVES

- SWING CHECK VALVE
  - 350 EXTERNALLY LEVER MOUNTED CHECK VALVE, FIELD CONVERTIBLE
  - HORIZONTAL CAST IRON WITH FLANGED ENDS.
  - CONVERTIBLE/SWING LEVER ARM
  - TEMPERATURE: 175 DEGREES F FROM
- GATE VALVE
  - MAIN BODY: BRONZE MOUNTED ALL EXTERIOR MOUNTED BOLTS AND NUTS SHALL BE STAINLESS STEEL, RUBBER OR EPDM ENCAPSULATED RESILIENT SEAT, SOLID WEDGE
  - GATE VALVES SHALL BE DESIGNED FOR 150 PSI MINIMUM WORKING PRESSURE
  - GATE VALVES SHALL BE HAND WHEEL OPERATED, NON-RISING STEM TYPE WITH FLANGED ENDS
  - WHEN FULL OPEN, GATE VALVES SHALL HAVE A CLEAR WATERWAY EQUAL TO THE NOMINAL DIAMETER OF THE PIPE. THE OPERATING NUT OR WHEEL SHALL HAVE AN ARROW CAST IN THE METAL INDICATING THE DIRECTION OF OPENING.
- SUPPORTS: USE SUPPORTS FOR PIPING, VALVES, AND METER CONSISTING OF SCHEDULE 40 GALVANIZED STEEL PIPING CONFORMING TO ASTM A53, PRESSURE FITTING ASME B16.3 OR ASME B16.11 GALVANIZED THREADED FITTINGS.

D MAIN CONTROL PANEL

- PRODUCT DESCRIPTION
  - FACTORY FABRICATED, SELF CONTAINED DUPLEX INCLUDING LOW VOLUME PUMP OFF PUMP ON, PUMP ON HIGH LEVEL, HIGH LEVEL ALARM, FIRED LIGHTS, ALTERNATOR TO ALTERNATE PUMP DUTY BETWEEN PUMPS ON SUCCESSIVE CYCLES OR SWITCH OPERATION OF PUMPS ON PUMP FAILURE INCLUDE HIGH WATER ALARMS AND VISUAL ALARM LIGHT AND PUSH LIGHT TO SILENCE OF HIGH WATER CONDITION OR FAILURE OF PUMPS
  - OVERPOWER WARNING AS REQUIRED FOR SELECTED PUMP
  - PHASE: 3
  - VOLTAGE AND VOLTAGE: 3
  - COORDINATE POWER REQUIREMENTS WITH OWNER
- ENCLOSURE: NEMA 4X 304N 316T, OUTDOOR MOUNTING GRD GALVANIZED STEEL, GRAY POLYESTER POWDER FINISH, PADLOCK HASP/STAPLE WITH EXPOSE STAINLESS SCREWS FOR DOOR CLOSURE AND LOCKING. PROVIDE CONTINUOUS STAINLESS PIANO HINGE WITH STAINLESS REMOVABLE PIN. ALUMINUM PANEL DRILLED AND TAPPED; MACHINE SCREW MOUNTED COMPONENTS
- ALARM LIGHT: LARGE RED STROBE LIGHT THAT CAN BE SEEN DURING DAYLIGHT HOURS.
- CIRCUIT BREAKER FOR SHORT CIRCUIT PROTECTION
- STARTER: ELECTROMAGNETIC, SOFT START
- OVERLOAD RELAY: BIMETAL TYPE AMBIENT COMPENSATED
- HEATER ELEMENT: CLASS 10 QUICK TRIP, ONE HEATER PER EACH MOTOR PHASE
- SWITCH: HAND-OFF-AUTOMATIC, 1/2 INCH NEMA 1
- LIGHT: PUMP MOTOR RUN, 1/2 INCH NEMA 1
- RAB FLOAT SWITCH AND LIGHT MOUNTING
- FUSE, CONTROL TRANSFORMER: PRIMARY WHEN USED MUST REQUIRE NEMPS OF NEC
- FUSE, CONTROL CIRCUIT: MEET REQUIREMENTS OF NEC
- TERMINAL STRIP: BOX LUGS FOR WIRING
- WIRING: COLOR CODED PER NEC REQUIREMENTS. BLACK POWER WIRING, RED NUMBERED CONTROL WIRING WHITE NUMBERED NEUTRAL WIRING GREEN GROUND WIRING
- ALTERNATOR: AUTOMATIC
- PUMP RUN RECORDERS/HOUR METERS TO TRACK EACH PUMP SEPARATELY
- THE SPARE I/O POINTS (3 ANALOG, 4 DIGITAL) PROVIDE THE ABILITY TO ENABLE THE ALARMS BACK TO THE PUMP FOR A PUMP FAILURE AND THE HIGH ALARM
- LOCKABLE ROA DISCONNECTS

E PROGRAMMABLE LOGIC COMPUTER (PLC) CONTROLLER

- ALL INPUTS SHALL TERMINATE AT PLC OR PUMP MAIN CONTROL PANEL. PLC SHALL ACTUATE ALL OUTPUT NOTIFICATION DEVICES.
- MINIMUM MEMORY: 16 MEGABYTES OF PROGRAMMABLE RAM MEMORY AND 8K OF DATA STORAGE WITH EEPROM BACKUP.
- POWER: 110/220 VAC POWER SUPPLY. THE PLC SHALL BE CONNECTED TO AN UNINTERRUPTIBLE POWER SUPPLY (UPS)
- UL LISTED (UL 508), CSA CERTIFIED (CSA 142)
- EXTERNAL COMMUNICATIONS VIA RS232/485/ETHERNET PORTS
- PROGRAMMING AND DIAGNOSTIC SOFTWARE SHALL BE WINDOWS BASED VIA RSLOGIX, ARCHER LOGIC (RSLL BASIC AND CUSTOM PROGRAMMING TOOLS FOR THE PLC. PROVIDE TO THE OWNER A LICENSED COPY OF ALL PROGRAMMING SOFTWARE USED TO CONFIGURE AND PROGRAM THE PLC PC. THE SOFTWARE SHALL INCLUDE BOTH THE SOFTWARE AND HARDWARE (I.E. CABLES, INTERFACE BOX, ETC.) REQUIRED FOR DIRECT PLC-TO-PC COMMUNICATIONS FOR PLC PROGRAMMING. ALL SOFTWARE SHALL BE PROVIDED ON CD ROM
- THE CONTRACTOR SHALL PROVIDE PROGRAMMING TIME REQUIRED TO CONFIGURE PLC TO PROVIDE COMPLETE CONTROL AND COMMUNICATION/NOTIFICATION FUNCTIONS AS SET FORTH HEREIN
- THE FOLLOWING CONDITIONS SHALL INITIATE THE PLC SEQUENCE FOR ALARM CONDITION AND NOTIFICATION: LEAD PUMP DOES NOT GO ON, LAG PUMP DOES NOT GO ON, HIGH LEVEL SWITCH IS ACTIVATED, PUMPING DO NOT TURN OFF
- ACCEPTABLE PLC MANUFACTURER: ALLEN-BRADLEY MICROLOGIX 1100 OR APPROVED EQUAL

F PIPE

- PRESSURE PIPING AND RELATED ACCESSORIES FOR FORCE MAIN PIPING WHERE THE WET WELL AND VALVE VAULT FOR THE FORCE MAIN TO THE AUXILIARY POWER.
- DUCTILE IRON PUMP DISCHARGE PIPING, ANSI A 21.51/AWA C151 WITH MINIMUM CLASS 52
- PUMP STATION INTERNAL PIPING – DUCTILE IRON, ANSI A 21.51/AWA 51, THICKNESS CLASS 56
- PUMP STATION EXTERNAL PIPING – 8 INCH ED9-11 HIGH DENSITY POLYETHYLENE FORCEMAIN
- 1 ¼ INCH SCHEDULE 80 PVC POTENTIAL FUTURE CONTROLS CONDUIT, WITH SPARE PULL STRING

G MAIN CONTROL PANEL INSTALLATION

- MOUNT AND WIRE CONTROL PANEL FOR PUMPING STATION OPERATION INCLUDING DUPLEX MOTOR CONTROLS, CIRCUIT BREAKER, STARTER, CONTROL TRANSFORMER, FUSE BOX TERMINAL BLOCK, ALTERNATOR ALARM AND RUNNING LIGHTS.
- WIRE IN ACCORDANCE WITH REQUIREMENTS OF NATIONAL ELECTRICAL CODE
- USE 16 AWG STRANDED WIRING FOR CONTROL CIRCUITS AND WHITE FOR NEUTRAL GROUNDED CONNECTIONS
- USE ALUMINUM 44 AWG BLACK POWER WIRING
- NUMBER EACH CONDUCTOR
- TIN ENDS OF WIRES WITH 60/40 LEAD TIN ALLOY SOLDER
- LOCATE AND CONNECT DIRECT BURIAL CABLE FROM CONTROL PANEL TO BASIN JUNCTION BOX
- LOCKABLE PANEL DISCONNECT TO BE INSTALLED AT A REMOTE LOCATION TO THE PUMP STATION AS SHOWN ON THE DRAWINGS. HEIGHT CONTROL PANEL ENCLOSURE (W 1'-0"/H 1'-0"/D 1'-0") NEMA 4X 304/316T STAINLESS STEEL FRAME. FRAME SUPPORT POST/GUARD BASE PLATE TO BE MOUNTED TO TOP OF WET WELL FOR SLAB WITH STAIN STEEL ANCHOR BOLTS OR IF INSTALLED NEXT TO THE WET WELL, TO BE SET IN CONCRETE FILLED NON-TIME BASE SET A MINIMUM OF 4 FEET BELOW FINISHED GRADE
- ALL PENETRATIONS TO THE ENCLOSURE PANEL SHALL BE ON THE SIDE OR BOTTOM AND NO PENETRATIONS ON THE TOP

H ELECTRICAL REQUIREMENTS

- OWNER TO ARRANGE POWER AND WILL BRING POWER INTO THE CONTRACTOR SUPPLIED CONTROL PANEL. THE CONTRACTOR SHALL PROVIDE ELECTRICAL SERVICE TO THE LIFT STATION PER CODE COMPLIANT UNDERGROUND ELECTRIC WIRING PROTECTED BY PROPERLY GROUNDED RIGID STEEL CONDUIT.

I STATION STARTUP, WIRING TESTING AND OPERATION

- NOTIFY OWNER 3 DAYS PRIOR TO PUMP RATE TESTING.
- PROVIDE STARTUP AND INITIAL TESTING OF SYSTEM, COORDINATE AND OPERATE PUMPS IN CONJUNCTION WITH THE OWNER AND THE OWS
- PROVIDE PLC PROGRAMMING AND SETUP OF ALIO DIALER NOTIFICATIONS WITH CONTACT(S) PROVIDED BY THE OWNER
- INTERNALLY TEST SYSTEM TO PERFORMANCE REQUIREMENTS BY RECORDED PUMPING AND DISCHARGED AND DELIVERY OF RATED FLOW PER WET WELL BASIN
- CORRECT FAILURES DURING TEST BY REPAIRING OR REPLACING MALFUNCTIONING PARTS OR EQUIPMENT OR FAULTY WORKMANSHIP, REGARDLESS OF CAUSE, WITHIN 48 HOURS AFTER NOTIFICATION FROM OWNER.
- AFTER CORRECTING FAILURES CAUSED BY DEFECTIVE EQUIPMENT, MATERIAL, OR FAULTY WORKMANSHIP, REPEAT UNTIL FAILURES ARE ELIMINATED
- CONFIRM GENERAL SEQUENCING OF PUMP AND FLOAT OPERATIONS AT BASIN AND CONTROL PANEL ARE IN ACCORDANCE WITH PERFORMANCE REQUIREMENTS
- DOCUMENT AND CERTIFY STARTUP RESULTS IN BRIEF REPORT

J MANUFACTURER'S FIELD SERVICES

- FURNISH FACTORY TRAINED REPRESENTATIVE AND FIELD TECHNICIAN, ASSISTANCE DURING THE FOLLOWING PERIODS OF MINIMUM SERVICE AMOUNTS/DAYS
  - UNLOADING OF STATION MATERIALS AND COMPONENTS
  - START-UP, TESTING AND DEMONSTRATION OF STATION INCLUDING BASIN, PUMP CHAMBER, PANEL, PLC PROGRAMMING, AND AUTO DIALER SIMULATION

K ADJUSTING

- ADJUST PUMP AND CONTROL PANEL SYSTEMS SO STATION OPERATES TO PERFORMANCE REQUIREMENTS AND IN ACCORDANCE WITH THESE SPECIFICATIONS

L DEMONSTRATION

- DEMONSTRATE OPERATION OF PUMPING STATION COMPONENTS, PUMP SYSTEM, AND CONTROL PANEL

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JUN 19 2015
THE AMECOM FOSTER WHEELER
PAGE THE CABINET HAS VOIDED THIS
DRAWING FOR THE PURPOSES
AS PART OF THE ADMINISTRATIVE RECORD

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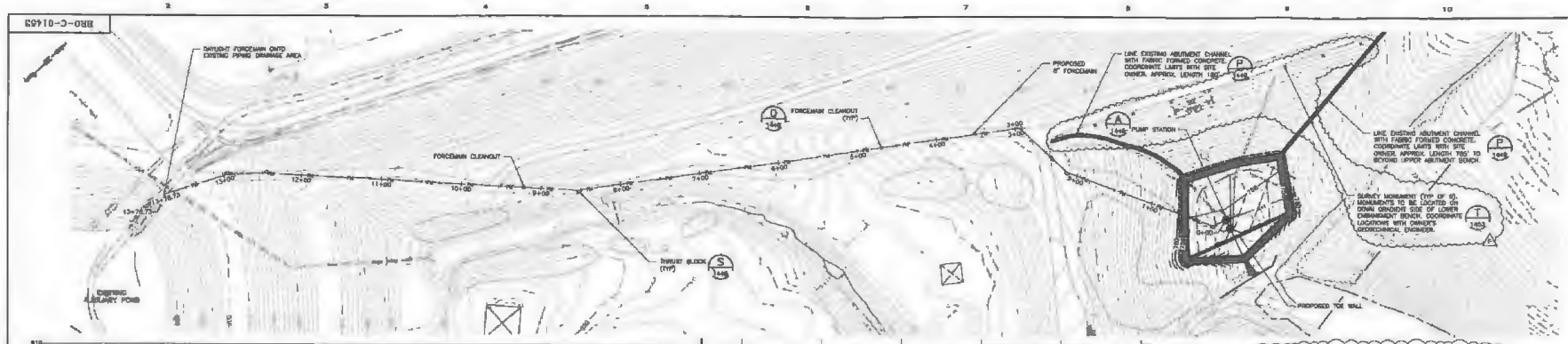
NO	DATE	DESCRIPTION	BY
A	3/13/15	ADDENDUM 1	JMH
B	4/16/15	ADDENDUM 2	JMH
C			
D			
E	6/19/15	ADDENDUM 3	JMH

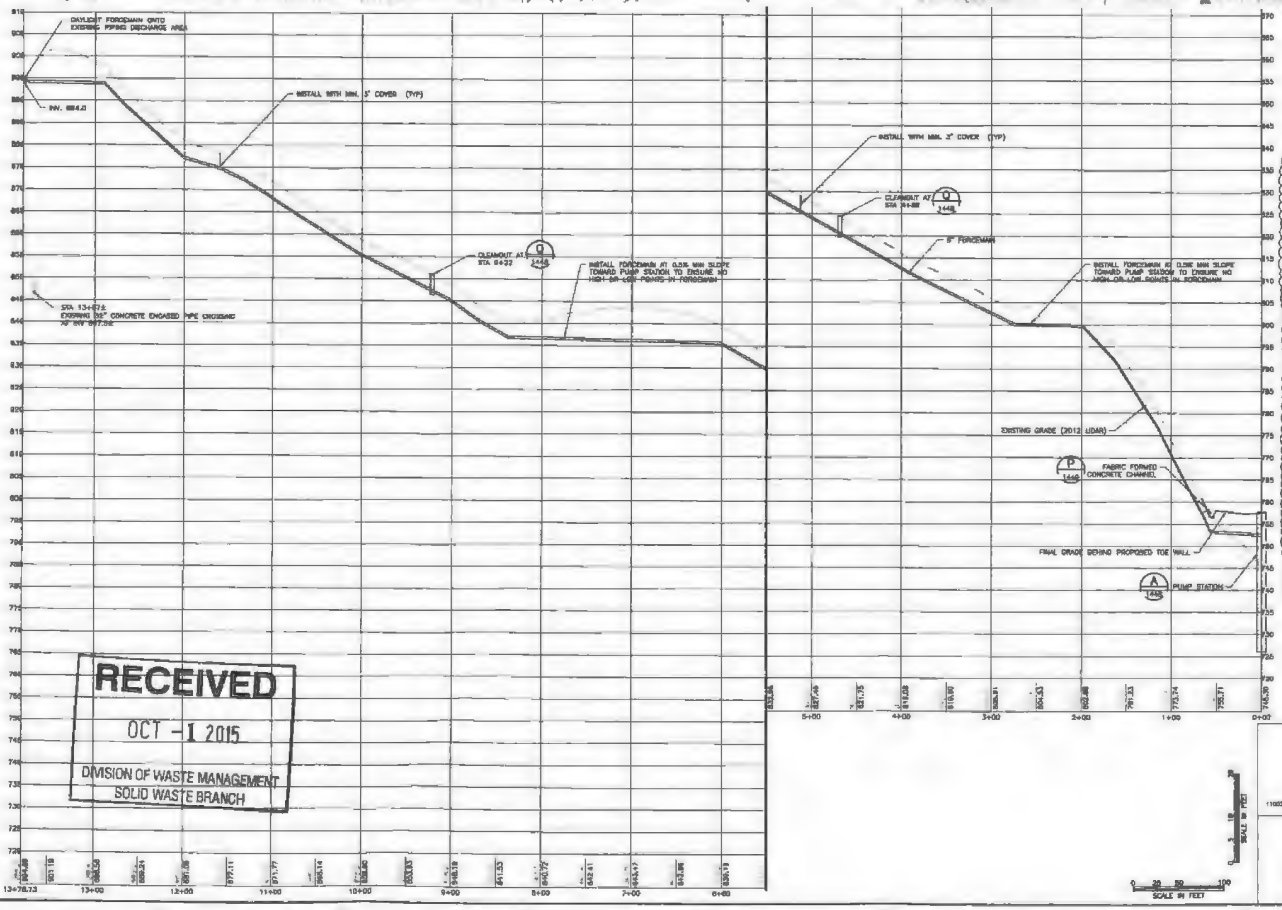
Kentucky Utilities Company

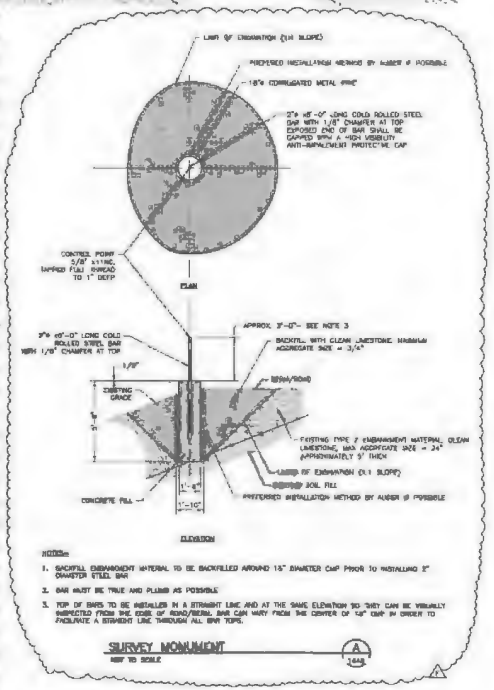
EW BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM – PHASE 1B
NOTES AND SPECIFICATIONS – 2

Drawing No. BRO-C-01458 E

BRO-C-01453







NOTES:

1. BACKFILL EMBANKMENT MATERIAL TO BE BACKFILLED AROUND 18" DIAMETER CMP PRIOR TO INSTALLING 3" DIAMETER STEEL BAR
2. BAR MUST BE TRUE AND PLUMB AS POSSIBLE
3. TOP OF BARS TO BE INSTALLED IN A STRAIGHT LINE AND AT THE SAME ELEVATION SO THEY CAN BE VISUALLY INSPECTED FROM THE EDGE OF ROAD/BERM. BAR CAN VARY FROM THE CENTER OF 18" CMP IN ORDER TO FACILITATE A STRAIGHT LINE THROUGH ALL BAR TOPS.

SURVEY MONUMENT
NOT TO SCALE

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REVISIONS			
no.	mm dd,	comm by	comm text
A	05/04/15	JNW	CLIENT
B	05/13/15	JNW	CLIENT
C	06/19/15	HJP	CLIENT
D		HJP	MMB
E	07/09/15	MB	MG
F	9/15/15	JNW	SW Comm

E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1C
TOE DRAIN FORCE MAIN TO OXIDATION POND

E.W. BROWN GENERATING STATION

Kentucky Utilities Company

Scale: 1"=20'HORIZ 1"=10' VERT
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Drawing No. BRO-C-01453 | Rev. F

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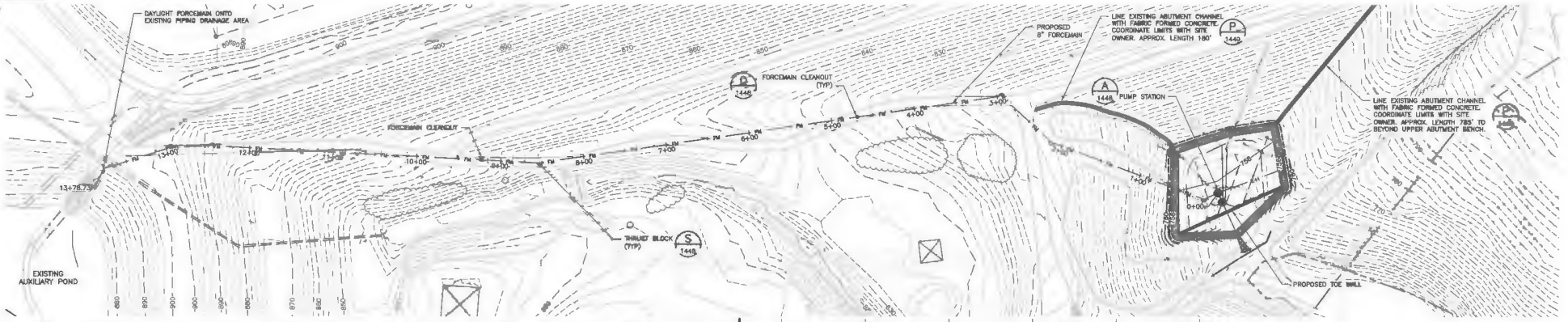

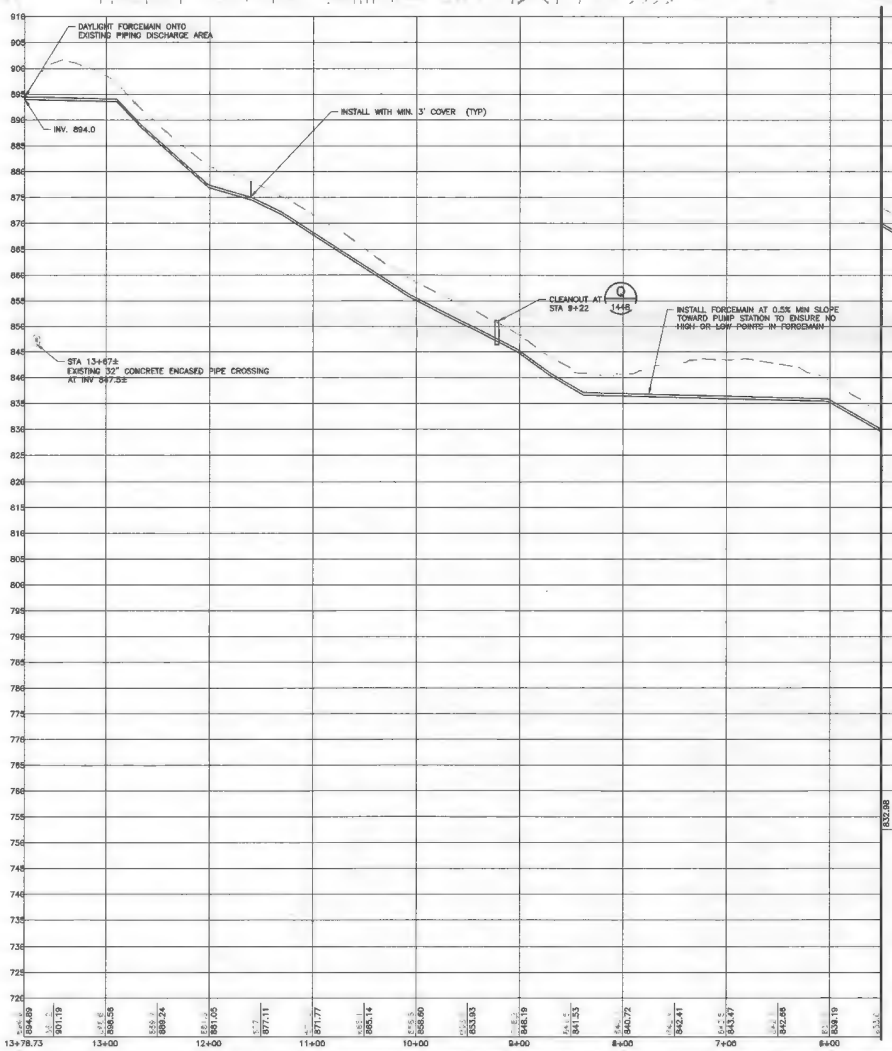

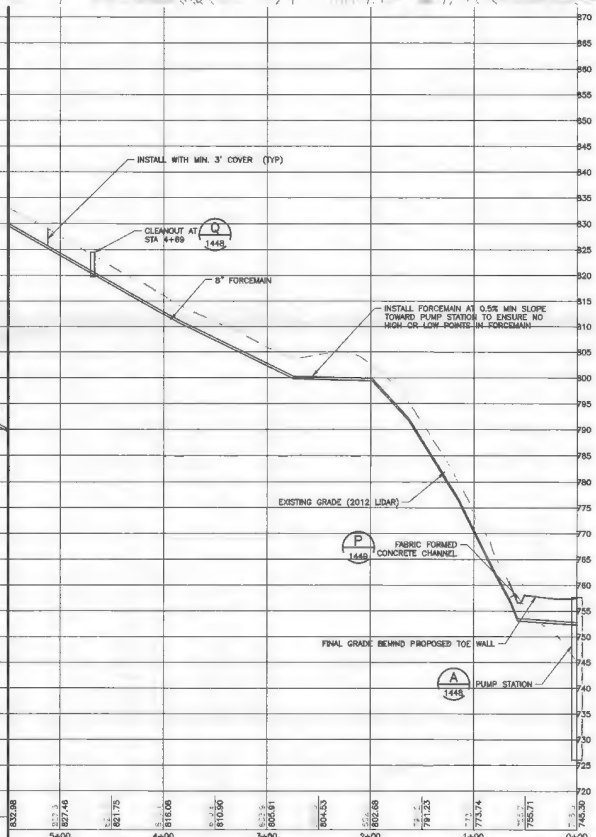

RECEIVED
JUN 10 2015
DIVISION OF WASTE MANAGEMENT SOLID WASTE BRANCH

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NOTE: NO REVISIONS THIS SHEET BEYOND REV C

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REVISIONS

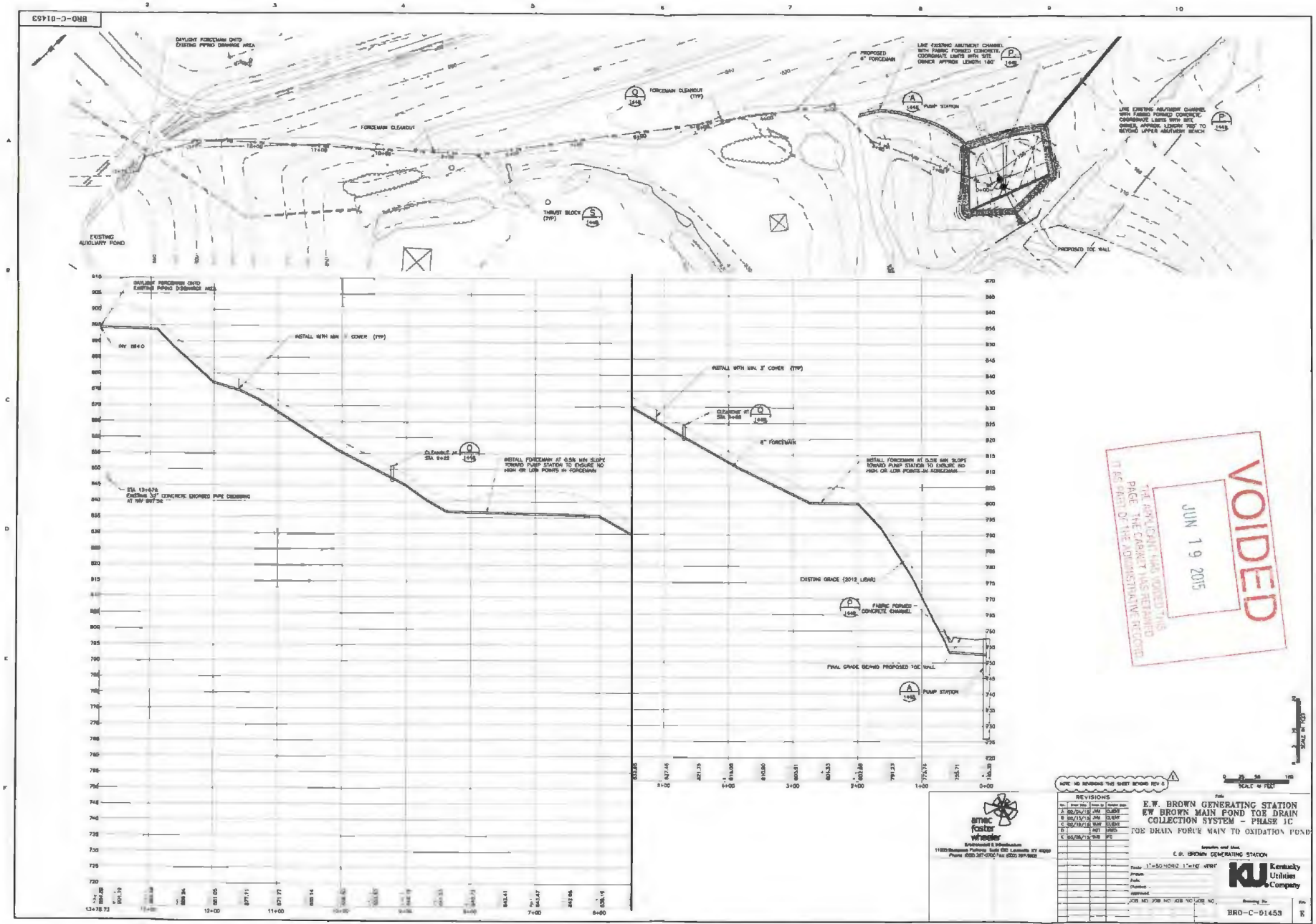
No	Date	Description	By
A	03/04/15	PW	DJM
B	05/13/15	PW	DJM
C	05/26/15	SW	DJM
D		NOT USED	
E	05/26/15	MD	PS

E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1C
TOE DRAIN FORCE MAIN TO OXIDATION POND

Location and Unit:
E.W. BROWN GENERATING STATION

Kentucky Utilities Company

Drawing No. BRO-C-01453 Rev. E


BRO-C-01453
DAYLIGHT FORCEMAIN ONTO EXISTING RIPRAP DRAINAGE AREA
FORCEMAIN CLEANOUT (TYP)
FORCEMAIN CLEANOUT
PROPOSED 6" FORCEMAIN
LINE EXISTING ABUTMENT CHANNEL WITH FABRIC FORMED CONCRETE, COORDINATE LIMITS WITH SITE OWNER APPROX LENGTH 180'
PUMP STATION
LINE EXISTING ABUTMENT CHANNEL WITH FABRIC FORMED CONCRETE, COORDINATE LIMITS WITH SITE OWNER, APPROX. LENGTH 750' TO BEYOND UPPER ABUTMENT BENCH
THRUST BLOCK (TYP)
EXISTING AUXILIARY POND
PROPOSED TOE WALL
INSTALL WITH MIN 3' COVER (TYP)
INV 884.0
CLEANOUT AT STA 9+23
INSTALL FORCEMAIN AT 0.5% MIN SLOPE TOWARD PUMP STATION TO ENSURE NO HIGH OR LOW POINTS IN FORCEMAIN
STA 13+76 EXISTING 24" CONCRETE ENCASED PIPE CROSSING AT INV 897.92
CLEANOUT AT STA 0+68
6" FORCEMAIN
EXISTING GRADE (2012 LIDAR)
FABRIC FORMED CONCRETE CHANNEL
FINAL GRADE BEHIND PROPOSED TOE WALL
PUMP STATION
13+78.73
12+00
11+00
10+00
9+00
8+00
7+00
6+00
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VOIDED
JUN 19 2015
THE APPLICANT HAS ABANDONED THE PROJECT AND HAS RETAINED THIS PAGE AS PART OF THE ADMINISTRATIVE RECORD
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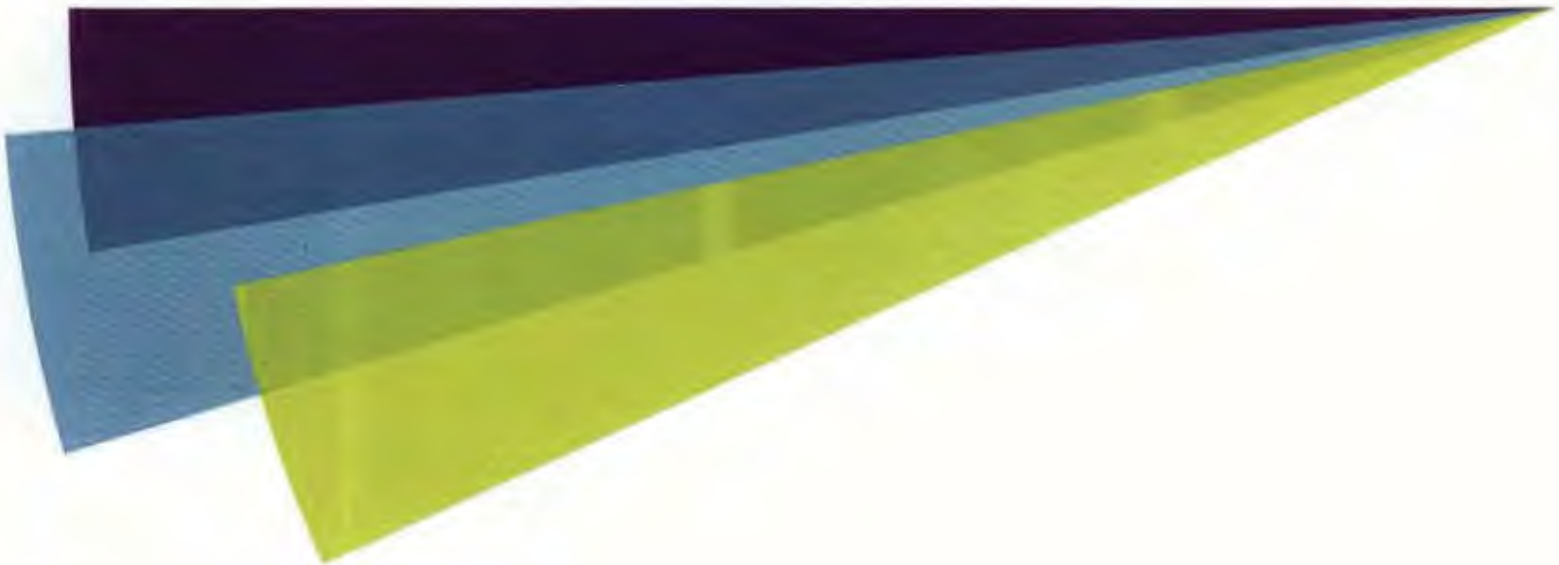
REVISIONS
E.W. BROWN GENERATING STATION
EW BROWN MAIN POND TOE DRAIN COLLECTION SYSTEM - PHASE 1C
TOE DRAIN FORCE MAIN TO OXIDATION POND
C.W. BROWN GENERATING STATION
Kentucky Utilities Company
BRO-C-01453

ATTACHMENT 4

DAM STABILITY ANALYSIS

E.W. Brown Main Ash Pond Dam Stability

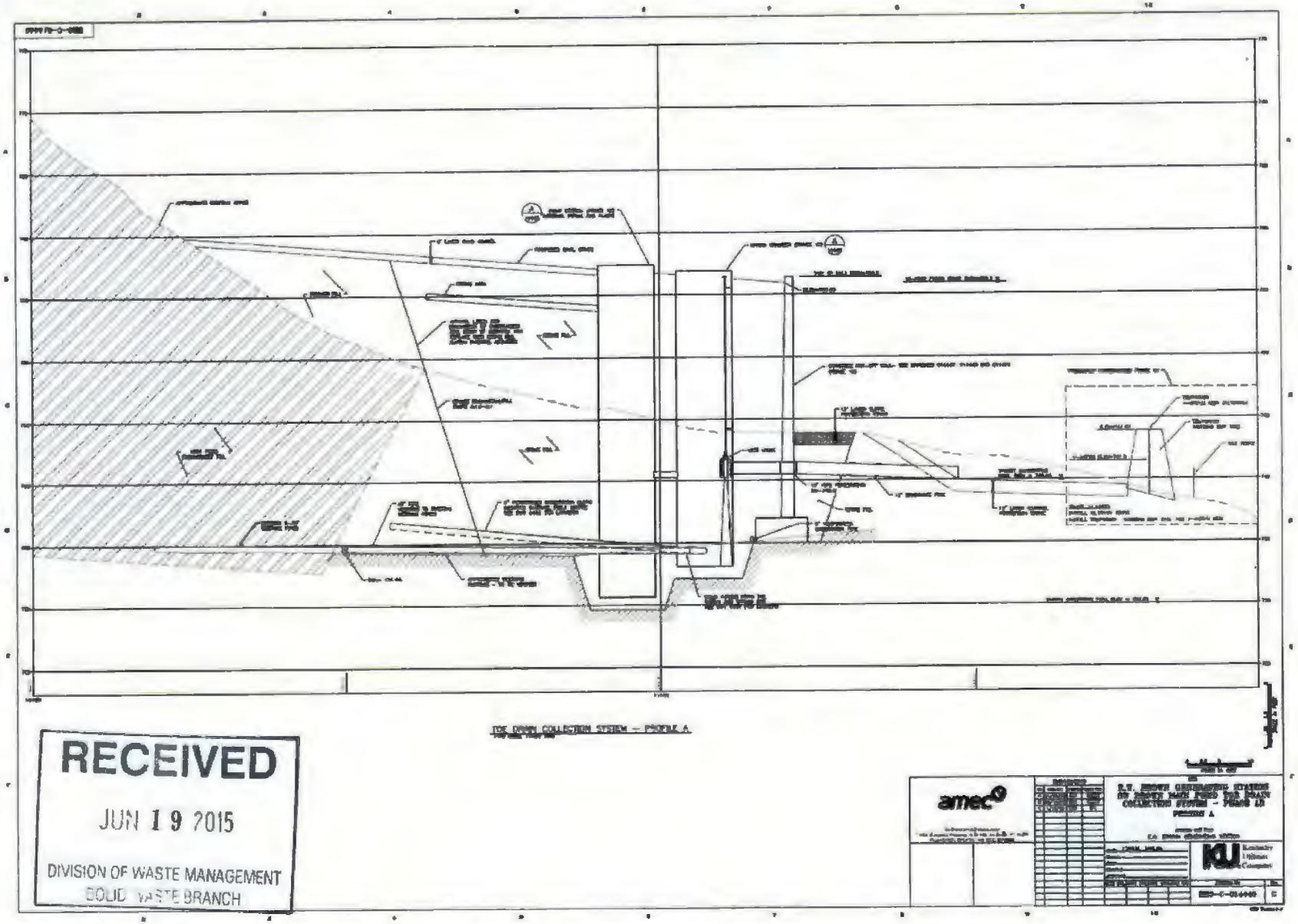
Proposed Toe Drain Cut-off Wall Seepage Collection Excavation



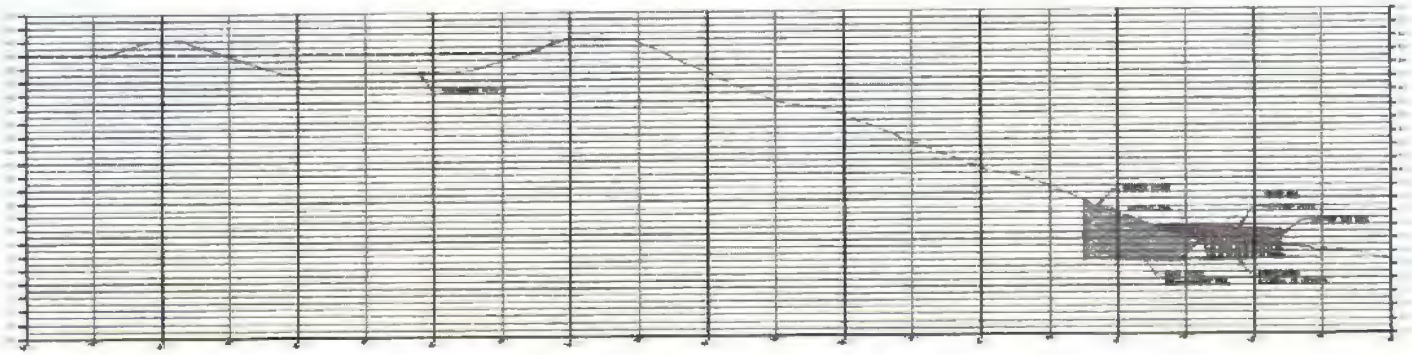
Toe Drain Excavation Stability Analysis

- Background
  - Closing Main Ash Pond with a Landfill
  - Seepage Collection System Water Shows Contamination
- Toe Drain Collection System
- Cut-Off Wall Profile
- FMSM Stability Analysis
  - 1990 As Built Plans
- Amec Foster Wheeler Stability Analysis
  - Total Stress
  - Effective Stress
  - Effective Stress with Seismic Load
  - Effective Stress with Seismic Load and Flooded Toe.
  - Effective Stress with Rapid Drawdown of Flood Event

E.W. Brown Main Pond
Toe Drain Collection System



E.W. Brown Main Pond
Cut off Wall Profile



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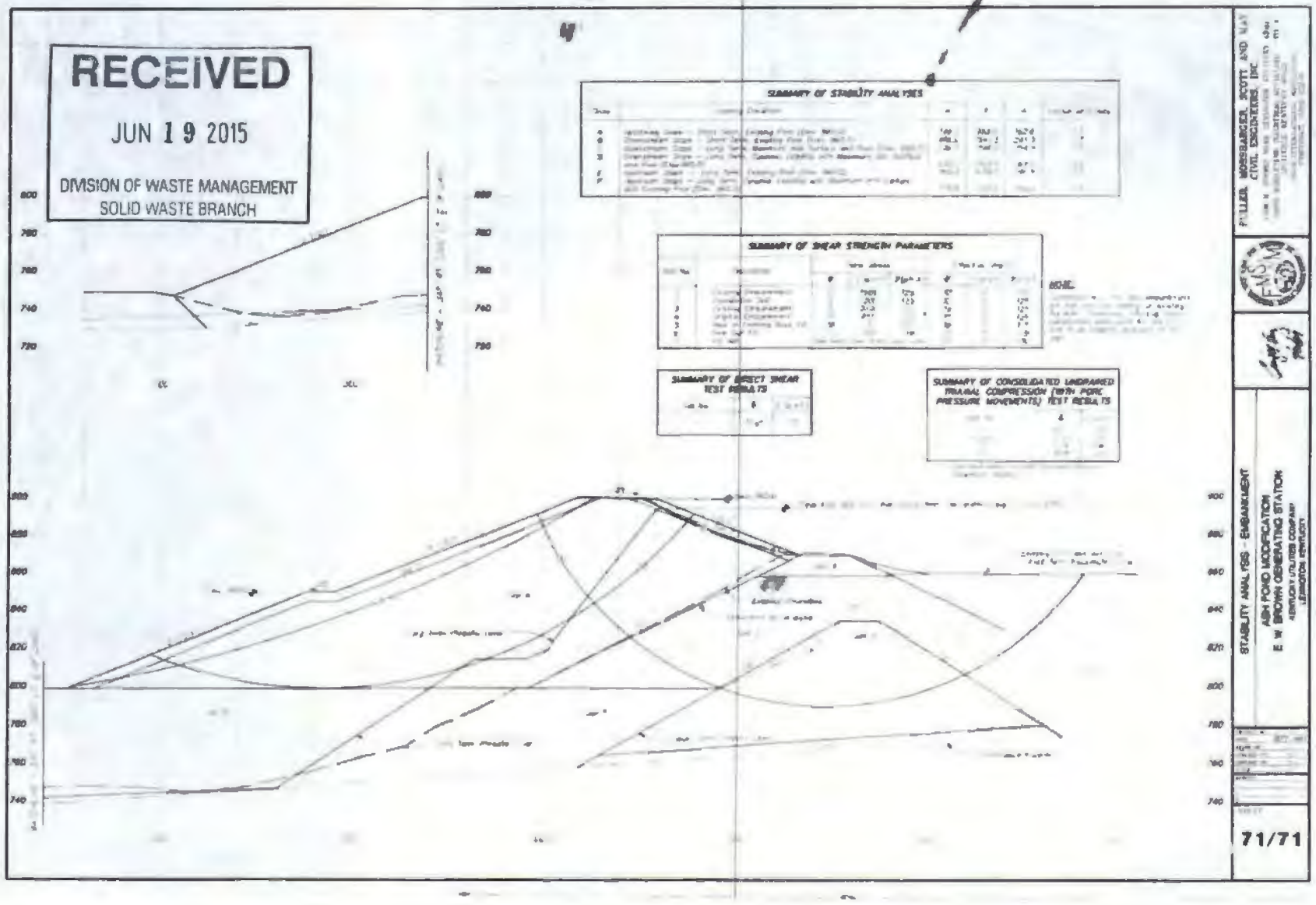
DIVISION OF WASTE MANAGEMENT
SOLID WASTE BRANCH

Stability Analysis
FMSM 1990 As Built Plans



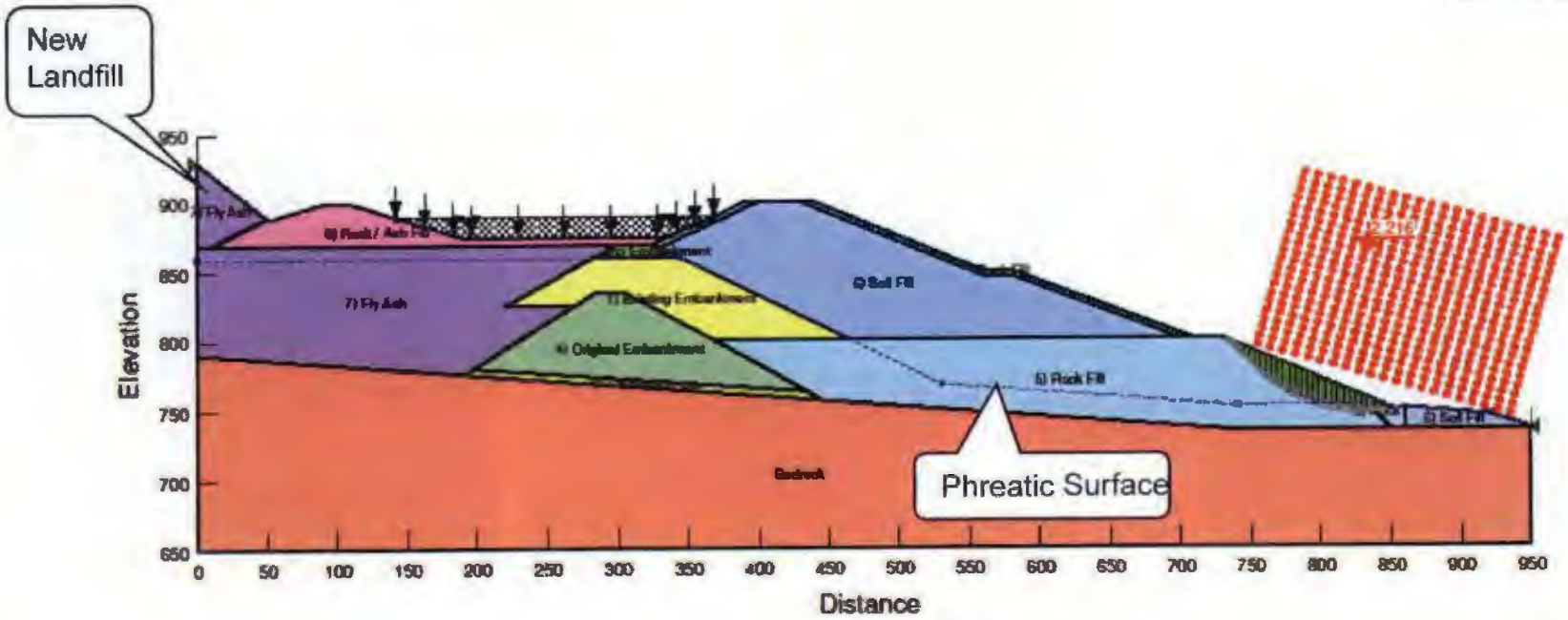
Existing Slope – Total Stress Analysis
Lowest Factor of Safety

Lined Pond is shown as a loading condition.

Phreatic Surface is based on piezometer, seepage collection system and observed seepage.

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 1500 psf Phi: 0 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 1200 psf Phi: 0 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 3000 psf Phi: 0 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 600 psf Phi: 0 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 1500 psf Phi: 0 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1

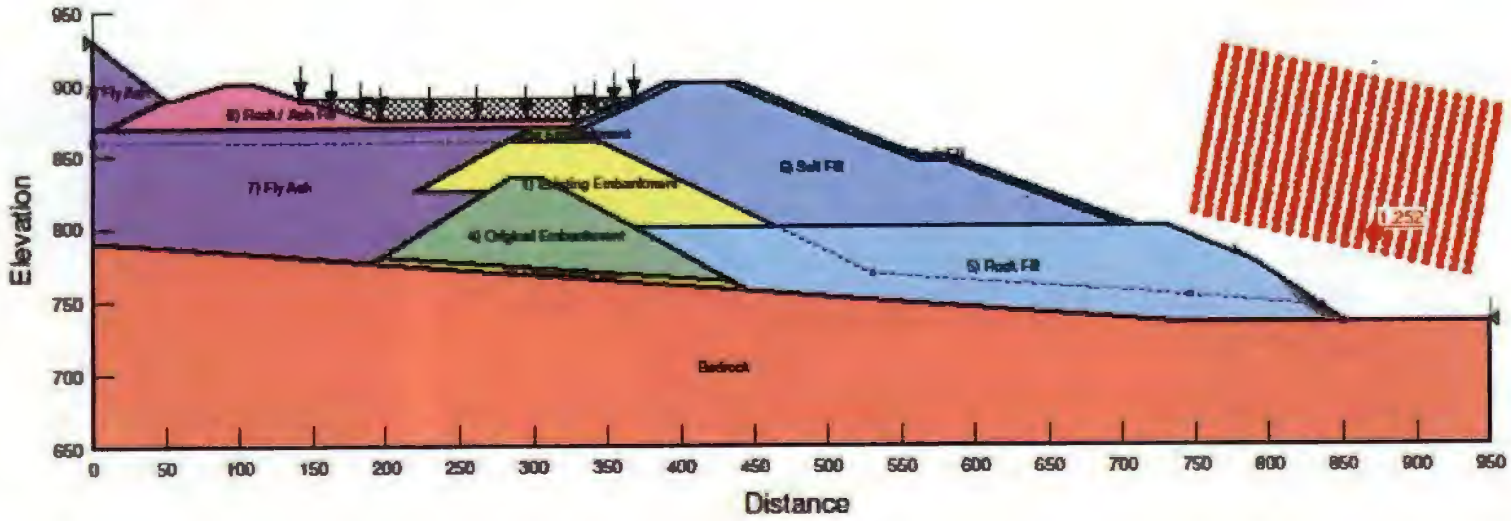
FOS = 2.216



Excavated Slope – Total Stress Analysis
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 1500 psf Phi: 0 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 1200 psf Phi: 0 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 3000 psf Phi: 0 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 600 psf Phi: 0 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 1500 psf Phi: 0 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1

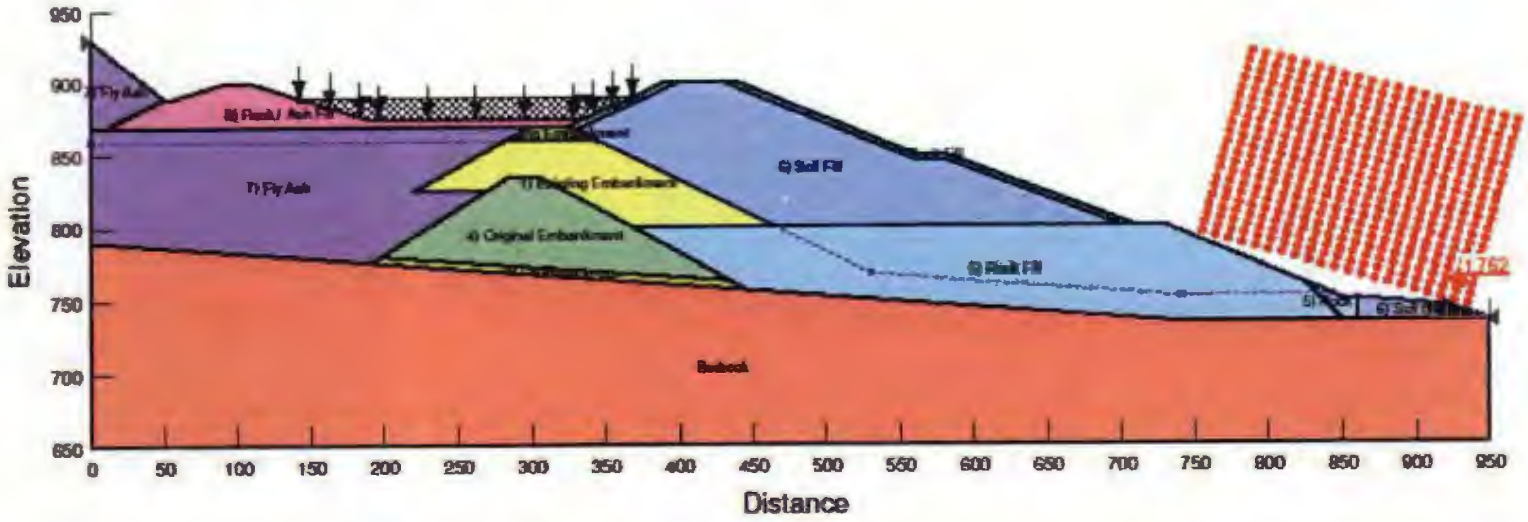
FOS = 1.252



Existing Slope – Effective Stress Analysis
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1

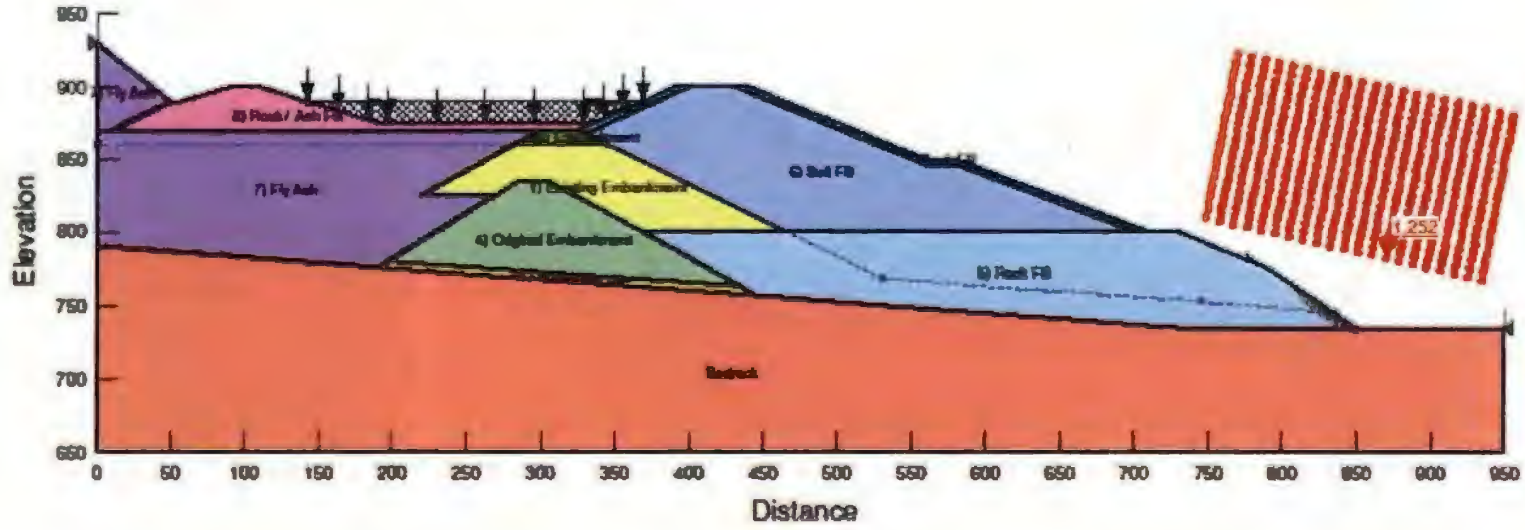
FOS = 1.762



Excavated Slope – Effective Stress Analysis
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1

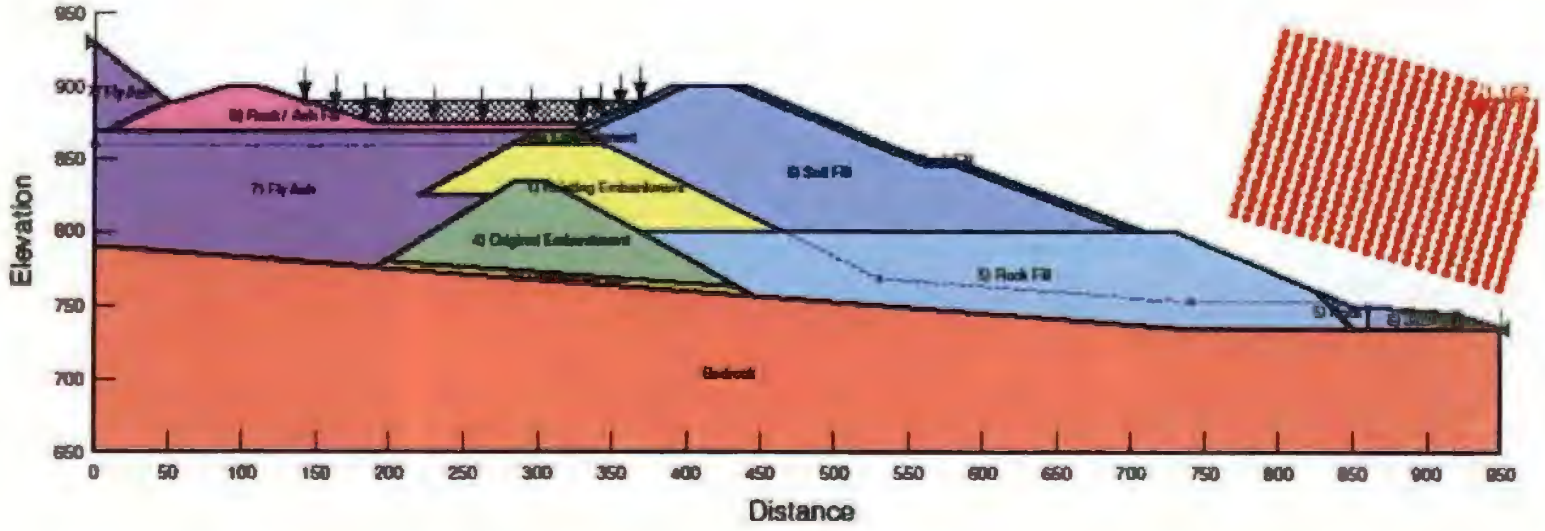
FOS = 1.252



Existing Slope
Effective Stress Analysis with Seismic
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1 Horz Seismic Load: 0.085

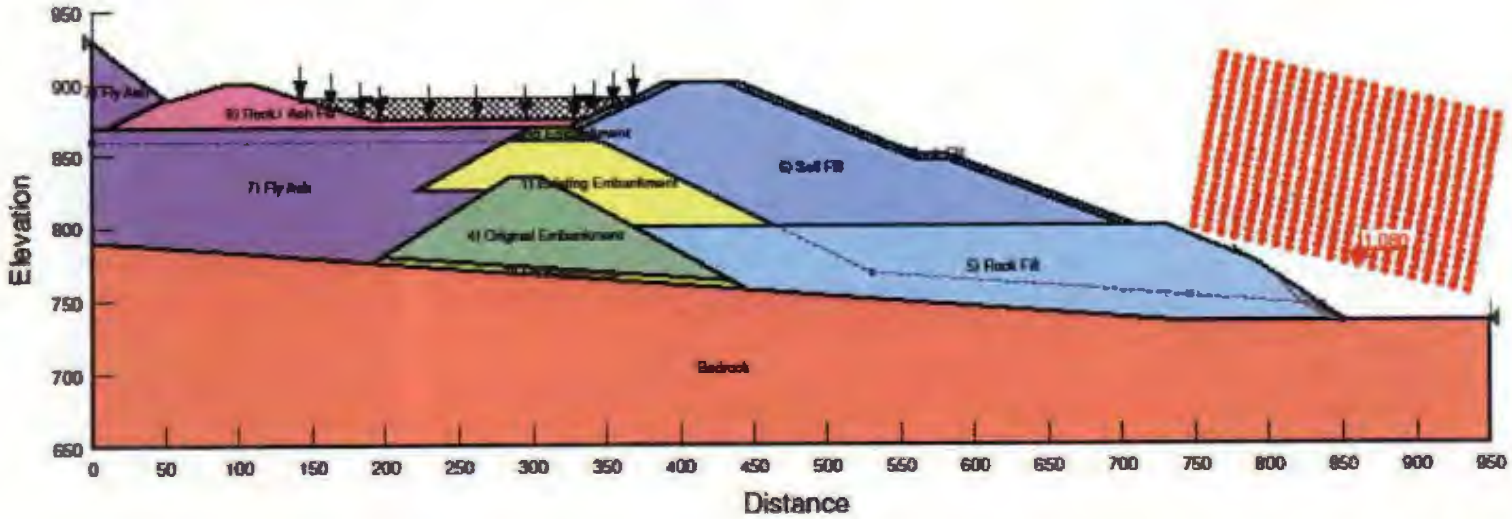
FOS = 1.162



Excavated Slope
Effective Stress Analysis with Seismic
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1 Horz Seismic Load: 0.085

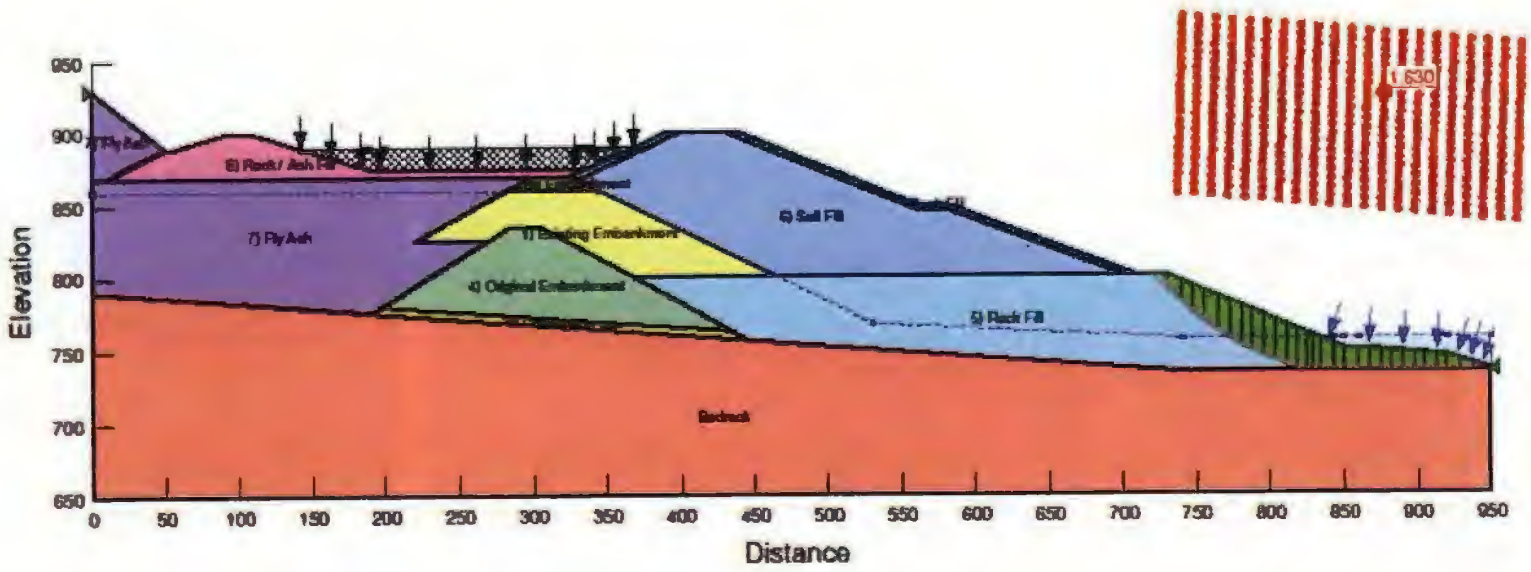
FOS = 1.080



Existing Slope
Effective Stress Analysis with Seismic and Flooded
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1 Horz Seismic Load: 0.085

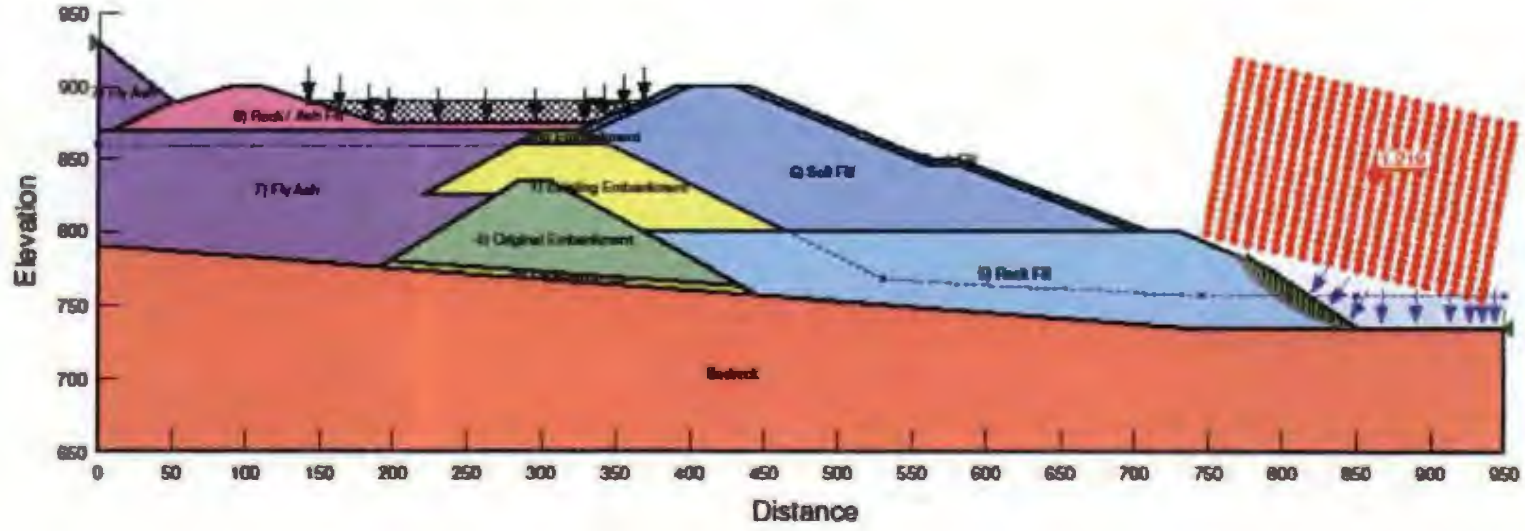
FOS = 1.630



Excavated Slope
Effective Stress Analysis with Seismic and Flooded
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1 Horz Seismic Load: 0.085

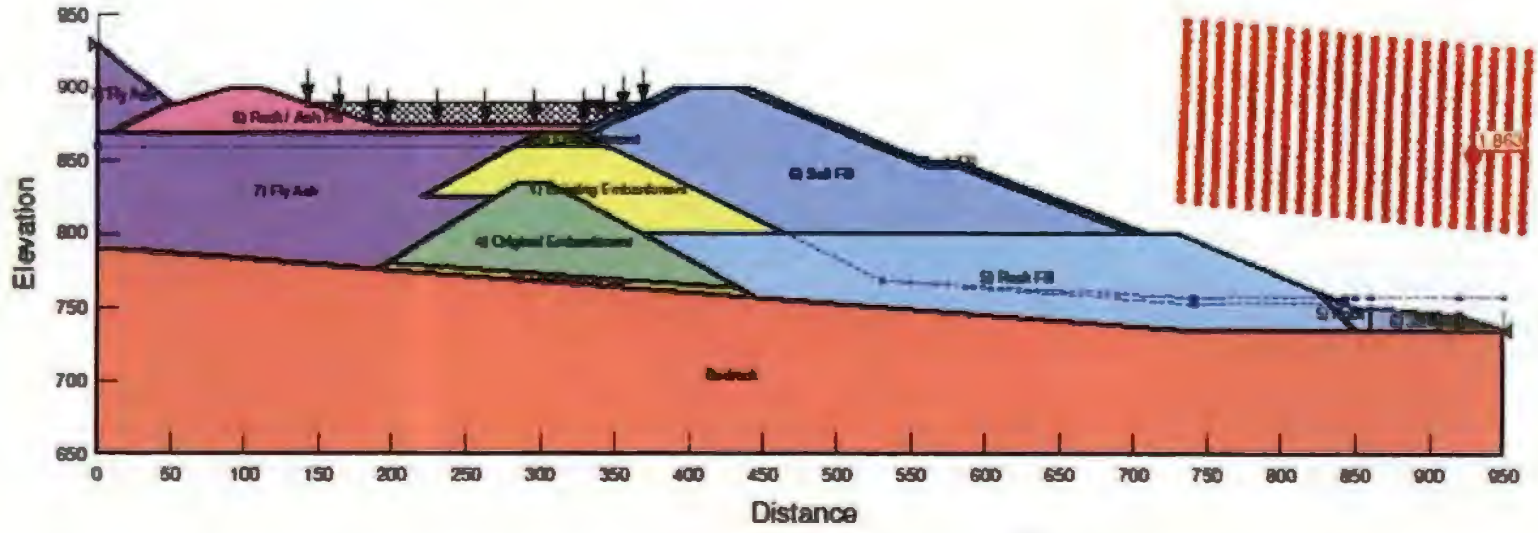
FOS = 1.219



Existing Slope
Rapid Drawdown Analysis
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 5) Rock Fill Unit Weight: 115 pcf Cohesion: 100 psf Phi: 38 ° Piezometric Line: 1
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1 Horz Seismic Load: 0

FOS = 1.863



Excavated Slope
Rapid Drawdown Analysis
Lowest Factor of Safety

Name: 1) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: 2) Foundation Soil Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 3) Existing Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: 4) Original Embankment Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
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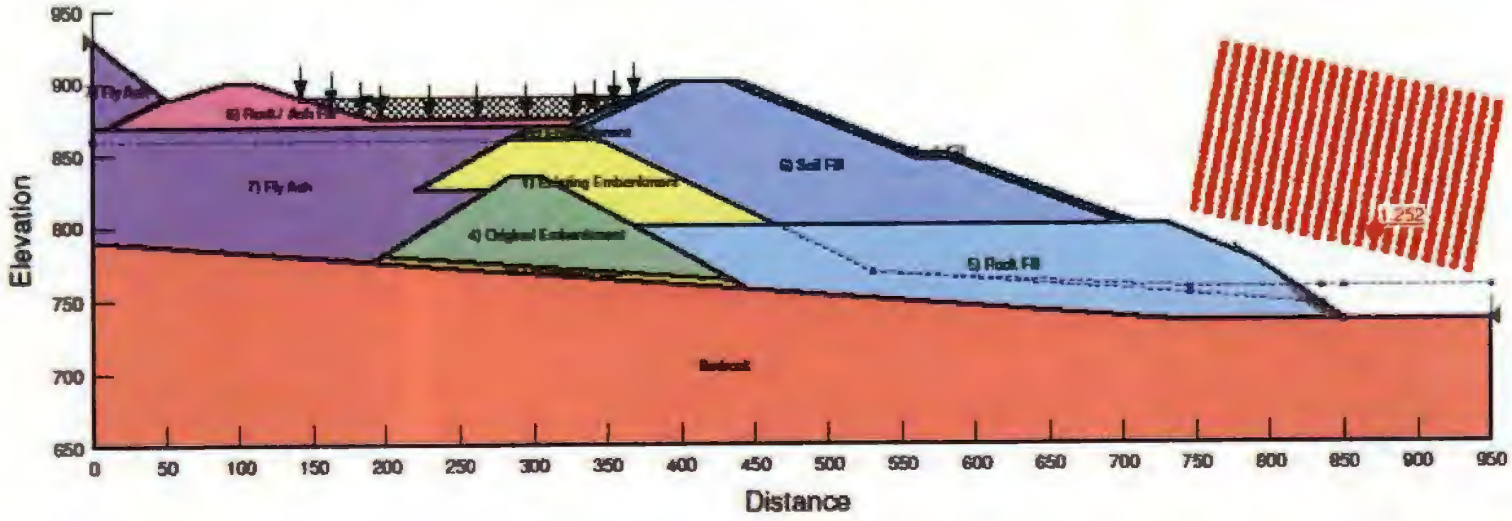
Name: 6) Soil Fill Unit Weight: 118 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 7) Fly Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 ° Piezometric Line: 1
Name: 8) Rock / Ash Fill Unit Weight: 105 pcf Cohesion: 0 psf Phi: 34 ° Piezometric Line: 1
Name: Bedrock Piezometric Line: 1

FOS = 1.252



Toe Drain Excavation Stability Analysis Summary

amec foster wheeler

Analysis Condition	Lowest Factor of Safety		Target Factor of Safety
	Existing Slope	Excavated Slope	
Total Stress	2.216	1.252	1.5
Effective Stress	1.762	1.252	1.5
Effective Stress with Seismic	1.162	1.080	1.0
Effective Stress with Seismic and Flooded Toe	1.630	1.219	1.0
Rapid Drawdown	1.863	1.252	1.2

- The Excavated Slope is laid back to a 1:1.5 slope.
  - Excavated slope will have a short-term exposure a few months or less
- The material properties are based on FMSM design properties with a small amount of cohesion added to the rock fill material.
- Target FOS from "Guidelines for the Geotechnical Investigation and Analysis of Existing Earth Dams" Kentucky Division of Water.

Toe Drain Excavation
Stability Analysis Summary

- Amec Foster Wheeler Stability Analysis
  - Total Stress
  - Effective Stress
  - Effective Stress with Seismic Load
  - Effective Stress with Seismic Load and Flooded Toe
  - Effective Stress with Rapid Drawdown of Flood Event
- All Factors of Safety above Target Values except
  - Short-term exposure cut-slope (FS = 1.252)
- Stability Analyses Results suggest Strength Parameter Selection is Conservative
- Movement of Dam Slope will by Monitored (See slide #18)

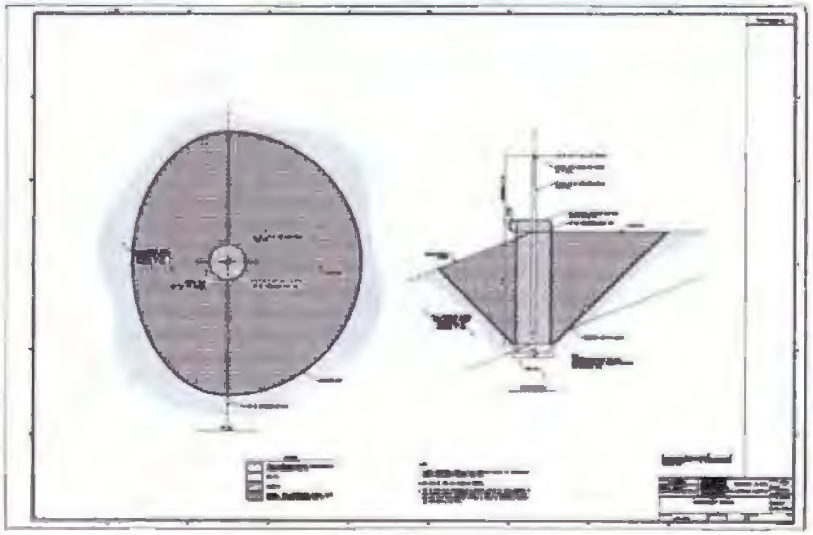
Embankment Movement Monitoring

amec foster wheeler

Monuments exist on Upper Bench

Similar monuments to be installed on the Lower Bench

Monuments to be monitored weekly until excavation is backfilled, and for one month after backfilling



Kentucky Energy and Environment Cabinet
Department for Environmental Protection
Division of Waste Management

PERMIT

Facility:

E. W. Brown Generating Station
815 Dix Dam Rd
Harrodsburg, KY 40330

Permittee:

Kentucky Utilities Co
220 W Main St
PO Box 32010
Louisville, KY 40232

Agency Interest:

KY Utilities Co - Brown Station
815 Dix Dam Rd
Harrodsburg, KY 40330

The Division has issued the permit under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. This permitted activity or activities are subject to all conditions and operating limitations contained herein. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits, licenses or approvals required by this Division or other state and local agencies.

No deviation from the plans and specifications submitted with your application or any condition specified herein is allowed, unless authorized in writing from the Division. Violation of the terms and conditions specified herein may render this permit null and void. All rights of inspection by representatives of the Division are reserved. Conformance with all applicable Waste Management Regulations is the responsibility of the permittee.

Agency Interest ID #: **3148**

Solid Waste Permit #: **sw08400010**

County: **Mercer**

Permitted Activities:

Subject Item	Activity	Type	Status
ACTV002	Special Waste Landfill-Coal/08400010	Construction/Operation	Active
ACTV004	Coal Combustion Residuals Surface Impoundment/08400010	Registered Permit-by-Rule	Active
ACTV005	Coal Combustion Residuals Surface Impoundment/08400010	Registered Permit-by-Rule	Active

PERMIT

Acreage Summary:

Waste Disposal Area (in Acres):

Activity	Disposal Area
Coal Combustion Residuals Surface Impoundment	8.80
Coal Combustion Residuals Surface Impoundment	29.90
Special Waste Landfill-Coal	105.30
Total Disposal Area	144.00
Total Permitted Area	377.00

Cost Estimate Summary:

Coverage Type	Cost Estimate	Effective	Comments
Closure	$11,027,960.00	09/22/2016	Approved under APE20160001
Post-Closure	$1,586,778.00	09/22/2016	Approved under APE20160001

Financial Assurance Summary:

The owner or operator shall maintain the following financial assurance approved by the Division in compliance with KRS Chapter 224.40-650, KRS Chapter 224.50-862, 401 KAR 45:080, and 401 KAR 48:310:

Instrument Type	Instrument Number	Amount	Date Received	Comments
Surety Bond	106094008	$3,000,000.00	09/12/2014	
Surety Bond	106569019	$12,614,738.00	09/13/2016	

First Operational Permit Effective Date: 09/22/2016

Permit Effective Date: 09/22/2016

Permit Expiration Date: Life of Facility

Permit issued: 09/22/2016

Danny Anderson

Danny Anderson, P.E.
Manager, Solid Waste Branch

Permit Conditions:

Facility Information and/or Conditions
Description of Special Waste Activities:

ACTV0002 - Special Waste Landfill-Coal Combustion By-Products totaling 105.3 acres (Formal Permit);

ACTV0004 - Coal Combustion By-Products Surface Impoundment-Main Ash Pond totaling 114.1 acres (105.3 acres overlapped by landfill, 8.80 acres remain) (Registered Permit-by-Rule);

ACTV0005 - Coal Combustion By-Products Surface Impoundment-Auxiliary Ash Pond totaling 29.9 acres (Registered Permit-by-Rule); and

GSTR0002 - Groundwater Monitoring - Spring Monitoring Group applies to the entire facility and includes the Special Waste Landfill (ACTV0002), the Main Ash Pond (ACTV0004), and the Auxiliary Ash Pond (ACTV0005).

Subject Items

ACTV0002 - Special Waste Landfill-Coal

Standard Requirements:

1. General: The owner or operator of a special waste facility shall comply with KRS Chapter 224 and 401 KAR Chapters 30, 40 and 45 for the construction and operation of special waste facilities. [KRS 224.50-760]

2. General: For construction and operation of the special waste landfill, the owner or operator shall comply with KRS Chapter 224.50-760, 401 KAR 45:030, 45:110 and the approved permit application(s). [401 KAR 45:110]

Variances, Alternate Specifications and Special Conditions:

1. Operation: Wastes shall be placed uniformly across the landfill. With the exception of the first layers used to fill in the sawtooth valleys, the waste shall be placed across the landfill in even layers no greater than ten (10) feet thick. The owner or operator shall place waste in thin lifts and adjoining phases shall not differ in thickness by more than ten (10) feet. Waste shall be placed only on constructed and approved liner. Waste shall be sloped to allow for proper drainage. This pattern of uniform loading across the landfill shall continue until final volume and slopes are achieved. [401 KAR 45:140 Section 2]

2. Construction: The owner or operator shall use a fully-loaded tandem axle dump truck or equivalent during proof-roll inspection(s). [401 KAR 45:140 Section 2]

3. Variance: A variance has been granted to the buffer zone requirement in 401 KAR 45:130, Section 1(3). The Special Waste Landfill (ACTV0002) bottom liner shall be constructed and maintained in accordance with the permit and approved plans. [401 KAR 45:130 Section 1, 401 KAR 30:020 Section 2]

4. Construction: The permittee shall install leachate collection systems using a minimum collection pipe diameter of 6 inches. [401 KAR 45:110 Section 1, 401 KAR 45:140 Section 2]

5. Construction: The distance between leachate collection system cleanouts shall be 1,000 ft or less. [401 KAR 45:110 Section 1, 401 KAR 45:140 Section 2]

6. Operation: This facility shall not result in a public nuisance because of blowing litter, debris, or other waste or material including, but not limited to, dust. The permittee may utilize non-contact storm water run-off throughout the facility to control dust. The permittee may also apply process water and/or leachate in waste areas directly above the liner system on days without precipitation at a rate not to exceed 6,000 gallons per day to control dust. [401 KAR 30:031 Section 11, 401 KAR 45:140 Section 2]

7. Construction: The bottom liner of the Special Waste Landfill, which also serves as the closure cap of the Main Ash Pond (ACTV0004), shall meet the construction requirements outlined in the approved landfill application (APE20110003) and closure plan (APE20140007). Any proposed deviation from the approved plans must be submitted to the Cabinet for approval prior to construction activities. [401 KAR 45:140 Section 2, 401 KAR 45:110]

8. Financial Assurance: The maximum extent of operation includes the area of the landfill identified by an operating permit and for which the final cover Construction Progress Report has not yet been approved by the Cabinet. The current maximum extent of operation for this activity is less than or equal to 105.3 acres. [401 KAR 45:080]

9. Wastestreams: The owner or operator may dispose of utility wastes (fly ash, bottom ash, scrubber sludge) generated by the E. W. Brown Generating Facility located in Mercer County, Kentucky. Any new waste stream or source shall be approved by the Cabinet prior to accepting the waste. [401 KAR 45:110 Section 3(7), 401 KAR 45:040 Section 1(3)(o), KRS 224.50-760]

Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:

1. 05-01-2013 - Groundwater Assessment Plan - AIN20120001 (The assessment process is site-wide.)
2. 07-30-2014 - New Special Waste Landfill, Construction Permit - APE20110003
3. 08-27-2015 - Modification to Remove Tracer Requirement - APE20150004
4. 10-14-2015 - Groundwater Remedial Action Plan - ARM20150001 (The assessment process is site-wide.)
5. 09-22-2016 - Construction Progress Report, Phase 1 Liner (42.3 acres) - APE20160001

ACTV0004 - Coal Combustion Residuals Surface Impoundment

Variances, Alternate Specifications and Special Conditions:

1. General: ACTV0004 consists of the Main Ash Pond totaling 114.1 acres. The Special Waste Landfill (ACTV0002, 105.3 acres) shall be constructed and operated on top of this coal combustion by-products surface impoundment; the remaining 8.80 acres (area not overlapped by the landfill) represents the remaining portion of the Main Ash Pond operating under the authority of a registered permit-by-rule. [401 KAR 45:140 Section 2, 401 KAR 45:060 Section 2(2)]

2. General: The Main Ash Pond is upgraded from a Permit-by-Rule to a Registered Permit-by-Rule in accordance with the requirements of 401 KAR 45:060. [401 KAR 45:060 Section 2(2), 401 KAR 30:031]

3. Construction: The permittee shall mechanically compact the temporary cap of Phase 3 of the Main Ash Pond to at least 92 percent of maximum dry density. After completion, the Cabinet shall be notified within two (2) working days in order to schedule inspection of the temporary cap. [401 KAR 40:020 Section 2(4), 401 KAR 45:140 Section 2]

4. Closure: The closure cap of the Main Ash Pond, which also serves as the bottom liner of the Special Waste Landfill (ACTV0002), shall meet the construction and operating requirements outlined in the approved landfill application (APE20110003) and closure plan (APE20140007). Any proposed deviation from the approved plans must be submitted to the Cabinet for approval prior to construction activities. [401 KAR 45:110, 401 KAR 45:140 Section 2]

Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:

1. 05-01-2013 - Groundwater Assessment Plan - AIN20120001 (The assessment process is site-wide.)
2. 07-30-2014 - Upgrade from Permit-by-Rule to a Registered Permit-by-Rule - APE20110003
3. 07-30-2014 - Main Ash Pond Closure Plan - APE20140007
4. 10-14-2015 - Groundwater Remedial Action Plan - ARM20150001 (The assessment process is site-wide.)

ACTV0005 - Coal Combustion Residuals Surface Impoundment

Variances, Alternate Specifications and Special Conditions:

1. General: ACTV0005 consists of an ash pond totaling 29.9 acres and is identified as the Auxiliary Ash Pond. This coal combustion by-products surface impoundment is approximately 100 feet to the south of the Main Ash Pond (ACTV0004). [401 KAR 45:140 Section 2]

2. General: The Auxiliary Ash Pond is upgraded from a Permit-by-Rule to a Registered Permit-by-Rule in accordance with the requirements of 401 KAR 45:060. [401 KAR 45:060 Section 2(2), 401 KAR 30:031]

Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:

1. 05-01-2013 - Groundwater Assessment Plan - AIN20120001 (The assessment process is site-wide.)
2. 07-30-2014 - Upgrade from Permit-by-Rule to a Registered Permit-by-Rule - APE20110003
3. 10-14-2015 - Groundwater Remedial Action Plan - ARM20150001 (The assessment process is site-wide.)

Financial Assurance

ACTV0003 - Financial Assurance

The following is a history of the financial assurance for this facility:

1. 09-12-2014 - SB # 106094008, $3,000.000.00
2. 09-13-2016 - SB# 106569019, $12,614,738.00

Monitoring Conditions

GSTR0002 - Groundwater Monitoring - Spring Monitoring Group

Group Members: STRC0007 - Spring CH-040; STRC0008 - Spring CH-044; STRC0009 - Spring CH-057; STRC0010 - Spring CH-052

Standard Requirements:

1. The owner or operator shall satisfy the requirements of 401 KAR 45:160 for all wastes and waste constituents contained in the site or facility. [401 KAR 45:160 Section 1]

2. The permittee shall monitor for other parameters as required by the Cabinet. [401 KAR 45:160 Section 8(2)(c)]

3. The owner or operator shall monitor groundwater on the approved schedule at each approved groundwater monitoring location in accordance with 401 KAR 45:160, the permit, and the approved plans. A table summarizing the parameters to be monitored, their respective limits and monitoring frequency is included herein. [401 KAR 45:160, 401 KAR 45:140 Section 1(1)]

4. The groundwater analytical data and statistical analysis shall be submitted on forms provided by the Cabinet, within sixty (60) days after sampling or 15 days of the completion of statistical analysis, whichever is sooner. [401 KAR 45:160 Section 4]

5. If the analysis of groundwater sample results indicates contamination (i.e., a statistical or MCL exceedence) as specified in 401 KAR 45:160 Section 5, the owner or operator shall notify the Cabinet within (forty-eight) 48 hours of receiving the results and shall arrange to split samples no later than ten (10) days from the receipt of the results. [401 KAR 45:160 Section 5]

6. The owner or operator shall provide alternate water supplies to all affected parties within twenty-four (24) hours of notification of the Cabinet that sample results indicate contamination of a drinking water supply if it has been determined that the special waste site or facility is the probable source of the contamination. [401 KAR 45:160 Section 3]

7. If required by the Cabinet, groundwater contamination assessment and corrective action shall be performed in full compliance with all provisions of 401 KAR 45:160 Section 5. [401 KAR 45:160 Section 5]

Variances, Alternate Specifications and Special Conditions:

1. General: GSTR0002 - Groundwater Monitoring-Spring Monitoring Group applies to the entire site. Activities included are ACTV0002, ACTV0004 and ACTV0005. [401 KAR 45:160]

2. Groundwater Assessment: The owner or operator shall submit a groundwater assessment report meeting the requirements of 401 KAR 45:160. [401 KAR 45:160, 401 KAR 45:030 Section 9(12), 401 KAR 45:140 Section 2]

3. Remedial Action Plan: The owner or operator shall, no later than 90 days of Cabinet approval of the Groundwater Assessment Report, submit a remedial action plan that meets the requirements of 401 KAR 45:160. [401 KAR 45:160, 401 KAR 45:030 Section 9(12), 401 KAR 45:140 Section 2]

4. Groundwater Monitoring: The permittee shall monitor Stonewall Spring (CH-052) as the background monitoring point in accordance with the approved groundwater monitoring plan. [401 KAR 45:160 Section 2(3)]

5. Groundwater Monitoring: The permittee shall monitor Dam Toe Right Spring (CH-040), Ditch Spring (CH-044), and Briar Patch Spring (CH-057) as the downgradient compliance monitoring points in accordance with the approved groundwater monitoring plan. Because the original location of the monitoring point for Dam Toe Right has been covered as a consequence of construction, this monitoring point shall be moved to the cutoff wall toe drain. [401 KAR 45:140 Section 2, 401 KAR 45:160 Section 2(3)]

6. Groundwater Monitoring: The permittee shall monitor groundwater at all approved monitoring locations pursuant to 401 KAR 45:160. Groundwater monitoring parameters listed in this permit were determined by the Cabinet based on the chemical analysis of the waste to be disposed pursuant to 401 KAR 45:160 Section 8(3). [401 KAR 45:140 Section 2, 401 KAR 45:160 Section 8(3)]

7. The owner or operator shall conduct statistical analysis of the groundwater data in accordance with 401 KAR 45:160 Section 6 and the approved applications. The statistical test chosen shall be conducted separately for each parameter at each monitoring location for each monitoring event. The results shall be maintained as part of the facility record throughout the operating and post-closure life of the facility. [401 KAR 45:160 Section 6, 401 KAR 45:140 Section 1(1)]

8. The owner or operator shall be required to prepare and submit an additional groundwater contamination assessment plan if laboratory analyses of one (1) or more public or private water supplies, or monitoring locations at the site, shows the presence of one (1) or more parameters above the maximum contaminant level (MCL), as specified in 401 KAR 30:031 or a statistically significant increase over background levels for parameters that have no MCL. [401 KAR 45:160 Section 5, 401 KAR 30:031]

PERMIT

Groundwater Monitoring Limits:

Subject Item	CAS Number	Parameter	Frequency	Lower Limit	Upper Limit	Units	Statistical Limit	Report Only
GSTR0002	07440-36-0	Antimony, Total (as Sb)	semiannually		0.006	mg/L		
GSTR0002	07440-38-2	Arsenic, Total (as As)	semiannually		0.01	mg/L		
GSTR0002	07440-39-3	Barium, Total (as Ba)	semiannually		2.0	mg/L		
GSTR0002	07440-41-7	Beryllium, Total	semiannually		0.004	mg/L		
GSTR0002	07440-42-8	Boron	semiannually			mg/L	Yes	
GSTR0002	07440-43-9	Cadmium, Total (as Cd)	semiannually		0.005	mg/L		
GSTR0002	07440-70-2	Calcium	semiannually			mg/L	Yes	
GSTR0002		Carbon, Total Organic	semiannually			mg/L	Yes	
GSTR0002		Chemical Oxygen Demand (COD)	semiannually			mg/L	Yes	
GSTR0002	16887-00-6	Chloride	semiannually			mg/L	Yes	
GSTR0002	07440-47-3	Chromium, Total (as Cr)	semiannually		0.1	mg/L		
GSTR0002	07440-48-4	Cobalt, Total	semiannually			mg/L	Yes	
GSTR0002	16984-48-8	Fluoride	semiannually		4.0	mg/L		
GSTR0002		Groundwater Elevation	semiannually			feet above mean sea level based on a USGS datum		Yes
GSTR0002	07439-89-6	Iron, Total (as Fe)	semiannually			mg/L	Yes	
GSTR0002	07439-92-1	Lead, Total (as Pb)	semiannually		0.015	mg/L		
GSTR0002		Lithium, (Total) as Li	semiannually			mg/L	Yes	
GSTR0002	07439-97-6	Mercury, Total (as Hg)	semiannually		0.002	mg/L		
GSTR0002		Molybdenum, Total (as Mo)	semiannually			mg/L	Yes	
GSTR0002		Radium 226 + Radium 228, Total	semiannually		5.0	pCi/L		
GSTR0002	07782-49-2	Selenium, Total (as Se)	semiannually		0.05	mg/L		
GSTR0002		Sodium, Total (as Na)	semiannually			mg/L	Yes	
GSTR0002		Solids, Total Dissolved	semiannually			mg/L	Yes	
GSTR0002		Specific Conductance	semiannually			umho/cm	Yes	
GSTR0002		Sulfate, Total (as SO4)	semiannually			mg/L	Yes	
GSTR0002		Temperature, Water Deg. Fahrenheit	semiannually			degrees Fahrenheit		Yes
GSTR0002	07440-05-3	Thallium, Total	semiannually		0.002	mg/L		
GSTR0002		pH	semiannually	6.0	8.5	standard units		

Kentucky Utilities Company

Application Exhibit 4

Maps and Drawings

a PPL company

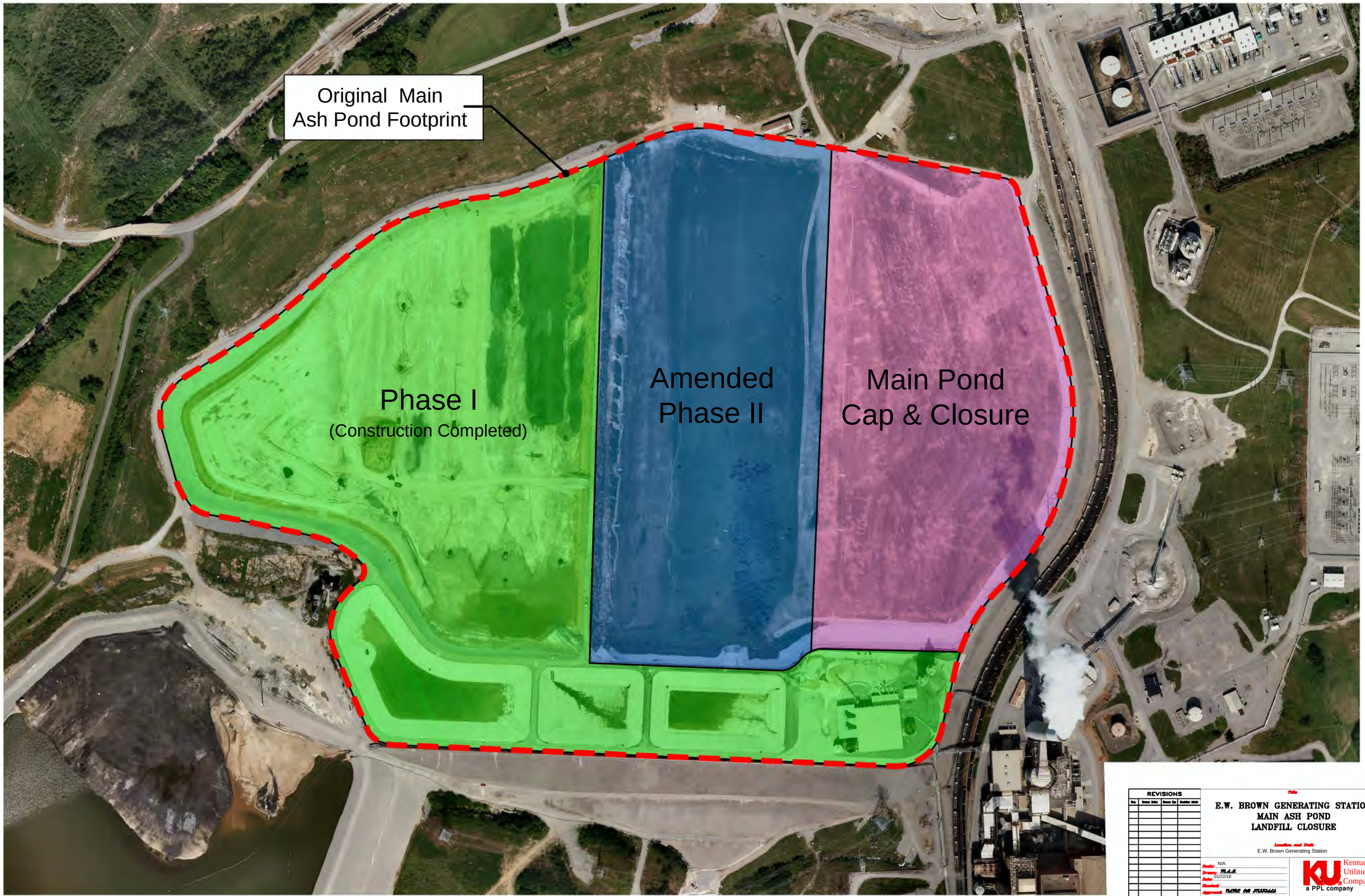
0 25 50 75 100 Miles

0 25 50 75 100 KM

Parallel scale at 38°N 0°E

a PPL company

E.W. BROWN GENERATING STATION
OVERALL SITE PLAN



REVISIONS			
No.	Drawn Date	Drawn By	Revision Made

Title

E.W. BROWN GENERATING STATION
MAIN ASH POND
LANDFILL CLOSURE

Location and Unit
E.W. Brown Generating Station

Kentucky Utilities Company
a PPL company

Scale: N/A
Drawn: M.A.R.
Date: 01/22/18
Checked:
Approved: PLANT GM SIGNATURE

JOB NO.	JOB NO.	JOB NO.	JOB NO.	Drawing No:	Rev.
NUMBER				Exhibit	A

DMS Version 2.0

Kentucky Utilities Company

Application Exhibit 5

Environmental Cost Recovery Surcharge

Tariff Sheets - Clean Version

Kentucky Utilities Company

P.S.C. No. 18, First Revision of Original Sheet No. 87
Canceling P.S.C. No. 18, Original Sheet No. 87

Adjustment Clause **ECR**

Environmental Cost Recovery Surcharge

APPLICABLE

In all territory served.

AVAILABILITY OF SERVICE

This schedule is mandatory to all Standard Electric Rate Schedules listed in Section 1 of the General Index except PSA and Special Charges, all Pilot Programs listed in Section 3 of the General Index, and the FAC (including the Off-System Sales Tracker) and DSM Adjustment Clauses. Standard Electric Rate Schedules subject to this schedule are divided into Group 1 or Group 2 as follows:

Group 1: Rate Schedules RS; RTOD-Energy; RTOD-Demand; VFD; AES; LS; RLS; LE; and TE.
Group 2: Rate Schedules GS; PS; TODS; TODP; RTS; FLS; EVSE; EVC; SPS; STOD; and OSL.

RATE

The monthly billing amount under each of the schedules to which this mechanism is applicable, shall be increased or decreased by a percentage factor calculated in accordance with the following formula.

Group Environmental Surcharge Billing Factor = Group E(m) / Group R(m)

As set forth below, Group E(m) is the sum of Jurisdictional E(m) of each approved environmental compliance plan revenue requirement of environmental compliance costs for the current expense month allocated to each of Group 1 and Group 2. Group R(m) for Group 1 is the 12-month average revenue for the current expense month and for Group 2 it is the 12-month average non-fuel revenue for the current expense month.

DEFINITIONS

1) For all Plans, E(m) = [(RB/12) (ROR + (ROR – DR) (TR / (1 – TR))] + OE – EAS + BR
   a) RB is the Total Environmental Compliance Rate Base.
   b) ROR is the Rate of Return on Environmental Compliance Rate Base, designated as the overall rate of return [cost of short-term debt, long-term debt, preferred stock, and common equity].
   c) DR is the Debt Rate [cost of short-term debt, and long-term debt].
   d) TR is the Composite Federal and State Income Tax Rate.
   e) OE is the Operating Expenses. OE includes operation and maintenance expense recovery authorized by the K.P.S.C. in all approved ECR Plan proceedings.
   f) EAS is the total proceeds from emission allowance sales.
   g) BR is the operation and maintenance expenses, and/or revenues if applicable, associated with Beneficial Reuse.
   h) Plans are the environmental surcharge compliance plans submitted to and approved by the Kentucky Public Service Commission pursuant to KRS 278.183.

DATE OF ISSUE: January 26, 2018

DATE EFFECTIVE: July 31, 2018

ISSUED BY: /s/ Robert M. Conroy, Vice President
State Regulation and Rates
Lexington, Kentucky

Issued by Authority of an Order of the Public Service Commission in Case No. 2017-00483 dated XXXX

Adjustment Clause **ECR**

Environmental Cost Recovery Surcharge

DEFINITIONS (continued)

2) Total E(m) (sum of each approved environmental compliance plan revenue requirement) is multiplied by the Jurisdictional Allocation Factor. Jurisdictional E(m) is adjusted for any (Over)/Under collection or prior period adjustment and by the subtraction of the Revenue Collected through Base Rates for the Current Expense month to arrive at Adjusted Net Jurisdictional E(m). Adjusted Net Jurisdictional E(m) is allocated to Group 1 and Group 2 on the basis of Revenue as a Percentage of Total Revenue for the 12 months ending with the Current Month to arrive at Group 1 E(m) and Group 2 E(m).

3) The Group 1 R(m) is the average of total Group 1 monthly base revenue for the 12 months ending with the current expense month. Base revenue includes the customer, energy, and lighting charges for each rate schedule included in Group 1 to which this mechanism is applicable and automatic adjustment clause revenues for the Fuel Adjustment Clause and the Demand-Side Management Cost Recovery Mechanism as applicable for each rate schedule in Group 1.

4) The Group 2 R(m) is the average of total Group 2 monthly base non-fuel revenue for the 12 months ending with the current expense month. Base non-fuel revenue includes the customer, non-fuel energy, and demand charges for each rate schedule included in Group 2 to which this mechanism is applicable and automatic adjustment clause revenues for the Demand-Side Management Cost Recovery Mechanism as applicable for each rate schedule in Group 2. Non-fuel energy is equal to the tariff energy rate for each rate schedule included in Group 2 less the base fuel factor as defined on Sheet No. 85.1, Paragraph 6.

5) Current expense month (m) shall be the second month preceding the month in which the Environmental Surcharge is billed.

DATE OF ISSUE: January 26, 2018

DATE EFFECTIVE: July 31, 2018

ISSUED BY: /s/ Robert M. Conroy, Vice President
State Regulation and Rates
Lexington, Kentucky

Issued by Authority of an Order of the Public Service Commission in Case No. 2017-00483 dated XXXX

Kentucky Utilities Company

Application Exhibit 5

Environmental Cost Recovery Surcharge

Tariff Sheets - Redline Version

Kentucky Utilities Company

P.S.C. No. 18, First Revision of Original Sheet No. 87
Canceling P.S.C. No. 18, Original Sheet No. 87

Adjustment Clause **ECR**

Environmental Cost Recovery Surcharge

APPLICABLE

In all territory served.

AVAILABILITY OF SERVICE

This schedule is mandatory to all Standard Electric Rate Schedules listed in Section 1 of the General Index except PSA and Special Charges, all Pilot Programs listed in Section 3 of the General Index, and the FAC (including the Off-System Sales Tracker) and DSM Adjustment Clauses. Standard Electric Rate Schedules subject to this schedule are divided into Group 1 or Group 2 as follows:

Group 1: Rate Schedules RS; RTOD-Energy; RTOD-Demand; VFD; AES; LS; RLS; LE; and TE.
Group 2: Rate Schedules GS; PS; TODS; TODP; RTS; FLS; EVSE; EVC; SPS; STOD; and OSL.

RATE

The monthly billing amount under each of the schedules to which this mechanism is applicable, shall be increased or decreased by a percentage factor calculated in accordance with the following formula.

Group Environmental Surcharge Billing Factor = Group E(m) / Group R(m)

As set forth below, Group E(m) is the sum of Jurisdictional E(m) of each approved environmental compliance plan revenue requirement of environmental compliance costs for the current expense month allocated to each of Group 1 and Group 2. Group R(m) for Group 1 is the 12-month average revenue for the current expense month and for Group 2 it is the 12-month average non-fuel revenue for the current expense month.

DEFINITIONS

1) For all Plans, E(m) = [(RB/12) (ROR + (ROR – DR) (TR / (1 – TR))] + OE – EAS + BR
   a) RB is the Total Environmental Compliance Rate Base.
   b) ROR is the Rate of Return on Environmental Compliance Rate Base, designated as the overall rate of return [cost of short-term debt, long-term debt, preferred stock, and common equity].
   c) DR is the Debt Rate [cost of short-term debt, and long-term debt].
   d) TR is the Composite Federal and State Income Tax Rate.
   e) OE is the Operating Expenses. OE includes operation and maintenance expense recovery authorized by the K.P.S.C. in all approved ECR Plan proceedings.
   f) EAS is the total proceeds from emission allowance sales.
   g) BR is the operation and maintenance expenses, and/or revenues if applicable, associated with Beneficial Reuse.
   h) Plans are the environmental surcharge compliance plans submitted to and approved by the Kentucky Public Service Commission pursuant to KRS 278.183.

DATE OF ISSUE: January 26, 2018

Deleted: July 7, 2017

DATE EFFECTIVE: July 31, 2018

Deleted: July 1, 2017

ISSUED BY: /s/ Robert M. Conroy, Vice President
State Regulation and Rates
Lexington, Kentucky

Issued by Authority of an Order of the Public Service Commission in Case No. 2017-00483 dated XXXX

Deleted: 2016-00370

Deleted: June 22, 2017 and modified June 29, 2017

Kentucky Utilities Company

P.S.C. No. 18, First Revision of Original Sheet No. 87.1
Canceling P.S.C. No. 18, Original Sheet No. 87.1

Adjustment Clause **ECR**
Environmental Cost Recovery Surcharge

DEFINITIONS (continued)

2) Total E(m) (sum of each approved environmental compliance plan revenue requirement) is multiplied by the Jurisdictional Allocation Factor. Jurisdictional E(m) is adjusted for any (Over)/Under collection or prior period adjustment and by the subtraction of the Revenue Collected through Base Rates for the Current Expense month to arrive at Adjusted Net Jurisdictional E(m). Adjusted Net Jurisdictional E(m) is allocated to Group 1 and Group 2 on the basis of Revenue as a Percentage of Total Revenue for the 12 months ending with the Current Month to arrive at Group 1 E(m) and Group 2 E(m).

3) The Group 1 R(m) is the average of total Group 1 monthly base revenue for the 12 months ending with the current expense month. Base revenue includes the customer, energy, and lighting charges for each rate schedule included in Group 1 to which this mechanism is applicable and automatic adjustment clause revenues for the Fuel Adjustment Clause and the Demand-Side Management Cost Recovery Mechanism as applicable for each rate schedule in Group 1.

4) The Group 2 R(m) is the average of total Group 2 monthly base non-fuel revenue for the 12 months ending with the current expense month. Base non-fuel revenue includes the customer, non-fuel energy, and demand charges for each rate schedule included in Group 2 to which this mechanism is applicable and automatic adjustment clause revenues for the Demand-Side Management Cost Recovery Mechanism as applicable for each rate schedule in Group 2. Non-fuel energy is equal to the tariff energy rate for each rate schedule included in Group 2 less the base fuel factor as defined on Sheet No. 85.1, Paragraph 6.

5) Current expense month (m) shall be the second month preceding the month in which the Environmental Surcharge is billed.

DATE OF ISSUE: January 26, 2018

DATE EFFECTIVE: July 31, 2018

ISSUED BY: /s/ Robert M. Conroy, Vice President
State Regulation and Rates
Lexington, Kentucky

Issued by Authority of an Order of the Public Service Commission in Case No. 2017-00483 dated XXXX

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