HollyFrontier Tulsa Refining LLC
1700 S. Union Avenue, Tulsa, Oklahoma 74107
Tel: 918-594-6000
hollyfrontier.com

December 10, 2021

Hillary Young
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality
707 North Robinson, P.O. Box 1677
Oklahoma City, Oklahoma 73101-1677

Re: Class 2 Permit Modification Request
HollyFrontier Tulsa Refining LLC – Tulsa East Refinery
EPA ID OKD990750960 / Permit # 990750960

Dear Ms. Young:

HollyFrontier Tulsa Refining LLC – East Refinery (HFTR) is submitting this request for a Class 2 permit modification to Post-Closure Permit No. 990750960 (Permit) for the HFTR East Refinery located at 902 W. 25th Street, Tulsa, Oklahoma 74107. The permit modification requests approval of a final remedial action for the riverbank area south of Zink Dam. The remedial action involves installation of a containment cap and collection system that will prevent hydrocarbon sheen from entering the Arkansas River at the location of the proposed remedy. The permit modification contains details of the installation, performance standards, and operation and maintenance of the remedial action.

The April 2, 2021 letter from HFTR to the Oklahoma Department of Environmental Quality (DEQ), *Conceptual Design for Interim Remedy to Mitigate Hydrocarbon Sheen,* provided the conceptual design of the containment cap and collection system. DEQ approved the conceptual design by letter dated July 20, 2021 and requested a final design package for review. Based on discussions with DEQ, HFTR intends to designate this as a final remedy via this permit modification.

HFTR is required to provide financial assurance (FA) per Title 40 Code of Federal Regulations (CFR) Part 264.101(c) for corrective actions beyond the facility property boundary. In the March 25, 2021 annual update of the FA that HFTR submitted to DEQ, HFTR included financial assurance for the cost to install the LNAPL Containment Cap and Collection System and costs for operation, maintenance and monitoring (OM&M) for 30 years.

The remedial objective identified by HFTR is to mitigate the potential for hydrocarbon sheens from forming along the bank of the Arkansas River. The design must also be compatible with the City of Tulsa and Tulsa Gathering Place development along the river associated with construction of the new Zink Dam and Gateway Bridge. A light non-aqueous phase liquid (LNAPL) containment cap remedy was selected as the most technically effective long-term solution to address the hydrocarbon sheen and most compatible with the current development along the river, including consideration for long-term aesthetics. The LNAPL containment cap is a proven and patented technology used at numerous similar projects. For these reasons, the LNAPL containment cap is considered an appropriate remedy.

The LNAPL containment cap will be placed from the base of the riverbed to the current top of the bank. The low permeability layer of the containment cap will act as a baffle (like an oil/water separator) and trap the lighter oil behind it while allowing groundwater to discharge underneath through the toe vent. This will allow groundwater levels behind the containment cap to maintain equilibrium with fluctuating river levels enhancing long-term slope stability. The low permeability layer will also create a physical barrier between residual hydrocarbons in the soil and the river water thus eliminating the potential for a hydrocarbon sheen. This capping system will allow containment of the full extent of the seep and impacted soil. The low permeability layer will consist of AquaBlok®, which is a proprietary product that consists of an aggregate coated with a layer of bentonite. When hydrated, AquaBlok® takes on the low-permeability property of

bentonite, reinforced with the strength of the aggregate. LNAPL extraction, as needed, will be incorporated into the containment cap design in the form of three LNAPL collection sumps that will be laid beneath the low permeability layer in a continuous layer of crushed stone. These sumps allow efficient removal of LNAPL via pump, vacuum truck and/or cartridges of sorbent media (e.g., petroleum absorbent socks). The containment cap will be finished with a protective layer consisting of articulated block mattress (ABM).

The sequence of containment cap construction is as follows:

- Install a coffer dam to protect the work area.
- Grade (cut and fill, as necessary) the riverbank to the slope of the containment cap.
- Place the AquaGate+Organoclay® toe vent gabions.
- Place a 12-inch thick layer of washed crushed stone (LNAPL collection layer) on the general fill/cut surface.
- Install the three 8-inch diameter LNAPL collection sumps in the layer of crushed stone.
- Place a 6-inch thick layer of AquaBlok® (low permeability layer) on top of the crushed stone.
- Place a 6-inch thick layer of select crushed stone bedding on top of the AquaBlok® (erosion protection layer).
- Place a 6-inch thick articulated block mattress (ABM) armor over the crushed stone bedding (erosion protection layer).
- Reposition the rock from the temporary diversion structure along the AquaGate+Organoclay® toe vent gabion as a supporting toe buttress.

Any waste or impacted soil from the cut portion of the project will be characterized and appropriately managed based on the characterization. It is anticipated that most of the waste and impacted material will be disposed as non-hazardous waste. The projected scope has a minimal volume of cut area and the project does not include excavation beyond what is required to install the cap & trap

Proposed Modification to Permit No. 990750960

HFTR proposes the following permit modifications as noted below:

Add Permit Condition III.J.7

HFTR is proposing to add Permit Condition III.J.7 as follows:

- The Permittee shall implement the LNAPL Containment Cap and Collection System as specified in the Permittee's *Operation, Maintenance and Monitoring Plan for the LNAPL Containment Cap and Collection System*, Permit Attachment 6. The Permittee will document the performance of the system, any necessary changes in inspections or monitoring, and any alterations of the containment cap and collection system in the semi-annual groundwater monitoring reports required by Permit Condition III.Q.2.

Provide Public Notice

As a Class 2 permit modification request, HFTR will mail and publish notice within 7 days before or after submittal of the modification package to DEQ. To facilitate this, a copy of the proposed public notice is included, that identifies the 60-day comment period, and provides announcement of the date, time and place of the public meeting. HFTR will provide evidence of the mailing and publication to DEQ. In addition, HFTR will make a copy of the permit modification request available in the Tulsa City County Library. The Public Notice language and mailing lists are provided as an attachment to this letter.

Add (New) Attachment 6, Operation, Maintenance and Monitoring Plan for the LNAPL Containment Cap and Collection System

HFTR is proposing to add a new Attachment 6 to the permit documents, that includes the following:

- *Operation, Maintenance and Monitoring Plan for the LNAPL Containment Cap and Collection System*
  - The OM&M Plan includes a description of the Containment Cap and Collection System; a proposed monitoring plan and schedule; discussion of maintenance activities; and performance standards and contingency plans.
  - The OM&M Plan includes the 100% design drawings in Appendix A, as requested in DEQ's July 20, 2021 letter.
  - Appendix B of the OM&M Plan contains example monitoring and maintenance forms and logs.

Modification Type and Classification

According to 40 CFR §270.42(a), Appendix I.C.8.b, incorporated by reference in OAC 252:205-3-2(k), the requests fall under a Class 2 modification, as a change to a corrective action program.

Modification Notice

Per the requirements of 40 CFR §270.42(a), HFTR will send a notice of the modification request to all persons on the facility mailing list maintained by the Director and to the appropriate units of State and local government. The notification will be made within 7 days before or after submittal of the modification.

This Report is consistent with the reporting requirements of the December 1, 2020 Resource Conservation and Recovery Act (RCRA) Corrective Action and Post-Closure Permit for the Remediation and Monitoring of Closed Hazardous Waste Management Units (OKD990750960). The permit modification request will go into the public repository today, December 10, 2021.

Thank you for your consideration of this modification. If you have any questions, or require additional information, please contact Brian Moore at (918) 935-6695 or Jennifer Sanchez at (918) 588-1167.

Sincerely,

Jennifer Sanchez
Environmental Manager
HollyFrontier Tulsa Refining LLC

Attachments: Public Notice and Mailing Lists
Permit Attachment 6, *Operation, Maintenance and Monitoring Plan for the LNAPL Containment Cap and Collection System*

cc: Arsin Sahba, HollyFrontier
Mike Holder, HollyFrontier
Brian Moore, HollyFrontier
Catriona Smith, TRC

PUBLIC NOTICE
AND
MAILING LISTS

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY
NOTICE OF PERMIT MODIFICATION REQUEST SUBMITTAL, PUBLIC REPOSITORY AVAILABILITY, AND PUBLIC MEETING

On December 10, 2021, HollyFrontier Tulsa Refining LLC (HFTR), East Refinery (the Refinery), submitted a Class 2 application for modification of the Resource Conservation and Recovery Act (RCRA) Corrective Action and Post-Closure Permit (No. 990750960) for the Refinery. In accordance with Title 40 Code of Federal Regulations (CFR) §270.42(b), and Oklahoma Administrative Code (OAC) 252:205-3-2(k), the Refinery posts this notice of the modification request submittal, repository availability, public meeting announcement, and opportunity for public comment. The Refinery is located in Township 19 North, Range 12 East, Sections 13, 14, 23 and 24, Tulsa County, Oklahoma at the following address:

HollyFrontier Tulsa Refining LLC
902 W 25th Street
Tulsa, Oklahoma 74107

The applicant requests approval of a remedial action for the riverbank area south of Zink Dam. The remedial action involves installation of a containment cap and collection system that will prevent hydrocarbon sheen from entering the Arkansas River at the location of the proposed remedy. The permit modification contains details of the installation, and operation and maintenance of the remedial action.

In accordance with 40 CFR 270.42(b)(3) interested citizens are invited to review copies of the application at the HFTR East Refinery document repository at the Tulsa City County Library at the following address:

Tulsa City County Library
400 Civic Center
Tulsa, OK 74103
(918) 549-7323

Or at the Oklahoma Department of Environmental Quality's (DEQ's) main office in Oklahoma City at the following address:

Oklahoma Department of Environmental Quality
707 North Robinson, PO Box 1677
Oklahoma City, OK 73101
Phone: (405) 702-5100

A copy of the permit modification may be accessed at:
https://www.deq.ok.gov/land-protection-division/permit-public-participation-process/

The designated facility contact who will address questions regarding the submittal is:

Arsin Sahba, P.G.
Corporate Environmental Specialist - Remediation
HollyFrontier Corporation
2828 N. Harwood, Suite 1300
Dallas, TX 75201
Phone: (972) 689-8540

In accordance with 40 CFR 270.42(b)(4), a public meeting to answer questions about the application has been scheduled for January 19, 2022 at 6:00 pm at the following location: Zarrow Public Library, 2224 W 51st St, Tulsa, OK 74107.

In accordance with 40 CFR 270.42(b)(5), written comments will be accepted from the public for 60 days from the publication of this notice and must be postmarked by February 14, 2022. Any person may submit written comments during the comment period; only those issues relevant to the proposed modifications are open for comment. Comments should be sent to the following DEQ contact:

Hillary Young
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality
707 North Robinson, PO Box 1677
Oklahoma City, OK 73101
Phone: (405) 702-5100

The permittee's compliance history during the life of the permit being modified is available from the DEQ contact person.

Date: December 10, 2021

Oklahoma Corp. Commission Jim Thorpe Bldg.
2101 N. Lincoln Blvd #129
Oklahoma City, OK 73105

Oklahoma Geological Survey
Sarkeys Energy Center
100 E. Boyd, Suite N-131
Norman, OK 73019-0628

State Historic Preservation Office
Oklahoma Historical Society
800 Nazih Zuhdi Drive
Oklahoma City, OK 73105

OK Water Resources Board
3800 N. Classen Blvd
Oklahoma City, Ok 73118

Oklahoma Department of Wildlife Conservation
1801 N. Lincoln Blvd
Oklahoma City, OK 73152

City of Tulsa City Council Office
175 E. 2nd St., 4th Floor
Tulsa, OK 74103

Director
US Geological Survey
202 NW 66th St., Suite 7
Oklahoma City, OK 73116

OK Conservation Commission
2800 Lincoln Blvd., Suite 200
Oklahoma City, OK 73105-4210

Tulsa DEQ Regional Office
9933 E 16th St.
Tulsa, OK 74128-4643

David Gray, Regional Administrator (6A)
US EPA Region VI
1201 Elm Street, Suite 500
Dallas, TX 75270

Ronnie Crossland, Director
Land, Chemicals & Redevelopment Division
US EPA Region VI
1201 Elm Street, Suite 500
Dallas, TX 75270

Field Supervisor
US Fish & Wildlife Service
9014 E 21st St.
Tulsa, OK 74129-1428

US Corps of Engineers Public Affairs Office
2488 E 81st Street
Tulsa, OK 74137

Bureau of Land Management
201 Stephenson Parkway, Suite 1200,
Norman, OK 73072

U.S Department of Agriculture
NRCS Oklahoma
100 USDA, Suite 206
Stillwater, OK 74074-2655

Tara Baker, Chairperson
Sierra Club
PO Box 60644
Oklahoma City, OK 73146-0644

Oklahoma Archeological Society
111 East Chesapeake St., Rm 102
Norman, OK 73019-5111

County of Tulsa
County Commissioner Office
500 S. Denver Ave.
Tulsa, OK 74103

*Addresses obtained through ODEQ list and confirmed/updated by TRC 12/09/21

FIRST BAPTIST CHURCH OF BROKEN ARROW OKLAHOMA
100 W ALBANY ST
BROKEN ARROW, OK 74012-8284

OKLAHOMA POWER CO
C/O PUBLIC SERVICE CO ATT PROPERTY TAX
PO BOX 660164
DALLAS, TX 75266

TEXAS-EMPIRE PIPELINE
C/O ENBRIDGE PIPELINES LLC-ROW DEPT
119 N 25TH ST E
SUPERIOR, WI 54880

GARRETT AND COMPANY
ATT CHERIE GARRETT MARTIN
9701 N BROADWAY EXTENSION
OKLAHOMA CITY, OK 73114

ONE BANK AND TRUST CO C/O SHARON GRIFFITH 8909 S YALE AVE STE 100
TULSA, OK 74136

WANEMACHER, JOSEPH M & MARK A
5110 S YALE STE 414
TULSA, OK 74133

GOODWILL INDUSTRIES OF TULSA INC
2800 SOUTHWEST BLVD
TULSA, OK 74107

PUBLIC SERVICE CO OF OKLA
212 E 6TH ST
TULSA, OK 74119

COCHRAN, GARY G 2444 S OLYMPIA AVE
TULSA, OK 74107

GRISEZ, WILLIAM R AND MARGARET RITA TRUSTEES
WILLIAM R GRISEZ TRUST
3833 S TRENTON AVE
TULSA, OK 74105

REMINGTON INVESTMENTS LLC
4626 E 31ST ST
TULSA, OK 74135

EET INVESTMENTS LLC
3310 S SANTA FE AVE
TULSA, OK 74107

CITY OF TULSA
175 E 2ND ST STE 260
TULSA, OK 74103

RIVER PARKS AUTHORITY
2121 S COLUMBIA, SUITE 205
TULSA, OK 74114

CLAYBON, JOHN
927 W 25TH ST
TULSA, OK 74107

NALL, TIMOTHY AND BARBARA
318 N MCKINLEY
SAND SPRINGS, OK 74063

SOUTHWEST BOULEVARD PROPERTIES LLC
C/O HOEY CONST
3310 SOUTHWEST BLVD
TULSA, OK 74107

DM WESTERN PINES LLC
5305 VILLAGE CREEK
PLANO, TX 75093

NALL, TIMOTHY AND BARBARA
PO BOX 9563
TULSA, OK 74157

SUAP LLC
18100 W 51ST ST S
SAND SPRINGS, OK 74063

FRED STORER
420 SOUTH MAIN ST., SUITE 205
TULSA, OK 74103

AMERICAN WASTE CONTROL INC
1420 W 35TH ST
TULSA, OK 74107

BROOKS, NALL R INC
PO BOX 9563
TULSA, OK 74157

*Addresses obtained from GIS tax data.

PERMIT ATTACHMENT 6
OPERATION, MAINTENANCE AND MONITORING PLAN FOR THE LNAPL CONTAINMENT CAP AND COLLECTION SYSTEM

HOLLYFRONTIER TULSA REFINING LLC
TULSA EAST REFINERY
TULSA, OKLAHOMA

PERMIT ATTACHMENT 6

OPERATION, MAINTENANCE AND MONITORING PLAN FOR THE LNAPL CONTAINMENT CAP AND COLLECTION SYSTEM

DECEMBER 2021

OPERATION, MAINTENANCE AND MONITORING PLAN FOR THE LNAPL CONTAINMENT CAP AND COLLECTION SYSTEM
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Operation, Maintenance and Monitoring Plan for the
LNAPL Containment Cap and Collection System
December 2021

1.0 INTRODUCTION

1.1 Project Background

This Operation, Maintenance and Monitoring Plan (herein after the OM&M Plan or Plan) has been prepared for the light non-aqueous phase liquid (LNAPL) containment cap and collection system. The Plan presents the activities and methods to perform routine monitoring, inspections and maintenance, evaluate site conditions and performance standards, and report results and findings, following the installation of the LNAPL containment cap and collection system at the Tulsa East Refinery (EPA ID: OKD990750960) in Tulsa, Oklahoma (Site).

A LNAPL plume appears to extend from areas within the facility in the north to areas adjacent to the Arkansas River to the south on property owned by American Electric Power/Public Service Company of Oklahoma (AEP/PSO). Investigation work indicates that the LNAPL likely consists of medium to heavy-end hydrocarbon such as a weathered petroleum naphtha. The investigation concluded that the LNAPL plume appears to be stable and is predominantly comprised of residual phase LNAPL, which is not mobile and is primarily trapped within the soil pores. The LNAPL plume adjacent to the river appears to be influenced by fluctuations in river level and bank erosion, causing sporadic hydrocarbon sheen on the surface of the water only during extremely low river levels.

The remedial objective identified by HFTR is to mitigate the potential for hydrocarbon sheens from forming along the bank of the Arkansas River in the vicinity of the containment cap. A LNAPL containment cap remedy was selected as the most technically effective long-term solution to address the hydrocarbon sheen and most compatible with the current development along the river, as further described in the *Conceptual Design for Interim Remedy to Mitigate Hydrocarbon Sheen* as submitted to the Oklahoma Department of Environmental Quality (DEQ) on April 2, 2021 (HFTR).

The LNAPL containment cap is planned to be constructed in 2022 in accordance with the *HollyFrontier Tulsa East River Bank LNAPL Trapping Cap* design drawings (TRC, 2021). The design drawings are provided in Appendix A. Details regarding the remedy installation will be available following construction in a separate construction completion report, which should be referenced by those performing monitoring as described in this Plan.

1.2 Site Setting

The planned LNAPL containment cap will be located on AEP/PSO property adjacent to the Arkansas River downstream of Zink Dam (Figure 1). Surface water in the river flows south through the City of Tulsa. At the location of the proposed containment cap, the river elevation typically fluctuates between 605 to 615 feet relative to mean sea level (MSL).

In general, the lithology in the area is comprised of a flood plain alluvium from ground surface up to 40 feet below ground surface (ft-bgs) consisting of silty sand, very fine to coarse sand, gravelly sand, and discontinuous lenses of silty clay in a generally fining upward sequence. Locally within the Site, these sediments are consistently composed of relatively homogenous fine to coarse sand, with minor amounts of silt and gravel that coarsens with depth. The bedrock is a shale of the Coffeyville Formation that is encountered at the Site at depths from 15 to 40 ft-bgs and serves as the bottom of the river channel. Additional site setting geology and hydrogeology information can be found in the *Arkansas Riverbank (near Zink Lake Dam) Investigation Report* (Hull, 2021).

1.3 Purpose and Scope

This Plan is intended to provide information related to the installation and operation, monitoring and maintenance activities for the LNAPL containment cap. Implementation of this Plan will aid in documenting the effectiveness and performance of the remedy and track the maintenance activities over time.

The Plan described herein includes monitoring and maintenance procedures for evaluating the effectiveness and performance of the LNAPL containment cap. Cap construction product specifications and data sheets will be included in a separate construction completion report, which will be available following construction and should be referenced in conjunction with this Plan. Monitoring and maintenance forms and logs are included in Appendix B to assist with tracking conditions and cap-related OM&M activities. This Plan should be reviewed and updated to reflect the Site conditions if changes have occurred that impact the implementation of this Plan and/or the remedy (the LNAPL containment cap).

This Plan includes the following information:

- General description of LNAPL containment cap and collection system components (Section 2)
- Monitoring plan and schedule (Section 3)
- Maintenance requirements (Section 4)
- Performance standards and contingency plans (Section 5)
- References (Section 6)
- Figure 1 showing the Site location
- Figure 2 showing the monitoring well and collection sump locations
- Appendix A including the containment cap and collection system design drawings
- Appendix B including a routine O&M form, maintenance log, and LNAPL recovery log are included.

2.0 CAP DESCRIPTION

2.1 LNAPL Containment Cap and Collection System Description

The LNAPL containment cap and collection system will be placed from the base of the riverbed to the current top of the bank elevation. This capping system will allow containment of the documented seep and impacted soil. The LNAPL containment cap will be comprised of multiple layers.

- A collection layer will form the base of the cap. LNAPL extraction, as needed, will be performed from three LNAPL collection sumps that will be laid within the collection layer. These sumps will allow efficient removal of LNAPL via pump, vacuum truck and/or cartridges of sorbent media (e.g., petroleum absorbent socks). The sumps will also allow for delivery of treatment chemicals, air sparging, or enhanced biological degradation, if needed. The details of the LNAPL containment cap design and construction are further presented below.

- The low permeability layer of the containment cap will act as a baffle (like an oil/water separator) and trap the lighter oil behind it, while allowing groundwater to discharge underneath through the toe vent. The toe vent will allow groundwater levels behind the containment cap to maintain equilibrium with fluctuating river levels enhancing long-term slope stability. The low permeability layer will form a physical barrier between residual hydrocarbons in the soil and the river water thus eliminating the potential for a hydrocarbon sheen. The low permeability layer will be visually and/or physically inspected as it is placed to assure its integrity. The low permeability layer will consist of AquaBlok®, which is a proprietary product that consists of an aggregate coated with a layer of bentonite. When hydrated, AquaBlok® takes on the low-permeability property of bentonite, reinforced with the strength of the aggregate.

- The north edge of the containment cap will be securely sealed against the concrete wing wall using hydrated bentonite and/or AquaBlok®. The south end of the containment cap will be securely sealed into the existing fire department emergency concrete boat launch ramp using hydrated bentonite and/or AquaBlok®.

- An armor layer consisting of articulated block mattress, a reinforced concrete product, will be placed over a bedding layer on top of the AquaBlok®. The armor layer protects the low permeability layer from damage.

The LNAPL containment cap is planned to be constructed at the Site in 2022. The monitoring well and collection sump locations are shown on Figure 2 and the LNAPL containment cap features are provided in Appendix A. The following sub-sections provide a general overview of the planned construction and LNAPL containment cap components. The construction completion report will include any field changes to the design drawings in Appendix A.

2.2 Excavation & Site Preparation

The following activities will be completed prior to constructing the LNAPL containment cap:

- Implementation of sediment/hydrocarbon sheen/oil containment to prevent migration from the work site throughout the duration of all construction activities.
- Installation of a perimeter coffer dam.
- Excavation and grading of soil and river sediment to achieve design bottom elevations. The toe of the cap at the river will be excavated to bedrock.

2.3 LNAPL Containment Cap Components

2.3.1 Collection Layer

Approximately 12-inches of crushed aggregate (1 1/2-inch diameter) will be placed over the excavated bottom to function as the Collection Layer, creating a porous zone for LNAPL to preferentially be collected. Appendix A contains material gradation information for the select crushed stone.

The Collection Layer will also include three LNAPL collection sumps constructed of 8-inch diameter stainless steel screens and casings. The LNAPL collection sumps will be sloped from the bottom of the Collection Layer to the top of the bank and will terminate at vaults where gauging and, if needed, collection of LNAPL can occur.

2.3.2 AquaGate® Gabion/Toe Vent

A filled gabion will serve as the toe of the cap at the intersection of the collection layer and the Arkansas River, as shown on the design drawings. The gabion will be 3-feet high and 3-feet wide, continuing the entire length of the LNAPL collection cap. The gabion will be filled with AquaGate®, which is stone coated with organoclay that forms a porous treatment media to allow groundwater to flow through but traps the lighter oil.

2.3.3 AquaBlok® Layer

AquaBlok® is a patented, composite-aggregate technology resembling small stones. It is typically comprised of a dense aggregate core, clay or clay-sized materials, and polymers. For typical freshwater product formulations, AquaBlok's® clay (sealant) component consists largely of bentonite clay. AquaBlok® particles expand when hydrated, with the degree of net vertical expansion determined largely by the formulation, application thickness, and salinity of the hydrating water. When a mass of particles is hydrated, the mass transforms into a continuous and relatively soft body of material. Once developed, the hydrated AquaBlok® material acts as an effective physical, hydraulic, and chemical environmental barrier by virtue of its relatively cohesive and homogeneous character, low permeability to water, and chemically active (sorptive) nature.

Approximately 6-inches of AquaBlok® will be placed over the Collection Layer to create an impermeable containment layer to the hydrocarbons. Appendix A contains material gradation information and product information for the AquaBlok®.

2.3.4 Articulated Block Mattress & Geogrid Protection Layer

Articulated block mattress (ABM) is a pre-fabricated unit of interconnected concrete blocks and is commonly used for bank protection along surface waters. ABM will be placed over the AquaBlok® to hold it in place, and to provide stability and protection against erosion. The ABM also provides a layer of armor against damage from incidental physical contact.

For installation, approximately 6-inches of select crushed stone and reinforcing geo-grid will be placed over the AquaBlok®. Then a layer of geotextile will be laid consistent with the requirements of the ABM manufacturer. The ABM will then be placed on top of the geotextile. The ABM is 6-inches thick. The voids in the ABM will be filled with graded material as required by the manufacturer, and the edges and seams will be grouted per the manufacturer guidelines.

To further grade and stabilize the containment cap, rip rap that was used as a coffer dam during construction will be moved to the toe of the cap to cover the AquaGate® toe vent and will be used to grade the top of the cap near the boat ramp and at the top of the concrete wing wall as shown on the design drawings.

2.3.5 LNAPL Collection Sumps

Three (3) LNAPL collection sumps will be installed within the porous collection layer to collect, monitor, and recover, if present, LNAPL. The sumps are each constructed of 8-inch diameter stainless steel pipe with 50-foot long stainless steel, wire-wrapped continuous slot screens (Johnson Free-Flow™ 307 80-Slot). An 8-inch expandable seal/plug (locking compression cap) will be placed at the surface inside the pipe casing to seal the sumps when not in use.

The sumps will be completed at the surface with flush-mounted steel protective covers, held in place by bolts. The location of the three (3) sumps are shown on Figure 2 and the design drawings in Appendix A.

2.4 As-Built Survey

As-Built details including post-construction survey data on the completed cap will be included in the construction completion report that will be available following installation of the cap.

3.0 MONITORING PLAN & SCHEDULE

3.1 LNAPL Containment Cap Monitoring

Listed below are the procedures for routine monitoring of the containment cap upon construction completion. Monitoring activities will be coordinated by HFTR and with the landowner prior to completion. If possible, monitoring should be done during clear and calm conditions to allow for more accurate measurements. Routine LNAPL containment cap monitoring will be conducted quarterly for the first 10 years, semi-annually for the following 5 years and then annually for the following 15 years. Monitoring activities performed for the containment cap will consist of the following:

- Visual Inspections – Walking the length of the containment cap and visually inspecting to ensure cap integrity is maintained (e.g., looking for signs of erosion, presence of trees/shrubs starting to grow in restricted areas, significant cap settling, etc.). Any issues identified will be documented in the attached log and promptly addressed in an appropriate manner (e.g., repair of erosion area(s), removal of trees/shrubs in restricted areas and/or investigation and repair of cap where it settled). This information will be documented on the Routine O&M Form (Appendix B).

- Hydrocarbon Sheen Monitoring – Hydrocarbon sheen monitoring is performed weekly as part of the RCRA permit and includes the location of the LNAPL containment cap. Performing visual observations of the surface water along the length of the containment cap interface with the Arkansas River to document that no hydrocarbon sheens are present in the area. If a hydrocarbon sheen is observed, Permit Condition III.J.6 will be implemented and further investigation on the origin of the hydrocarbon sheen may be performed. The presence of a hydrocarbon sheen will trigger the contingency plan in Section 5.2.

- LNAPL Measurement and Recovery – LNAPL collection Sump 1, Sump 2, and Sump 3 and monitoring wells MW-343, MW-372, MW-373, MW-374, and MW-375 will be gauged for depth to LNAPL/water and LNAPL thickness, if present. Checking the collection sumps and monitoring wells for LNAPL accumulation will be performed using an electronic oil/water interface probe or oil absorbing material (e.g., PIG® Monitoring Well Skimming Sock). Use of an electronic oil/water interface probe is the preferred method to gauge for the absence/presence and, if present, thickness of LNAPL due to the accuracy of the meter.

    - LNAPL Measurement Procedure – The interface probe will be slowly lowered into the sump or well until the sounder beeps or the LED illuminates. If LNAPL is present, the beep will be continuous; when water is encountered the beep will be intermittent. The probe tape should be slowly lowered down the sump or well casing until an initial beep of LNAPL or water is detected. This measurement is then recorded. If LNAPL is detected first, the probe shall be slowly lowered further until tone changes from constant to intermittent, which indicates where the oil/water interface is. The measurements will be read from the tape to the nearest 0.01 foot increment and recorded on the Routine O&M Form (Appendix B). The meter will be decontaminated prior to and following each measurement.

If LNAPL (6-inch-thick layer or greater) is observed/measured in any of the collection sumps, the LNAPL in that sump will be recovered as described below (LNAPL recovery frequency will depend upon the rate of LNAPL accumulation, if any).

If any LNAPL (0.01-feet-thick layer or greater) is observed/measured in any of the monitoring wells sumps, the contingency plan in Section 5.2 will be triggered.

- LNAPL Recovery Procedure – The LNAPL sumps are designed to allow for a variety of recovery techniques to remove accumulated LNAPL. LNAPL removal with be coordinated by HFTR, and consideration will be given to LNAPL disposal or recycling options (e.g., reinsertion into the refining process) prior to performing LNAPL removal. This information will be documented on the Recovery Log (Appendix B). Some common LNAPL removal methods include:

    1. Pumping the LNAPL with a small battery-operated pump (i.e., peristaltic or submersible) to a container (e.g., 5-gallon bucket) for transfer to a drum or other collection area.
    2. Removing LNAPL with oil absorbent socks that can be placed in the sumps to collect LNAPL over time and can be disposed of periodically.
    3. Pumping LNAPL with a drum-vacuum or vacuum truck using a hose inserted into the sump and extraction using high vacuum.

- Water Level Elevation – Surface water elevations will be measured from a location marked on the side of the concrete wall on the upstream edge of the cap.
    - Surface Water Level Measurement Procedure – First locate the measuring point on the concrete wall. Then measure and record the distance to the surface water level at the measuring point location to the nearest 0.01 foot. Record the measurement on the Routine O&M Form in Appendix B.

3.2 Monitoring Schedule

LNAPL containment cap monitoring will be conducted on the frequency described in Section 3.1. This Plan can be updated as the monitoring schedule changes over time.

4.0 MAINTENANCE

4.1 LNAPL Containment Cap Maintenance

The design of the LNAPL containment cap is such that no routine maintenance is required; however, future maintenance may be needed if the cap becomes damaged or altered. Physical damage due to impact from a boat or other large object, or natural forces like significant storms, ice, flooding, or erosion/scouring can require maintenance or repair. All maintenance activities will be coordinated with HFTR and the landowner prior to completion.

The typical maintenance items for the cap may include the following:

- Removal of trees and shrubs from the cap
- Replacing/regrading rip rap rock cover
- Replacing or mending the articulated block mattress
- Mending the geogrid layer
- Repairing the AquaBlok® layer

If any of the items listed above require maintenance or repair, the work will be done in accordance with the original design specifications and construction as described in the attached design drawings and the construction completion report. All maintenance and/or repairs completed will be recorded in the Maintenance Log (Appendix B).

4.2 LNAPL Sump Maintenance

The three (3) LNAPL sumps will require some maintenance over the long-term to keep them in proper working order.

The following items will be maintained as needed:

- Keep the sump covers free from overlying materials and vegetation so they remain visible and accessible
- Clean the bolts and threads on the flush mount sump covers and locks at least annually
- Replace stripped, rusted, or missing bolts for the flush mount sump covers
- Clean the expansion plug's rubber gasket and replace if/when the plug no longer seals tightly
- Remove accumulated water in the flush mount wellhead casing to prevent backflowing into the sump or freezing in the winter months.

5.0 PERFORMANCE STANDARDS AND CONTINGENCY PLANS

5.1 Performance Standards

The LNAPL Containment Cap is designed to achieve the following performance standards.

1. No visible hydrocarbon sheen or LNAPL observed in the Arkansas River adjacent to the containment cap during weekly inspections.
1. No LNAPL detected in the two downgradient sentinel monitoring wells.

Construction of the remedy as designed, and the monitoring and maintenance of the remedy as described above in Sections 3 and 4 should enable the LNAPL containment cap to achieve these performance standards. The following Section 5.2 further describes these performance standards and a contingency plan if there are observations of hydrocarbon sheen and/or LNAPL on the surface water or LNAPL in the downgradient sentinel monitoring wells.

HFTR will provide updates on achieving these performance standards and any contingency actions conducted in the Semi-Annual Monitoring Reports (SMRs) that are submitted to DEQ.

5.2 LNAPL Containment Cap Contingency Plan

The purpose of the LNAPL containment cap contingency plan is to identify how to address a scenario where hydrocarbon sheen and/or LNAPL are observed on the surface water in the vicinity of the LNAPL containment cap or LNAPL is observed in the downgradient sentinel monitoring wells. The primary purpose of the LNAPL containment cap remedial action is to mitigate the potential for hydrocarbon sheens from forming along the bank of the Arkansas River in the vicinity of the containment cap. The effectiveness of the remedy will be monitored as described in Section 3 of this Plan to determine if the performance standards in Section 5 of this Plan are being achieved. This contingency plan is provided for implementation if either of the performance standards are not achieved. Contingency actions will be coordinated by HFTR and with the landowner prior to completion.

1. Observable Hydrocarbon Sheen in the River – If hydrocarbon sheen is observed in the surface water along the length of the containment cap, Permit Condition III.J.6 will be implemented, and additional observations may be made to identify potential source(s) of the hydrocarbon sheen. If the hydrocarbon sheen appears to originate from the reach of bank adjacent to the cap then the initial action will be to conduct a visual inspection of the containment cap integrity. If the hydrocarbon sheen occurs in a sufficient quantity to sample, then a secondary action may be to collect a sample of the hydrocarbon sheen for forensic analysis to determine if the hydrocarbon sheen is related to the LNAPL identified in this area (baseline data collection was conducted prior to design and implementation of the remedy). After a determination is made, HFTR will consider next steps based upon the outcome of the analysis as presented below:
    - Hydrocarbon Sheen not HFTR-related (No Contingency Needed) – If the hydrocarbon sheen is determined to be emanating from a source other than the plumes associated with HFTR, no additional response activities are recommended and HFTR will continue routine

monitoring for the containment cap; however, notification of the observation will be communicated to DEQ.

- Hydrocarbon Sheen is HFTR-related (Contingency Plan Triggered) – If the investigation indicates that the hydrocarbon sheen is related to plumes associated with HFTR, a contingency plan will be triggered. An evaluation to determine the appropriate course of action will be performed; the contingency plan will be communicated to DEQ.

2. Observed LNAPL in Downgradient Monitoring Wells – Two sentinel monitoring wells are proposed to be installed at the top of the riverbank to evaluate the potential migration of LNAPL downgradient of the containment cap, as shown in Figure 2 (i.e., MW-374 and MW-375). In addition, two monitoring wells (i.e., MW-372 and MW-373) will be installed at the top of the riverbank adjacent to the containment cap in the general vicinity of MW-344 and MW-345 (which were plugged and abandoned). The four monitoring wells will be installed after installation of the containment cap. One downgradient sentinel monitoring well is proposed at the top of the boat launch ramp (MW-374) and one downgradient sentinel monitoring well is proposed along the top of the riverbank immediately west of the downgradient toe of the containment cap (MW-375). Assuming no LNAPL is identified in these monitoring wells immediately after well installation, observation of LNAPL in these wells could indicate downgradient migration of LNAPL.

   If LNAPL is observed in either of the two sentinel monitoring well, additional observations should be made to confirm the presence of LNAPL in the well. If the presence of LNAPL is confirmed, a sample of the LNAPL may be collected and submitted for forensic analysis to determine if the LNAPL is associated with plumes from HFTR (baseline data collection was conducted prior to design and implementation of the remedy). The results of forensic analysis will be communicated to DEQ, and a plan will be developed as appropriate. After a determination is made, HFTR will consider next steps based upon the outcome of the analysis as presented below:

   - LNAPL observed in Sentinel Monitoring Well is not HFTR-related (No Contingency Needed) – If LNAPL is observed in either sentinel monitoring well and the LNAPL is determined to be emanating from a source other than HFTR, no additional response activities are recommended and HFTR will continue routine monitoring for the containment cap; however, notification of the observation will be communicated to DEQ and HFTR may conduct follow-up of the non-HFTR related LNAPL.
   - LNAPL observed in the northern Sentinel Monitoring Well is HFTR-related (Contingency Plan Triggered) – If analysis or other evaluation indicates that the LNAPL is related to HFTR, the monitoring frequency of the two sentinel monitoring wells may be increased. Any changes to the monitoring frequency will be noted in the SMRs.
   - LNAPL observed in the southern Sentinel Monitoring Well is HFTR-related (Contingency Plan Triggered) – If analysis or other evaluation indicates that the LNAPL is related to HFTR, prompt notification will be provided the DEQ. A new monitoring well may be installed to the

south (downgradient) of the southern sentinel monitoring well. Visual observation for hydrocarbon sheen along the riverbank downstream of the containment cap will be increased in accordance with Permit Condition III.J.6. Changes to the visual observation frequency will be noted in the SMRs.

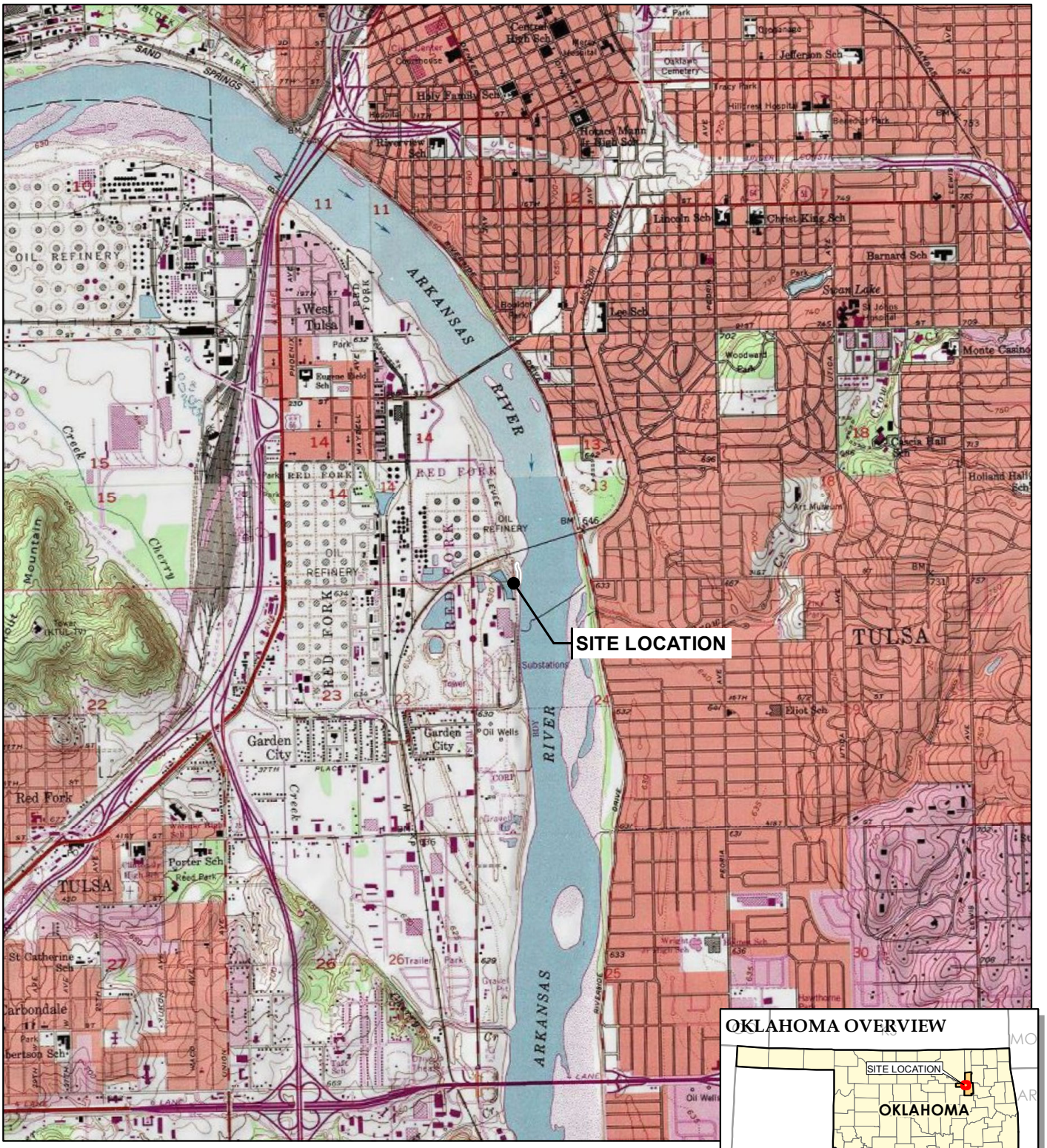
6.0 REFERENCES

HFTR. 2021. Conceptual Design for Interim Remedy to Mitigate Hydrocarbon Sheen as submitted to the Oklahoma Department of Environmental Quality. April 2, 2021

Hull. 2021. Arkansas Riverbank (near Zink Lake Dam) Investigation Report. April 2, 2021.

TRC. 2021. HollyFrontier Tulsa East River Bank LNAPL Trapping Cap Design Drawings. August 2021.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 2,000 4,000
FEET

TRC HULL
Environment / Energy / Infrastructure

708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

TRC - GIS

PROJECT:

HOLLYFRONTIER TULSA REFINING LLC
TULSA, OKLAHOMA

TITLE:

SITE LOCATION

DRAWN BY:	M. HORN
CHECKED BY:	J. RICE
APPROVED BY:	D. SHERMAN
DATE:	FEBRUARY 2020
PROJ. NO.:	328732
FILE:	328732-002slm_v2.mxd

FIGURE 1

S:\1-PROJECTS\HollyFrontier\Tulsa_East\328732-SheenCAP\328732-002slm_v2.mxd -- Saved By: MHORN on 2/19/2020, 12:02:26 PM

HOLLYFRONTIER TULSA REFINING LLC

PUBLIC SERVICE COMPANY OF OKLAHOMA

ZINK DAM

Arkansas River

WING WALL

MW-342

MW-343

MW-372

MW-373

MW-374

MW-375

SUMP 1

SUMP 2

SUMP 3

605

610

620

625

615

TIE-IN SLOPE TO EXISTING GROUND SURFACE MAXIMUM SLOPE 1.5:1

3:1 SLOPE, TARGETING 625'

BASE ELEVATION: 605'

BOAT LAUNCH RAMP

LEGEND

CONCEPTUAL CAP LOCATION

- 1.5:1 MAX TIE IN
- 3:1 CAP DESIGN SLOPE
- LNAPL COLLECTION SUMP
- APPROXIMATE PROPERTY BOUNDARIES
- HFTR OPDES OUTFALL EASEMENT AREA
- MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATIONS
- PROPOSED SUMP LOCATIONS

NOTES

1. HFTR OPDES OUTFALL EASEMENT FROM HULL. INC. FIGURE B-1, OCTOBER 2018.
2. TOPOGRAPHIC CONTOURS FROM SURVEY CONDUCTED BY LEMKE LAND SURVEYING, LLC. 8/30/2019. CONTOURS BELOW RIVER LEVEL AT TIME OF SURVEY ARE ASSUMED BASED ON MEASUREMENTS OBTAINED ALONG WING WALL.
3. THIS DRAWING IS NOT INTENDED FOR BIDDING OR CONSTRUCTION. FEATURES SHOWN ARE APPROXIMATE.

AREA OF CAP: 0.27 acres

FRONTAGE OF CAP ALONG RIVERFRONT: 270 ft

0 50 100 Feet

1 " = 50 '

1:600

PROJECT:

HOLLYFRONTIER TULSA REFINING LLC
TULSA, OKLAHOMA

TITLE:

MONITORING WELL AND SUMP LOCATIONS

DRAWN BY:	A. FOJTIK	PROJ NO.:	428197
CHECKED BY:	K. VATER		
APPROVED BY:	J. RICE		**FIGURE 2**
DATE:	DECEMBER 2021		

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FILE NO.: 428197-001.mxd

TRC - GIS

Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet (Foot US)
Map Rotation: 0

Plot Date: 12/9/2021, 11:30:59 AM by AFOJTIK -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\HollyFrontier\Tulsa_East\328732-SheenCAP\428197-001.mxd

Appendix A. 100% Design Drawings

HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP

PREPARED FOR: HOLLYFRONTIER TULSA REFINING LLC
TULSA, OKLAHOMA

PREPARED BY: TRC ENVIRONMENTAL CORPORATION
MADISON, WISCONSIN

DATE: AUGUST 2021

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	EXISTING PLANNED CONDITIONS AND SITE LAYOUT
3	EXCAVATION AND FILL
4	SECTIONS A, B & C
5	SECTIONS D, E & F
6	DETAILS
7	DETAILS
8	DETAILS
9	SPECIFICATIONS
10	SPECIFICATIONS

NOTE

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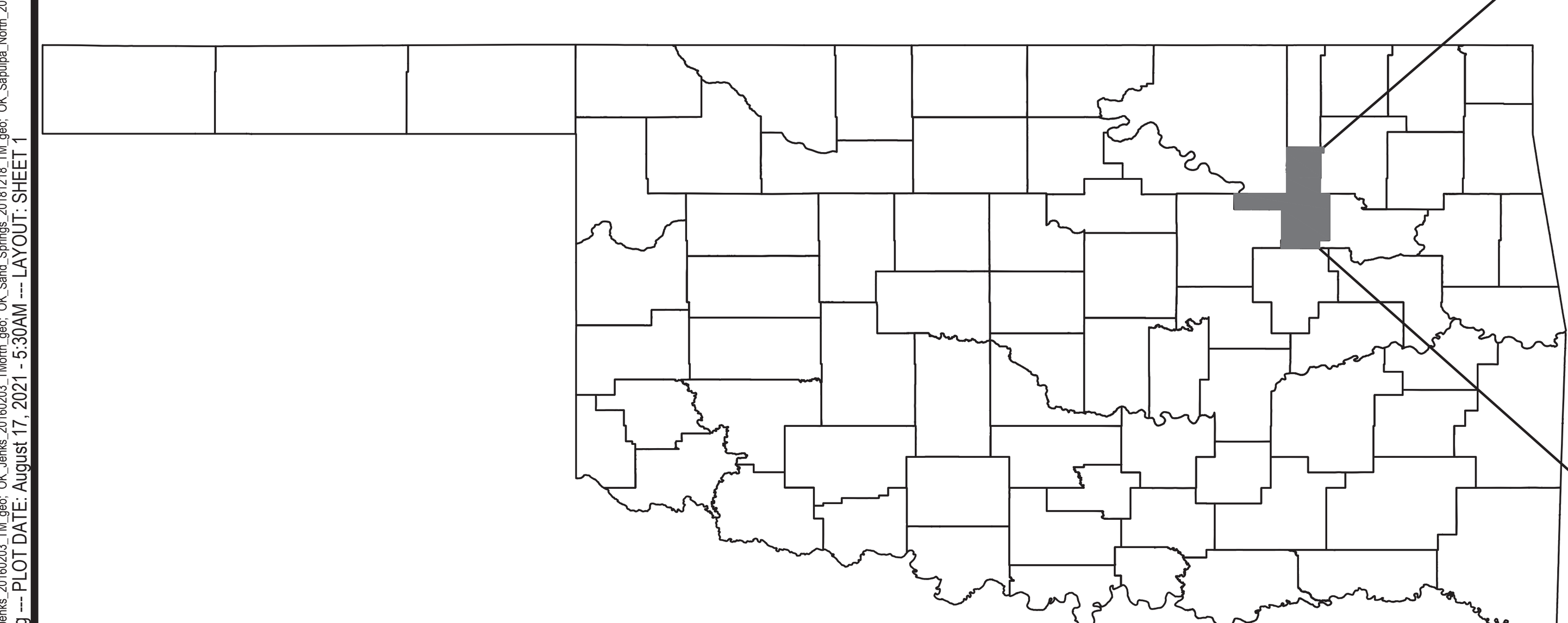
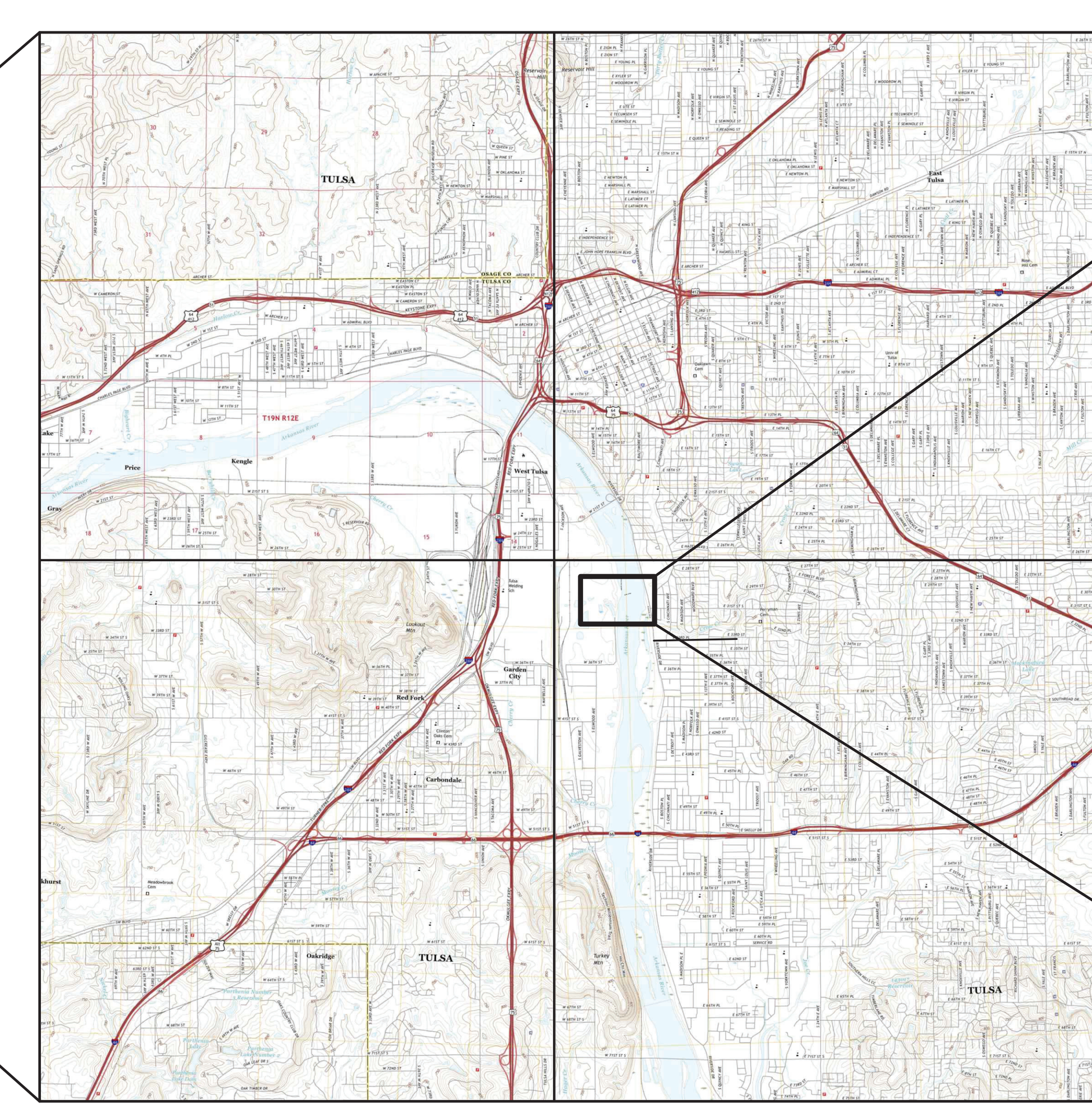


OKLAHOMA

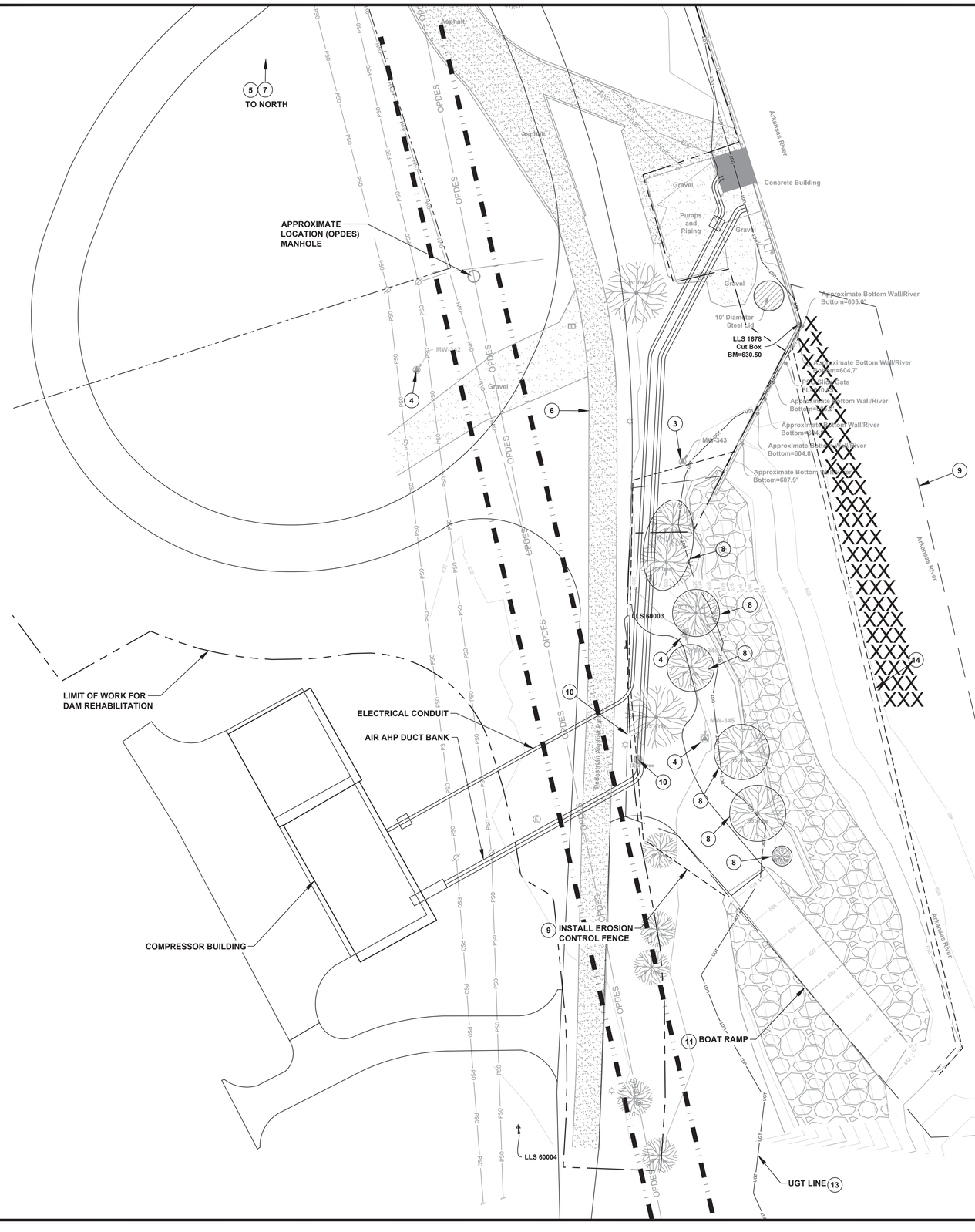


TULSA COUNTY

SITE LOCATOR

TRC
708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

22x34 --- USER: TFiebranz --- ATTACHED XREFS: Tulsa - Ex Features --- ATTACHED IMAGES: OK_Jenks_20160203_TM_geo; OK_Jenks_20160203_TMorth_geo; OK_Sand_Springs_20181218_TM_geo; OK_Sapulpa_North_20160203_TM_geo; OK_Tulsa_20160203_TM_geo;
DRAWING NAME: J:\Holly Frontier\Tulsa\328732\0000\ 328732 - CS.dwg --- PLOT DATE: August 17, 2021 - 5:30AM --- LAYOUT: SHEET 1
Version: 2017-10-21



TOPOGRAPHIC LEGEND

- MONITORING WELL
- LIGHT POLE
- POWER POLE
- GUY POLE
- DOWN GUY
- ELECTRIC MANHOLE
- ELECTRIC VAULT
- BENCHMARK
- CRAPE MYRTLES
- GUARD POST
- EROSION CONTROL FENCE
- UGT — UGT LINE
- OPDES EASEMENT
- CHAINLINK FENCE
- PSO — OVERHEAD ELECTRIC LINES
- OVH — OVERHEAD GUY WIRES
- EUG — UNDERGROUND ELECTRIC CABLES
- OPDES — OPDES LINE (OKLAHOMA POLLUTANT DISCHARGE ELIMINATION SYSTEM)
- 625 — GROUND SURFACE CONTOUR
- TREE DRIP LINE
- CONCRETE
- ASPHALT
- GRAVEL
- RIP RAP
- CONSTRUCTION LIMITS

SURVEY CONTROL

ON SITE HORIZONTAL AND VERTICAL CONTROL SET BY LEMKE LAND SURVEYING				
60003	413777.307	2561968.915	630.84	SET 60D NAIL
60004	413613.207	2561931.989	634.23	SET 60D NAIL
BM 1678	413887.783	2562028.026	630.50	BM CUT BOX
HORIZONTAL CONTROL DATUM: OKLAHOMA STATE PLANE NAD83 (2011) NORTH ZONE 3501				
VERTICAL CONTROL NAVD88				

1. LOCATION OF FEATURES IS APPROXIMATE. PLANNED FEATURES BASED ON CITY OF TULSA BID DOCUMENTS FOR ZINK DAM IMPROVEMENTS (CH2MHILL, MARCH 2020) AND RIVER PARKS AUTHORITY/ GATEWAY BRIDGE, LLC GATEWAY BRIDGE BID DOCUMENTS (MICHAEL VAN VALKENBURGH ASSOCIATES, INC., JUNE 2020).
2. TOPOGRAPHIC CONTOURS FROM SURVEY CONDUCTED BY LEMKE LAND SURVEYING, LLC. 8/30/2019. CONTOURS BELOW RIVER LEVEL AT TIME OF SURVEY ARE ASSUMED BASED ON MEASUREMENTS OBTAINED ALONG WING WALL.
3. PROTECT MW-343.
4. MW-342, MW344, AND MW-345 PREVIOUSLY ABANDONED.
5. STAGING AREA(S) WILL BE HOLLYFRONTIER TULSA EAST PROPERTY.
6. BIKE PATH WILL BE CLOSED BY OTHERS DURING THE WORK WITH POSSIBLE LIMITED ONE-DAY REQUIRED OPENINGS. CONTRACTOR WILL BE NOTIFIED OF OPENINGS PRIOR TO OCCURRENCE.
7. ACCESS TO HOLLYFRONTIER TULSA EAST PROPERTY TO NORTH. CLEARANCE UNDER CITY OF TULSA BRIDGE BETWEEN WORK AREA AND HOLLYFRONTIER PROPERTY IS 13 FEET HIGH AND 24 FEET WIDE.
8. REMOVE TREES IN WORK AREA, IF PRESENT.
9. INSTALL SITE CONTROLS AROUND WORK AREA/CONSTRUCTION LIMITS.
10. PROTECT TREES DURING WORK UNLESS OTHERWISE DIRECTED BY HOLLYFRONTIER (AS DETERMINED BETWEEN HOLLYFRONTIER, PSO AND RPA).
11. BOAT RAMP TO BE ACCESSIBLE AT ALL TIMES UNLESS CONTRACTOR IS ACTIVELY USING EQUIPMENT ON THE RAMP. ALL DAMAGE TO THE RAMP TO BE REPAIRED IN KIND BY CONTRACTOR.
12. DO NOT DIG BEYOND LIMITS OF THE CAP. BURIED TREATED WASTEWATER DISCHARGE PIPE, ELECTRICAL AND AIR DUCT EXIST TO THE EAST OF THE BIKE PATH.
13. UNKNOWN UNDERGROUND UTILITY (UGT) LINE REPORTED EAST OF BIKE PATH. DEPTH, AGE, AND CONDITION IS UNKNOWN. CONTRACTOR TO DETERMINE PRESCENCE AND/OR ABSENCE OF UTILITY PRIOR TO INSTALLATION OF THE CAP. IF INACTIVE, CONTRACTOR TO PROPERLY ABANDON AND REMOVE UTILITY. IF ACTIVE, CONTRACTOR TO NOTIFY UTILITY OWNER AND DETERMINE ACTION NEEDED TO ALLOW PROJECT TO PROCEED.
14. TURBIDITY CURTAIN AND OIL BOOM INSTALLED BY OTHER WITHIN THE COFFER DAM.

PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
EXISTING PLANNED CONDITIONS AND SITE LAYOUT

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		**SHEET 2 OF 10**
DATE:	AUGUST 2021		

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FILE NO.: 328732 - EC.dwg

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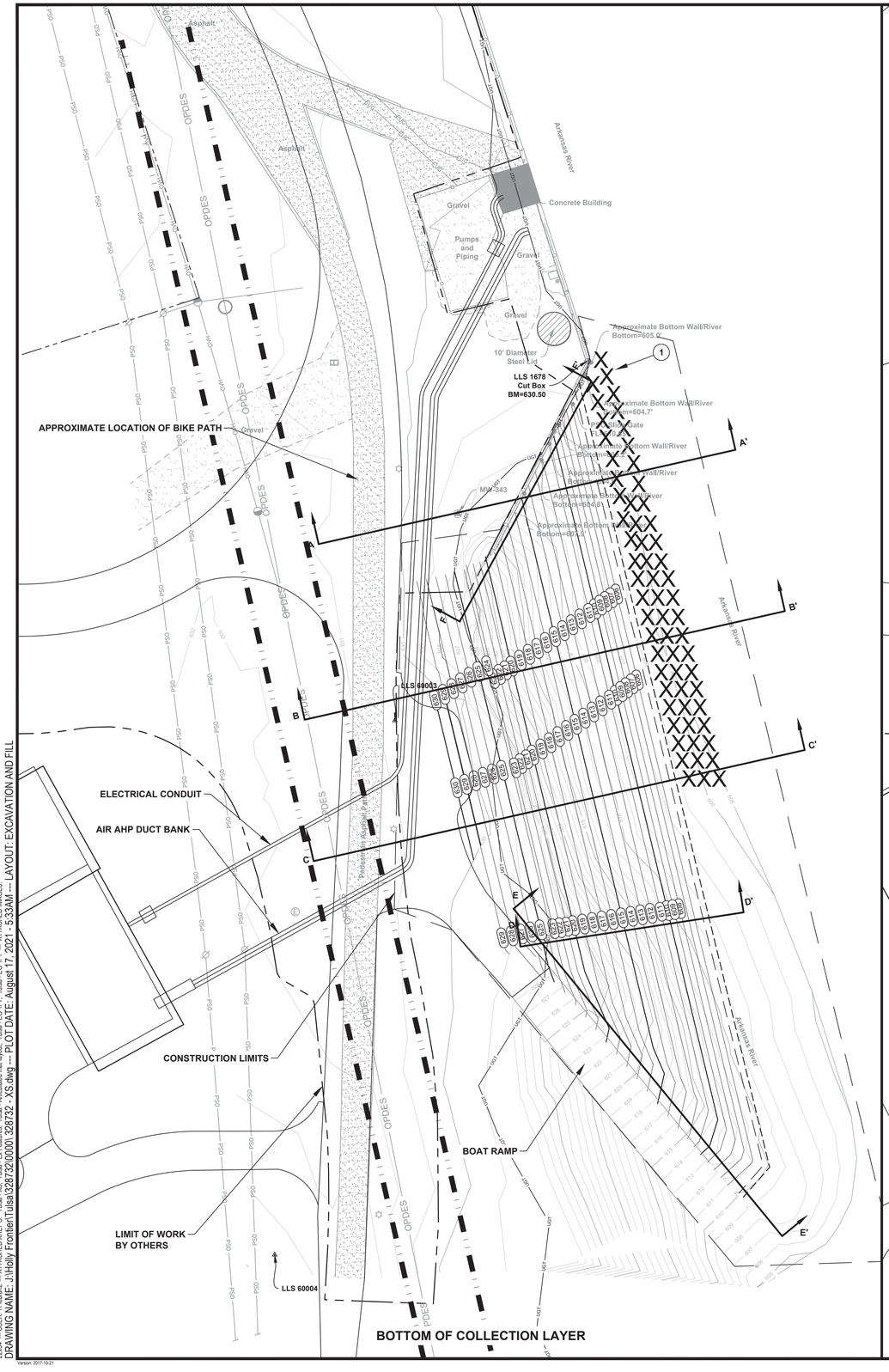
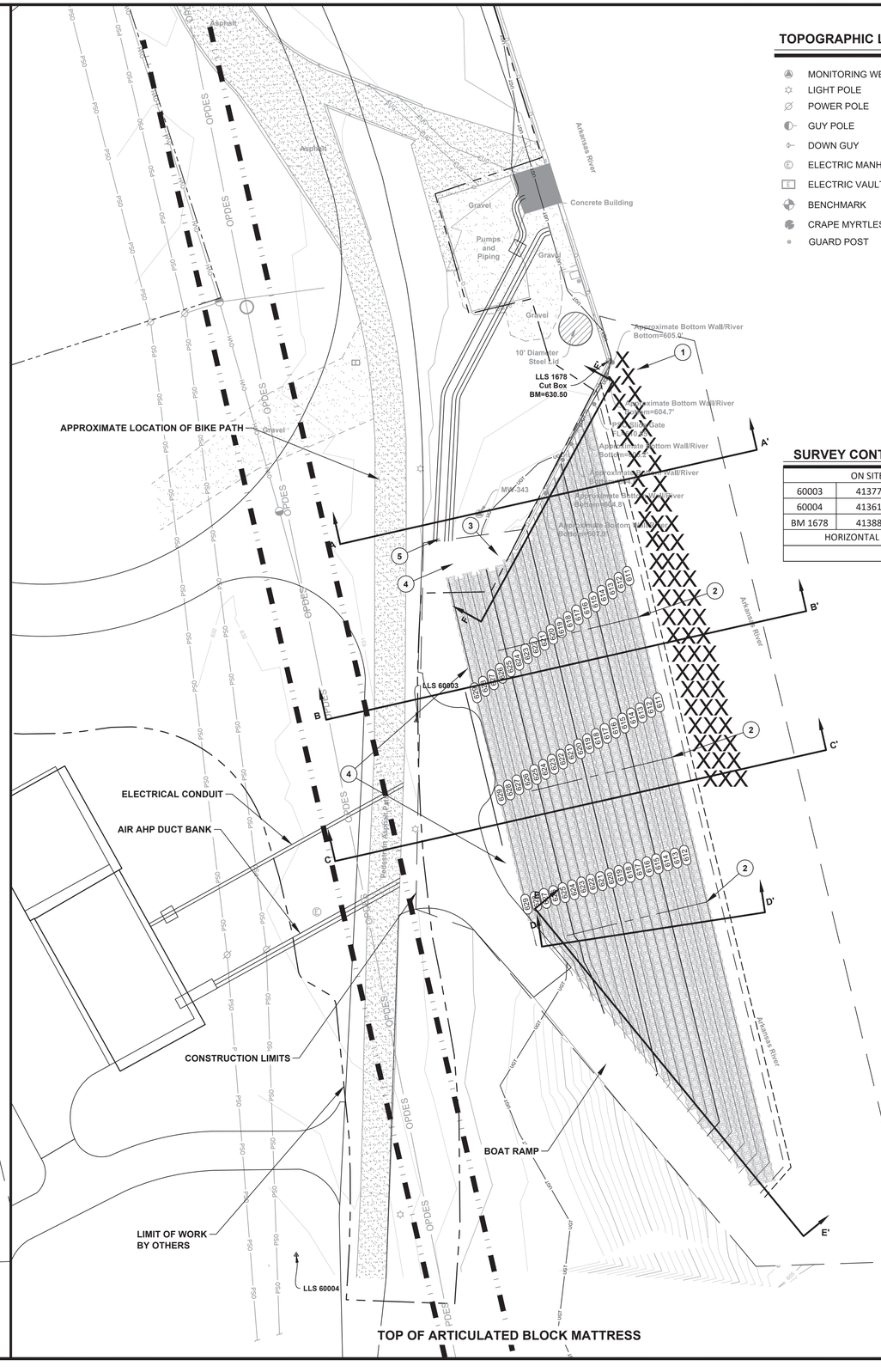
DRAWING NAME: J:\Holly Frontier\Tulsa\328732\0000\328732 - EC.dwg -- PLOT DATE: August 17, 2021 - 5:31AM -- LAYOUT: EXISTING PLANNED CONDITIONS AND SITE LAYOUT
Version: 2017-10-21





TOPOGRAPHIC LEGEND

- MONITORING WELL
- LIGHT POLE
- POWER POLE
- GUY POLE
- DOWN GUY
- ELECTRIC MANHOLE
- ELECTRIC VAULT
- BENCHMARK
- CRAPE MYRTLES
- GUARD POST
- CHAINLINK FENCE
- OVERHEAD ELECTRIC LINES
- OVERHEAD GUY WIRES
- UNDERGROUND ELECTRIC CABLES
- OPDES LINE (OKLAHOMA POLLUTANT DISCHARGE ELIMINATION SYSTEM)
- GROUND SURFACE CONTOUR
- TREE DRIP LINE
- COFFER DAM
- TURBIDITY CURTAIN
- UGT LINE
- OPDES EASMENT
- OIL BOOMS
- COLLECTION SUMP
- CONCRETE
- ASPHALT
- GRAVEL
- RIP RAP
- ARTICULATED BLOCK MATTRESS
- CONSTRUCTION LIMITS

SURVEY CONTROL

ON SITE HORIZONTAL AND VERTICAL CONTROL SET BY LEMKE LAND SURVEYING				
60003	413777.307	2561968.915	630.84	SET 60D NAIL
60004	413613.207	2561931.989	634.23	SET 60D NAIL
BM 1678	413887.783	2562028.026	630.50	BM CUT BOX
HORIZONTAL CONTROL DATUM: OKLAHOMA STATE PLANE NAD83 (2011) NORTH ZONE 3501				
VERTICAL CONTROL NAVD88				

1. CONSTRUCT COFFER DAM AS REQUIRED FOR WORK. RIP RAP COFFER DAM SHOWN ON PLANS IS APPROXIMATELY 150-FEET LONG.
2. THREE COLLECTION SUMPS TO BE SPACED EVENLY FROM 10-FEET SOUTH OF THE WING WALL TO 10-FEET NORTH OF THE TOP OF THE BOAT RAMP.
3. RESTORE ERODED AREA AT END OF WING WALL BY PLACING GENERAL FILL TO ELEVATION OF BOTTOM OF ARTICULATED BLOCK MATTRESS AND WITHIN 1-FOOT OF EXISTING GROUND SURFACE AT TOP OF SLOPE. PLACE RIP RAP TO ELEVATION OF TOP OF ARTICULATED BLOCK MATTRESS AND EXISTING GROUND SURFACE AT TOP OF SLOPE. PLACE ADDITIONAL RIP RAP AS NEEDED TO PROVIDE STABLE SLOPE AND GRADE. GRADE TO MATCH SURROUNDING GRADES.
4. RESTORE DISTURBED AREAS BY GRADING TO MATCH SURROUNDING GRADES AND PLACING SOD. RESTORE ALL AREAS OF DISTURBANCE UP TO 5-FT EAST OF BIKE PATH.
5. SUBSURFACE UTILITIES NOT SHOWN SO THAT FINISHED SURFACES/GRADES ARE VISIBLE. REFER TO BOTTOM OF COLLECTION LAYER PLAN FOR FULL EXTENT OF UTILITIES.

0 20 40 60 80
SCALE IN FEET

PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
EXCAVATION AND FILL

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		SHEET 3 OF 10
DATE:	AUGUST 2021		

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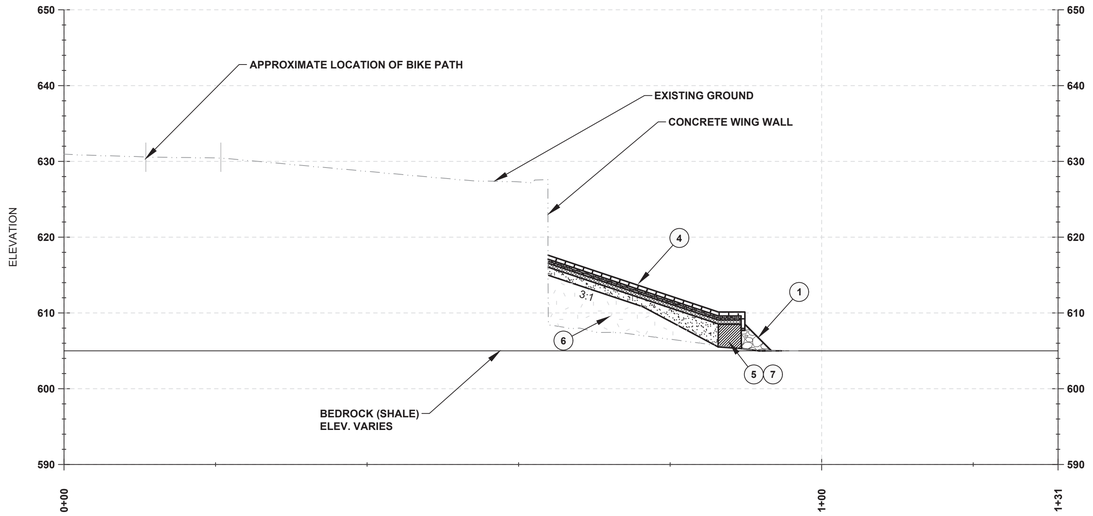
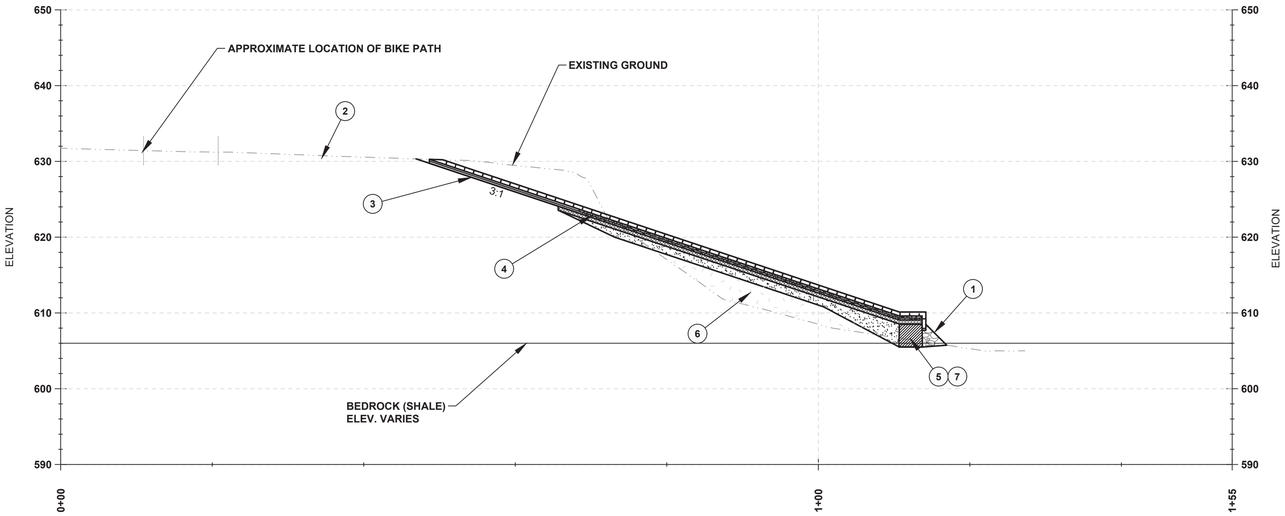
FILE NO.: 328732 - XS.dwg



Section A



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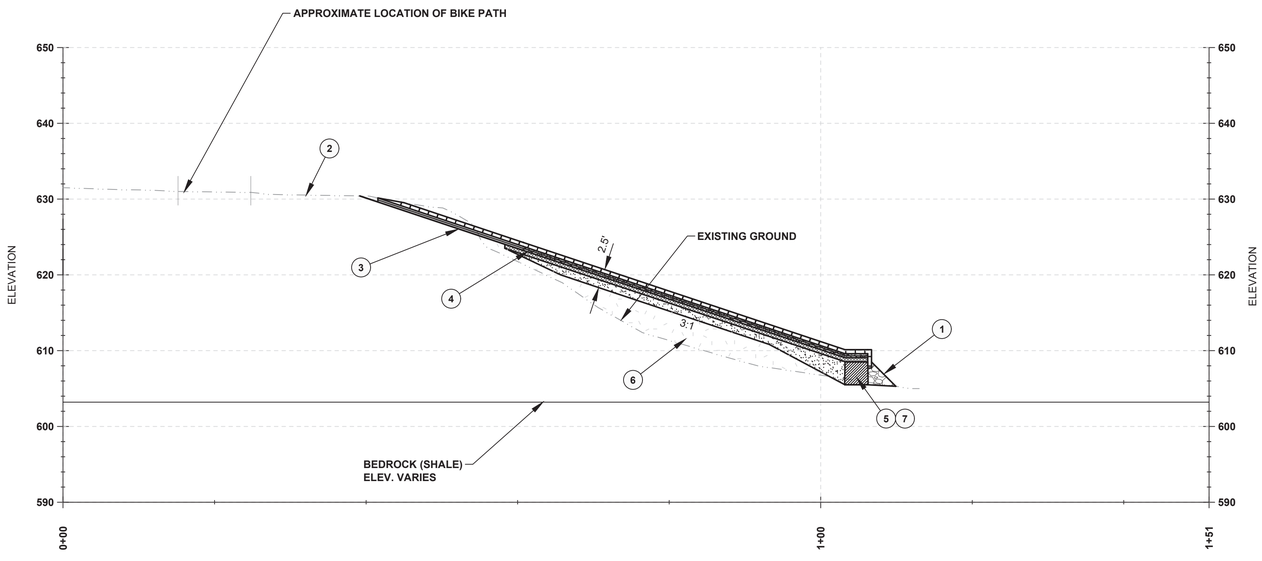
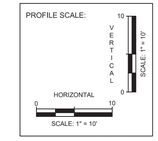


Section B

1. ANGLE OF REPOSE OF RIP RAP SHOWN AS 1:1. RIP RAP WILL LIKELY EXTEND ABOVE HEIGHT OF ARTICULATED BLOCK MATTRESS. PLACE RIP RAP IN 1:1 SLOPE ALONG TOE OF CAP AS MATERIAL ALLOWS.
2. RESTORE DISTURBED AREAS ABOVE ARTICULATED BLOCK MATTRESS WITH GRADING, TOPSOIL, AND SOD.
3. APPROXIMATE EXTENT OF EXCAVATION. EXCAVATE AS REQUIRED TO CONSTRUCT CAP. EXCAVATE A SHALLOW TRENCH OF APPROXIMATELY 1.5-FEET DEPTH AT THE LOCATION OF THE THREE (3) COLLECTION SUMPS AS REQUIRED TO PLACE SUMPS ON 3:1 SLOPE TO GRADE. BACKFILL TRENCH WITH SELECT CRUSHED STONE TO GRADE REQUIRED FOR PLACEMENT OF GEOTEXTILE AND ARTICULATED BLOCK MATTRESS.
4. PLACE SELECT CRUSHED STONE AS NEEDED FOR ARTICULATED BLOCK MATTRESS PLACEMENT.
5. AQUAGATE GABION.
6. REMOVE ALL DEBRIS/ROCK (GREATER THAN 12-INCHES IN DIMENSION). SMOOTH NATIVE SOILS AND/OR PROVIDE GENERAL FILL TO GRADE OF BASE OF COLLECTION LAYER. ALL CONCRETE, WOOD, AND NON-ROCK DEBRIS SHALL BE CONTAINERIZED FOR OFF-SITE DISPOSAL BY OTHERS. ROCK DEBRIS CAN BE PLACED INTO THE DIVERSION STRUCTURE AND REMAIN ON-SITE. CONCRETE DEBRIS CAN REMAIN AND BE GRADED AS LONG AS IT IS CRUSHED TO LESS THAN 12-INCHES IN DIMENSION.
7. BEDROCK ELEVATION VARIES. REMOVE SEDIMENT/FILL AS REQUIRED TO PLACE GABION DIRECTLY ON BEDROCK SURFACE. PLACE AQUABLOK BENEATH GABION IF NEEDED TO LEVEL AND OR SECURE THE GABION.



VERTICAL EXAGGERATED = 1X

LEGEND

- GENERAL FILL
- RIP RAP
- SELECT CRUSHED STONE/GEOGRID
- AQUABLOK
- SELECT CRUSHED STONE LAYER
- ARTICULATED BLOCK MATTRESS

NOTE

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PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
SECTIONS A, B & C

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		SHEET 4 OF 10
DATE:	AUGUST 2021		

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Madison, WI 53717
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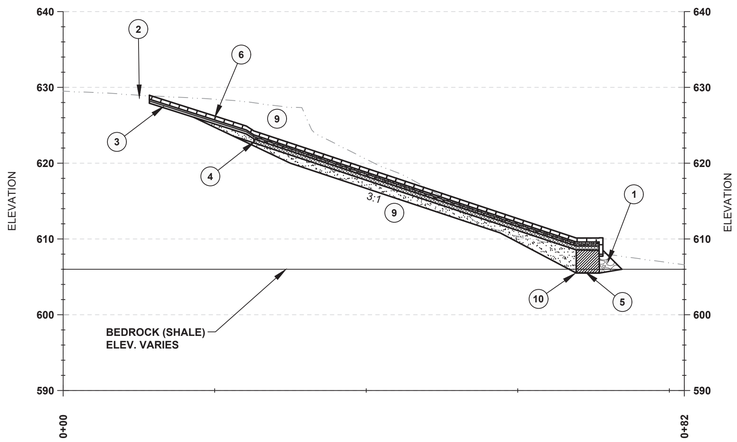
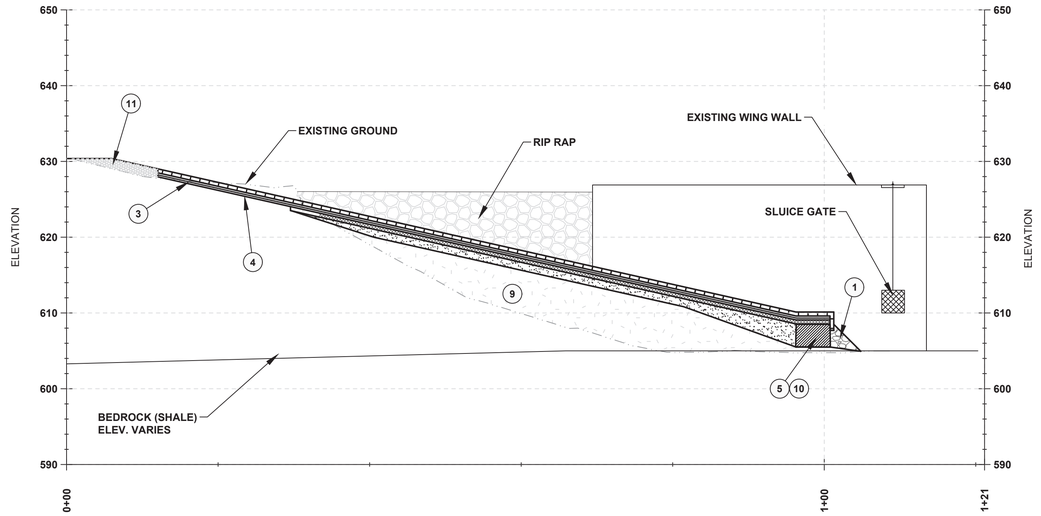
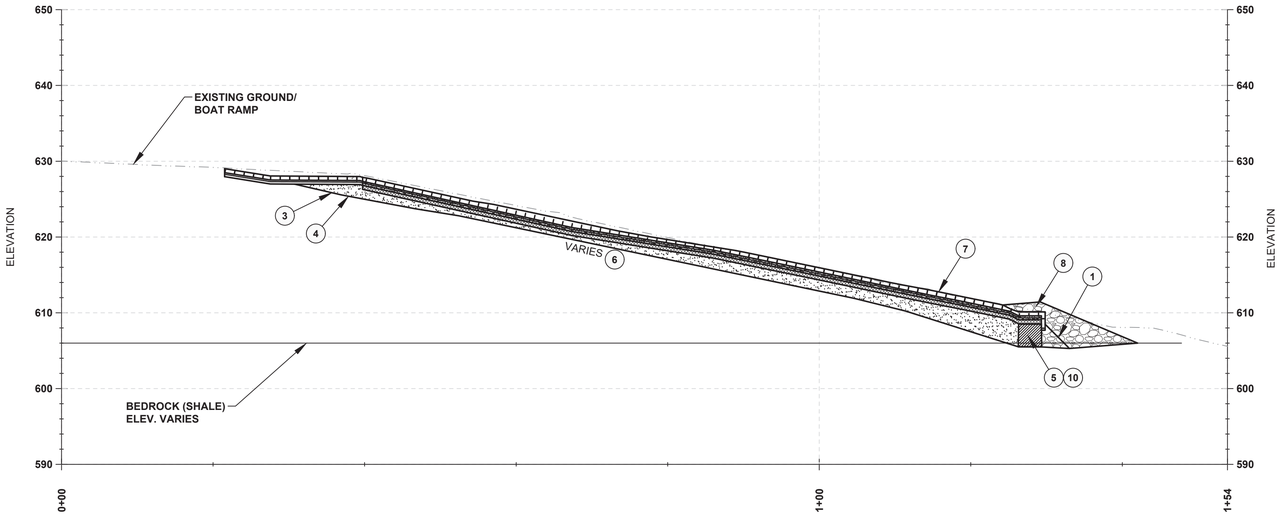
FILE NO.: 328732 - XS.dwg



Section D

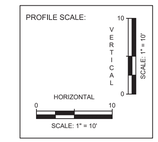


Section F



Section E

1. ANGLE OF REPOSE OF RIP RAP SHOWN AS 1:1. RIP RAP WILL LIKELY EXTEND ABOVE HEIGHT OF ARTICULATED BLOCK MATTRESS. PLACE RIP RAP IN 1:1 SLOPE ALONG TOE OF CAP AS MATERIAL ALLOWS.
2. RESTORE DISTURBED AREAS ABOVE ARTICULATED BLOCK MATTRESS WITH GRADING, TOPSOIL, AND SOD.
3. APPROXIMATE EXTENT OF EXCAVATION. EXCAVATE AS REQUIRED TO CONSTRUCT CAP. EXCAVATE A SHALLOW TRENCH OF APPROXIMATELY 1.5-FEET DEPTH AT THE LOCATION OF THE THREE (3) COLLECTION SUMPS AS REQUIRED TO PLACE SUMPS ON 3:1 SLOPE TO GRADE. BACKFILL TRENCH WITH SELECT CRUSHED STONE TO GRADE REQUIERD FOR PLACEMENT OF GEOTEXTILE AND ARTICULATED BLOCK MATTRESS.
4. PLACE SELECT CRUSHED STONE AS NEEDED FOR ARTICULATED BLOCK MATTRESS PLACEMENT.
5. AQUAGATE GABION.
6. EXISTING BOAT RAMP SLOPE IS 5:1. MAINTAIN AQUABLOK AND UNDERLYING SELECT CRUSHED STONE LAYER AT 3:1 SLOPE TO BOAT RAMP. INCREASE THICKNESS OF OVERLYING SELECT CRUSHED STONE/GEOGRID LAYER AS NEEDED TO BRING FINAL ELEVATION OF ARTICULATED BLOCK MATRESS FLUSH WITH THE BOAT RAMP SURFACE.
7. AT THE BOTTOM OF THE BOAT RAMP (AT OR BELOW THE WATER SURFACE) THE TOP OF THE ARTICULATED BLOCK MAT MAY PROTRUDE ABOVE THE BOAT RAMP SURFACE. THE ARTICULATED BLOCK MAT MAY NOT BE MORE THAN 3-INCHES EXPOSED ABOVE THE BOAT RAMP SURFACE. FIELD EXCAVATE BASE OF EXCAVATION LOWER AS NEEDED TO MEET THIS REQUIREMENT.
8. PLACE ADDITIONAL RIP RAP OVER THE ARTICULATED BLOCK MATTRESS ADJACENT TO THE BOTTOM OF BOAT RAMP TO PROTECT THE CAP. RIPRAP SHOULD BE AT LEAST 1-FOOT HIGHER THAN THE BOAT RAMP.
9. REMOVE ALL DEBRIS/ROCK (GREATER THAN 12-INCHES IN DIMENSION). SMOOTH NATIVE SOILS AND/OR PROVIDE GENERAL FILL TO GRADE OF BASE OF COLLECTION LAYER. ALL CONCRETE, WOOD, AND NON-ROCK DEBRIS SHALL BE CONTAINERIZED FOR OFF-SITE DISPOSAL BY OTHERS. ROCK DEBRIS CAN BE PLACED INTO THE DIVERSION STRUCTURE AND REMAIN ON-SITE. CONCRETE DEBRIS CAN REMAIN AND BE GRADED AS LONG AS IT IS CRUSHED TO LESS THAN 12-INCHES IN DIMENSION.
10. BEDROCK ELEVATION VARIES. REMOVE SEDIMENT/FILL AS REQUIRED TO PLACE GABION DIRECTLY ON BEDROCK SURFACE. PLACE AQUABLOK BENEATH GABION IF NEEDED TO LEVEL AND OR SECURE THE GABION.
11. PLACE RIP RAP ON 1:1 SLOPE ON TOP OF ARTICULATED BLOCK MATTRESS TO TOP OF WING WALL AND GRADE TO MATCH SURROUNDING GRADES.



VERTICAL EXAGGERATED = 1X

LEGEND

- GENERAL FILL
- RIP RAP
- SELECT CRUSHED STONE/GEOGRID
- AQUABLOK
- SELECT CRUSHED STONE LAYER
- ARTICULATED BLOCK MATTRESS

NOTE

1. THIS SHEET DEPICTS VARIOUS INTELLECTUAL PROPERTY OF TRC COMPANIES, INC. PATENT NUMBER US 8,419,314 & US 8,651,768. ALL RIGHTS RESERVED.

PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
SECTIONS D, E & F

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		**SHEET 5 OF 10**
DATE:	AUGUST 2021		

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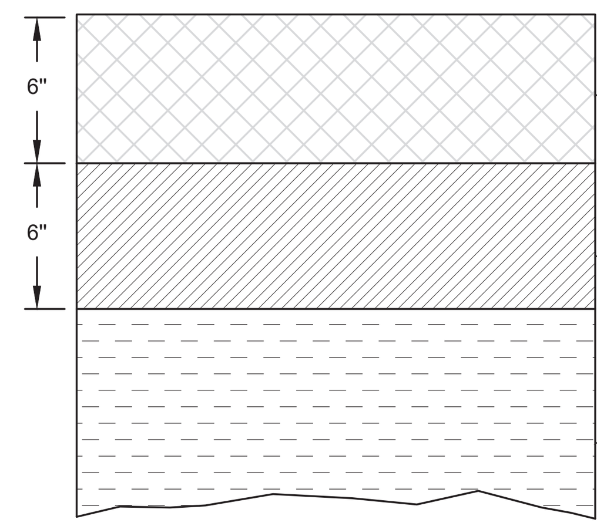
FILE NO.: 328732 - XS.dwg

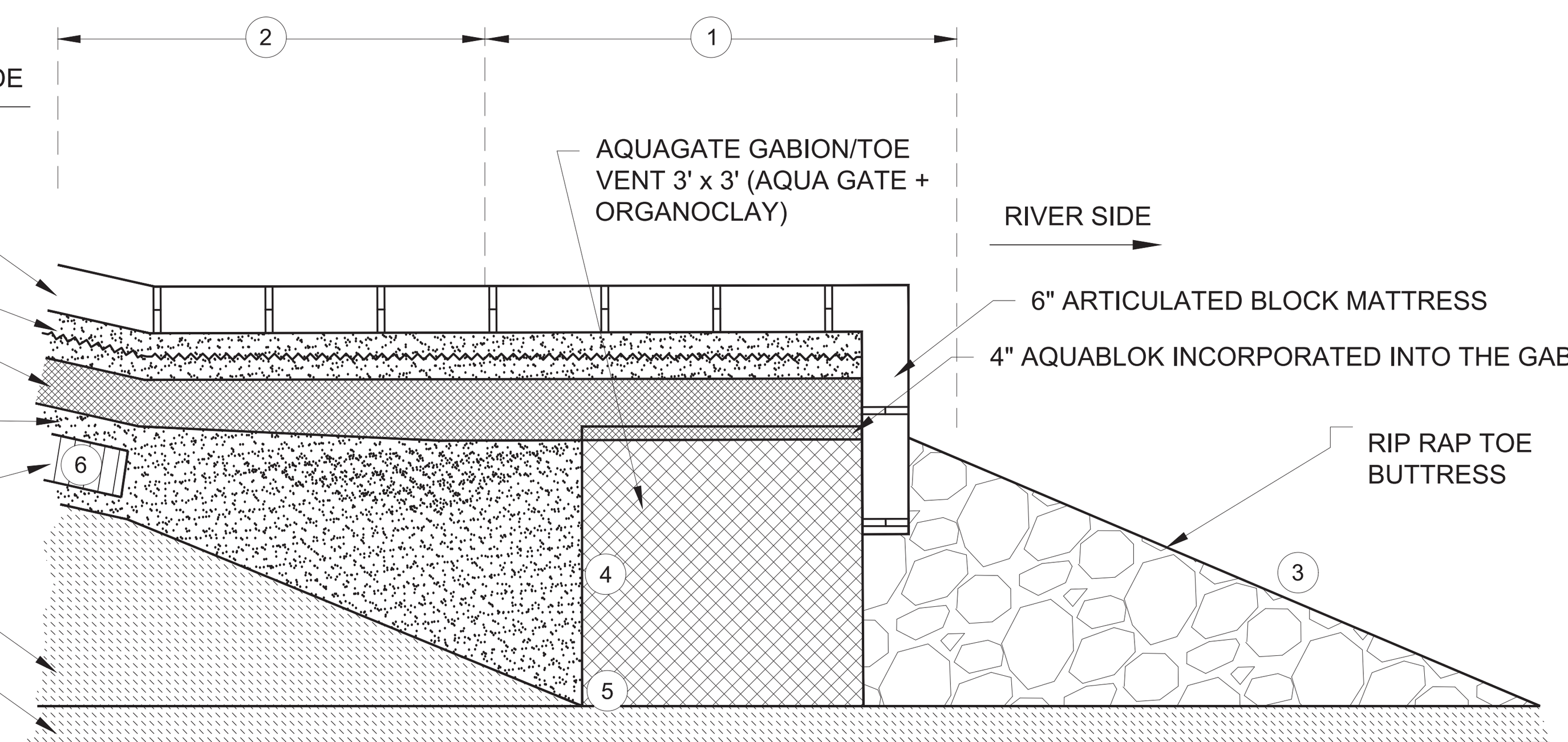
NOTES

1. PLACE SOIL IN LIFTS NOT TO EXCEED 1 FOOT.
2. COMPACT EACH LIFT OF GENERAL FILL WITH SPECIALIZED COMPACTION EQUIPMENT. SPECIALIZED EQUIPMENT SHALL INCLUDE TAMPING ROLLER, VIBRATORY ROLLER, PNEUMATIC TIRE ROLLER, OR OTHER EQUIPMENT DESIGNED FOR COMPACTION AND APPROVED BY ENGINEER DURING CONSTRUCTION.
3. GRADE TO PROMOTE POSITIVE DRAINAGE AND PREVENT PONDING OF SURFACE WATER.
4. FILL RUTS AND DEPRESSION THAT APPEAR DURING CONSTRUCTION TO MAINTAIN POSITIVE DRAINAGE.



1/6 **TYPICAL BACKFILL FOR PRE-EXISTING GRASSY AREAS**

NOT TO SCALE

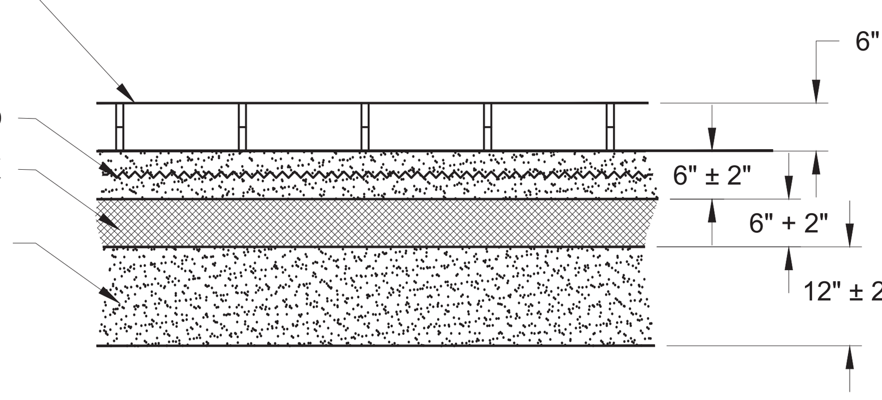


NOTES:

1. ARTICULATED BLOCK MATTRESS TO EXTEND PAST RIVER SIDE END OF AQUABLOK AND OVER THE TOP OF THE AQUAGATE GABION. PER DETAIL 2, SHEET 8.
2. ARTICULATED BLOCK MATTRESS TO EXTEND PAST SLOPE SIDE AND RIVER SIDE EDGES OF THE COLLECTION LAYER.
3. ANGLE OF REPOSE TO RIP RAP. RIP RAP MAY EXTEND OVER THE ARTICULATED BLOCK MATTRESS DEPENDING ON QUANTITY.
4. MAINTAIN CONNECTION BETWEEN TOE VENT / SELECT CRUSHED STONE COLLECTION LAYER.
5. SEAL TOE VENT TO THE BEDROCK WITH AQUABLOK, AS NEEDED.
6. COLLECTION SUMP TO EXTEND TO APPROXIMATELY 606' AND A MINIMUM OF 5' (HORIZONTAL) AWAY FROM THE AQUAGATE GABION/TOE VENT.

2/6 **CAP TOE VENT DETAIL**

NOT TO SCALE

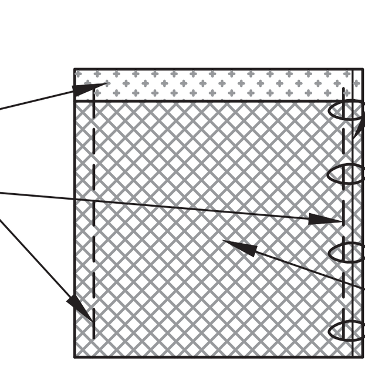


NOTES:

1. CAP SLOPE TO BE 3:1 MAXIMUM SLOPE TO EXTENTS SHOWN ON CROSS SECTIONS.

3/6 **CAP CONSTRUCTION DETAIL**

NOT TO SCALE



NOTE: GABION BASKET WILL BE ASSEMBLED ON SITE BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR UNLOADING, STORAGE, ASSEMBLY, AND PLACEMENT OF GABIONS REQUIRED FOR WORK.

4/6 **TYPICAL GABION BASKET DETAIL**

NOT TO SCALE

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LEGEND

- GENERAL FILL/NATIVE SOIL
- RIP RAP
- SELECT CRUSHED STONE/GEOGRID
- AQUABLOK
- SELECT CRUSHED STONE LAYER
- ARTICULATED BLOCK MATTRESS

PROJECT: **HOLLYFRONTIER TULSA EAST RIVER BANK LNAPL TRAPPING CAP TULSA, OKLAHOMA**

TITLE: **DETAILS**

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE	**SHEET 6 OF 10**	
APPROVED BY:	K.VATER		
DATE:	AUGUST 2021		

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FILE NO.: 328732-DT.dwg

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DRAWING NAME: J:\Holly Frontier\Tulsa\328732\0000\ 328732-DT.dwg --- PLOT DATE: August 17, 2021 - 5:34AM --- LAYOUT: DETAILS5

NOTES

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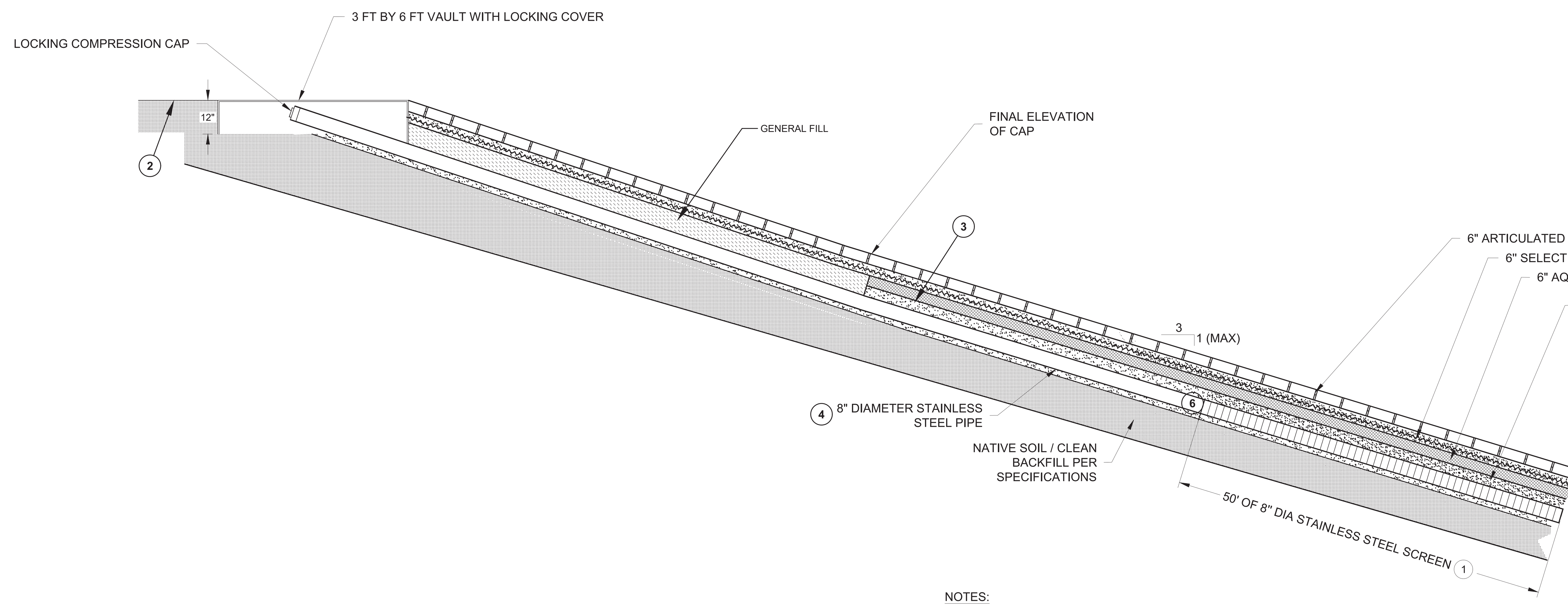
LEGEND

- GENERAL FILL/NATIVE SOIL
- RIP RAP
- SELECT CRUSHED STONE/GEOGRID
- AQUABLOK
- SELECT CRUSHED STONE LAYER
- ARTICULATED BLOCK MATTRESS

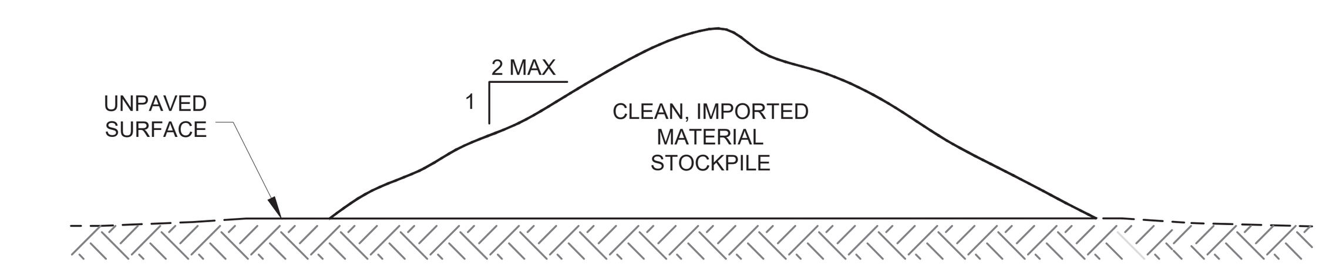


NOTES:

1. END OF SCREEN TO EXTEND TO APPROXIMATELY 606' AND THE MINIMUM OF 5-FT (HORIZONTAL) AWAY FROM THE AQUAGATE GABION/TOE VENT.
2. GRADE TO MATCH SURROUNDING GRADE AND FINAL ELEVATION OF CAP. PROVIDE GENERAL FILL AS REQUIRED. PROVIDE SOD AS FINAL SURFACE RESTORATION.
3. COLLECTION LAYER TO BE MINIMUM 4-INCHES THICK BETWEEN TOP OF PIPE AND AQUABLOK LAYER.
4. SCREEN AND RISER PIPE TO BE FIELD FIT.
5. INSTALL VAULT SUCH THAT LNAPL COLLECTION SUMP CAN BE ACCESSED WITH A VACUUM TRUCK/SUBMERSIBLE PUMP.
6. TOP OF SCREEN ELEVATION APPROXIMATELY 622'.

1/7 **LNAPL COLLECTION SUMP DETAIL**

NOT TO SCALE

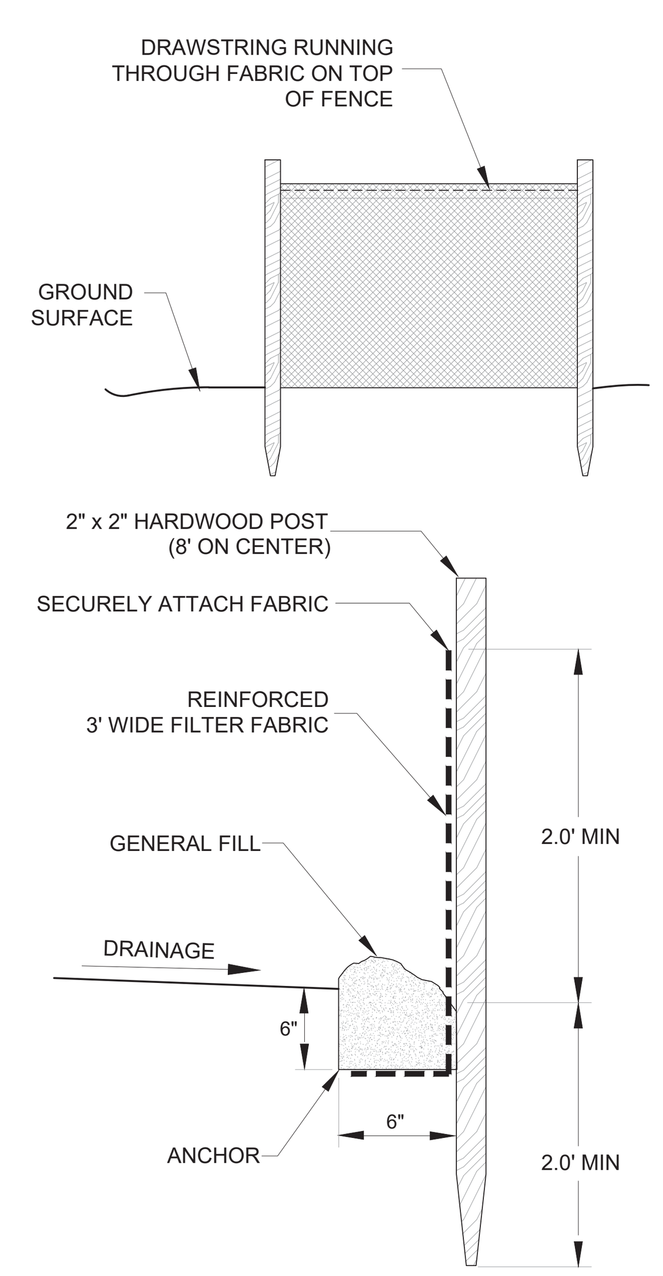


NOTES:

1. CLEAN FILL TO INCLUDE ANY IMPORTED MATERIAL.
2. INSTALL EROSION CONTROLS AS REQUIRED BY HOLLYFRONTIER.
3. PLACE STOCKPILES AS ALLOWED BY HOLLYFRONTIER.
4. STOCKPILES MAY ONLY BE PLACED ON HOLLYFRONTIER PROPERTY. BRING MATERIALS FOR DAILY USE TO THE WORK AREA.

3/7 **TYPICAL CLEAN STOCKPILE DETAIL**

NOT TO SCALE

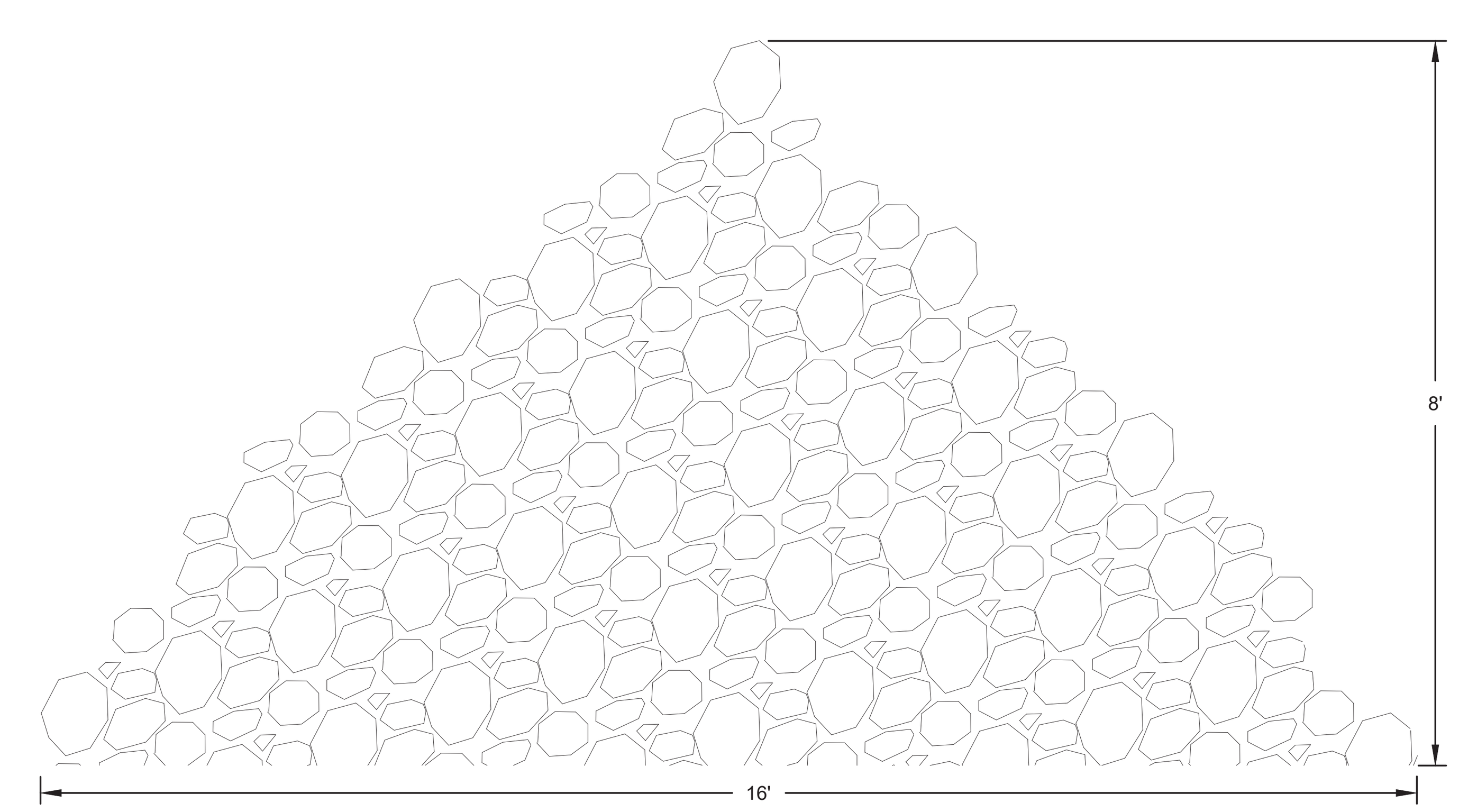


NOTES:

1. FENCE POSTS SHALL BE PLACED 8 FEET CENTER-TO- CENTER OR CLOSER. THEY SHALL EXTEND AT LEAST 2 FEET INTO THE GROUND AND EXTEND AT LEAST 2 FEET ABOVE THE GROUND. POSTS SHALL BE CONSTRUCTED OF HARD WOOD WITH A MINIMUM DIAMETER THICKNESS OF $1\frac{1}{2}$ INCHES.
2. A METAL FENCE WITH 6 INCH OR SMALLER OPENINGS AND AT LEAST 2 FEET HIGH MAY BE UTILIZED, FASTENED TO FENCE POSTS, TO PROVIDE REINFORCEMENT AND SUPPORT TO THE GEOTEXTILE FABRIC WHERE SPACE FOR OTHER PRACTICES IS LIMITED AND HEAVY SEDIMENT LOADING IS EXPECTED.
3. A GEOTEXTILE FABRIC RECOMMENDED FOR SUCH USE BY THE MANUFACTURER, SHALL BE BURIED AT LEAST 6 INCHES DEEP IN THE GROUND. THE FABRIC SHALL EXTEND AT LEAST 2 FEET ABOVE THE GROUND. THE FABRIC MUST BE SECURELY FASTENED TO THE POSTS USING A SYSTEM CONSISTING OF METAL FASTENERS (NAILS OR STAPLES) AND A HIGH STRENGTH REINFORCEMENT MATERIAL (NYLON WEBBING, GROMMETS, WASHERS, ETC.) PLACED BETWEEN THE FASTENER AND THE GEOTEXTILE FABRIC. THE FASTENING SYSTEM SHALL RESIST TEARING AWAY FROM THE POST. THE FABRIC SHALL INCORPORATE A DRAWSTRING IN THE TOP PORTION OF THE FENCE FOR ADDED STRENGTH.
4. INSTALL SILT FENCE AT LOCATIONS AS DIRECTED BY ENGINEER.
5. INSPECT THE SILT FENCE PERIODICALLY AND AFTER EACH STORM EVENT.
6. IF FENCE FABRIC TEARS, STARTS TO DECOMPOSE, OR IN ANY WAY IS DAMAGED, REPLACE THE AFFECTED PORTION IMMEDIATELY.
7. REMOVE DEPOSITED SEDIMENT WHEN IT REACHES 33% HEIGHT POINT OR IS CAUSING THE FABRIC TO BULGE.
8. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEAN OUT.
9. AFTER THE CONTRIBUTING DAMAGE AREA HAS BEEN STABILIZED, REMOVE SEDIMENT DEPOSITS, BRING THE DISTURBED AREA TO GRADE, STABILIZE.
10. SILT FENCE WILL REMAIN IN PLACE UNTIL SOD IS INSTALLED AND WATERED.

2/7 **TYPICAL SILT FENCE DETAIL**

NOT TO SCALE



NOTES:

1. USE RIP RAP.

4/7 **COFFER DAM**

NOT TO SCALE

PROJECT:	**HOLLYFRONTIER TULSA EAST RIVER BANK LNAPL TRAPPING CAP TULSA, OKLAHOMA**
TITLE:	**DETAILS**
DRAWN BY: T. FIEBRANZ	PROJ. NO.: 328732.0000.0000
CHECKED BY: J. RICE	SHEET 7 OF 10
APPROVED BY: K.VATER	
DATE: AUGUST 2021	
TRC	708 Heartland Trail Suite 3000 Madison, WI 53717 Phone: 608.826.3600
FILE NO.:	328732-DT.dwg

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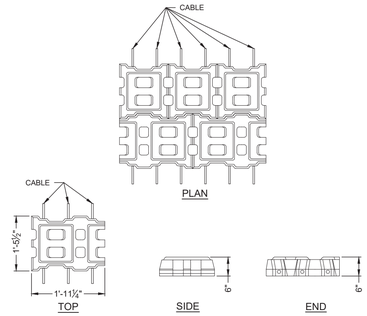
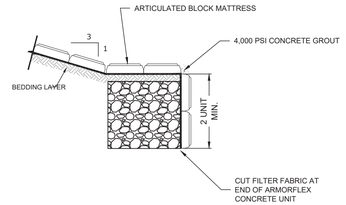
DRAWING NAME: J:\Holly Frontier\Tulsa\328732\0000\ 328732-DT.dwg — PLOT DATE: August 17, 2021 - 5:34AM — LAYOUT: DETAILS6

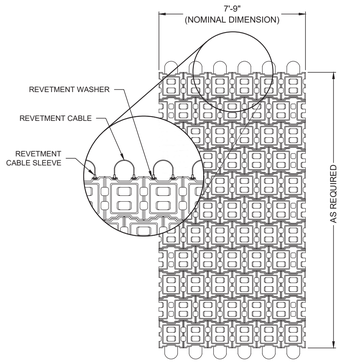
Version: 2017-10-21



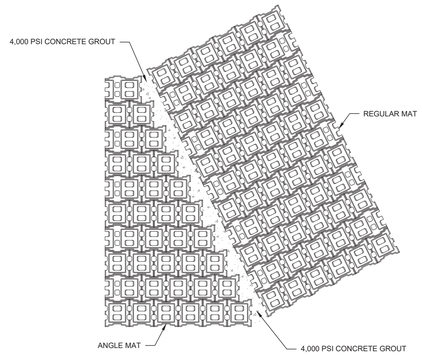
1/8 **TYPICAL 50 - 1.5 BLOCK**
NOT TO SCALE



2/8 **TYPICAL GABION MAT TERMINUS**
NOT TO SCALE

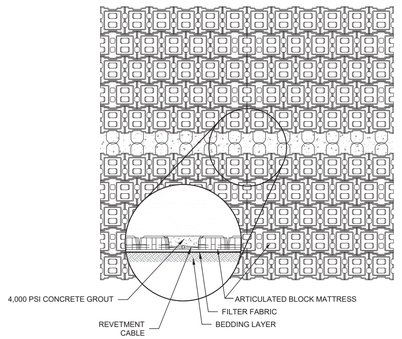


3/8 **TYPICAL 50 BLOCK 1.5 MAT**
NOT TO SCALE



NOTE:
ANGLE MATS WILL BE CONSTRUCTED BY OMITTING THE REQUIRED UNITS SO THE REQUIRED MAT DIMENSIONS CAN BE OBTAINED.

4/8 **TYPICAL ANGLE MAT**
NOT TO SCALE



5/8 **TYPICAL MAT TO MAT**
NOT TO SCALE

NOTES

1. DETAILS 1, 3, 4, AND 5 ON SHEET 8 FROM CONTECH (R) ENGINEERED SOLUTIONS, ARMORFLEX. ARMORFLEX-MEDIUM BAH 50-MODEL1 (NO DATE), ARMORFLEX-MEDIUM BAH 50-MODEL2 (NO DATE), AND ARMORFLEX DETAIL - MEDIUM BAH 50 (9/26/18).

2. DETAIL 2 ON SHEET 8 BASED ON CONTECH (R) ENGINEERED SOLUTIONS, ARMORFLEX DETAILS REFERENCED IN NOTE 1.

PROJECT:	HOLLYFRONTIER TULSA EAST RIVER BANK LNAPL TRAPPING CAP TULSA, OKLAHOMA
TITLE:	DETAILS
DRAWN BY:	T. FIEBRANZ
CHECKED BY:	J. RICE
APPROVED BY:	K.VATER
DATE:	AUGUST 2021
PROJ. NO.:	328732.0000.0000
	SHEET 8 OF 10

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SITE PREPARATION

A. CLEARING AND GRUBBING

1. PRIOR TO EXCAVATION, SITE TO BE CLEARED BY STRIPPING OF TREES, SHRUBS, BRUSH, LOGS, STUMPS, AND PLANT LIFE AND DISPOSAL OF DEBRIS AND SPOILS.

2. CLEARING: REMOVE TREES, SHRUBS, BRUSH, LOGS, STUMPS, AND OTHER PLANT GROWTH WITHIN CONSTRUCTION LIMITS TO A MAXIMUM OF 3 INCHES ABOVE GROUND LEVEL.

3. CONTAINERIZE ALL DEBRIS AND SPOILS FOR OFF-SITE DISPOSAL BY OTHERS.

4. PRESERVE AND PROTECT FROM DAMAGE TREES, VEGETATION, LANDSCAPING, UTILITIES, AND OTHER FEATURES ON-SITE OUTSIDE THE EXCAVATION AND CONSTRUCTION LIMITS. CUT OR SCARRED TREES AND SHRUBS WILL BE PRUNED OR REPLACED BY THE CONTRACTOR.

5. BURNING OF DEBRIS IS NOT PERMITTED

CONSTRUCTION FACILITIES

A. ELECTRICITY:

1. CONTRACTOR TO PROVIDE GENERATOR OR OTHER TEMPORARY SERVICE AS REQUIRED FOR THE WORK.

B. WATER:

1. CLEAN WATER TO BE USED TO DECONTAMINATE EQUIPMENT AND COMPLETE CONSTRUCTION OPERATIONS.

2. CONTRACTOR TO OBTAIN CLEAN WATER FROM OFF-SITE/HOLLYFRONTIER.

C. SANITARY FACILITIES.

1. CONTRACTOR TO PROVIDE AND MAINTAIN REQUIRED SANITARY FACILITIES. SANITARY FACILITIES SHOULD BE SECURED/TIED DOWN.

D. GENERAL RUBBISH

1. CONTROL ACCUMULATION OF WASTE MATERIALS AND RUBBISH AND CONTAINERIZE. COORDINATE CONTAINERS AND MAINTENANCE THEREOF WITH HOLLYFRONTIER.

2. MAINTAIN SITE IN A CLEAN ORDERLY CONDITION.

3. REMOVE ALL TEMPORARY FACILITIES TO RESTORE ORIGINAL CONDITIONS AT COMPLETION OF PROJECT.

SITE CONTROLS

A. PROVIDE AND MAINTAIN CONTROLS TO MINIMIZE TRANSPORT OF SOIL, WATER, AND OILS OUTSIDE THE WORK AREA BOUNDARY AS SHOWN ON THE DRAWINGS.

1. SILT FENCE

a. MATERIALS TO BE USED AS SHOWN IN THE DRAWINGS.

b. INSTALL SILT FENCE AT LOCATION SHOWN ON DRAWINGS AND AS DIRECTED BY ENGINEER.

c. INSTALL SILT FENCE AS SHOWN ON THE DETAILS.

2. TEMPORARY SURFACE WATER CONTROL

a. THE FOLLOWING CONTROLS ARE TO BE USED TO CONTAIN WORK WITHIN THE RIVER CHANNEL.

b. TURBIDITY CURTAIN AND OIL BOOM

(1) TO BE INSTALLED AND MAINTAINED BY OTHERS.

(2) CONTRACTOR TO PROTECT TURBIDITY CURTAIN AND OIL BOOM DURING WORK.

c. COFFER DAMS

(1) MATERIALS TO BE USED AS SHOWN IN THE DRAWINGS.

(2) INSTALL COFFER DAM AT LOCATION SHOWN ON DRAWINGS AND AS DIRECTED BY ENGINEER.

(3) INSTALL COFFER DAM AS SHOWN ON THE DETAILS.

(4) COFFER DAM TO PREVENT POTENTIAL SCOUR OR DOWNCUTTING OF THE BANK DURING CONSTRUCTION.

COLLECTION SUMPS

A. CONSTRUCT AND COMPLETE COLLECTION SUMPS AT 50 FOOT INTERVALS ALONG THE EXTENT OF THE CAP AS SHOWN ON THE DRAWINGS.

B. REFER TO: ANSI/AWWA C206, ASTM A53, ASTM C150, AWWA A100.

C. STEEL CASING AND SCREENS

1. CASING MATERIAL: STAINLESS STEEL, AISI TYPE 304, STANDARD WEIGHT, 8 INCH DIAMETER.

2. SCREEN MATERIAL: 50 FEET LENGTH OF STAINLESS STEEL, AISI TYPE 304, WIRE-WRAPPED, CONTINUOUS SLOT. SELECT MAXIMUM WELL SLOT THAT IS LESS THAN 0.187 INCHES (JOHNSON FREE-FLOW™ 307 STAINLESS STEEL 80-SLOT MEETS CRITERIA).

3. JOINTS: FLUSH-JOINT, THREADED OR WELDED.

4. FITTINGS: TYPE 304 STAINLESS STEEL. END FITTING WELDED TO SCREEN BODY.

D. FILTER PACKS TO BE GRAVEL PACKS PER CRUSHED STONE FILL.

E. SEALS TO BE PER AQUABLOK FILL.

F. SUMP HEAD PROTECTION

1. FLUSH-MOUNTED PROTECTIVE CASING WITH VENTED, HINGED, LOCKABLE LID. INSTALL IN A MANNER THAT INCIDENTAL CONTACT FROM TRAFFIC WILL NOT DAMAGE SUMP.

2. PROVIDE HEAVY DUTY PADLOCKS ON ALL CASINGS, KEYED ALIKE. BRAINARD-KILMAN OR APPROVED EQUAL.

G. PLACEMENT

1. SET SUMPS IN LOCATIONS ON DRAWINGS DURING INSTALLATION OF CRUSHED STONE COLLECTION ZONE AND PRIOR TO PLACEMENT OF AQUABLOK LAYER.

2. MAINTAIN STRAIGHTNESS AND PLUMBNESS IN ACCORDANCE WITH AWWA A100. GUARANTEE THAT WHEN COMPLETE, SUMP SHALL BE SUFFICIENTLY INSTALLED FOR THE FREE INSTALLATION AND OPERATION OF A VACUUM HOSE VALVE ATTACHMENT AND/OR INJECTION HOSE PIPING AND/OR SUBMERSIBLE PUMP.

3. SUMPS (SCREENS AND RISERS) SHALL BE PLACED ON MINIMUM OF 2-INCHES OF CRUSHED STONE AS BEDDING LAYER.

H. QUALITY CONTROL

1. TOLERANCES

a. HORIZONTAL PLANE: CENTERED WITHIN 10 FEET OF LOCATIONS SHOWN ON DRAWINGS.

b. VERTICAL PLANE: SCREENS SET TO INTERSECT THE CAP AT THE ELEVATIONS SHOWN ON THE DRAWINGS. SCREEN TO BE FULLY CONTAINED IN CRUSHED STONE FILL, AT A MINIMUM OF 4 INCHES BELOW THE TOP OF THE CRUSHED STONE COLLECTION ZONE.

c. SUMP HEAD TO BE COMPLETED AT THE FINAL GRADE OF THE ARTICULATED BLOCK MATTRESS, WITHIN -3 INCHES TO +0 INCHES.

2. PERFORM ALL WORK IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL REQUIREMENTS.

3. CERTIFICATION OF WELDER QUALIFICATIONS TO BE SUBMITTED TO ENGINEER 10 DAYS PRIOR TO COMMENCEMENT OF CAP CONSTRUCTION. CERTIFICATION WILL VERIFY TRAINING AND CURRENT LICENSURE TO WORK ON SPECIFIED MATERIALS.

I. SUMP DEVELOPMENT BY OTHERS. NOTIFY ENGINEER WHEN INSTALLATION IS COMPLETE.

MONITORING WELL PROTECTION

A. OUTSIDE THE FOOTPRINTS OF EXCAVATION: PROTECT EXISTING SITE MONITORING WELLS DURING EXCAVATION AND CONSTRUCTION ACTIVITIES. REPAIR ANY DAMAGES TO MONITORING WELLS.

1. PROTECTION: PROTECT WELL CASINGS AND BORINGS FROM INFILTRATION OF SURFACE WATER, OTHER WATER, SOIL, AND ANY FOREIGN MATERIALS. NOTIFY ENGINEER OF NECESSARY ALTERNATIONS AND/OR DAMAGES TO MONITORING WELLS.

2. REPAIR: REPAIR ANY WELL DAMAGED BY CONTRACTOR'S OPERATIONS BY EXCAVATING TO BELOW THE BROKEN CASING, EXTENDING PVC TO PREVIOUS GRADE, AND REPLACING PROTECTIVE CASING AND TOP SEAL TO PREVIOUS CONDITION. ENGINEER TO APPROVE REPAIR. REPAIR AND REPLACEMENT SHALL BE DONE AT NO EXPENSE TO THE OWNER.

EXCAVATION AND DISPOSAL

A. EXCAVATION ON THE SITE INCLUDES DREDGING, DIGGING, STABILIZING, LOADING, HAULING, AND DISPOSING OF MATERIAL TO ACHIEVE BASE ELEVATIONS SHOWN ON THE DRAWINGS OR DIRECTED BY ENGINEER.

B. PREPARATION

1. SURVEYOR TO ESTABLISH REQUIRED CONSTRUCTION SURVEY CONTROL LINES AND DATUM.

2. CONTRACTOR TO COORDINATE WITH ENGINEER AND SURVEYOR ON ALL ELEMENTS OF THE WORK REQUIRING SURVEY.

C. PROTECTION OF EXISTING SITE

1. NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS.

2. LOCATE, IDENTIFY, AND PROTECT EXISTING UTILITIES FROM DAMAGE.

3. OUTSIDE FOOTPRINTS OF EXCAVATION: PROTECT BENCH MARKS, SURVEY MONUMENTS, MONITORING WELLS, EXISTING STRUCTURES, FENCES AND GATES, SIDEWALKS, PAVING, AND CURBS FROM DAMAGE BY EXCAVATION EQUIPMENT AND VEHICULAR TRAFFIC. NOTIFY ENGINEER IF FEATURE MUST BE DISTURBED AND OBTAIN APPROVAL FOR RESTORATION OF FEATURE.

4. PROTECT EXCAVATIONS BY SLOPING, BENCHING, SHORING, BRACING, SHEET PILING, OR OTHER METHODS REQUIRED TO PREVENT CAVE-IN OR LOOSE SOIL FROM FALLING INTO THE EXCAVATION.

5. PROVIDE REINFORCEMENT OR USE OTHER MEASURES TO PREVENT DAMAGE TO STRUCTURES ADJACENT TO EXCAVATION WORK, INCLUDING THE PNEUMATIC LINE BEHIND THE EXISTING CONCRETE WING WALL.

6. DO NOT REMOVE OR DISTURB ANY MATERIALS OUTSIDE THE EXCAVATION AND CONSTRUCTION LIMITS.

D. EXCAVATION

1. GRADE PERIMETER OF EXCAVATION TO PREVENT SURFACE WATER DRAINAGE INTO EXCAVATION.

2. REMOVE DEBRIS, SUCH AS LOGS, BOULDERS, AND CONCRETE, AS THEY ARE ENCOUNTERED. ALL DEBRIS GREATER THAN 12-INCHES IN DIMENSION WILL BE REMOVED.

a. CONTAINERIZE DEBRIS FOR OFF-SITE DISPOSAL BY OTHERS.

b. ROCKS MAY BE PLACED INTO THE DIVERSION STRUCTURE AND REMAIN ON-SITE.

c. CONCRETE DEBRIS CAN REMAIN AS LONG AS IT IS CRUSHED TO LESS THAN 12-INCHES IN DIMENSION. CONCRETE DEBRIS TO REMAIN MAY NOT CONTAIN REBAR, METAL, OR OTHER MATERIALS.

d. SEGREGATE IMPACTED MATERIAL IN SEPARATE CONTAINER FOR DISPOSAL BY OTHERS.

3. NOTIFY ENGINEER OF UNEXPECTED SUBSURFACE CONDITIONS AND DISCONTINUE WORK IN AFFECTED AREA UNTIL NOTIFIED WORK CAN RESUME.

4. DREDGE SEDIMENT AND EXCAVATE SOIL TO ACHIEVE MINIMUM BASE GRADES AS SHOWN ON DRAWINGS. ENGINEER MAY REQUIRE ADDITIONAL EXCAVATION BASED ON SITE CONDITIONS.

E. FIELD QUALITY CONTROL

1. EXCAVATE TO MINIMUM BASE GRADES AS SHOWN ON DRAWINGS. ENGINEER MAY REQUIRE ADDITIONAL EXCAVATION BASED ON SITE CONDITIONS. COORDINATE WITH ENGINEER TO OBTAIN SURVEY (BY OTHERS) WHEN BASE GRADES ARE REACHED.

2. FOR CAP CONSTRUCTION, EXCAVATE TO ELEVATIONS SHOWN FOR BASE GRADE OF COLLECTION LAYER WITHIN -1.5 FEET TO +0.5 FEET TOLERANCE OF ELEVATIONS SHOWN ON DRAWINGS. COORDINATE MEASUREMENT WITH ENGINEER AND SURVEYOR.

F. SOLIDIFICATION

1. ESTABLISH ON-SHORE STAGING AREA FOR SOLIDIFICATION OF EXCAVATED MATERIAL IF REQUIRED FOR OFF-SITE DISPOSAL.

2. SOLIDIFY EXCAVATED MATERIAL AS REQUIRED TO PASS PAINT FILTER TEST PRIOR TO OFF-SITE DISPOSAL. SOLIDIFICATION METHOD/MATERIAL TO BE DISCUSSED WITH ENGINEER PRIOR TO USE.

G. LOAD FOR DISPOSAL

1. LOAD MATERIAL ONTO CONTAINERS FOR OFF-SITE DISPOSAL BY OTHERS. SEGREGATE IMPACTED SOILS FROM OTHER DEBRIS AND CLEAN FILL.

2. COORDINATE CONTAINER REMOVAL AND DELIVERY WITH ENGINEER.

3. COVER CONTAINERS WHEN NOT IN USE.

4. CONTRACTOR TO COORDINATE WITH OTHERS TO ALLOW ACCESS MATERIAL FOR SAMPLING, LOADING, AND HAULING.

DEWATERING (ONLY AS DETERMINED NECESSARY BY CONTRACTOR AND ENGINEER)

A. CONTROL RIVER WATER IN EXCAVATIONS ADJACENT TO THE RIVER AS NECESSARY TO COMPLETE CONSTRUCTION. COORDINATE WITH ENGINEER IF DEWATERING MAY BE NECESSARY.

TOPSOIL & SOD

A. PLACE TOPSOIL (IF NEEDED) AND SOD AS SHOWN ON THE DRAWINGS AND TO RESTORE ALL AREAS DISTURBED BY THE WORK.

B. PREPARATION

6. REMOVE VEGETATION, FOREIGN MATERIALS, UNSATISFACTORY SOILS, OBSTRUCTIONS, AND MATTER HARMFUL TO PLANT GROWTH FROM THE GROUND SURFACE BEFORE PLACEMENT.

7. PREPARE SUBSOIL TO ELIMINATE UNEVEN AREAS AND LOW SPOTS. MAINTAIN LINES, LEVELS, PROFILES, AND CONTOURS. MAKE GRADUAL CHANGES TO THE GRADE. BLEND SLOPES INTO LEVEL AREAS. MEET GRADES SHOWN ON DRAWINGS.

a. IF RESTORATION OF GREATER THAN 12-INCHES IS NEEDED, PLACE GENERAL FILL TO 12-INCHES BELOW GRADE IN PREPARATION FOR PLACEMENT OF TOPSOIL AND SOD.

b. PLACE TOPSOIL TO WITHIN 6-INCHES OF ELEVATIONS SHOWN ON DRAWINGS AND/OR TO MATCH SURROUNDING GRADE IN PREPARATION FOR PLACEMENT OF SOD.

c. BREAK DOWN ANY CLODS AND LUMPS IN GENERAL FILL OR TOPSOIL.

d. PLACE SOD TO ELEVATIONS SHOWN ON DRAWINGS AND/OR TO MATCH SURROUNDING GRADE.

FILL

A. TRANSPORT, STORE, AND INSTALL MATERIALS AS SPECIFIED HEREIN AND IN THE DRAWINGS.

B. REFER TO: ASTM D422, ASTM D1140, ASTM D2434, AND ASTM D5084.

C. MATERIALS

1. GENERAL FILL

a. GENERAL FILL TO BE USED WHERE DRAWINGS CALL FOR BACKFILL ON UPLAND AREAS PAST THE EXTENT OF THE AQUABLOK LAYER OF THE CAP.

b. MATERIAL TO BE FREE FROM ORGANIC MATTER, REFUSE, MASONRY, METAL, OR OTHER DEBRIS.

c. GENERAL FILL TO BE NATIVE GRANULAR MATERIAL WITH NO SIGN OF CONTAMINATION UPON REVIEW OF ENGINEER OR IMPORTED GENERAL FILL OF THE FOLLOWING GRADATION:

SIEVE SIZE	%PASSING BY WEIGHT
3"	100
1"	60-100
#200	0-30

d. NON-NATIVE FILL MATERIAL EXCAVATED FOR THE WORK WILL NOT BE ACCEPTED AS GENERAL FILL. E.G., DEBRIS, OR OTHER HISTORIC FILL. REMOVE AS DESCRIBED IN EXCAVATION.

2. GENERAL WASHED FILL

a. GENERAL WASHED FILL TO BE USED WHERE DRAWINGS CALL FOR BACKFILL IN EXCAVATIONS WITHIN THE RIVER CHANNEL AND EXCAVATIONS BENEATH THE EXTENT OF THE AQUABLOK LAYER OF THE CAP.

b. MATERIAL TO BE FREE FROM ORGANIC MATTER, REFUSE, MASONRY, METAL, OR OTHER DEBRIS.

c. GENERAL WASHED FILL TO BE NATIVE GRANULAR MATERIAL WITH NO SIGN OF CONTAMINATION UPON REVIEW OF ENGINEER OR IMPORTED GENERAL WASHED FILL, WHICH IS WELL GRADED, SUBROUNDED TO ROUNDED STONE MEETING THE FOLLOWING:

SIEVE SIZE	% PASSING BY WEIGHT
3"	100
#4	0-10
#200	0-3

d. NON-NATIVE FILL MATERIAL EXCAVATED FOR THE WORK WILL NOT BE ACCEPTED AS GENERAL FILL. E.G., DEBRIS, OR OTHER HISTORIC FILL. REMOVE AS DESCRIBED IN EXCAVATION.

3. SELECT CRUSHED STONE FILL

a. SELECT CRUSHED STONE FILL TO BE USED FOR CONSTRUCTION OF COLLECTION ZONE AND BEDDING LAYER.

b. SELECT CRUSHED STONE FILL TO MEET REQUIREMENTS OF AASHTO 5:

SIEVE SIZE	% PASSING BY WEIGHT
1 1/2"	100
1"	90-100
3/4"	20-55
1/2"	0-10
3/8"	0-5

c. A MINIMUM HYDRAULIC CONDUCTIVITY OF 0.1 CM/S AT THE DRY DENSITY AND MOISTURE CONTENT ACHIEVED DURING PLACEMENT.

d. CRUSHED STONE FILL SHALL BE WASHED PRIOR TO PLACEMENT BELOW THE CAP AND PLACEMENT WITHIN THE RIVER CHANNEL.

4. AQUABLOK FILL

a. AQUABLOK ® 2080 FW MANUFACTURED BY AQUABLOK, LTD.

b. MEET GRAIN SIZE OF AASHTO 57 OR EQUIVALENT AS MANUFACTURED.

c. MAXIMUM 5% OF THE AGGREGATE VOLUME MAY REMAIN UNCOATED BY THE BENTONITE.

d. MAXIMUM HYDRAULIC CONDUCTIVITY OF 10-7 CM/S.

D. MATERIAL STOCKPILES

1. STOCKPILE CONSTRUCTION MATERIALS ON HOLLYFRONTIER PROPERTY IN SEPARATE PILES WITH SUFFICIENT QUANTITIES TO MEET PROJECT SCHEDULE AND REQUIREMENTS. NOTIFY ENGINEER IF ADDITIONAL MATERIALS ARE NEEDED.

2. MAINTAIN STOCKPILES DAILY DURING CONSTRUCTION. GRADE STOCKPILES TO PROVIDE POSITIVE DRAINAGE TO PREVENT EROSION OR DETERIORATION OF MATERIALS.

3. AQUABLOK FILL TO BE STOCKPILED ON WATERPROOF MATERIAL WHICH IS RAISED TO PREVENT SURFACE DRAINAGE ONTO THE MATERIAL. STOCKPILE NO MORE AQUABLOK FILL THAN IS NEEDED TO ACCOMMODATE THE FOLLOWING DAY'S CONSTRUCTION UNLESS LONG-TERM DRY (COVERED) STORAGE IS PROVIDED.

E. PLACEMENT

1. GENERAL FILL

a. PLACE IN ACCORDANCE WITH DETAIL.

b. PLACE IN LIFTS UP TO 1 FOOT THICKNESS TO ACHIEVE GRADES AS SHOWN ON DRAWINGS.

c. COMPACT EACH LIFT OF UNSATURATED FILL WITH SPECIALIZED COMPACTION EQUIPMENT. SPECIALIZED EQUIPMENT SHALL INCLUDE TAMPING ROLLER, PNEUMATIC TIRE ROLLER, VIBRATORY ROLLER OR OTHER EQUIPMENT DESIGNED FOR COMPACTION AND APPROVED BY ENGINEER DURING CONSTRUCTION.

2. GENERAL WASHED FILL

a. PLACE IN LIFTS UP TO 1 FOOT THICKNESS TO ACHIEVE GRADES AS SHOWN ON DRAWINGS.

b. COMPACT EACH LIFT OF UNSATURATED FILL WITH SPECIALIZED COMPACTION EQUIPMENT. SPECIALIZED EQUIPMENT SHALL INCLUDE TAMPING ROLLER, PNEUMATIC TIRE ROLLER, VIBRATORY ROLLER OR OTHER EQUIPMENT DESIGNED FOR COMPACTION AND APPROVED BY ENGINEER DURING CONSTRUCTION.

3. AQUAGATE GABION

a. AQUAGATE GABIONS TO BE ASSEMBLED ON-SITE AND INSTALLED AT THE TOE OF THE CAP AS SHOWN ON THE DRAWINGS.

b. TRANSPORT, STORE, AND INSTALL GALVANIZED GABIONS AND ALL MATERIALS REQUIRED FOR THE GABIONS AS SPECIFIED HEREIN, IN THE DRAWINGS, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

c. REFERENCES: ASTM A975-97, ASTM A641/A641M-03, AND ASTM A370-97A.

d. MATERIALS

(1) FILTER FABRIC - REFER TO FILTER FABRIC SECTION

(2) GALVANIZED HARDWARE CLOTH WITH A MESH OPENING OF 0.108 INCHES OR LESS, SUCH AS EDWARD J. DARBY & SON INC. ITEM #8GA.017PL-3X100.

(3) GALVANIZED GABION BASKETS, SUCH AS BY MACCAFERRI.

(4) AQUAGATE+OC AS MANUFACTURED BY AQUABLOK.

e. DELIVERY, STORAGE, AND HANDLING

(1) UNLOAD GALVANIZED GABION BASKETS AND OTHER PRODUCTS AS TO CAUSE NO DAMAGE.

(2) PROTECT PRODUCTS FROM DAMAGE ON-SITE PRIOR TO USE. PROTECT GABION BASKETS FROM CRUSHING OR EXCESSIVE WEIGHT THAT WOULD DAMAGE THEM.

f. ASSEMBLE GALVANIZED GABIONS INDIVIDUALLY BY ERECTING THE SIDES, ENDS, AND DIAPHRAGMS, ENSURING ALL PANELS ARE IN THE CORRECT POSITION. CONNECTIONS SHOULD BE TIED WITH EITHER APPROPRIATE LACING WIRE OR FASTENERS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

g. ONCE ASSEMBLED, GABION BASKETS WILL BE PLACED ON A PREPARED FINAL SURFACE IN THE WATER AND JOINED TOGETHER ALONG THE VERTICAL AND TOP EDGES OF THE SIDES IN CONTACT WITH EACH OTHER WITH EITHER LACING WIRES OR FASTENERS. USE LIFTING AND INSTALLATION METHODS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

h. GABIONS WILL BE PLACED IN SUCH A WAY THAT THE LID OPENS AWAY FROM THE SLOPE TO FACILITATE PLACEMENT OF AQUAGATE.

i. GALVANIZED HARDWARE CLOTH WITH A MESH OPENING OF 0.108 INCHES OR LESS WILL BE PLACED IN THE GABIONS ALONG THE OUTER SIDES OF THE GABION SYSTEM.

j. NON-WOVEN GEOTEXTILE FABRIC WILL BE PLACED ON THE INTERIOR OF THE GABIONS AND CUT WITH ENOUGH FABRIC TO COVER ALL SIDES OF THE GABION. THE GEOTEXTILE WILL HAVE HOLES PUNCHED THROUGH THE SAME SIDE AS THE HARDWARE CLOTH TO SECURE THE GEOTEXTILE TO THE HARDWARE CLOTH AND TO THE GABION BASKET WITH LACING WIRES OR ENGINEER APPROVED EQUIVALENT.

k. AQUAGATE WILL BE PLACED INSIDE THE GABIONS ON TOP OF THE FABRIC. FILL THE GABIONS PER THE MANUFACTURER'S INSTRUCTIONS, INCLUDING IN 1-FOOT LIFTS IF REQUIRED. FILL EACH GABION WITH A MINIMUM OF 27-CUBIC FEET OF AQUAGATE. ANY EMPTY SPACE ABOVE THE AQUAGATE SHALL BE FILLED WITH AQUABLOK TO FILL THE GABIONS ENTIRELY, BUT A MAXIMUM OF 4-INCHES OF THICKNESS OF AQUABLOK IS ALLOWABLE. IF THE THICKNESS TO BE FILLED IS GREATER THAN 4-INCHES, ADDITIONAL AQUAGATE SHOULD BE ADDED BEFORE ANY AQUABLOK.

l. AFTER FILLING IS COMPLETE, THE FABRIC WILL BE WRAPPED OVER THE TOP, THE LID WILL BE PULLED TIGHT TO THE PERIMETER EDGE AND SECURED WITH EITHER LACING WIRES OR FASTENERS.

m. PLACE ADDITIONAL AQUAGATE BETWEEN GABIONS FROM BEDROCK TO TOP OF GABION WHERE GABIONS RE NOT INSTALLED IMMEDIATELY ADJACENT (+1/2-INCH) ONE ANOTHER.

n. AFTER PLACEMENT OF THE AQUAGATE GABIONS IS COMPLETE, PROCEED WITH CONSTRUCTION OF THE CAP FILL LAYERS, BEGININNING WITH THE SELECT CRUSHED STONE FILL COLLECTION LAYER.

4. SELECT CRUSHED STONE FILL COLLECTION LAYER

a. PLACE AND SPREAD SELECT CRUSHED STONE FILL AFTER EXCAVATION GRADES HAVE BEEN ESTABLISHED. PLACEMENT SHALL PROGRESS UPWARDS FROM THE TOE OF SLOPE. PLACE SELECT CRUSHED STONE FILL IN MULTIPLE LIFTS ALLOWING FOR PLACEMENT OF THE COLLECTION SUMPS AT 100 FEET INTERVALS ALONG THE LENGTH OF THE CAP AS SHOWN ON THE DRAWINGS AND AS SPECIFIED IN COLLECTION SUMPS.

b. GRADE TOP OF COLLECTION LAYER TO ACHIEVE MINIMUM THICKNESS OF 12" + 6"/-2" ON TOP OF NATIVE MATERIAL AND/OR GENERAL FILL. GRADE TOP OF COLLECTION LAYER TO ACHIEVE CONSTANT POSITIVE SLOPES AS SHOWN ON THE DRAWINGS.

c. AFTER PLACEMENT OF THE SELECT CRUSH STONE COLLECTION LAYER AND COLLECTION SUMPS, PROTECT THE GABIONS FROM CONTACT WITH FUGITIVE SEDIMENT AND AQUABLOK.

5. AQUABLOK FILL

a. PLACE ONLY DRY GRANULAR AQUABLOK WITH NO CLUMPS. DO NOT PLACE ALREADY HYDRATED AQUABLOK FILL.

b. PLACE AND SPREAD AQUABLOK FILL TO THICKNESS IN ONE LIFT. PLACEMENT WILL PROGESS UPWARD FROM THE TOE OF SLOPE IN 10 TO 20 FEET WIDE LIFTS, AS EQUIPMENT ALLOWS.

c. GRADE AND FINISH TO ACHIEVE A LAYER THICKNESS OF 6" +/- 2", WITH A MINIMUM THICKNESS OF 4 INCHES OVER THE EXTENT OF THE CAP.

d. COVER AQUABLOK FILL WITH SELECT CRUSHED STONE FILL AND GEOGRID AT THE END OF EACH DAY. MAINTAIN 3 TO 5 FEET OF AN UNCOVERED EDGE OF AQUABLOK TO ACCOMMODATE PLACEMENT THE FOLLOWING DAY. OVERLAP DAILY AQUABLOK APPLICATIONS 1 TO 3 FEET.

e. MAINTAIN AN OPEN FACE ON THE DOWNSTREAM SIDE OF THE AQUABLOK UNTIL SELECT CRUSHED STONE FILL AND GEOGRID HAS BEEN PLACED OVER THE AQUABLOK BEFORE PROCEEDING WITH THE NEXT DOWNSTREAM SECTION.

f. REMOVE AND REPLACE AQUABLOK FILL THAT DOES NOT MEET SPECIFIED MATERIAL TESTING REQUIREMENTS.

6. SELECT CRUSHED STONE BEDDING LAYER

a. PLACE SELECT CRUSHED STONE FILL IN 3" +/- 1" LIFT ON TOP OF AQUABLOK FILL LAYER. PLACE GEOGRID AS SPECIFIED IN GEOGRID. PLACE ANOTHER 3" +/- 1" LIFT OF SELECT CRUSHED STONE ON TOP OF THE GEOGRID.

b. PLACE ARTICULATED BLOCK MATTRESS ON TOP OF SELECT CRUSHED STONE BEDDING LAYER PER ARTICULATED BLOCK MATTRESS.

F. FIELD QUALITY CONTROL

1. COORDINATE FOR SURVEY WITH ENGINEER AND SURVEYOR.

a. SURVEYOR TO SURVEY BOTTOM OF COLLECTION LAYER, TOP OF COLLECTION LAYER, AND FINAL CAP AND SITE CONDITIONS.

b. CONTRACTOR TO PROTECT ALL SURVEY STAKES AND OTHER SURVEY MARKERS DURING CONSTRUCTION.

2. GENERAL FILL AND TOPSOIL IN UPLAND AREAS

a. ACHIEVE FINAL GRADES AS SHOWN ON THE DRAWINGS +/- 6 INCHES.

3. SELECT CRUSHED STONE FILL COLLECTION LAYER BASE

a. ACHIEVE ELEVATION GRADES SHOWN ON THE DRAWINGS WITHIN -1.5 FEET TO + 6 INCHES.

b. EXCAVATE OR FILL TO ACHIEVE BASE GRADES AS DIRECTED BY ENGINEER.

4. SELECT CRUSHED STONE FILL COLLECTION LAYER TOP

a. ACHIEVE ELEVATIONS SHOWN ON THE DRAWINGS FOR TOP OF COLLECTION LAYER WITHIN THE TOLERANCE OF +6/-2 INCHES.

b. ACHIEVE MINIMUM THICKNESS OF 6 INCHES FOR COLLECTION LAYER.

c. MAINTAIN POSITIVE SLOPE NOT TO EXCEED 3:1 BETWEEN THE TOE OF SLOPE AND TOP OF SLOPE BETWEEN OVER ENTIRE SURFACE OF THE TOP OF THE COLLECTION LAYER.

d. STEEPER SLOPES OR NEGATIVE SLOPES ONLY ALLOWED IF REQUIRED BY SITE FEATURES AND APPROVED BY ENGINEER.

e. REGRADE, FILL, AND/OR EXCAVATE SELECTED CRUSHED STONE FILL TO ACHIEVE TOP ELEVATION, THICKNESS, AND SLOPE REQUIREMENTS AS DIRECTED BY ENGINEER.

5. AQUABLOK LAYER TOP

a. ACHIEVE MINIMUM THICKNESS OF 6 INCHES +4 INCHES/-1 INCH, FOR MAXIMUM THICKNESS OF 10 INCHES.

b. ADD ADDITIONAL AQUABLOK PER THE SPECIFICATION AS DIRECTED BY THE ENGINEER AT LOCATIONS WHERE MINIMUM THICKNESS ARE NOT ACHIEVED.

c. REMOVED AQUABLOK AND REPLACE AS NEEDED TO MEET SPECIFICATIONS AND AS DIRECTED BY ENGINEER FOR CASE WHERE MAXIMUM THICKNESS IS EXCEEDED.

d. MAXIMUM THICKNESS MAY BE EXCEEDED IF APPROVED BY ENGINEER FOR SPECIFIC LOCATIONS AND IF DOES NOT CAUSE SLOPE TO EXCEED 2:1.

6. BEDDING LAYER - GEOGRID BASE

a. ACHIEVE MINIMUM THICKNESS OF 3 INCHES +/- 1 INCHES.

b. ADD ADDITIONAL SELECT CRUSHED STONE PER THE SPECIFICATION AS DIRECTED BY THE ENGINEER AT LOCATIONS WHERE MINIMUM THICKNESS ARE NOT ACHIEVED.

c. REMOVE SELECT CRUSHED STONE AND REPLACE AS NEEDED TO MEET SPECIFICATIONS AND AS DIRECTED BY ENGINEER FOR CASE WHERE MAXIMUM THICKNESS IS EXCEEDED.

d. MAXIMUM THICKNESS MAY BE EXCEEDED IF APPROVED BY ENGINEER FOR SPECIFIC LOCATIONS AND IF DOES NOT CAUSE SLOPE TO EXCEED 2:1.

e. INSTALL GEOGRID ON TOP OF BEDDING LAYER-GEOGRID BASE AS SPECIFIED IN GEOGRID.

7. BEDDING LAYER TOP

a. ACHIEVE MINIMUM THICKNESS OF 3 INCHES +/- 1 INCH ON TOP OF GEOGRID.

b. ADD ADDITIONAL SELECT CRUSHED STONE PER THE SPECIFICATION AS DIRECTED BY THE ENGINEER AT LOCATIONS WHERE MINIMUM THICKNESS ARE NOT ACHIEVED.

c. REMOVED CRUSHED STONE AND REPLACE AS NEEDED TO MEET SPECIFICATIONS AS DIRECTED BY ENGINEER FOR CASE WHERE MAXIMUM THICKNESS IS EXCEEDED.

d. MAXIMUM THICKNESS MAY BE EXCEEDED IF APPROVED BY ENGINEER FOR SPECIFIC LOCATIONS AND IF DOES NOT CAUSE SLOPE TO EXCEED 2:1.

e. ESTABLISH METHOD TO DEMONSTRATE MINIMUM 1-FOOT THICKNESS OF SELECT CRUSHED STONE FILL WILL MAINTAIN DIRECT CONNECTION WITH RIVER AT TOE VENT AS SHOWN IN THE DETAILS FOR APPROVAL.

f. IMPLEMENT APPROVED QUALITY CONTROL METHOD.

g. REPAIR GABION AS DIRECTED BY ENGINEER IF NECESSARY.

h. REPLACE GEOGRID IF DAMAGED DURING PLACEMENT OF BEDDING LAYER TOP.

8. COMPACTION AND SETTLING

a. CONTRACTOR TO BE RESPONSIBLE TO MAINTAIN SPECIFIED GRADES UP TO 12-MONTHS FROM COMPLETION OF WORK.

GENERAL NOTE

1. THIS SHEET DEPICTS VARIOUS INTELLECTUAL PROPERTY OF TRC COMPANIES, INC. PATENT NUMBER US 8,419,314 & US 8,651,768. ALL RIGHTS RESERVED.

PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
SPECIFICATIONS

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		**SHEET 9 OF 10**
DATE:	AUGUST 2021		

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FILE NO.: 328732 - SPEC.dwg

RIP RAP

A. RIPRAP SHALL BE PLACED TO OVERLAY THE CAP IN THE VICINITY OF THE RIVER CHANNEL. TRANSPORT, STORE, AND INSTALL MATERIALS AS SPECIFIED HEREIN AND IN THE DRAWINGS.

B. MATERIAL SHALL BE DURABLE FIELD OR QUARRY STONE THAT IS A SOUND, HARD, DENSE, RESISTANT TO ACTION OF AIR AND WATER, AND FREE FROM SEAMS, CRACKS, OR OTHER STRUCTURAL DEFECTS.

C. STONE PIECES TO MEET THE FOLLOWING SIZE REQUIREMENTS:

%	LIGHTER BY DIA. (FT.)	LIGHTER BY WEIGHT (LBS)
100	3.92 - 3.6	9,060 - 6,000
50	3.0 - 1.75	4,000 - 800
15	2.1 - 0.83	1,100 - 90

D. STONE PIECES SHALL BE SUB-ROUNDED TO ROUNDED.

E. PRIOR TO PLACEMENT OF THE RIPRAP, EXCAVATE TO THE LINES AND GRADES REQUIRED AS SHOWN ON THE DRAWING AND COMPLETE BACKFILL AND CAP CONSTRUCTION AS SPECIFIED IN SPECIFICATIONS AND DRAWINGS.

F. PLACEMENT

1. PLACE AND FINISH RIPRAP AS SHOWN ON THE DRAWINGS.
2. RIPRAP SHALL EXTEND TO THE RIVER SIDE EDGE OF THE ARTICULATED BLOCK MATTRESS. RIP RAP SHALL EXTEND A MINIMUM OF 5-FEET BEYOND THE RIVER SIDE EXTENT OF THE AQUABLOK.
3. PLACE RIPRAP WITH CARE SO NO DAMAGE IS DONE TO UNDERLYING LAYERS OF CAP. DO NOT DROP RIPRAP FROM A HEIGHT GREATER THAN 1 FOOT.
4. PLACE RIPRAP FROM THE BASE OF THE SLOPE UPWARD. PLACE SMALLER STONES TO FILL VOIDS BETWEEN THE LARGER SIZE STONES.

FILTER FABRIC

A. FILTER FABRIC TO BE PLACED UPON THE BEDDING LAYER TO THE EXTENTS SHOWN ON THE DRAWINGS.

B. TRANSPORT, STORE, AND INSTALL MATERIALS AS SPECIFIED HEREIN, IN THE DRAWINGS, AND PER MANUFACTURER'S INSTRUCTIONS.

C. REFERENCES: OKLAHOMA DEPARTMENT OF TRANSPORTATION CONSTRUCTION MATERIAL SPECIFICATION SECTION 712.02 AND 714.04 FOR PERMANENT EROSION CONTROL FABRICS.

D. MATERIAL

1. FILTER FABRIC SHALL BE: SKAPS INDUSTRIES GE-180 NON-WOVEN GEOTEXTILE, US FABRICS US 205NW NON-WOVEN GEOTEXTILE, OR EQUAL.

E. DELIVERY, STORAGE, AND HANDLING

1. UNLOAD AND HANDLE AS TO CAUSE NO DAMAGE.
2. PROTECT FILTER FABRIC FROM SUNLIGHT, MOISTURE, MUD, DIRT, DUST, EXCESSIVE TEMPERATURES, PUNCTURE, OR OTHER DAMAGING CONDITIONS.

F. PLACEMENT

1. PLACE FILTER FABRIC ON COMPLETED BEDDING LAYER. SURFACE SHALL BE FREE OF RUBISH, DEBRIS, OR OTHER FOREIGN OBJECTS THAT COULD RIP, TEAR, OR OTHERWISE DAMAGE THE FILTER FABRIC.
2. INSTALL FILTER FABRIC IN ACCORDANCE WITH THE GUIDELINES PROVIDED BY THE MANUFACTURER AND AS DIRECTED BY ENGINEER.
3. UPON PLACEMENT OF FILTER FABRIC, SECURE ALL FILTER FABRIC IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ANCHORS MAY BE TEMPORARY OR PERMANENT.
   i. PLACE SANDBAGS OR WEIGHTED EQUIVALENT ON THE FILTER FABRIC TO PREVENT MOVEMENT/UPLIFT UNTIL PLACEMENT OF ARTICULATED CONCRETE BLOCK. REMOVE SANDBAGS IMMEDIATELY PRIOR OR, IF POSSIBLE, AFTER PLACEMENT OF THE ARTICULATED CONCRETE BLOCK.
   ii. PENETRATING ANCHORING MATERIALS SHALL NOT PENETRATE AQUABLOK FILL LAYER.
4. OVERLAP FILTER FABRIC SHEETS/ROLLS BY AT LEAST 18-INCHES OR AS REQUIRED BY MANUFACTURER'S INSTALLATION INSTRUCTIONS.
5. TAKE ANY NECESSARY PRECAUTIONS TO PREVENT DAMAGE TO UNDERLYING LAYERS OF FILL MATERIALS DURING PLACEMENT OF FILTER FABRIC. AFTER PLACEMENT, THE FILTER FABRIC SHALL NOT BE LEFT EXPOSED FOR A PERIOD IN EXCESS OF 1 DAY. FOLLOW THE MANUFACTURER'S RECOMMENDATIONS FOR EXPOSURE TO SUNLIGHT AND DO NOT LEAVE EXPOSED LONGER THAN THEIR RECOMMENDATION OR 1 DAY, WHICHEVER IS LESS.
6. EXAMINE FILTER FABRIC AFTER INSTALLATION TO ENSURE THAT NO POTENTIALLY HARMFUL FOREIGN OBJECTS HAVE DAMAGED THE FILTER FABRIC.

ARTICULATED BLOCK MATTRESS & BACKFILL

A. ARTICULATED BLOCK MATTRESS SHALL BE PLACED ON TOP OF THE FILTER FABRIC BEDDING LAYER TO THE EXTENTS SHOWN ON THE DRAWINGS.

B. TRANSPORT, STORE, AND INSTALL MATERIALS AS SPECIFIED HEREIN, IN THE DRAWINGS, AND PER MANUFACTURER'S INSTRUCTIONS.

C. REFERENCES: ASTM D 7276, ASTM D 7277, AND ASTM D 6884.

D. MATERIALS

1. ARTICULATED BLOCK MATTRESS SHALL BE: CONTECH ARMORFLEX OPEN BLOCK CLASS 50, WITH A NOMINAL THICKNESS OF 6-INCHES, OR EQUAL.
2. ARTICULATED BLOCK MATTRESS BACKFILL SHALL BE 3/8-INCH TO 3/4-INCH CRUSHED STONE.
3. GROUT SHALL BE 4,000 PSI NON-SHRINKING GROUT OR CONCRETE.

E. DELIVERY, STORAGE, AND HANDLING

1. UNLOAD AND HANDLE AS TO CAUSE NO DAMAGE.
2. STORE ARTICULATED BLOCK MATTRESS PER MANUFACTURER'S RECOMMENDATIONS. INSPECT MATERIALS UPON DELIVERY AND INTERMITTENTLY DURING STORAGE FOR ANY DAMAGE. KEEP ARTICULATED BLOCK MATTRESS FREE OF DIRT AND DEBRIS DURING STORAGE.
3. STORE ARTICULATED BLOCK MATTRESS BACKFILL PER FILL, INCLUDING MAINTAINING A SEPARATE STOCKPILE FOR BACKFILL FROM ALL OTHER STOCKPILES.
4. DELIVER GROUT AS REQUIRED FOR DAILY WORK. DO NOT STORE GROUT ON-SITE.

F. PLACEMENT

1. PLACE ARTICULATED BLOCK MATTRESS ON BEDDING LAYER AND FILTER FABRIC PER MANUFACTURER'S INSTRUCTIONS AND REQUIREMENTS. NO GROOVES OR DEPRESSIONS (INCLUDING FOOTPRINTS) GREATER THAN 1/2-INCH IN DEPTH WITH A DIMENSION EXCEEDING 1-FOOT IN ANY DIRECTION ARE PERMITTED. NO FOLDS, WRINGLES, OR TENSION ARE PERMITTED IN THE FILTER FABRIC.
2. LIFT ARTICULATED BLOCK MATTRESS USING A SPREADER BAR OR AS OTHERWISE RECOMMENDED BY THE MANUFACTURER. USE PERSONNEL WITH THE APPROPRIATE TRAINING FOR LIFTING AND PLACING THE MATERIALS. HANDPLACEMENT OF THE ARTICULATED BLOCK MATTRESS SHOULD BE LIMITED ONLY TO SPECIFIC SMALL AREAS REQUIRING HAND PLACEMENT DUE TO GEOMETRY.
3. START PLACEMENT OF THE ARTICULATED BLOCK MATTRESS DOWNSTREAM AND PROCEED UPSTREAM.
4. FILL ALL LOOP ENDS, 2-INCH OR GREATER GAPS, GABIAN FACE CORNER, AND ALL OTHER GAPS AS DIRECTED BY ENGINEER WITH GROUT.
5. FILL OPENINGS IN ARTICULATED BLOCK MATTRESS WITH BACKFILL. PLACE AND SPREAD BACKFILL SO THAT ALL OPENINGS IN THE BLOCK ARE FILLED TO THE SURFACE.

G. FIELD QUALITY CONTROL

1. NO INDIVIDUAL BLOCK WITHIN THE PLANE OF THE ARTICULATED BLOCK MATTRESS MAY PROTRUDE MORE THAN 1/2-INCH ABOVE THE PLANE OF THE MATTRESS. REPAIR SUBGRADE AS REQUIRED TO MITIGATE ANY PROTRUSIONS.

GEOGRID

A. TRANSPORT, STORE, AND INSTALL GEOGRIDS AS SPECIFIED HEREIN AND IN THE DRAWINGS.

B. REFER TO: ASTM D5261, ASTM D6637, CWO 22125, AND GRI GG4(b).

C. MATERIAL

1. GEOGRID SHALL CONSIST OF POLYPROPYLENE (WOVEN OR NONWOVEN).

D. DELIVERY, STORAGE, AND HANDLING

1. UNLOAD AND HANDLE GEOGRIDS SO AS TO CAUSE NO DAMAGE.
2. PROTECT GEOGRIDS FROM SUNLIGHT, MOISTURE, MUD, DIRT, DUST, EXCESSIVE TEMPERATURES, PUNCTURE, OR OTHER DAMAGING CONDITIONS.

E. PLACEMENT

1. PREPARE BEDDING LAYER OF SELECT CRUSHED STONE OF 3" +/- 1" ABOVE THE TOP OF THE AQUABLOK GRADES.
2. PLACE GEOGRID ON PREPARED BEDDING LAYER.
3. OVERLAP ADJACENT GEOGRID PANELS A MINIMUM OF 18 INCHES.
4. GEOGRID SHALL BE INSTALLED IN ACCORDANCE WITH THE GUIDELINES PROVIDED BY THE MANUFACTURER AND AS DIRECTED BY THE ENGINEER.
5. TAKE ANY NECESSARY PRECAUTIONS TO PREVENT DAMAGE TO UNDERLYING LAYERS OF MATERIALS DURING PLACEMENT OF THE GEOGRID. AFTER PLACEMENT, THE GEOGRID SHALL NOT BE LEFT EXPOSED FOR A PERIOD IN EXCESS OF 1 DAY. FOLLOW THE MANUFACTURER'S RECOMMENDATIONS FOR EXPOSURE TO SUNLIGHT AND DO NOT LEAVE EXPOSED LONGER THAN THEIR RECOMMENDATION OR 1 DAY, WHICHEVER IS LESS.
6. SECURE ALL GEOGRIDS IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS. ANCHORING MATERIALS SHALL NOT PENETRATE AQUABLOK LAYER. ANCHORING MATERIALS SHALL BE INSTALLED PERMANENTLY.
7. EXAMINE THE GEOGRID SURFACE AFTER INSTALLATION TO ENSURE THAT NO POTENTIALLY HARMFUL FOREIGN OBJECTS ARE PRESENT. REMOVE ANY SUCH OBJECTS AND REPLACE ANY DAMAGED GEOGRID.
8. PLACE REMAINING LAYER OF 3" +/- 1" SELECT CRUSHED STONE BED CAREFULLY ON TOP OF GEOGRID. PLACE ADDITIONAL LAYERS OF MATERIALS ON TOP OF THE GEOGRID AND SELECT CRUSHED STONE BED WITH CARE TO ENSURE THAT GEOGRID AND UNDERLYING LAYERS ARE NOT DAMAGED, THAT GEOGRID DOES NOT MOVE, AND THAT EXCESS STRESSES AT WRINKLES ARE NOT PRODUCED IN THE GEOGRID.

F. FIELD QUALITY CONTROL

1. THE ENGINEER MAY RANDOMLY INSPECT GEOGRID BEFORE, DURING, AND AFTER (USING TEST PITS) INSTALLATION.
2. ANY DAMAGED OR DEFECTIVE (I.E. FRAYED COATING, SEPARATED JUNCTIONS, SEPARATED LAYERS, TEARS) WILL BE REPAIRED AND/OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
   a. REPAIR: ANY ROLL OF GEOGRID DAMAGED BEFORE, DURING, OR AFTER INSTALLATION SHALL BE REPAIRED PER MANUFACTURER'S AND ENGINEER'S DIRECTION BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
   b. REPLACEMENT: ANY GEOGRID NEEDING REPLACEMENT SHALL BE REMOVED AND THE AFFECTED AREA PLUS 3 FEET OF GEOGRID TO ALL SIDES OF THE AFFECTED AREA SHALL BE REPLACED. ANCHOR REPLACEMENT SECTION PER MANUFACTURER'S AND ENGINEER'S DIRECTIONS.

SITE USE

A. WITHIN THE CONSTRUCTION LIMITS, THE FOLLOWING ACTIVITIES ARE NOT ALLOWED:

1. FUEL STORAGE OR EQUIPMENT MAINTENANCE.
2. WASHOUT OF CONCRETE OR BENTONITE CONTAINING VEHICLES/CONTAINERS/ETC.
3. STAGING OF EQUIPMENT OR PARKING OF VEHICLES/EQUIPMENT THAT ARE NOT IN USE.
4. CHEMICAL STORAGE EXCEPT IN APPROVED CONTAINERS FOR DAILY USE ONLY.

B. PREVENT TRACK-IN/TRACK-OUT OF SOIL ON VEHICLES. WASH VEHICLE TIRES AS NEEDED.

C. CONTAINERIZE AND COVER ALL RUBISH, TRASH, DEBRIS, AND WASTE MATERIALS FOR DISPOSAL. PREVENT BLOWING OF TRASH, DEBRIS, OR WASTE MATERIALS.

D. FUELING SHOULD BE COMPLETED IN APPROVED AREAS ON HOLLYFRONTIER PROPERTY IF POSSIBLE. FUELING SHOULD NOT BE DONE ON THE CAP OR ADJACENT THE RIVER.

E. ENGINEER WILL INSPECT THE USE OF THE SITE AND MAINTAIN DOCUMENTATION. ENGINEER WILL NOTIFY CONTRACTOR AND HOLLYFRONTIER IF SITE USE DOES NOT MEET THE REQUIREMENTS OF THESE DRAWINGS.

F. SITE ACCESS CONTROLS BEYOND THE LIMITS OF WORK WILL BE INSTALLED BY OTHERS WITHIN ADJACENT WORK AREAS. MAINTAIN SITE ACCESS CONTROLS (FENCES, ETC.) AS NEEDED FOR THE WORK AND DURING ALL SHORT DURATION OPENINGS OF THE BIKE TRAIL. REPAIR DAMAGE TO SITE ACCESS CONTROLS IF DAMAGED BY CONTRACTOR DURING THE WORK.

REFERENCES

A. REFER TO HOLLYFRONTIER ENGINEERING PRACTICES AS RELEVANT. DISCUSS ANY VARIATIONS BETWEEN THE ENGINEERING PRACTICES AND THESE PROJECT SPECIFICATIONS WITH HOLLYFRONTIER AND ENGINEER.

GENERAL NOTE

1. THIS SHEET DEPICTS VARIOUS INTELLECTUAL PROPERTY OF TRC COMPANIES, INC. PATENT NUMBER US 8,419,314 & US 8,651,768. ALL RIGHTS RESERVED.

PROJECT:
HOLLYFRONTIER TULSA EAST
RIVER BANK LNAPL TRAPPING CAP
TULSA, OKLAHOMA

TITLE:
SPECIFICATIONS

DRAWN BY:	T. FIEBRANZ	PROJ. NO.:	328732.0000.0000
CHECKED BY:	J. RICE		
APPROVED BY:	K.VATER		**SHEET 10 OF 10**
DATE:	AUGUST 2021		

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Appendix B. Monitoring and Maintenance Forms and Logs

Routine O&M Form

December 2021

Routine O&M Form

LNAPL Containment Cap and Collection System

HollyFrontier Tulsa East Refinery, Tulsa County, Oklahoma

DATE: _____ TIME ARRIVE ON SITE (HH:MM AM/PM): _____

INSPECTED BY: _____ TIME OFF SITE (HH:MM AM/PM: _____

SITE CONDITIONS (circle): snow cover ground wet/soft standing water frozen water/ice other: _____

WEATHER (circle): sunny partly cloudy overcast rain snow other precip: _____ wind: _____ approx. temp (deg F): _____

RECOVERY SUMPS & MONITORING WELLS

Location ID	Time	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Thickness (ft)
Sump 1				
Sump 2				
Sump 3				
MW-343				
MW-372				
MW-373				
MW-374				
MW-375				

NOTE: Take measurement from bottom & center of pipe. A weighted line or rigid metal wire "fish-tape" may be needed to get the probe down the slanted pipe to the fluid level.

Sump/Clean-out Observations and Maintenance Notes: _____

SURFACE WATER OBSERVATIONS

Top of Concrete Wall to Arkansas River	Depth to Surface Water (ft)
Time	
Reading	

Note: Take direct reading measurement from location marked on side of concrete wall to the nearest 0.01 foot.

Condition of Reference Measurement Point **(OK / Damaged)**

Comment: _____

Was hydrocarbon sheen observed anywhere along the LNAPL Containment Cap and Collection System? **(YES / NO)**

Comment: _____

Routine O&M Form - LNAPL Containment Cap and Collection System,
HollyFrontier Tulsa East Refinery, Tulsa County, Oklahoma

DATE: _____

LNAPL TRAPPING CAP

After walking the length of the cap were any of the following conditions present?

Signs of erosion on or adjacent to the cap? **(YES / NO)**

Comment: _____

Signs of significant settling? **(YES / NO)**

Comment: _____

Trees growing on top of or within 5 feet of the cap? **(YES / NO)**

Comment: _____

Shrubs growing on top of the cap? **(YES / NO)**

Comment: _____

GENERAL NOTES

Comments/Notes: _____

Maintenance Log

Maintenance Log
LNAPL Containment Cap and Collection System
HollyFrontier Tulsa East Refinery, Tulsa County, Oklahoma

Date	Component Description (i.e. sump, armor rock, staff gauge, etc.)	Scope of Work					Maintenance Activity Description	Condition Causing Need for Maintenance or Repair
		Maintained	Repaired	Modified	Replaced	Other		

Name:

Signature:

LNAPL Recovery Log

December 2021

LNAPL Recovery Log
LNAPL Containment Cap and Collection System
HollyFrontier Tulsa East Refinery, Tulsa County, Oklahoma

Date	Sump 1			Sump 2			Sump 3			Recovery Method	Total Volume Recovered (Gal)	Management Location	Notes
	Initial LNAPL Thickness (ft)	Final LNAPL Thickness (ft)	Volume LNAPL Removed (Gal)	Initial LNAPL Thickness (ft)	Final LNAPL Thickness (ft)	Volume LNAPL Removed (Gal)	Initial LNAPL Thickness (ft)	Final LNAPL Thickness (ft)	Volume LNAPL Removed (Gal)				

Name:

Signature: