APPENDIX A: U.S. DEPARTMENT OF AGRICULTURE, RURAL DEVELOPMENT ENVIRONMENTAL ASSESSMENT FOR LOCK 11 COORDINATION – HABITAT ASSESSMENT

USDA RD EA FOR LOCK 11 COORDINATION – TECHNICAL MEMORANDUM
KENTUCKY RIVER LOCK AND DAM NO. 11 HYDROELECTRIC PROJECT, P-14276-011
ESTILL COUNTY, KENTUCKY

Submitted to: Mr. David Brown Kinloch, Appalachian Hydro Associates

Date: December 18, 2023

Appalachian Hydro Associates has contracted ICF Jones & Stokes (ICF) to prepare a United States Department of Agriculture (USDA) Rural Utilities Service (RUS) Development Environmental Assessment (EA) for Hydropower License, Kentucky River Lock and Dam No. 11 Hydroelectric Project near Waco, Kentucky (Figure 1). Appalachian Hydro Associates is seeking funding from USDA to install a turbine in the Kentucky River to generate hydro power. As the applicant, Appalachian Hydro Associates must provide the USDA with information that is required for an environmental review process in accordance with the National Environmental Policy Act (NEPA) of 1969 and 7 CFR part 1970. The following resources must be addressed in an EA: land use, floodplains, wetlands, biological resources (federal and state-listed species and vegetation), historical and cultural properties and human health risks. This technical memorandum has been prepared as a result of the field surveys completed on November 22nd, 2023. ICF ecologists conducted a wetland delineation, vegetation survey, and a habitat assessment for federally listed species in the immediate vicinity of Lock and Dam 11. Prior to initiating fieldwork, ICF completed a desktop evaluation of available resources, including United States Geological Survey topographic and geologic quadrangle maps, karst potential maps, land use maps and aerial photographs, United States Fish and Wildlife Service (USFWS) National Wetland Inventory maps, and known habitat maps for the Indiana bat and northern long-eared bat. This document describes the existing vegetation resources and the likelihood of potential impacts to wetlands and federally listed species and their habitats as a result of the project.

1.0 PROJECT & HABITAT ASSESSMENT AREA DESCRIPTION

The proposed project area includes the 12.9-acre Kentucky River Lock and Dam 11 property owned by the Kentucky River Authority (Figure 2). Direct impacts from construction will only occur in the Lock 11 chamber and the adjacent river right floodplain. The proposed hydroelectric project will be operated on a "run-of-river" basis and will not draw water below the crest of Dam 11. The Kentucky River upstream of Dam 11 will not be affected by the project and was therefore not evaluated. The habitat assessment area included the Lock 11 chamber, the Kentucky River immediately downstream (400 feet) of Lock and Dam 11 and the river right floodplain where the control building, point of interconnection, fishing area, and canoe portage path would be located (Figure 3). The river right floodplain, 10.41 acres located in Estill County, consists of a large concrete esplanade, remnant lock keeper structure(s) foundation, disturbed open grasslands, and a small amount of riparian forest adjacent to the river. All project components will be located within the lock chamber and along river right (Estill County), as such, the 2.45-acres located in Madison County was not evaluated.

2.0 WETLANDS

A wetland field survey was conducted by ICF to identify and delineate all "waters of the United States" (e.g., wetlands, rivers, streams, ponds, lakes) within the project area. The field identification of wetlands was based on the three-factor approach described in the 1987 *Corps of Engineers Wetland Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)*. No wetlands or tributary streams were identified within the site and the only "waters of the United States" is the Kentucky River. See Figure 3 for Wetland Determination Data Form and High Gradient Bioassessment Stream Visit Sheet data point locations.

3.0 VEGETATION RESOURCES

ICF ecologists evaluated the plant communities of the project area by recording dominant vegetation. Additionally, all invasive plant species were noted. The overall vegetation in the project area is disturbed, and mostly lacking intact, native plant communities. Non-native pasture grasses and the concrete esplanade make up the majority of aerial coverage of the project area.

Herbaceous Vegetation: The project area is mostly open, grazed by livestock, and dominated by non-native pasture grasses. Dominant grass species include KY 31 fescue (*Schedonorus arundinaceus*), orchard grass (*Dactylis glomerata*), and hairy crabgrass (*Digitaria sanguinalis*). Small amounts of native grasses including beaked panic grass (*Panicum anceps*), broom-sedge (*Andropogon virginicus*), and redtop grass (*Tridens flavus*) are also scattered within the project area. Dominant flowering forbs within the project area include frost aster (*Symphyotrichum pilosum*), Canada goldenrod (*Solidago canadensis*), common blue violet (*Viola sororia*), common ragweed (*Ambrosia artemisiifolia*), ironweed (*Vernonia gigantea*), white clover (*Trifolium repens*), red clover (*T. pratense*), frostweed (*Verbesina virginica*), and cocklebur (*Xanthium strumarium*).

Woody Vegetation: Somewhat intact, early to mid-successional forest patches occur on the eastern and western ends of the project area and are dominated by eastern sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), silver maple (*A. saccharinum*), red maple (*A. rubrum*), black locust (*Robinia pseudoacacia*), black willow (*Salix nigra*), and black walnut (*Juglans nigra*). Additionally, there are a few large scattered black walnut and silver maple trees located in the central portion of the project area.

Invasive Vegetation: Numerous plant species listed by the Kentucky Exotic Pest Plant Council (KEPPC) as being a severe or significant threat to natural plant communities occur within the project area (KEPPC 2013). Plants listed by the KEPPC occurring within the project area listed as a severe threat include Japanese stiltgrass (*Microstegium vimineum*), Japanese knotweed (*Polygonum cuspidatum*), hairy jointgrass (*Arthraxon hispidus*), bush honeysuckle (*Lonicera maackii*), sericea lespedeza (*Lespedeza cuneata*), tree-of-heaven (*Ailanthus altissima*), and KY 31 fescue. Japanese hops (*Humulus japonicus*) were also observed onsite and is considered a significant threat by the KEPPC.

4.0 FEDERALLY LISTED THREATENED AND ENDNAGERED SPECIES

This memorandum includes the identification of listed species for the project, the assessment methodology and results, effects analysis for federally listed species, and a proposed effects determination for each species.

4.1 Identification of Listed Species

The identification of species listed under the Endangered Species Act (ESA) was based on a review of occurrence records maintained by the USFWS. The USFWS's Information for Planning and Consultation (IPaC) website was used to obtain an official list of species and critical habitats (USFWS Project Code: 2024-0023535) that may occur within the vicinity of the proposed project (USFWS IPaC 2023). The official species list fulfills the requirements of the USFWS under Section 7(c) of the ESA to provide information as to whether proposed or listed species may be present within the vicinity of the project. No other consultation with the USFWS has been conducted for this project. As summarized in Table 1, the review identified eleven federally threatened, endangered, proposed and candidate species that are known to occur or have the potential to occur in the project area. No designated critical habitat was identified within the vicinity of the project. The IPaC official species list is provided as an attachment.

Table 1. Federally threatened, endangered, proposed and candidate species that may be present within the vicinity of the Lock 11 Hydroelectric project.

Group	Scientific Name	Common Name	Federal Status	Critical Habitat
Mammals	*Myotis grisescens*	Gray Bat	Endangered	No
	Myotis septentrionalis	Northern Long-eared Bat	Endangered	No
	Myotis sodalis	Indiana Bat	Endangered	No
	Corynorhinus townsendii virginianus	Virginia Big-eared Bat	Endangered	No
Mussels	*Pleurobema clava*	Clubshell Mussel	Endangered	No
	Cyprogenia stegaria	Fanshell Mussel	Endangered	No
	Quadrula cylindrica cylindrica	Rabbitsfoot Mussel	Threatened	No
	Obovaria subrotunda	Round Hickorynut	Threatened	No
	Simpsonaias ambigua	Salamander Mussel	Proposed Endangered	No
Insects	*Danaus plexippus*	Monarch Butterfly	Candidate	No
Plants	*Physaria globosa*	Short's Bladderpod	Endangered	No

Species studied include the four listed bats, five listed mussels, and Short's bladderpod. These species were studied based on their potential occurrence in the project area and the potential for suitable habitat within the project area. The monarch butterfly is a candidate species that will not require consultation.

The USFWS Kentucky Field Office (KFO) maintains maps of known habitat for the Indiana and northern long-eared bats in the state of Kentucky. According to the known habitat maps for the Indiana bat and northern long-eared bat, the proposed project is located within "Potential" habitat for the Indiana bat and the northern long-eared bat (USFWS KFO 2019, USFWS KFO 2019).

4.2 Methodology

An assessment was conducted within the project area to determine if suitable habitat is present for the identified federally listed species. The assessment included an in-house review of available resources, including USGS topographic and geologic quadrangle maps, karst potential maps, land use maps and aerial photographs. Field surveys took place on November 22nd , 2023, to delineate the extent of each habitat and assess its potential for use by the identified species. Suitable habitat for federally listed species was assessed based on known life history preferences for each species.

Bats: Potential hibernacula for the gray, Indiana, northern long-eared, and Virginia big-eared bats, including caves, abandoned mine portals, sinkholes, and other underground features, were evaluated during the in-house review, per the *2023 Range-wide Indiana Bat Survey Guidelines*. Identified features were mapped utilizing ArcView geographic information system (GIS) software to determine their location relative to the project. Based on the localized impacts associated with the project and the lack of blasting, a search for previously unidentified features within one-half mile of the project was not warranted; however, a search for features was performed within the project area during the field survey.

Potential foraging and commuting habitat for the gray bat was identified using USGS topographic maps and aerial photographs to locate streams, lakes, and other water bodies within the project area. During the field survey, potential foraging and commuting habitat identified within the project area was further assessed based on observed stream flow, in-stream habitat, and riparian canopy closure. Suitable summer habitat for the Indiana bat was considered to be forested areas comprised of trees that have a diameter at breast height (dbh) of five inches or greater. Forested areas comprised of trees that have a dbh of three inches or greater were considered to be suitable summer habitat for the northern long-eared bat. Isolated trees were considered to be suitable roosting habitat if they exhibit the characteristics of a suitable roost tree for either species and are located within 1,000 feet of other suitable habitat. During the field survey, summer habitat identified for each species within the project area was marked on field maps generated from recent aerial photographs and project plans. These marked areas were then entered into a GIS program to calculate the acreage of summer habitat for both species within the project area.

Mussels: Potential habitat for the listed mussel species was identified using USGS topographic maps and aerial photographs to locate perennial streams within the project area. During the in-house review, the Kentucky River was identified as a perennial stream and a habitat assessment of the stream was conducted during the field survey. A mussel habitat assessment took place within the Lock 11 chamber and in the Kentucky River immediately downstream of the lock and dam for approximately 400 feet, where potential impacts could occur. The lock chamber, riverbed and right bank were visually inspected to characterize the active bed substrate and to observe any live or remnant mussels.

Short's bladderpod: ICF biologists also conducted a pedestrian survey of suitable habitat for Short's bladderpod within the 10.41-acre Estil County portion of the project area. Any areas containing characteristics associated with Short's bladderpod were deemed suitable habitat for the species.

4.3 Habitat Assessment Results

Bats: No caves, abandoned mine portals, sinkholes, or other underground features that could provide potential hibernacula for the gray, Indiana or northern long-eared bat were identified within the project area. As a result, no potential hibernacula for these species are present. The Kentucky River is considered suitable foraging and commuting habitat for the gray bat. Wooded habitat present within the project area was identified as suitable summer roosting, foraging, and commuting habitat for the Indiana and northern long-eared bats. No gray, Indiana, northern long-eared or Virginia big-eared bats or signs of use were observed during the habitat assessment. Two habitat assessment points were assessed for summer bat habitat (Figure 3). Phase 1 Summer Habitat Assessment Forms are included as an attachment to this document and contain detailed information related to each assessed area.

Habitat Assessment Point 1 (HA-1) is located just downstream of Lock 11 along the right bank. This area consists of a riparian, early-mid successional forest dominated by sycamore and red maple. Size composition of live trees is approximately 10% 3-8” diameter breast height (dbh) trees and shrubs, 80% 9-15” dbh trees, and 10% >15” dbh trees. No snags or trees with exfoliating bark, cracks, crevices or hollows were observed in this assessed area. The adjacent Kentucky River provides travel and foraging habitat for listed bats and HA-1 provides marginal roosting potential for Indiana and northern long-eared bats.

Habitat Assessment Point 2 (HA-2) is just upstream of Lock 11 along the right bank of the Kentucky River. This area consists of a riparian, early successional forest. The low-lying floodplain is dominated by red maple, sycamore, and black willow. Size composition of live trees is approximately 90% 3-8” dbh trees and saplings, and 10% 9-15” dbh trees. No snags or trees with exfoliating bark, cracks, crevices or hollows were observed in this assessed area. HA-2 also provides marginal roosting potential for Indiana and northern long-eared bats.

No caves, cave like features or rock shelters are located within the project area; therefore, no habitat for the Virginia big-eared exists.

Mussels: During the assessment, the Kentucky River watershed was in a moderate to severe drought category and the river discharge was less than half the median flow, approximately 600 cubic feet per second. The Kentucky River is a seventh order stream that is approximately 300-feet wide at the dam. Within the abandoned lock chamber, the substrate is composed of concrete, and downstream bedrock, large boulders, and silt/sand dominate the riverbed. The river below the lock and dam is characterized as a large, deep scour pool created by high energy acceleration as flow drops over the dam. High flows over the dam currently scour the bed and banks causing bed material and streambank instability and channel widening throughout the downstream project area. Immediately below the lock chamber and esplanade the river is approximately 500 feet wide, double the width of the river in the surrounding area. The scour-deposition pattern downstream of Dam 11 substantially affects the character and suitability of potential mussel habitat features. Additionally, the river channel has cut down to bedrock in areas further destabilizing substrate material. No live or remnant shells were observed within the river or along the bank. Based on these factors, no mussel habitat exists within the project area immediately below Lock and Dam 11.

Short's bladderpod: The portion of the project area along the right bank (10.41-acres) of the Kentucky River is highly disturbed and consists mainly of open, grazed grassland, a concrete esplanade, and two small riparian forest blocks. No limestone outcroppings, rocky/talus areas or cliffs are present.

4.4 Effects Analysis & Determinations

Bats: No potential bat hibernacula, caves, cave like features or rock shelters are located in the project area, and the project will not require the use of blasting or extensive excavation. The proposed hydroelectric project will not require tree or riparian habitat removal and no bats or evidence of bat use was observed. Potential impacts to the Kentucky River during construction of the powerhouse will be temporary, minimal, and localized within the lock chamber. Based on these factors, **"no effect"** is proposed for the gray, Indiana, northern long-eared, and Virginia big-eared bats.

Mussels: The hydroelectric project will operate in a run-of-river mode whereby inflows to the project would equal outflows and excess flows would be discharged over the crest of the dam, as occurs under existing conditions. Therefore, project related flow effects immediately downstream of the dam are considered unlikely. Potential impacts to the Kentucky River during construction of the powerhouse will be temporary, minimal, and localized within the lock chamber. No other impacts to the river are anticipated. Based on the lack of suitable substrate within the lock chamber and the proposed run-of-river operations, **"no effect"** is proposed for listed mussels.

Short's bladderpod: The 10.41-acre project area does not contain any limestone outcroppings, rocky/talus areas or cliffs. As a result, a **"no habitat, no effect"** is proposed for Short's bladderpod.

We appreciate the opportunity to work with you on the Lock 11 hydroelectric project. Please contact Rick Larsen (502) 259-0470 with any questions you have during your review of the attached memorandum.

Sincerely,

Rick Larsen

Rick Larsen
Senior Ecologist

Attachments:

-Figure 1: Project Location Map
-Figure 2: Site Location Map
-Figure 3: Habitat Assessment Map
-Wetland Determination Upland Data Form
-High Gradient Bioassessment Stream Sheet
-IPaC Official Species List
-Phase 1 Summer Habitat Assessment Forms
-Representative Photographs

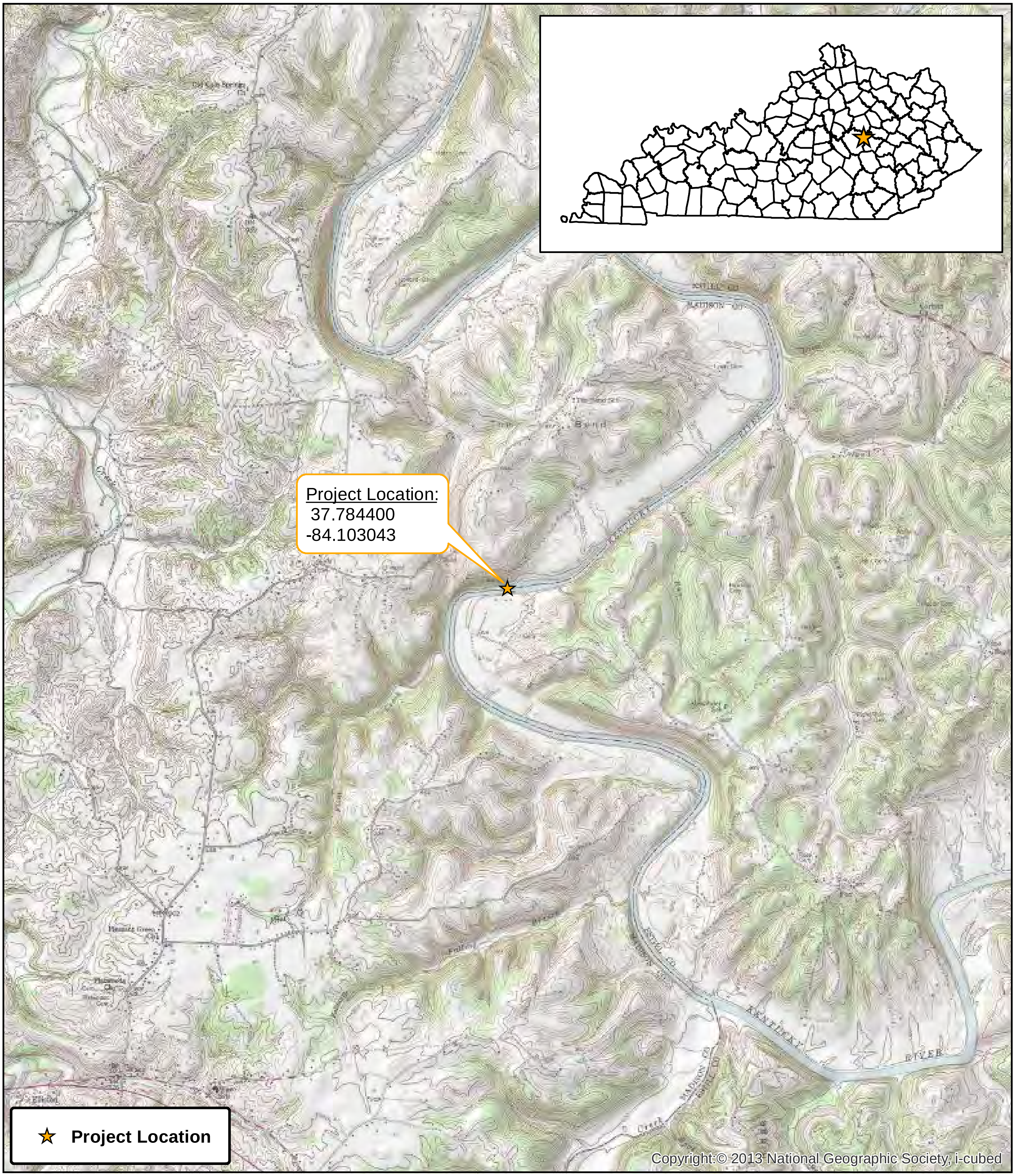
Literature Cited

Kentucky Exotic Pest Plant Council (KEPPC). 2013. *Exotic Invasive Plants of Kentucky (Third Edition).* Accessed on December 12, 2023, at: https://www.se-eppc.org/ky/KYEPPC_2013list.pdf.

USFWS IPaC. 2023. Information for Planning and Consultation. Website. Accessed on December 6, 2023, at: https://ipac.ecosphere.fws.gov/.

USFWS KFO. 2019. *Known Indiana bat habitat in Kentucky and within 20 miles (August 2019)*. Map. Kentucky Ecological Services Field Office. Frankfort, KY.

USFWS KFO. 2019. *Known northern long-eared bat habitat in Kentucky and within 20 miles (August 2019)*. Map. Kentucky Ecological Services Field Office. Frankfort, KY.



Environmental Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

N

0 0.325 0.65 1.3 Miles

1 inch = 4,000 feet

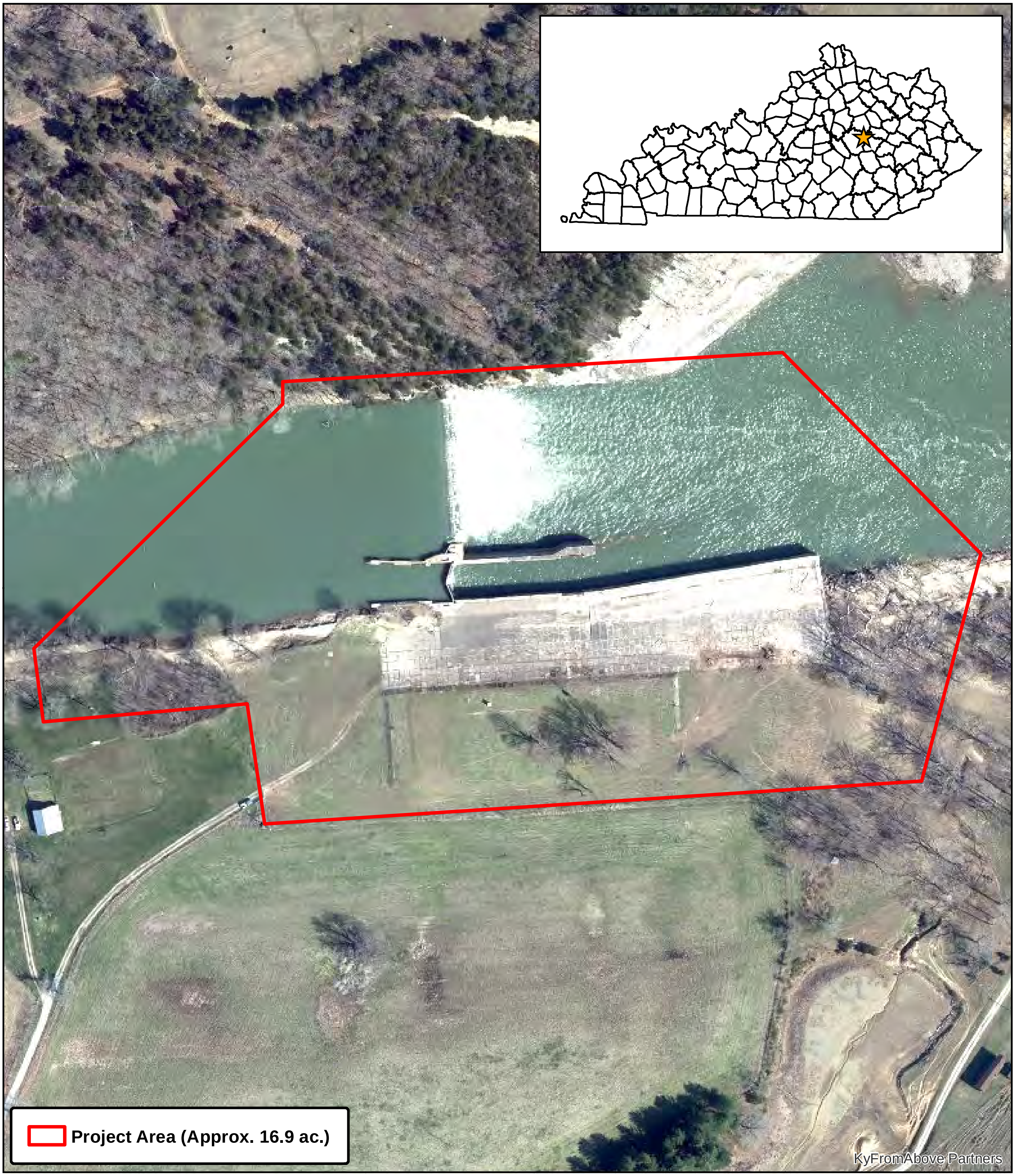
FIGURE 1

Project Location Map

ICF

Drawn by: SAS | Print Date: 12/7/2022

Prepared For: KDFWR



N

Environmental Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

0 80 160 320 Feet

1 inch = 188 feet

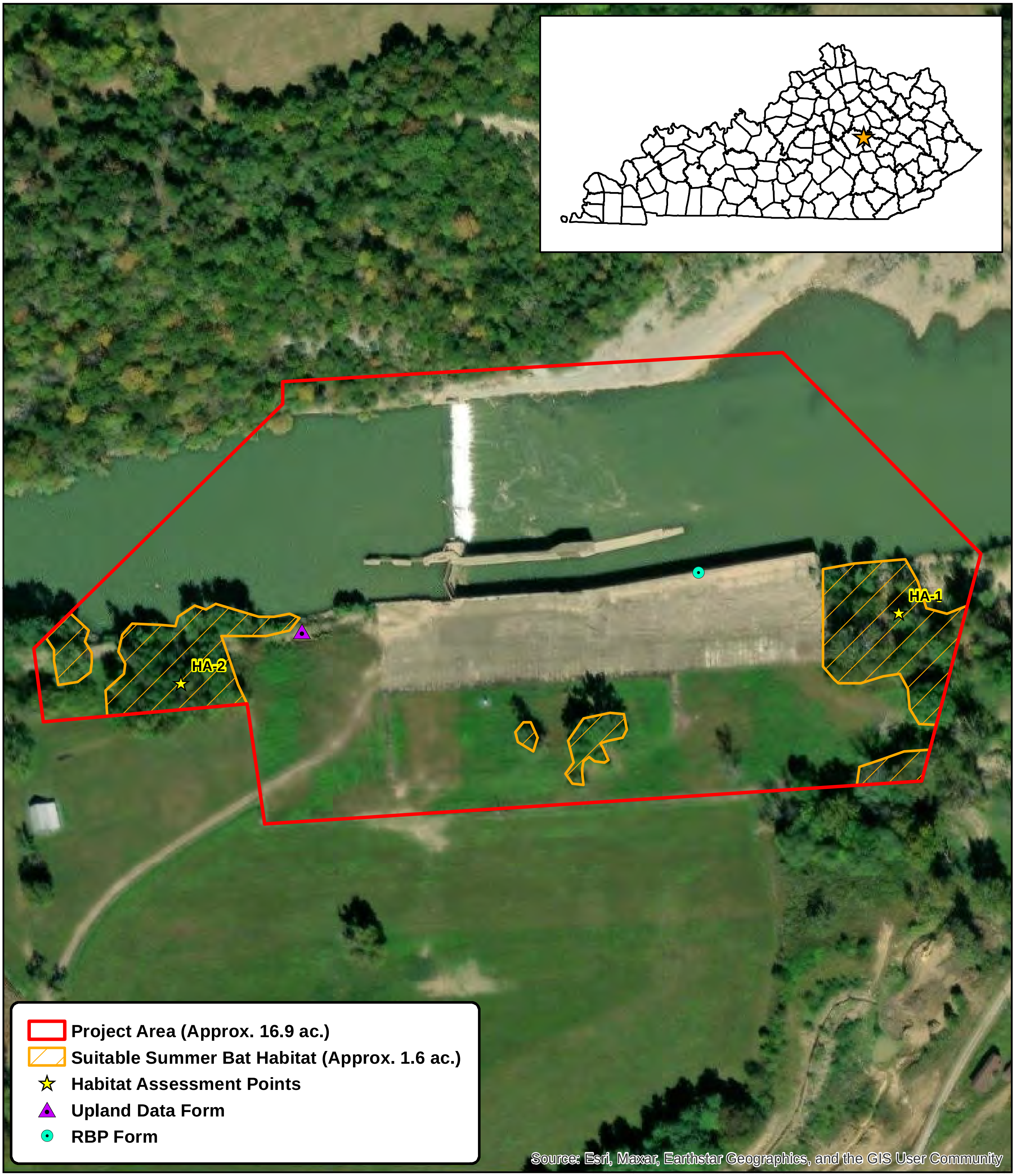
FIGURE 2

Site Location Map

ICF

Drawn by: SAS | Print Date: 12/7/2022

Prepared For: KDFWR



N

Environmental Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

0 80 160 320 Feet

1 inch = 188 feet

FIGURE 3

Habitat Assessment Map

ICF

Drawn by: SAS | Print Date: 12/7/2022

Prepared For: KDFWR

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: LOCK 11 City/County: ESTILL Sampling Date: 11/22/23
Applicant/Owner: APP. HYDRO State: KY Sampling Point: UPL
Investigator(s): RL & SS Section, Township, Range: NA
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______
Subregion (LRR or MLRA): LRR N Lat: ______ Long: ______ Datum: NAD 83
Soil Map Unit Name: Grigsby-Chavies-Yeager complex, 2-55% slopes, freq. flood NWI classification: NA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______	No ✓	Is the Sampled Area within a Wetland?	Yes ______ No ✓
Hydric Soil Present?	Yes ______	No ✓		
Wetland Hydrology Present?	Yes ______	No ✓		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Aquatic Fauna (B13)
- __ True Aquatic Plants (B14)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres on Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __ Surface Soil Cracks (B6)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Drainage Patterns (B10)
- __ Moss Trim Lines (B16)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Stunted or Stressed Plants (D1)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ Microtopographic Relief (D4)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ______	No ✓	Depth (inches): ______
Water Table Present?	Yes ______	No ✓	Depth (inches): ______
Saturation Present? (includes capillary fringe)	Yes ______	No ✓	Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators observed

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: UPL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. NONE	–	–	–
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: –	20% of total cover: –		

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. SILVER MAPLE	5	Y	FACW
2. BLACK WILLOW	5	Y	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Herb Stratum (Plot size: 5)	Absolute % Cover	Dominant Species?	Indicator Status
1. CRABGRASS (D. sanguinalis)	98	Y	FACU
2. RUMEX CRISPUS	2	N	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Woody Vine Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. NONE	–	–	–
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: –	20% of total cover: –		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 5/3	100	—	—	—	—	SILTY SAND	
8-14	10YR 7/3	100	—	—	—	—	SAND	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ 2 cm Muck (A10) **(LRR N)**
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7)
- __ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- __ Thin Dark Surface (S9) **(MLRA 147, 148)**
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- __ Umbric Surface (F13) **(MLRA 136, 122)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- __ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10) **(MLRA 147)**
- __ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NA

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✓

Remarks:

No indicators observed

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: KY RIVER		**LOCATION:** LOCK 11	
STATION #:		**COUNTY:** ESTILL	**PROGRAM: PROJECT:** NA
INVESTIGATORS: RL & SS		**DATE:** 11/22/23	**TIME (24hr)** Start: 11:45 Finish:
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☐N/A			

	Station	Reach Downstream	Reach Upstream
LAT	37.784193		
LONG	-84.102038		

CANOPY COVER:: ☑ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☐ Partially Shaded (50-75%) ☐ Fully Shaded (75-100%)

STREAM TYPE: ☑ Perennial ☐ Ephemeral ☐ Intermittent

WEATHER

Has there been a scouring rain in the last 14 days? ☐ Yes ☑ No

Now	Past 24 hours	
☐	☐	Heavy rain
☐	☐	Steady rain
☐	☑	Intermittent showers
☐	☐	Clear/sunny
☑	☐	Cloudy

LOCAL WATERSHED FEATUREES (Predominant Surrounding Land Use):

☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal ☐ Residential
☐ Construction ☐ Commercial ☐ Industrial ☑ Row Crops
☑ Forest ☑ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES

Stream Width 175 ft
Maximum Depth 10+ ft
Reach Length ____ m

Riffle/Run/Pool Sequence (No. Sampled in Reach)

____ Riffle ____ Run 1 Pool

HYDRAULIC STRUCTURES ☑ Dams ☐ Bridge Abutments ☐ Island ☐ Waterfalls ☐ Other:

STREAM FLOW ☐ Dry ☐ Pooled ☑ Low ☐ High ☐ Normal

RIPARIAN VEGETATION

Dominate Type: ☑ Trees ☐ Herbaceous ☐ Grasses ☐ Shrubs

Number of strata ____ Dom. Tree/Shrub Taxa

CEDAR, SILVER SYCAMORE MAPLE

CHANNEL ALTERATIONS ☐ Dredging ☐ Channelization (☐Full ☐Partial)

P-CHEM Instrument Used: ________ Date Calibrated: ________

Temp(°C)________ D.O. (mg/l)________ %Saturation________ pH(S.U.)________ Cond.________ Turb.________

Sample Collection Verification

Algae	Sample: ☐ QualMHC ☐ Other ☐ Visual Assessment	Lead Collector:
Fish	☐BPEF ☐ Seine ☐ Other Time: BPEF ____ Seine ____	Lead Collector:
Habitat	☐ RBP ☐ Substrate ☐ Other:	Lead Collector:
Invertebrates	☐ $1m^2$ ☐ Qual ☐ Other:	Lead Collector:
	☐ 20 Jab (#Jabs: Cobble____ Snags____ Veg. Banks____ Sand____ Macrophytes____ Other ____)	
Tissue:	No. of Samples collected________ Sp:	Lead Collector:
Water Chem	☐ Acid/Alk ☐ Bulk ☐ Nutrients ☐ Metals ☐ Low Hg	Lead Collector:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☐Est. ☐P.C.	Riffle____%	Run____%	Pool____%	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)				
Gravel (2-64 mm)				
Cobble (64 – 256 mm)				
Boulders (>256 mm)				
Bedrock				

NOTES/COMMENTS:

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover Score 5	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 8	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 6	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 12	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 18	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration Score 5	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 3	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 9 RB 10	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 1 RB 1	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 8 RB 1	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

Total Score

87

NOTES/COMMENTS:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
Phone: (502) 695-0468 Fax: (502) 695-1024
Email Address: kentuckyes@fws.gov

In Reply Refer To:
Project Code: 2024-0023535
Project Name: Lock 11 Hydroelectric Project

December 06, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do..

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

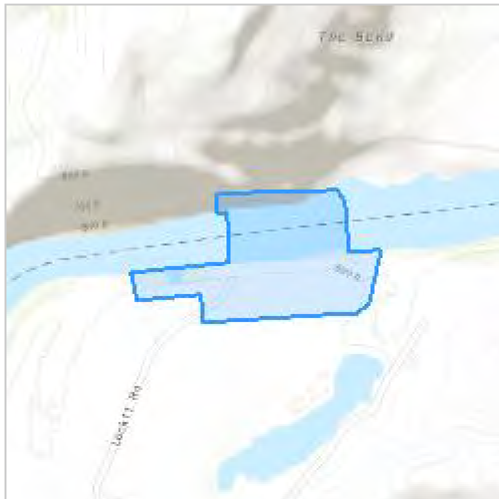
This species list is provided by:

Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0468

PROJECT SUMMARY

Project Code: 2024-0023535
Project Name: Lock 11 Hydroelectric Project
Project Type: Power Gen - Hydropower - FERC
Project Description: Hydroelectric project on KY river.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.7841545,-84.10228622901299,14z



Counties: Estill and Madison counties, Kentucky

ENDANGERED SPECIES ACT SPECIES

There is a total of 11 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Gray Bat *Myotis grisescens*	Endangered
Indiana Bat *Myotis sodalis*	Endangered
Northern Long-eared Bat *Myotis septentrionalis*	Endangered
Virginia Big-eared Bat *Corynorhinus (=Plecotus) townsendii virginianus*	Endangered

Gray Bat *Myotis grisescens* — Endangered

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:

- The project area includes potential gray bat habitat.

Species profile: https://ecos.fws.gov/ecp/species/6329
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf

Indiana Bat *Myotis sodalis* — Endangered

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
This species only needs to be considered under the following conditions:

- The project area includes 'potential' habitat. All activities in this location should consider possible effects to this species.

Species profile: https://ecos.fws.gov/ecp/species/5949
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf

Northern Long-eared Bat *Myotis septentrionalis* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9045
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf

Virginia Big-eared Bat *Corynorhinus (=Plecotus) townsendii virginianus* — Endangered

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/8369
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf

CLAMS

NAME	STATUS
Clubshell *Pleurobema clava* Population: Wherever found; Except where listed as Experimental Populations No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3789 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/5639.pdf	Endangered
Fanshell *Cyprogenia stegaria* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4822 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/5639.pdf	Endangered
Rabbitsfoot *Quadrula cylindrica cylindrica* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5165 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/5639.pdf	Threatened
Round Hickorynut *Obovaria subrotunda* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9879	Threatened
Salamander Mussel *Simpsonaias ambigua* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6208	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Short's Bladderpod *Physaria globosa* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7206	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency:	Private Entity
Name:	RICK LARSEN
Address:	8055 Warwick Ave
City:	Louisville
State:	KY
Zip:	40222
Email	rick.larsen@icf.com
Phone:	7702959846

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Department of Agriculture

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: Appalachian Hydro Lock 11 Date: 11/22/23

Township/Range/Section: NA

Lat Long/UTM/ Zone: 37.783957, -84.102752 Surveyor: SS, RL

Brief Project Description

Appalachian Hydro and Associates proposes to install a hydroelectric power generator within the exisiting Lock 11 structure on the Kentucky River.

Project Area

	Total Acres	Forest Acres			Open Acres
Project	12.9	1.6			11.3
Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing		
	0	0	1.6		

Vegetation Cover Types

Pre-Project	Post-Project
Open Field Forest	Open Field Forest

Landscape within 5 mile radius

Flight corridors to other forested areas?

The Kentucky River provides a large corridor to many other forested areas

Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

The surrounding land use is a mosaic of agriculture (grazing, hayfields, row crops), forest, residential, and commercial. Multiple tributaries to the Kentucky River are present.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The Bluegrass Army Depot lies approximately 8.4 miles to the SW of the project area and the Daniel Boone NF lies approximately 9.6 miles to the SE.

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-1

Assessment point located in a heavily scoured river bank downstream of Lock 11.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral: 0	Intermittent: 0	Perennial: 1	Describe existing condition of water sources: Kentucky River is approximately 300 feet wide and has been dammed by Lock 11
Pools/Ponds (# and size)	0	Open and accessible to bats? NA		
Wetlands (approx. ac.)	Permanent: 0	Seasonal: 0		

Forest Resources at Sample Site

Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81-100%
	4	1	1	
Dominant Species of Mature Trees	eastern sycamore, red maple			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	1	6	1	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable

IS THE HABITAT SUITABLE FOR INDIANA BATS? yes

Additional Comments:

The assessed area is within a heavily scoured river bank area that receives frequent disturbance due to flooding.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations: understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-2

Assessment point located in a depressional wooded area upstream of Lock 11

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Kentucy River is approximately 300 feet wide and has been dammed by Lock 11.
			1	
Pools/Ponds (# and size)	0	Open and accessible to bats?		
		NA		
Wetlands (approx. ac.)	Permanent	Seasonal		
	0	0		

Forest Resources at Sample Site

Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81-100%
	3	4	2	
Dominant Species of Mature Trees	red maple, black willow, eastern sycamore			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	6	1	0	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable

IS THE HABITAT SUITABLE FOR INDIANA BATS? yes

Additional Comments:

The assessed area is within an early successional riparian forest depression.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations: understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Lock 11 Hydroelectric Project – Photographs
11.22.2023


Lock and Dam 11


Proposed control building location


Kentucky River downstream of lock chamber


Remnant lock keeper structure(s) foundation

Lock 11 Hydroelectric Project – Photographs
11.22.2023

Right riverbank downstream of project area

Wetland determination upland data point

HA-1

HA-2

Lock 11 Hydroelectric Project – Photographs
11.22.2023


Canoe portage path area


Herbaceous vegetation site conditions


Proposed parking lot area


Canoe portage upstream access area

APPENDIX B: BIOLOGICAL ASSESSMENT REPORT

BIOLOGICAL ASSESSMENT REPORT

For The

COLLEGE HILL HYDROELECTRIC PROJECT
KENTUCKY RIVER LOCK 11

Submitted to:

U.S. FISH AND WILDLIFE SERVICE
KENTUCKY FIELD OFFICE

Prepared for:

United States Department of Agriculture
Rural Utilities Service
1400 Independence Avenue SW
Washington, DC 2050

Prepared by:

ICF Jones & Stokes, Inc.

March 21, 2025

TABLE OF CONTENTS

List of Figures

1.0 INTRODUCTION

ICF Jones and Stokes, Inc. (ICF), on behalf of the United States Department of Agriculture (USDA) Rural Development's (RD) Rural Utilities Service (RUS), is pleased to submit this Biological Assessment Report (BA) in support of the proposed College Hill Hydroelectric Project. Lock 11 Hydro Partners proposes to install turbines in the Kentucky River at Lock 11 to generate hydropower (see Figure 1). ICF has prepared this BA to support RUS's National Environmental Policy Act of 1969 review of the College Hill Hydroelectric Project (hereafter project). The proposed Action is presented in more detail below in terms of description of the Action, the purpose and need for the Action, and identification of federally listed species for inclusion in the assessment.

1.1 PROPOSED ACTION

The proposed project would be located at Lock and Dam Number 11 at river mile (RM) 201.0 on the Kentucky River. Lock and Dam Number 11 is owned by the Commonwealth of Kentucky and operated by the Kentucky River Authority (KRA) for water supply. The existing 208-foot-long fixed crest concrete dam has a 148-foot-long by 52-foot-wide lock chamber. The 482-acre reservoir provides approximately 4,820 acre-feet of storage and only operates at run-of-river levels (i.e., does not draw water from below its crest). The existing lock chamber of the structure is abandoned, and a concrete bulkhead has been placed in the lock chamber, below the upper miter gates, to prevent failure and loss of pool.

Lock 11 Hydro partners would remove the concrete bulkhead and construct a 28.4-foot by 52-foot by 49.5-foot steel and reinforced concrete powerhouse. A 58-foot by 52-foot horizontal trash rack would be installed to sit three feet below the normal pool level from the lock chamber upper sill to the back wall of the powerhouse. An inflatable rubber dam would be installed on top of the powerhouse wall to maintain the pool during normal operating conditions.

Lock 11 Hydro Partners would install four 642-kW Voith 14.9 and two 222-kW Voith 8.95 StreamDiver turbine-generators into the existing lock chamber of Lock and Dam Number 11. These submersible units directly couple permanent magnet generators with turbines, eliminating the need for a gearbox and associated oil lubrication. A prefabricated-steel and reinforced 42-foot by 20-foot by 28-foot concrete control building would be installed atop a concrete foundation at the edge of the existing concrete esplanade and would be connected to the powerhouse via an underground cable trench. The control building would house the switchgear, controls, transformers, and the main circuit breaker for the plant. The control building would be interconnected to the existing 15-kV overhead distribution line which runs to the site from Madison County, which will be re-conductored to three-phase. Project plans are provided in Appendix A.

The proposed Action will be limited to the “Action Area”, which encompasses the area where the effects of the Action may influence physical, chemical, or biological habitat components (Figure 2). The proposed Action and associated Action Area are discussed in greater detail in Section 2.0.

1.2 PURPOSE AND NEED

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The project is located in the Central Subregion of the Southeastern Electric Reliability Council, which is one of six regional reliability councils of NERC. According to NERC’s most recent 2022 forecast for the Central Subregion, the total internal demand is projected to grow at an annual rate of 0.9 percent from 2023 through 2033 (NERC 2022).

The purpose of the proposed project is to provide hydroelectric generation to meet part of the region’s power requirements, resource diversity, and capacity needs. The proposed project would have an installed capacity of 3.01 megawatts (MW) and generate approximately 13,556 mega-watt hour (MWh) per year. The project would provide low-cost power that could displace generation from non-renewable sources. Power produced will be put into a Clark Energy Rural Electric Cooperative distribution line, wheeled over to the East Kentucky Power Cooperative (EKPC) Union City substation, and then be put into the EKPC system. EKPC will then sell the power to local cooperatives, primarily to Clark Energy members served by the Union City substation.

1.3 IDENTIFICATION OF LISTED SPECIES

The identification of species listed under the Endangered Species Act (ESA) was based on a review of occurrence records maintained by the United States Fish and Wildlife Service (USFWS). The identification process is described below in terms of resource agency coordination and species selection.

1.3.1 Resource Agency Coordination

The USFWS’s Information for Planning and Consultation (IPaC) website was used to obtain an official list of species that may occur within the Action Area (USFWS IPaC 2025). The official species list was provided by the USFWS Kentucky Field Office (KFO) and fulfills the requirements of the USFWS under Section 7(c) of the ESA to provide information as to whether proposed or listed species may be present within the Action Area. As summarized in the following table, the review identified seven federally listed species and two proposed species that may occur in the Action Area. The IPaC official species list (Project Code: 2024-0023535) is provided in Appendix B.

Group	Scientific Name	Common Name	Federal Status
Mammals	*Myotis grisescens*	gray bat	Endangered
	Myotis sodalis	Indiana bat	Endangered
	Corynorhinus townsendii virginianus	Virginia Big-eared Bat	Endangered

Group	Scientific Name	Common Name	Federal Status
	Obovaria subrotunda	Round Hickorynut	Threatened
	Simpsonaias ambigua	Salamander Mussel	Proposed Endangered
	**Plethobasus cyphyus*	*Sheepnose	Endangered
	**Epioblasma triquetra*	*Snuffbox	Endangered
Insect	*Danaus plexippus*	Monarch butterfly	Proposed Threatened
Plants	*Physaria globosa*	Short's Bladderpod	Endangered

*Mussel species added to proposed project list by KFO

The USFWS KFO maintains maps of known habitat for the Indiana bat in the state of Kentucky. According to the known habitat maps for the Indiana bat, the proposed project is located within "Potential" habitat for the Indiana bat (USFWS KFO 2019).

1.3.2 Selection of Species for Study

Species studied under this assessment include the two listed mussels identified on the IPaC official species list. Per the request of the USFWS KFO, the sheepnose and snuffbox mussels will additionally be addressed. These species were studied based on their known occurrence in the Action Area or possible occurrence based on the potential for suitable habitat in the Action Area.

No potential bat hibernacula, caves, cave like features or rock shelters are located in the project area, and the project will not require the use of blasting or extensive excavation. The proposed hydroelectric project will not require tree or riparian habitat removal and no bats or evidence of bat use was observed. Potential impacts to the Kentucky River during construction of the powerhouse will be temporary, minimal, and localized within the lock chamber. Based on these factors, "no effect" is proposed for the gray, Indiana, and Virginia big-eared bats.

On December 12, 2024, the USFWS published a proposal to list the monarch butterfly as threatened under the ESA and designate critical habitat. Potentially suitable habitat for the monarch butterfly occurs statewide and may be present within the Action Area. No breeding habitat for the monarch butterfly is present within the disturbance limits for the project and no milkweed (*Asclepias* spp.) or other nectar bearing plants were observed. Based on the scope of the Action and the range and distribution of this species, the proposed Action is "not likely to jeopardize the continued existence" of the monarch butterfly. Therefore, this species is not studied further under this assessment.

The project area along the right bank (10.41-acres) of the Kentucky River is highly disturbed and consists mainly of open, grazed grassland, a concrete esplanade, and two small riparian forest blocks. No limestone outcroppings, rocky/talus areas or cliffs are present. As a result, "no effect" is proposed for Short's bladderpod.

1.3.3 Species for Informal Consultation

The proposed Action is anticipated to result in discountable effects to the salamander mussel. Therefore, an effects determination of "may affect, not likely to adversely affect" has been made for this species. Informal consultation with the USFWS is requested to address the salamander mussel, which is discussed in Section 3.0.

1.3.4 Species for Formal Consultation

The proposed Action will result in adverse effects to the round hickorynut, sheepnose, and snuffbox; therefore, an effects determination of "may affect, likely to adversely affect" has been made for these three mussel species. Formal consultation with the USFWS is requested to address these three species, as discussed beginning in Section 4.0 and throughout the remainder of the report.

The effects determination and USFWS consultation method for the four mussel species is summarized in the following table.

Group	Common Name	Effects Determination	USFWS Consultation
Mussels	Round Hickorynut	LTAA	Formal
	Salamander Mussel	NLTAA	Informal
	Sheepnose	LTAA	Formal
	Snuffbox	LTAA	Formal

NLTAA = may affect, not likely to adversely affect; LTAA = may affect, likely to adversely affect

2.0 PROPOSED ACTION

The proposed Action involves the installment of six turbine-generators (powerhouse) into the existing lock chamber of Lock and Dam Number 11 and construction of a concrete control building. The proposed Action is presented below in terms of identification of the Action Area and a description of the Action components.

2.1 ACTION AREA

The projects Action Area includes the Kentucky River downstream of Lock and Dam No. 11 where changes in normal flow between existing and proposed conditions at predicted to occur. The 10.7-acre Action Area includes Lock and Dam No. 11 and the Kentucky downstream of the dam for approximately 1,190 feet (Figure 2). BioSurvey Group's transect T5 was used as the downstream extent of the Action Area to assess potential impacts to mussels (Appendix C). All construction activities will be limited to a work area within the lock chamber below the upper miter gates, concrete esplanade, and adjacent KRA property.

2.2 PLANNING COMPONENT

Planning is the first component of the proposed Action and includes all necessary activities prior to construction activities. These activities include, but are not limited to, securing project funding; developing project timeframes and schedules; designing project plans; performing site visits; preparing preliminary assessments and reports; completing required consultations and permitting; and coordinating with the project team. The planning component is considered an administrative action only and will not result in potential impacts to any federally listed species. As a result, this component will have no effect on listed species and is not discussed further in this report.

2.3 CONSTRUCTION COMPONENT

Construction is the second component of the proposed Action and includes three separate activities: 1.) site preparation, 2.) control building, and 3.) powerhouse concrete and draft tubes. Project plans for the proposed Action are provided as Appendix B, and each construction component is discussed in greater detail below.

1. Site preparation is the first construction component. Activities associated with site preparation include:
- installation of erosion prevention and sediment control (EPSC) measures
- installation of a temporary access road
- installation of all rock anchors and cofferdam
- dewatering of the lock
- grouting of north and south walls needed to prevent water seepage
- establishment of staging areas
- improvement and construction of access roads

EPSC measures will be installed prior to construction activities to minimize erosion and sedimentation into the Kentucky River. Next a temporary cofferdam will be installed and sealed on the downstream miter gate sill to block off water from entering the lock chamber. Next, the lock chamber will be dewatered and cleaned down to bedrock.

2. The control building work scope includes:
- control building excavation
- construction of the control building concrete structure
- backfilling and grading around control building
- fabrication and installation of structural steel
- installation of the pre-fabricated metal building

3. Powerhouse work scope includes:
- installation of rock dowels along the powerhouse base
- installation of forms and rebar for mas concrete placements

- placement of mass concrete in lifts up to 565.0' to accommodate installation of embedded steel draft tubes, stoplog slots and conduits

Once clean bedrock is exposed, concrete construction can begin in the lock chamber of the powerhouse. The powerhouse is a mass concrete pour with embedded horizontal draft tubes. The trash rack system and rubber dams are then installed. The final installation is the turbine generators with shut-off valves, which are bolted to the receiving plates on the front of the draft tubes. Once all the equipment is installed, the upper concrete bulkhead and lower temporary cofferdam is removed, allowing water into the new plant.

Additionally, to provide recreational opportunities at the project, Lock 11 Hydro Partners proposes to: implement a Recreation Resources Management Plan to direct construction, operation, and maintenance of recreational resources at the project that includes the following:

- construction of a new portage trail around the lock and dam
- providing designated bank-fishing access to the tailrace
- construction of a new parking area for four to six vehicles, adjacent to an existing access road on KRA-owned land

2.4 OPERATION COMPONENT

The proposed project would operate in run-of-river using flows between 196 cubic feet per second (cfs) and 2,636 cfs for power generation. The turbines would be operated sequentially, based on inflow, and would maintain run-of-river operation levels. Lock 11 Hydro Partners proposes to install monitoring equipment in the lock chamber and headwater pool that is designed to shut down the generating units when water levels in the impoundment fall below 617.38 feet.

The proposed project would generate 13,556 MWh annually. Power would be transmitted from the powerhouse to the Clark Energy/East Kentucky Power Cooperative Hunt Substation. All power generated would be sold to the East Kentucky Power Cooperative at approved tariff rates based on spot-market pricing.

Trash-rack maintenance would be periodically performed by deflating the rubber dam atop the powerhouse and allowing water to wash accumulated debris downstream. Once the trash rack is cleared of debris, the rubber dam would be re-inflated to restore operating pool levels.

In addition to run-of-river operation, Lock 11 Hydro Partners proposes measures to ensure that the project does not affect municipal water withdrawals from the Kentucky River. The proposed project would not operate when flow limits on the Kentucky River are below thresholds required by the KDEP Division of

Water, which may occur during severe droughts. Similarly, the project would not operate if KRA were to implement bypass valve releases in order to increase water levels downstream.

2.5 CONSERVATION MEASURES

Several conservation measures are proposed to avoid and minimize impacts from the proposed Action to the listed species and their habitats.

- Implement EPSC measures in the work area, including but not to:
    1. Stabilization of disturbed areas as soon as practicable but no more than seven (7) days after construction activities have temporarily or permanently ceased in any portion of the work area. At a minimum, interim and permanent practices implemented to stabilize disturbed areas will include: temporary and/or permanent seeding, erosion control matting, mulching, and/or sodding.
    2. Revegetation of disturbed areas immediately following completion of ground disturbing activities.
    3. Implementation of BMPs when operating machinery on the lock chamber or within the riparian area to avoid and minimize the potential for accidental spills and implementation of a spill response plan, should an accidental spill occur.

- Relocation survey and future monitoring to reduce take.
    1. Prior to project operation, in mid-April, mussels will be salvaged from the zone of predicted highest impact and relocated immediately downstream of the Action Area (see Figure 3).
    2. Prior to relocation efforts a year 0 mussel survey will be conducted. Survey methods and survey extent will follow BioSurvey Group's October 2024 mussel survey.
    3. Mussel monitoring will be conducted in years 1, 3, and 5 post project operation. Monitoring methods and survey extent will follow BioSurvey Group's October 2024 mussel survey for direct comparison of any changes (see Figure 4).
    4. For diver health and safety concerns mussel relocation and survey efforts will only take place when river conditions allow. Surveys must be conducted in low to moderate flows, with water temperature greater than 50°F, and air temperature greater than 32°F.

These measures will be implemented throughout the work area during construction, as necessary and appropriate. The conservation measures are anticipated to help avoid and minimize adverse effects to the mussel species and their habitat; however, these measures are not expected to eliminate all adverse effects that may result from the proposed Action.

2.6 INTERRELATED AND INTERDEPENDANT ACTIONS

As described in the ESA, interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No projects that are directly related to the hydropower project are planned or currently being developed, and no interrelated or interdependent actions to the proposed Action are known at this time.

3.0 SPECIES FOR INFORMAL CONSULTATION

Species addressed under informal consultation include the salamander mussel. The following section includes an assessment of habitat for the salamander mussel in the Action Area and an analysis of effects that may occur to this species as a result of the proposed Action.

3.1 LISTED MUSSEL SPECIES HABITAT

The Kentucky River downstream of Lock and Dam 11 was determined by the USFWS KFO to be suitable habitat for listed mussels. On September 9, 2024, the KFO provided ICF with a map of Lock and Dam 11 showing areas that appear to be suitable habitat for mussels (stable sandy gravel). Similar areas within the Kentucky River were found to have round hickorynut mussels. As such, the USFWS KFO recommended a mussel survey take place.

3.2 MUSSEL SURVEY

The presence/probable absence survey for listed mussel was conducted by BioSurvey Group on October 7-8, 2024. The mussel survey extent was determined based on guidance from the USFWS KFO. The survey area extended from approximately 160 meters (m) to 420m downstream of the dam and 50m riverward from each bank. Six 50m transects, spaced at 50m intervals, were established perpendicular to flow on each bank, for a total transect length of 600m. Survey efforts yielded a total of 180 live mussels representing 12 species, including 17 federally threatened round hickorynut and a weathered dead federally endangered sheepnose shell. Most mussels, including federally listed species, were collected on the right descending half of the channel in sandy bed material. No fanshell or salamander mussels were found. See Appendix C, College Hill Hydro Project On The Kentucky River – Mussel Survey Report.

3.3 EFFECTS ANALYSIS

Although the Kentucky River provides suitable habitat for the salamander mussel, this species either never has been documented in this portion of the river or are only known from historic records. Based on the results of the survey, the salamander mussel is unlikely to be present in the Action Area. As a result, adverse effects to this species are not anticipated from the proposed Action.

3.4 EFFECTS DETERMINATION

Based on the presumed absence of the salamander mussel in the Action Area, effects to this species are considered discountable. Therefore, the effects determination for the salamander mussel species as a result of the Action is "**may affect, not likely to adversely affect**".

4.0 SPECIES FOR FORMAL CONSULTATION

Background information for the three mussel species proposed for formal consultation is presented below, including species status, distribution, and habitat.

4.1 ROUND HICKORYNUT

The round hickorynut *Obovaria subrotunda* (Rafinesque, 1820) is a small- to medium-sized mussel up to 3 inches (75 millimeters) in size, which lives up to 15 years. It is found in small streams to large rivers, and prefers a mixture of sand, gravel, and cobble substrates. The round hickorynut mussel is a wide-ranging species, historically known from 12 states, though now occurs in 9, as well as the Canadian Province of Ontario. It is currently found in five major basins: Great Lakes, Ohio (where it is most prevalent), Cumberland, Tennessee, and Lower Mississippi (where it is most rare). The number of known populations in the U.S. has declined by 77 percent, from 301 populations documented historically to 69 today (USFWS 2019).

The round hickorynut exhibits a preference for sand and gravel in riffle, run, and pool habitats in streams and rivers, but also may be found in sandy mud. They can be found in shallow habitats with gentle flows at less than one foot with abundant American water-willow, but in larger rivers are commonly found up to depths of 6.5 feet. The round hickorynut and other adult freshwater mussels within the genus *Obovaria* are suspension-feeders, consuming food filtered from the water. Their diet consists of a mixture of algae, bacteria, detritus, and microscopic animals.

Round hickorynut adults are greenish-olive to dark or chestnut brown, sometimes blackish in older individuals, and may have a yellowish band. The shell is thick, solid, and up to three inches long, but usually is less than 2.4 inches. A distinctive characteristic is that the shell is round, nearly circular. The foot can be pale tan to pale pinkish orange.

4.2 SHEEPNOSE

The sheepnose was listed as endangered under the ESA on April 12, 2012 throughout its entire range in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin (USFWS 2012). Historically, the sheepnose was known to occur throughout much of the Mississippi River system (NatureServe 2020); however, this species has been extirpated from over 65 percent of its historical range (25 streams currently from 77 streams historically), including thousands of miles of the Mississippi, Wisconsin, Illinois, Ohio, Cumberland, and Tennessee Rivers and their tributaries. Of the 25 extant populations, nine are thought to be stable and eight are considered to be declining. The Allegheny River in Ohio and the Green River in Kentucky are the only locations where the species is considered to be improving in population status. Six other populations are considered extant; however, the status of these populations is unknown. In Kentucky, populations exist in the Ohio, Licking, Kentucky, and Green Rivers (USFWS 2012).

The sheepnose is generally considered a large-river species; however, it also inhabits medium-sized rivers. The species is typically found in deep water (greater than two meters) with slight to swift currents and mud, sand, or gravel bottoms. The sheepnose may also inhabit riffles with gravel/cobble substrates and appears capable of surviving in reservoirs (NatureServe 2020).

4.3 SNUFFBOX

The snuffbox was listed as endangered by the USFWS on February 14, 2012. The snuffbox historically occurred in 210 streams and lakes in 18 States and 1 Canadian province: Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin; and Ontario, Canada. The major watersheds of historical streams and lakes of occurrence include: the upper Great Lakes sub-basin (Lake Michigan drainage), lower Great Lakes sub-basin (Lakes Huron, Erie, and Ontario drainages), upper Mississippi River sub-basin, lower Missouri River system, Ohio River system, Cumberland River system, Tennessee River system, lower Mississippi River sub-basin, and White River system. Extant populations of the snuffbox are known from 79 streams in 14 States and 1 Canadian province, representing a 62% decline in occupied streams. In Kentucky, the snuffbox is associated with the following river systems: Licking, Green, Tygarts, Kinniconick, Little Sandy, Red(s), Barren, Cumberland, Salt, Rolling Fork, and parts of the Rockcastle River. Distribution is sporadic and nearly statewide.

The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated. The umbos are located somewhat anterior of the middle, and are swollen, turned forward and inward, and extended above the hinge line. The anterior end of the shell is rounded, and the posterior end is truncated, highly so in females. The posterior ridge is prominent, being high and rounded, while the posterior slope is widely flattened. The posterior ridge and slope in females is covered with fine ridges and grooves, and the posterioventral shell edge is finely toothed. The shell is yellow or yellowish-green and covered with dark green rays or chevrons. The nacre is white or with a slightly iridescent bluish-white. Cardinal teeth are relatively large and serrated; lateral teeth are thick and short.

The snuffbox is usually found in small streams to medium-sized rivers, inhabiting areas with a swift current, although it is also found in Lake Erie and some larger rivers. Adults often burrow deep in sand, gravel or cobble substrates, except when they are spawning, or the females are attempting to attract host fish. They can be found in water as shallow as 2 inches to 2 feet, usually in shallower areas of moderate to swiftly flowing streams.

5.0 ENVIRONMENTAL BASELINE

The following sections include an analysis of past and on-going human and natural factors leading to the current status of the three mussel species, their habitat, and ecosystem within the Action Area. The environmental baseline is a “snapshot” of the species’ health in the Action Area at this time and does not include the effects of this Action.

5.1 SPECIES STATUS WITHIN THE ACTION AREA

A recent survey conducted by BioSurvey Group in October of 2024 observed 17 live round hickorynut and a weathered dead sheepnose shell. The survey area extended from approximately 160m to 420m downstream of the dam and 50m riverward from each bank. As shown in the table below, two of the three mussel species have been documented within the Action Area. Additionally, on August 30, 2023, a mussel survey contractor found a round hickorynut mussel on the right descending bank approximately 845 meters (~0.5 mile) downstream of the lock and dam #14 on the Kentucky River.

Species	Downstream of Action Area	Action Area	Upstream of Action Area
Round hickorynut	X	X	X
Sheepnose	X	X	
Snuffbox			X

X = known locations

Mussel surveys performed by the BioSurvey Group in October, 2024 documented the presence of a diverse mussel bed extending from the end of the esplanade wall downstream approximately 875 feet (see Appendix C). Based on the results of the mussel survey several concerns regarding the downstream impact from the planned hydro projects operation on federally listed mussels was raised by the KFO. To better understand the potential change in flow conditions, Lock 11 Hydro partners contracted Kleinschmidt Associates to prepare a hydraulic analysis to evaluate and compare the existing and proposed flow conditions (operation) at Lock and Dam No. 11. The results of the hydraulic model and the evaluation of the potential impacts of flow condition changes on the federally listed mussel species and their host fish to provide a prediction for where downstream changes in flow and water velocity will occur (see Appendix D).

5.2 ACTION AREA NUMBERS

Semi-quantitative data from the 2024 BioSurvey Group survey was used to calculate mussel densities downstream of Lock and Dam No. 11. During the survey, 109 mussels were found along the six 50-meter transects, which included an area of 600 square meters. Based on these results, a density of 0.81 mussels per square meter in present in the semi-quantitative survey area. A total of 17 round hickorynut individuals were found during the semi-quantitative survey; therefore, the estimated density for this species is 0.0283 mussels per square meter (17 individuals ÷ 600 m^2 in survey area = 0.0283 mussels/m^2). One dead sheepnose individual was also encountered during the survey, resulting in an estimated density of 0.0016 mussels per square meter.

No individuals of snuffbox were encountered during the survey, and this species have not been documented in this portion of the Kentucky River. Although presence of this species has not been confirmed, it could potentially occur in this portion of the river and are likely to be present. Therefore, one individual of snuffbox is likely to be present in the semi-quantitative survey area. The estimated density for snuffbox is 0.0016 mussels per square meter. The estimated density calculated for each species in the semi-quantitative survey area downstream of Lock and Dam No. 11 is summarized in the following table.

Species	Estimated Density in Survey Area (mussels/m^2)
Round hickorynut	0.0283
Sheepnose	0.0016
Snuffbox	0.0016

The estimated density calculated for each species for the semi-quantitative survey area is assumed to be similar throughout the Action Area downstream of Lock and Dam No. 11; therefore, these values were used to estimate the number of individuals of each species within the Action Area. The portion of the Action Area downstream of Lock and Dam No. 11 totals approximately 42,896 square meters. To calculate the estimated number of individuals of each species in the Action Area, the Action Area size was multiplied by the estimated density for each species, which is summarized in the following table. For example, the calculation for the estimated number of round hickorynut individuals is 0.0283 mussels/m^2 x 43,301 m^2 = 1, 225 round hickorynut individuals. Each value was rounded up to the nearest whole number.

Species	Estimated Individuals in Action Area
Round hickorynut	1,225
Sheepnose	69
Snuffbox	69

5.3 ACTION AREA CONSERVATION NEEDS AND THREATS

The primary factor affecting the three mussel species in the Action Area is the presence of Lock and Dam No.'s 10 and 11. The remnant lock and dams act as a barrier in the Kentucky River that affects flow, sediment deposition, water quality, and the movement of aquatic organisms. Construction of the lock and dams have caused a large portion of the river to become pooled and have altered the natural flow regime, causing riffles and shoals with clean sand and gravel bed materials to be replaced by slow-flowing, silt-bottomed pools that do not provide suitable habitat for the listed mussel species. These conditions have been present in this portion of the Kentucky River since construction of the lock and dams in the early 1900's. The presence of the dams also acts as a barrier to fish movement, potentially limiting contact between mussels and fish hosts and limiting reproduction.

Other factors that could affect the three mussel species in the Action Area include increased sedimentation and inputs of contaminants. Runoff associated with agricultural and logging activities contributes to the introduction of sediment, suspended solids, pesticides, herbicides, fertilizers, petroleum-based products, and other contaminants to the Kentucky River. Point source releases from wastewater treatment and storm water discharge also cause contamination. Contaminants may also enter the Kentucky River through inputs of groundwater when petroleum-based products (e.g., fuel, oil, hydraulic fluid) from vehicles, trains, heavy equipment, and other sources enter the karst system in the area.

6.0 EFFECTS OF THE ACTION

The following sections include an analysis of effects that may occur as a result of the proposed Action to the three mussel species. As previously mentioned, the Action Area includes Lock and Dam No. 11 and the Kentucky downstream of the dam for approximately 1,190 feet. The upstream extent of the Action Area includes the top of the dam and the upper miter gates (Figure 2). Therefore, no effects to mussels or their habitat is anticipated upstream of the Action Area. Based on activities associated with the proposed Action and known threats to these species, the following stressors have been identified: 1) sediment disturbance; 2) changes to flow; and 3) displacement of individuals. Each of these stressors is discussed in more detail below through Stressor-Exposure-Response pathways. The pathways identify the circumstances for an individual mussel to be impacted by the Action and summarize potential effects. Potential effects in the pathways are referred to as stressors (i.e., the overlap in time and space between an impact and an individual). The pathways also include conservation measures when appropriate to reduce the exposure probability of an individual mussel to the stressor or the severity of the stressor on an individual.

Upon review of the 2024 BioSurvey Group mussel survey report, the USFWS KFO had three primary concerns regarding the impact to federally listed mussels from planned operations associated with the College Hill Hydroelectric Project.

1. Sediment transport through the lock or scouring of sediment in the immediate vicinity of the Project that may deposit and bury the existing mussel beds.
2. Changes in flow conditions that would cause dislodgement of existing mussels.
3. Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.

To better address the potential impacts and concerns from the proposed project, Kleinschmidt Associates performed a hydraulic analysis to evaluate and compare the existing and proposed (operation) flow conditions at Lock and Dam No. 11. The results of the hydraulic model and the evaluation of the potential impacts to flow condition changes on the federally listed mussel species and their host fish provide a prediction for where downstream changes in flow and water velocity will occur (see Appendix D). The existing and proposed flow scenario findings have been incorporated in the following stressors.

6.1 SEDIMENT DISTURBANCE

Site preparation, construction of the powerhouse, control building, site stabilization, and project operation will result in land and sediment disturbance. Sediment disturbance within the lock chamber, along the riverbanks and adjacent areas could expose soil and increase erosion, allowing sediment to enter the Kentucky River through runoff. Sediment disturbance from hydropower operations within the river could displace sediment in one location and deposit it in another location, potentially exposing or burying mussels. Potential impacts to the three mussel species from sediment disturbance in the work area and the Action Area downstream of the work area are discussed in the following sections.

<u>Work Area</u>

The construction of a temporary access road and parking lot during site preparation will disturb soil near the Kentucky River. Prior to site preparation, EPSC measures will be implemented and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. Vehicles and equipment used during site preparation will be limited to the riverbanks and adjacent areas and will not enter the river. The project will not require tree removal and sediment displacement associated with site preparation will be minimal.

Construction will take place over a period of about two years. Before construction can begin in the lock chamber, rock anchors will be installed in the shore side lock wall. Next a temporary cofferdam will be installed and sealed on the downstream miter gate sill to block off water from entering the lock chamber. Next, the lock chamber will be dewatered and cleaned down to bedrock. Once clean bedrock is exposed, concrete construction can begin in the lock chamber of the powerhouse. The powerhouse is a mass concrete pour with embedded horizontal draft tubes. The trash rack system and rubber dams are then installed. The final installation is the turbine-generators with shut-off valves, which are bolted to the receiving plates on the front of the draft tubes. Once all the equipment is installed, the concrete upper bulkhead and lower temporary cofferdam will be removed, allowing water into the new plant. Based on construction phasing and dewatered conditions, downstream sediment disturbance from work within the lock chamber is considered unlikely.

During periods when the river level is too high to work on the powerhouse in the lock chamber, work will commence to build the adjacent control building and conduit trench. Control building construction (excavation, backfill, grade) and conduit trench excavation will temporarily disturb soil adjacent to the river. EPSC measures will reduce the potential for sediment to enter the river and affect downstream mussels. Additionally, listed mussels are unlikely to be present in the adjacent lock chamber due to lack of suitable habitat, reducing the potential for sediment disturbance to impact individuals in this area. Site stabilization activities after construction will reduce the potential for sediment to enter the Kentucky River through seeding of disturbed areas and dressing of the access road and parking area. EPSC measures will also be maintained until the site is stabilized. As a result, sediment disturbance from this construction component is expected to be minimal and will not smother mussels or render habitat unsuitable.

<u>Action Area Downstream of Work Area</u>

As discussed above, site preparation, project construction, and stabilization activities are not expected to cause inputs of sediment beyond the work area due to the use of EPSC measures. Inputs that do occur are anticipated to be minimal and will be dispersed quickly over a large area due to the flow of the river.

During hydropower operation the river’s natural movement of sediment (bed and suspended loads) will be transported through the lock chamber and will move downstream in the water column before settling. Mussels downstream of Lock and Dam No. 11 are currently exposed to the river’s transport of suspended (silt and clay) load and bed material (sand and gravel) load that come to rest or fall back to the bed during base and high flow conditions. During operations, sediment that is transported through the powerhouse and lock chamber will occur as a result of the river’s natural process of sediment transport and will not significantly impact the three mussel species beyond existing conditions.

The scouring of sediment in the immediate downstream vicinity of the lock chamber could potentially expose and/or smother mussels or render habitat unsuitable, causing individuals to move to other areas. The sandy substrate between Lock and Dam No. 11 and BioSurvey Group survey Location 1 (approximately 200-foot-long reach along the right bank) will likely be mobilized once power generation is online. This sediment load movement is expected to be a one-time occurrence until a new equilibrium is reached post-project implementation. The suspended load sediments are expected to settle within or immediately downstream of the project area. Therefore, while initial scour and sediment deposition may occur, the volume is not expected to smother the mussel beds. The volume of sediment is not expected to exceed what is naturally scoured, transported, and deposited annually as the river continually fluctuates between base flow and peak flow conditions. The risk of sediment scour or deposition is greatest during high-flow conditions and is not tied to the hydropower operations.

Under normal flow conditions the area at the outlet of the lock chamber is expected to be the most affected by hydropower operations. This is also the deepest part of the river that contains boulder, cobble, and gravel bed materials. The water column depth and coarse bed materials are likely the result of this area continually receiving the majority of discharge during high-water events. As such, these coarse bed materials are not expected to scour under the proposed normal flow conditions. Some sand is present in Location 1, which may potentially be mobilized once the proposed project is in full operation, ultimately leaving more coarse bed materials (i.e., boulder, cobble, and gravel) behind, as seen in BioSurvey Group survey Locations 2 and 3 (see Figure 4). This potential change is expected to be temporary as sediment is moved farther downstream and a new equilibrium is reached.

Sediment transported and deposited during operations in the Action Area downstream of the work area is not expected to result in significant scouring or deposition causing mussels to be exposed, smothered or render habitat unsuitable. Although mussels may be able to respond to minimal, temporary sediment deposition, the initial movement of sediment from downstream of the lock chamber may result in substantial deposition that would not allow all individuals to adjust. Sediment deposition that occurs during periods of low water temperatures and decreased mussel activity will also reduce the ability of individuals to respond to deposition events.

The sediment disturbance described above could also result in impacts to habitat for fish hosts for the three mussel species. Sediment displacement and deposition may damage or bury habitat used by fish hosts for foraging, reproduction, and sheltering. The alteration or loss of habitat could cause host fish to move from the area, limiting their exposure to the mussel species and potentially affecting mussel reproduction and recruitment.

<u>Applicable Science</u>

Sedimentation is believed to adversely affect mussel populations that require clean, stable streams and has contributed to the decline of mussel populations nationwide (Vannote and Minshall 1982, Brim-Box and Mossa 1999). Specific biological effects to mussels from sedimentation include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms (Vannote and

Minshall 1982, Waters 1995, Hartfield and Hartfield 1996). In addition, mussels may be indirectly affected if high turbidity levels significantly reduce the amount of light available for photosynthesis by potential food items or impede the ability of mussels to attract host fishes (Kanehl and Lyons 1992). Sedimentation can also eliminate or reduce the recruitment of juvenile mussels by clogging interstitial spaces, interfering with feeding activity, and acting as a vector in delivering contaminants to streams (Brim-Box and Mossa 1999).

Effects Pathway – Mussel Species #1	
Activity: Site Preparation, Site Stabilization	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Activity
Exposure (space)	Work Area, Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Revegetate disturbed areas immediately following completion of ground disturbing activities.
Effect	Insignificant
Interpretation	Appropriate EPSC measures will be installed and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. No construction components will occur upstream of the Action Area or downstream of the work area. Inputs of sediment into these areas are not expected due to the use of EPSC measures, and inputs that do occur are anticipated to be minimal. Effects from sediment disturbance caused by construction of the access road and parking lot are considered discountable.

Effects Pathway – Mussel Species #2	
Activity: Construction of the Powerhouse, Conduit Bank, & Control Building	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Activity
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Dewater and clean lock chamber to bedrock to allow construction in the dry. • Perform powerhouse activities during periods of normal or low flows.
Effect	Insignificant

Interpretation	Appropriate EPSC measures will be installed and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. Vehicles and equipment will not enter the river, and all river work will occur within the lock chamber. Effects from sediment disturbance caused by construction of the conduit bank and control building are considered discountable. In addition, the areas immediately adjacent to the work area where the potential for impacts is highest do not provide suitable habitat for the three mussel species.

Effects Pathway – Mussel Species #3	
Activity: Construction of the Powerhouse, Conduit Bank, & Control Building	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Activity
Exposure (space)	Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Revegetate disturbed areas immediately following completion of ground disturbing activities.
Effect	Insignificant
Interpretation	No construction components will occur upstream of the Action Area or downstream of the work area. Inputs of sediment into these areas are not expected due to the use of EPSC measures, and inputs that do occur are anticipated to be minimal.

Effects Pathway – Mussel Species #4	
Activity: Hydropower Operation	
Stressor: Sediment Disturbance	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	N/A
Effect	Discountable
Interpretation	The proposed project would operate in run-of-river using flows for power generation and no effects due to sediment disturbance will occur upstream of the Action Area or in the work area. Additionally, the work area does not provide suitable habitat for the listed mussel species.

Effects Pathway – Mussel Species #5	
Activity: Hydropower Operation	
Stressor: Sediment Disturbance	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration or smothering due to sediment deposition • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Effect	Adverse (harm, mortality)
Interpretation	The movement and deposition of sediment during hydropower operation could smother mussels or make habitat unsuitable, causing individuals to move to other areas.

6.2 CHANGES TO FLOW

Run-of-river hydroelectric plant operation is the only proposed Action component that could result in changes to flow in the Kentucky River. Site preparation and stabilization will not result in changes to flow due to the lack of in-stream activities associated with these components. Changes to flow from hydropower operations could impact mussels and their habitat by altering the morphology of the river channel, causing sediment degradation and aggradation, and affecting water quality. Potential impacts to the three mussel species from changes to flow in the work area and the Action Area downstream of the work area are discussed in the following sections.

<u>Work Area</u>

The hydroelectric plant (powerhouse) will be installed entirely within the upper portion of the abandoned lock chamber. The powerhouse is the only construction component located within the Action Area. The hydroelectric plant will operate in run-of-river using flows between 196 cfs and 2,636 cfs for power generation. The turbines would be operated sequentially, based on inflow, and would maintain run-of-river operation levels. Units will turn on to operate as the upstream pool level increases and water flow in the river justifies additional generation. The plant units will cycle off to continually maintain some water running over the spillway. Lock 11 Hydro Partners proposes to install monitoring equipment in the lock chamber and headwater pool that is designed to shut down the generating units when water levels in the impoundment fall below 617.38 feet. The work area (powerhouse) is unsuitable for mussels. As a result, impacts to mussels in this area are not anticipated as a result of the project.

Action Area Downstream of Work Area

Changes to the hydraulic conditions below Lock and Dam No. 11 in the Kentucky River during existing and proposed (operation) flow conditions were analyzed by Kleinschmidt. In particular changes in flow conditions over and near the existing mussel beds that could alter the likely presence of host fish species for the round hickorynut and sheepnose were evaluated. Host fish species include the round hickorynut host the eastern sand darter (*Ammocrypta pellucida*) and sheepnose host the sauger (*Sander canadensis*).

According to the results of the hydraulic model, the expected maximum change in peak depth-averaged velocity between existing and proposed conditions across the Action Area is negligible in most flow scenarios. The most noticeable differences between existing and proposed conditions is during the Normal Flow (2,636 cfs) scenario. In the Normal Flow scenario, most locations are not expected to have a noticeable change in peak depth-averaged velocity. However, Locations 1 and 2 (Figure 4) are expected to experience a 2.0 feet per second (fps) and a 1.2 fps change in water velocity under the proposed conditions, respectively. During existing normal flows, water is prevented from entering the lock structure, and all flow is routed over the existing spillway over a wide cross-sectional area. This allows more uniform dispersal of flows across the river channel. Conversely, under proposed conditions at normal flows, water will be routed through the proposed powerhouse and discharged at the outlet of the existing lock structure. This creates an area of increased water velocities at the edge of the concrete esplanade along the right descending bank at Location 1 as water exits the existing lock structure. Continuing downstream, flow patterns begin to distribute across the river channel through Locations 3 and 4 and begin to resume "normal" flow patterns across Locations 5 and 6 and exiting the survey reach (Figure 4). Another potential change in flow pattern under the Normal Flow scenario includes the creation of an eddy along the left bank during normal flow conditions. This eddy may allow fine sediments to settle when normal flows resume after a post-high event. The area is predominately bedrock substrates and generally unsuitable for mussels.

Under hydropower operations, increased water velocities in Locations 1 and 2 (i.e., a maximum depth-averaged velocity of 2 fps) and changes to flow patterns under Normal Flow scenario have the potential to affect mussels in the immediate vicinity. The area at the outlet of the existing lock structure is expected to be most affected. Coincidentally, this is also the deepest part of the river that contains boulder, cobble, and gravel bed materials. The water column depth and coarse material types are likely the result of this area continually receiving the majority of discharge during high-water events. As such, these coarse bed materials are not expected to scour under the proposed normal flow conditions. Some sand is present in Location 1, which may potentially be mobilized once the proposed project is in full operation, ultimately leaving more coarse bed materials (i.e., boulder, cobble, and gravel) behind, as seen in Locations 2 and 3. However, this potential change is expected to be a one-time occurrence until a new equilibrium is reached.

Although some flow pattern changes are expected in the Action Area downstream of the work area during hydropower operations normal flow conditions at Locations 1 and 2, the changes in water velocities and flow patterns are not expected to alter habitats in a way that would affect the presence of known or potential fish host species.

Applicable Science

Dams alter flow by impounding or pooling long reaches of free-flowing rivers, resulting in changes to hydrology and channel morphology, increased sediment deposition, altered water quality, decreased habitat heterogeneity, altered flood patterns, and decreased movement of mussels and fish (Neves et al. 1997, Watters 2000). Habitat heterogeneity is often reduced from six or seven habitat types to three or four, some of which are highly modified from the existing habitat or new to the river system. Although the original channel remains upstream of the dam, increased depth and slower flow rapidly alters existing habitats. Decreased flow reduces sediment transport, causing fine sediment to settle and blanket the substrate with silt. Siltation of the river bottom can affect mussels through smothering, diminishing food supply by limiting light penetration, altering temperatures, and reducing recruitment (Watters 2000). Siltation can also change species composition in the impounded or pooled areas by reducing the presence of species intolerant of silt with silt-tolerant species (Holland-Bartels 1990, Parmalee and Hughes 1993).

Changes in flow downstream of dams leads to scouring and bank erosion, reduced dissolved oxygen, temperature fluctuations, and changes in mussel and fish composition (Neves et al. 1997, Watters 2000). The acceleration of water as it flows over a run-of-river dam results in scour of the stream bed and banks, often producing a scour area or plunge pool at the base of the dam (Csiki and Rhoads 2014, Pearson and Pizzuto 2015). Scouring at the base of the dam mobilizes fine sediments and smaller coarse sediments, leaving only cobble, boulders, and bedrock (Skalak et al. 2009, Csiki and Rhoads 2014). A mid-channel bar often forms downstream of the dam that consists of scoured materials (Csiki and Rhoads 2014). Scouring immediately below dams can be extensive and can eliminate or prevent mussels from inhabiting these areas (Miller and Payne 1992).

Effects Pathway – Mussel Species #6	
Activity: Hydropower Operation	
Stressor: Changes to Flow	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Mortality due to alteration of loss of flow regime • Reduction or loss of fish hosts due to changes to flow regime
Conservation Measures	• N/A
Effect	Discountable
Interpretation	The project will operate as a run-of-river facility and will not attenuate flows upstream beyond existing conditions. The work area contains unsuitable habitat for the three mussel species.

Effects Pathway – Mussel Species #7	
Activity: Hydropower Operation	
Stressor: Changes to Flow	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of the Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Mortality due to alteration of loss of flow regime • Reduction or loss of fish hosts due to changes to flow regime
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Effect	Adverse (harm, mortality)
Interpretation	Based on hydraulic analysis modeling, changes in flows are expected to be minimal. Increased water velocity and changes to flow patterns during normal flows directly downstream of the lock chamber have the potential to affect mussels in the Action Area.

6.3 DISPLACEMENT OF INDIVIDUALS

Run-of-river hydroelectric plant operation is the only proposed Action component that could result in displacement of individuals. Site preparation and stabilization will not displace individuals due to the lack of in-stream activities associated with these components. Changes to flow from hydropower operations could disturb the downstream river substrate and displace an adjacent individual. Displaced mussels could be moved to an area of unsuitable habitat, requiring the individual to move to a more suitable area and expend energy. Displacement may also lead to harm or mortality if the mussel is unable to find suitable habitat quickly. Potential impacts to the three mussel species from displacement of individuals in the work area and Action Area downstream of the work area are discussed in the following sections.

Work Area

The hydroelectric plant will be installed entirely within the upper portion of the abandoned lock chamber. The work area (powerhouse) is unsuitable for mussels and is unlikely to displace individuals. As a result, the displacement of individuals in this area is not anticipated as a result of the project.

Action Area Downstream of Work Area

Changes to the hydraulic conditions that could cause dislodgement of mussels below Lock and Dam No. 11 in the Kentucky River during proposed (hydropower operations) flow conditions were additionally analyzed by Kleinschmidt. According to the results of the hydraulic model, during the Normal Flow scenario, flow conditions are expected to change at Locations 1 and 2. However, due to the existing depth and coarse bed materials, the expected increase in water velocity is unlikely to scour the riverbed and displace mussels when compared to the yearly flow velocity changes that already exist. An important consideration when examining potential project effects is the flow conditions and river fluctuations that are currently experienced. This reach of the river frequently experiences flashy flows, particularly in the winter and spring months. As observed within the Mean Peak Flow scenario under existing conditions, water velocities increase 4.2 fps in Location 1 compared to the Normal Flow scenario. These flows pose a greater risk to bed scour and mussel displacement than the expected increase of 2.0 fps at Normal Flow once the hydropower facility is in operation. The risk of mussel displacement and the movement of sediment occurs during high-flow events, which frequently happen under existing conditions. Under the proposed operation conditions, there is no observable difference in flow condition during the Mean Peak Annual Flow and is not likely to increase the risk of riverbed scour and mussel displacement than the existing conditions. Therefore, the displacement of individuals in the Action Area downstream of the work area is unlikely. However, the bed materials between the end of the lock chamber and Location 1, presumed to be finer (sand), may potentially shift to coarser types after project implementation. This is due to the increased water velocity keeping the bed materials in this deeper channel free of finer sediments, which is expected to stabilize post-project operation.

Applicable Science

Published data on the downstream displacement of mussels from hydroelectric plants located within abandoned lock chambers is unavailable.

Effects Pathway – Mussel Species #8	
Activity: Hydropower Operation	
Stressor: Displacement of Individuals	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles)
Individual response	• Harm or mortality if displaced to unsuitable habitat • Movement of displaced individuals to suitable habitat, which may lead to increased energy expenditure and decreased fitness
Conservation Measures	N/A
Effect	Discountable
Interpretation	The project will operate as a run-of-river facility and will not attenuate flows upstream beyond existing conditions. The work area contains unsuitable habitat for the three mussel species.

Effects Pathway – Mussel Species #9	
Activity: Hydropower Operation	
Stressor: Displacement of Individuals	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles)
Individual response	• Harm or mortality if displaced to unsuitable habitat • Movement of individuals to suitable habitat, which may lead to increased energy expenditure and decreased fitness
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Effect	Adverse (harm, mortality)
Interpretation	The proposed operation is unlikely to increase the risk of riverbed scour and mussel displacement beyond existing conditions. However, bed materials

	between the end of the lock chamber and Location 1, presumed to be finer (sand), may potentially shift to coarser types after project operation. The displacement of individuals in the Action Area downstream of the work area is unlikely.

6.4 CUMULATIVE EFFECTS

Cumulative effects are those that are reasonably certain to take place in the future as a result of activities unrelated to the proposed Action. The purpose of the proposed Action is to generate clean carbon-free renewable electricity to help combat climate change and generate distributed power near the locations where power is used. Future activities, such as increased residential or commercial development, agricultural practices, increased traffic, or tourism in the area are not reasonably certain to occur as a result of the Action. Based on these factors, no cumulative effects to the three mussel species are anticipated as a result of the proposed Action.

6.5 SUMMARY OF EFFECTS

The proposed Action could expose the three mussel species to the stressors evaluated in the previous section. Anticipated adverse effects to the three mussel species are limited to: sediment disturbance, changes to flow, and displacement of individuals in the Action Area downstream of the work area (powerhouse) during hydropower operations normal flow conditions. Potential effects to the three mussel species are summarized in the following table.

Stressor	Action Component	Location	Effect	
			Adverse	Insignificant/Discountable
Sediment Disturbance	Site Preparation & Stabilization	Work Area & Action Area DS of Work Area		X
	Project Construction	Work Area		X
		Action Area DS of Work Area		X
	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	
Changes to Flow	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	
Displacement of Individuals	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	

6.6 EFFECTS DETERMINATION

Potential impacts to the three mussel species have been minimized to the extent possible through the use of conservation measures; however, adverse effects to the mussel species are expected as a result of the proposed Action. Therefore, the effects determination for the round hickorynut, sheepnose, and snuffbox as a result of the Action is "**may affect, likely to adversely affect**".

7.0 CONCLUSION

The biological assessment for the proposed Action included a habitat assessment and a survey for federally listed mussels. During the habitat assessment, forested habitat within the project area was identified as suitable summer roosting, foraging, and commuting habitat for the Indiana bat. The Kentucky River was identified as suitable gray bat foraging habitat and suitable habitat for federally listed mussel species. No potential bat hibernacula, caves, cave like features or rock shelters were observed in the Action Area, and the project will not require the use of blasting or extensive excavation. The proposed hydroelectric project will not require tree or riparian habitat removal, and no bats or evidence of bat use was observed. Potential impacts to the Kentucky River during construction of the powerhouse will be temporary, minimal, and localized within the lock chamber. Based on these factors, "**no effect**" is proposed for the gray, Indiana, and Virginia big-eared bats. No limestone outcroppings, rocky/talus areas or cliffs are present within the Action Area. As a result, "**no effect**" is proposed for Short's bladderpod.

A presence/probable absence survey for federally listed mussels was conducted below Lock and Dam No. 11 during October of 2024. The survey area extended from approximately 160m to 420m downstream of the dam and 50m riverward from each bank. Survey efforts yielded a total of 180 live mussels representing 12 species, including 17 round hickorynut and a weathered dead sheepnose shell. Effects to the salamander mussel are considered discountable. Therefore, an effects determination of "**may affect, not likely to adversely affect**" has been made for this species, and informal consultation with the USFWS is requested to address potential effects to the salamander mussel.

The proposed Action is expected to result in adverse effects to the round hickorynut, sheepnose, and snuffbox. Therefore, an effects determination of "**may affect, likely to adversely affect**" has been made for these three mussel species. Formal consultation with the USFWS is requested to address potential adverse effects to these species.

8.0 REFERENCES

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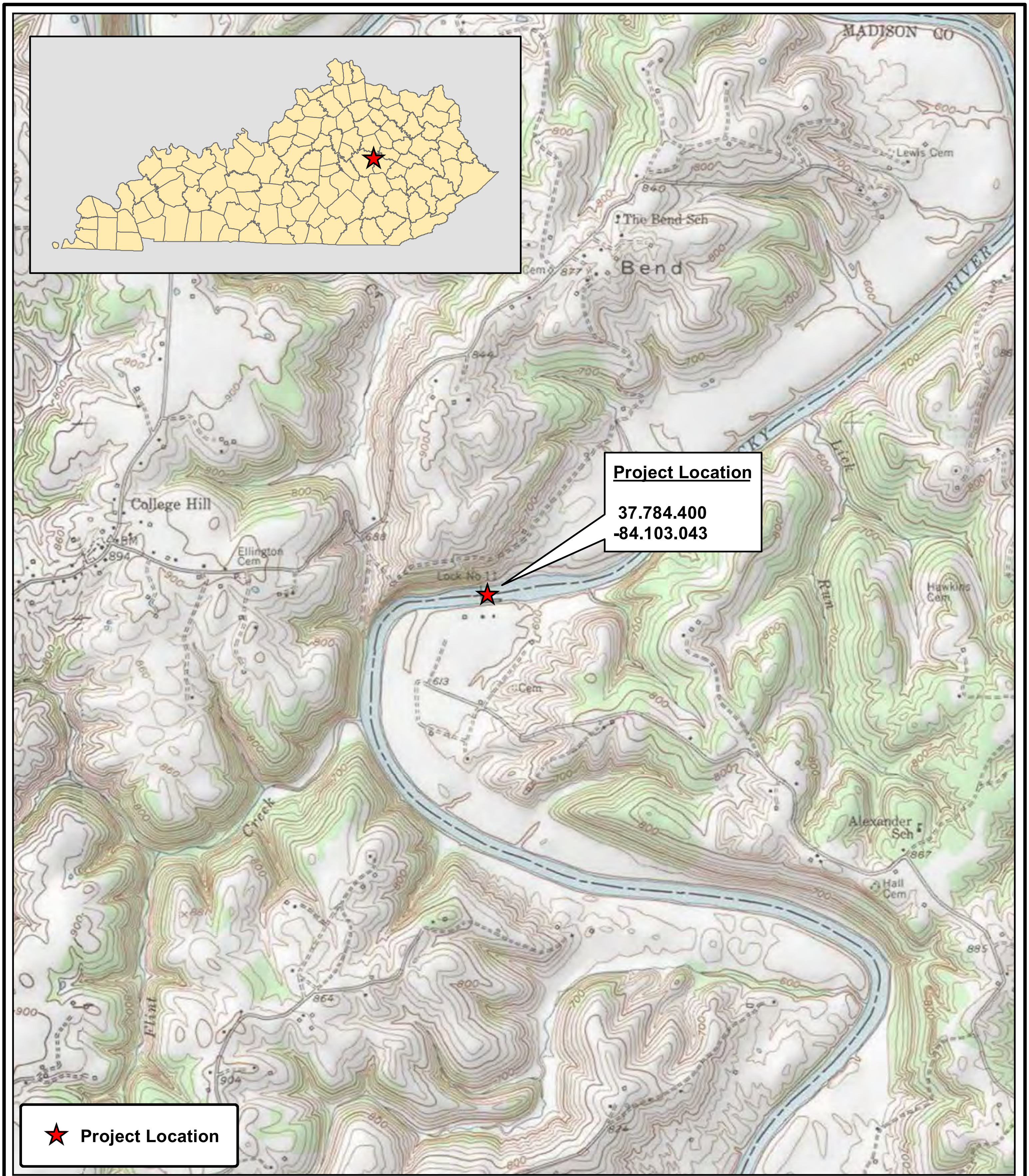
FIGURES



Biological Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

FIGURE 1

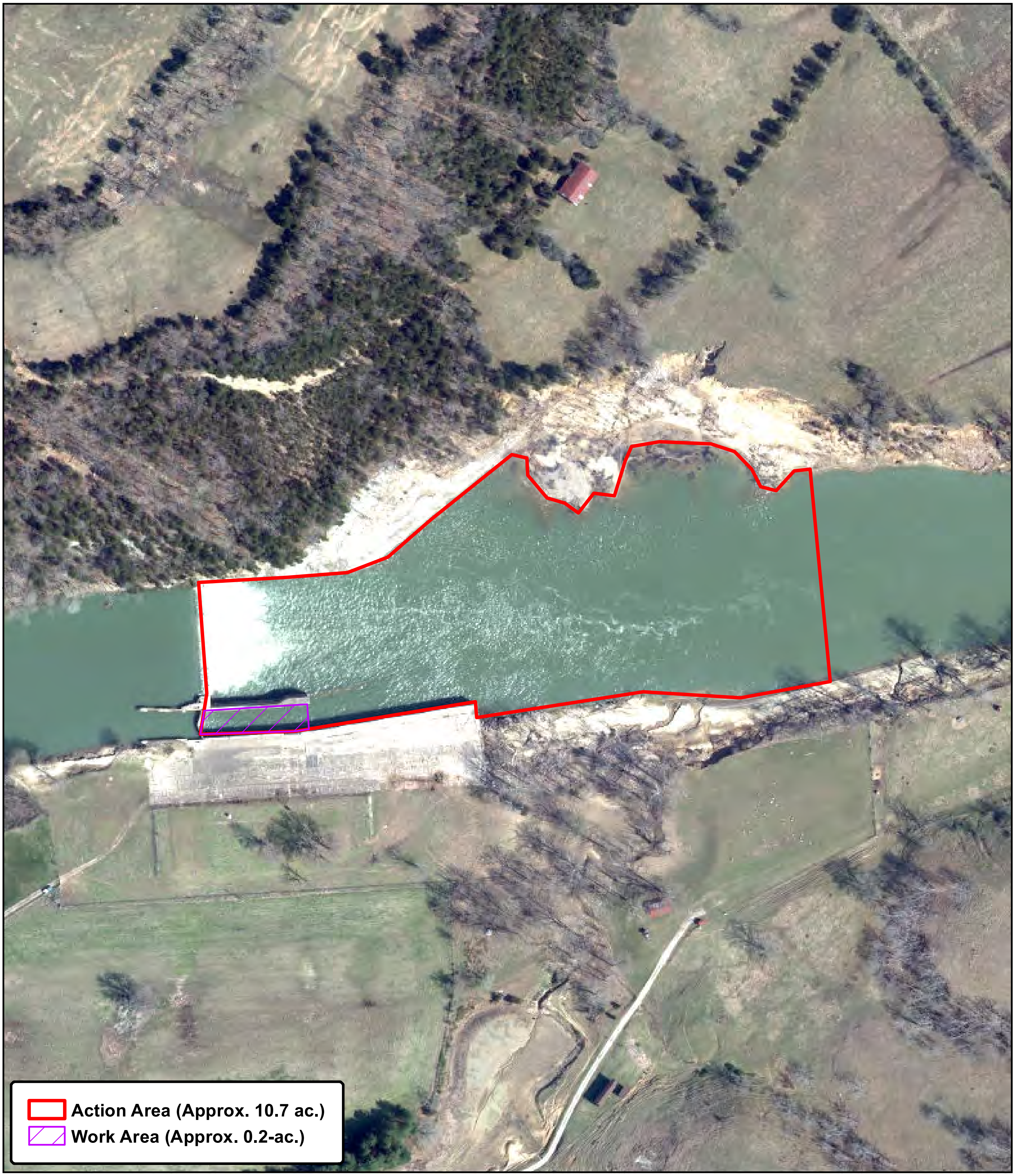
Project Location Map

ICF

Drawn by: SAS

Print Date: 11/18/2024

Prepared For: Appalachian Hydro



N

Biological Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

0 112.5 225 450
Feet

1 inch = 250 feet

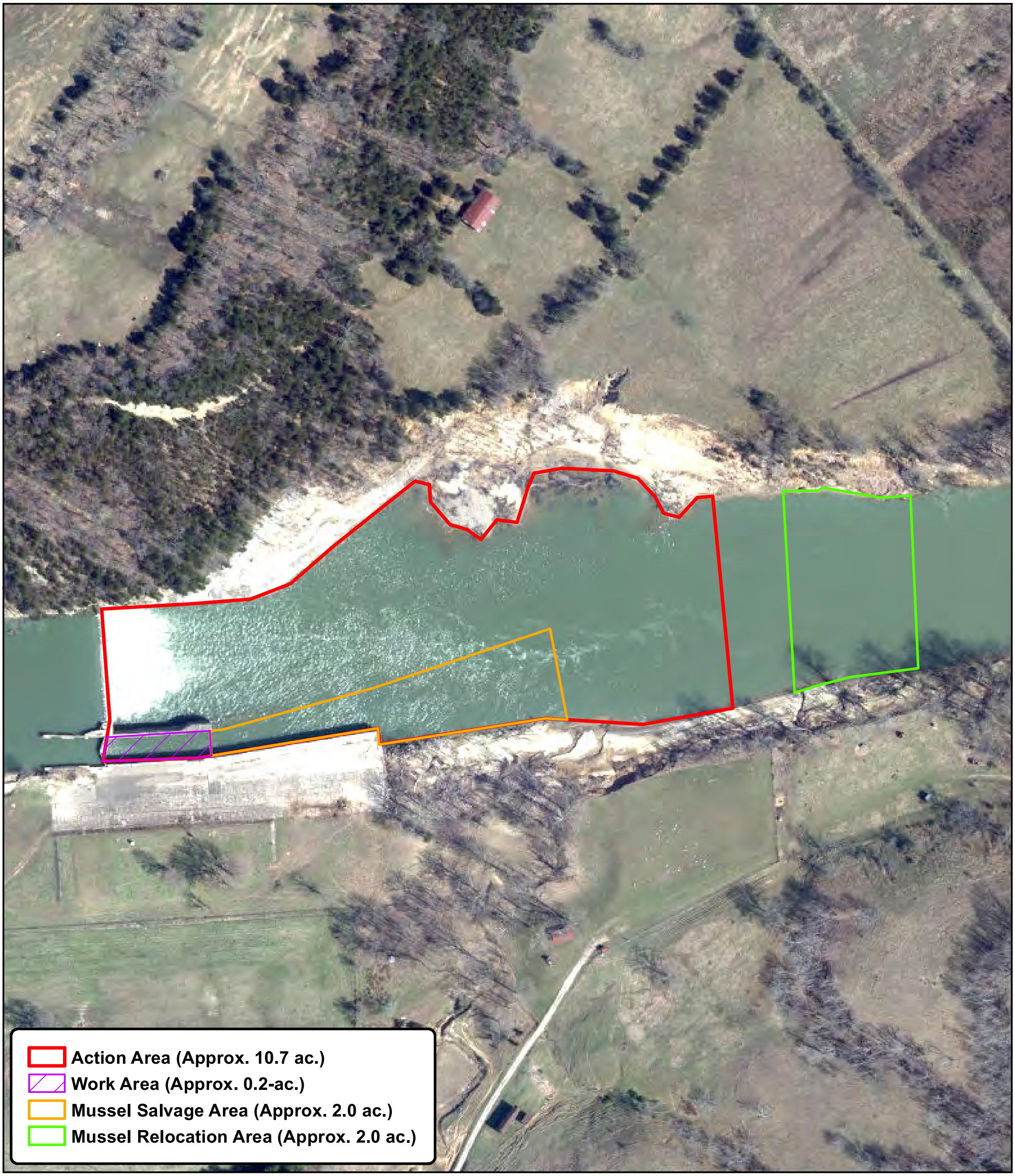
FIGURE 2

Action Area Map

ICF

Drawn by: SAS | Print Date: 3/20/2025

Prepared For: Appalachian Hydro



N

0 112.5 225 450 Feet

1 inch = 250 feet

Biological Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

FIGURE 3

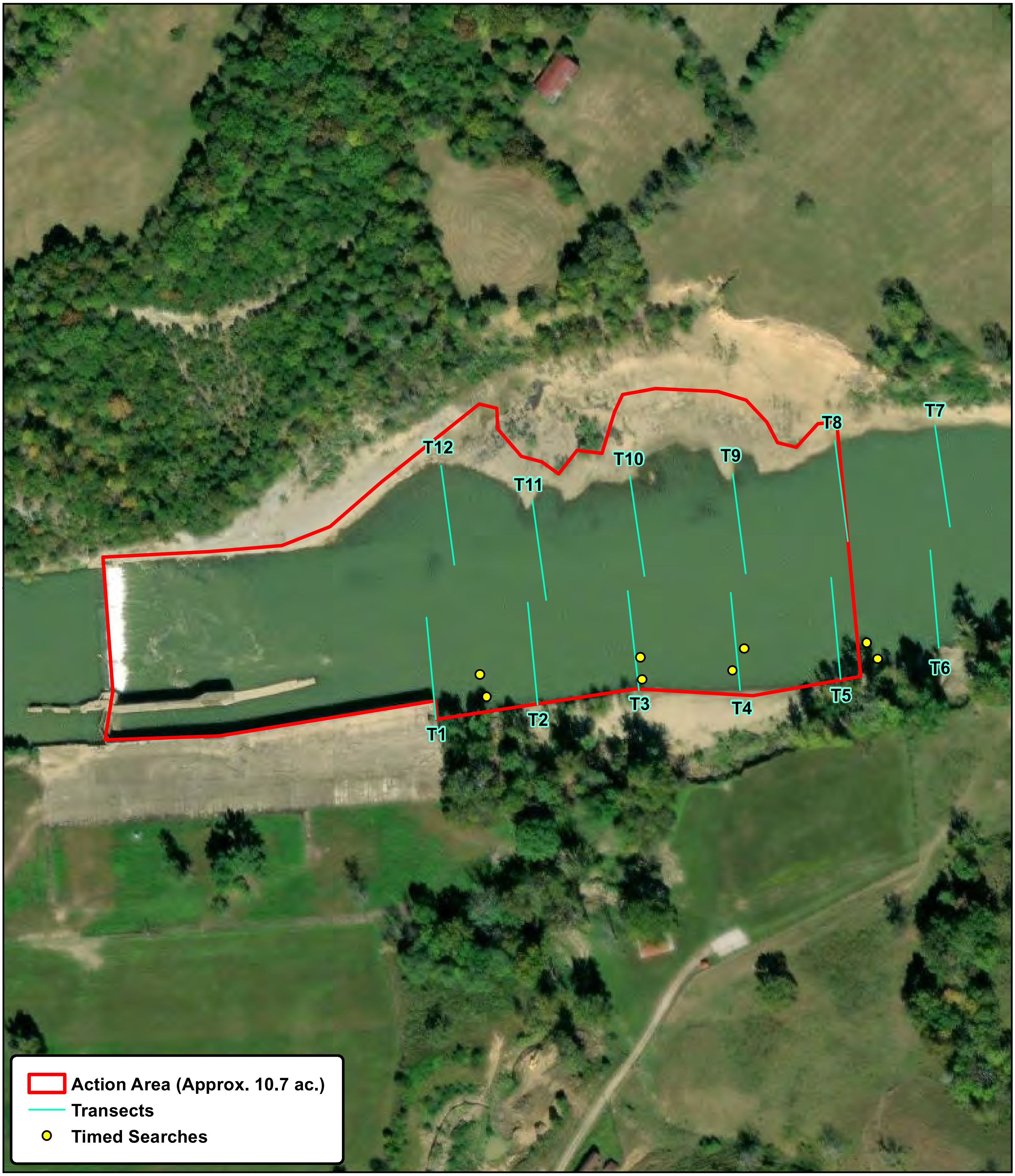
Mussel Salvage and Relocation Map

ICF

Drawn by: SAS

Print Date: 3/20/2025

Prepared For: Appalachian Hydro



N

0 90 180 360 Feet

1 inch = 208 feet

Biological Assessment
Lock 11 Hydroelectic Project
Madison and Estill Counties, KY

FIGURE 4

Mussel Monitoring Map

ICF

Drawn by: SAS

Print Date: 3/7/2025

Prepared For: Appalachian Hydro

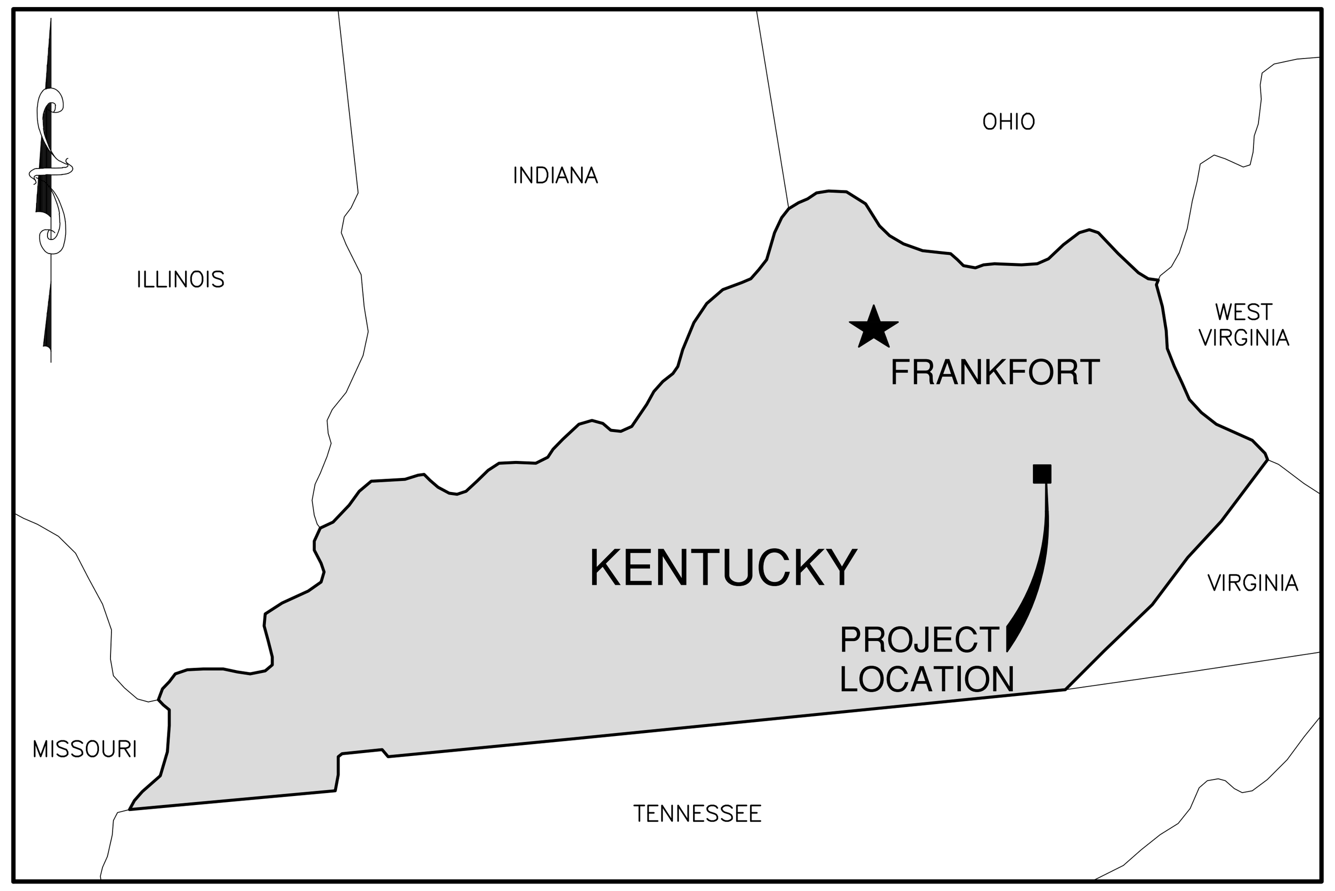
APPENDIX A

Project Plans

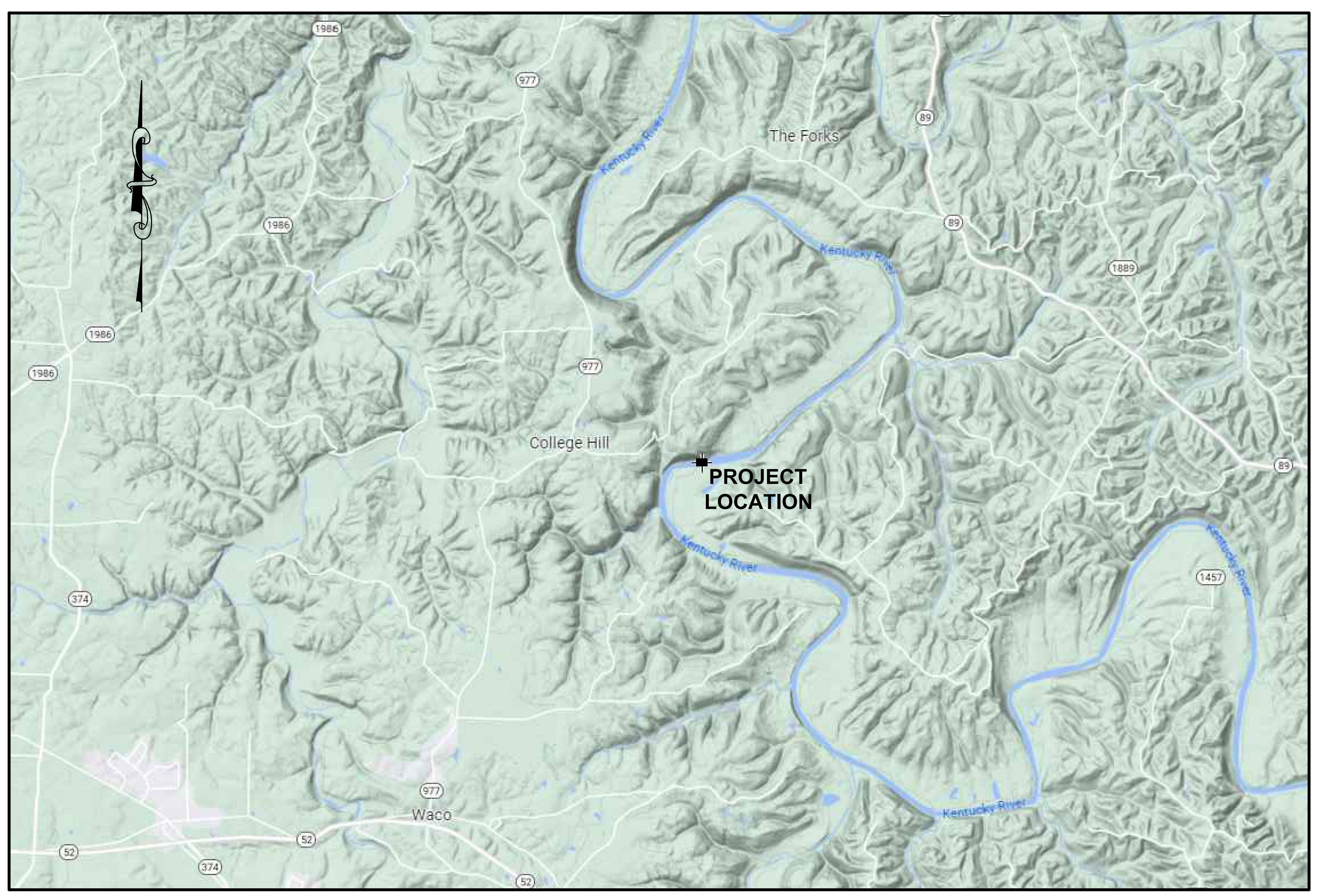
APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

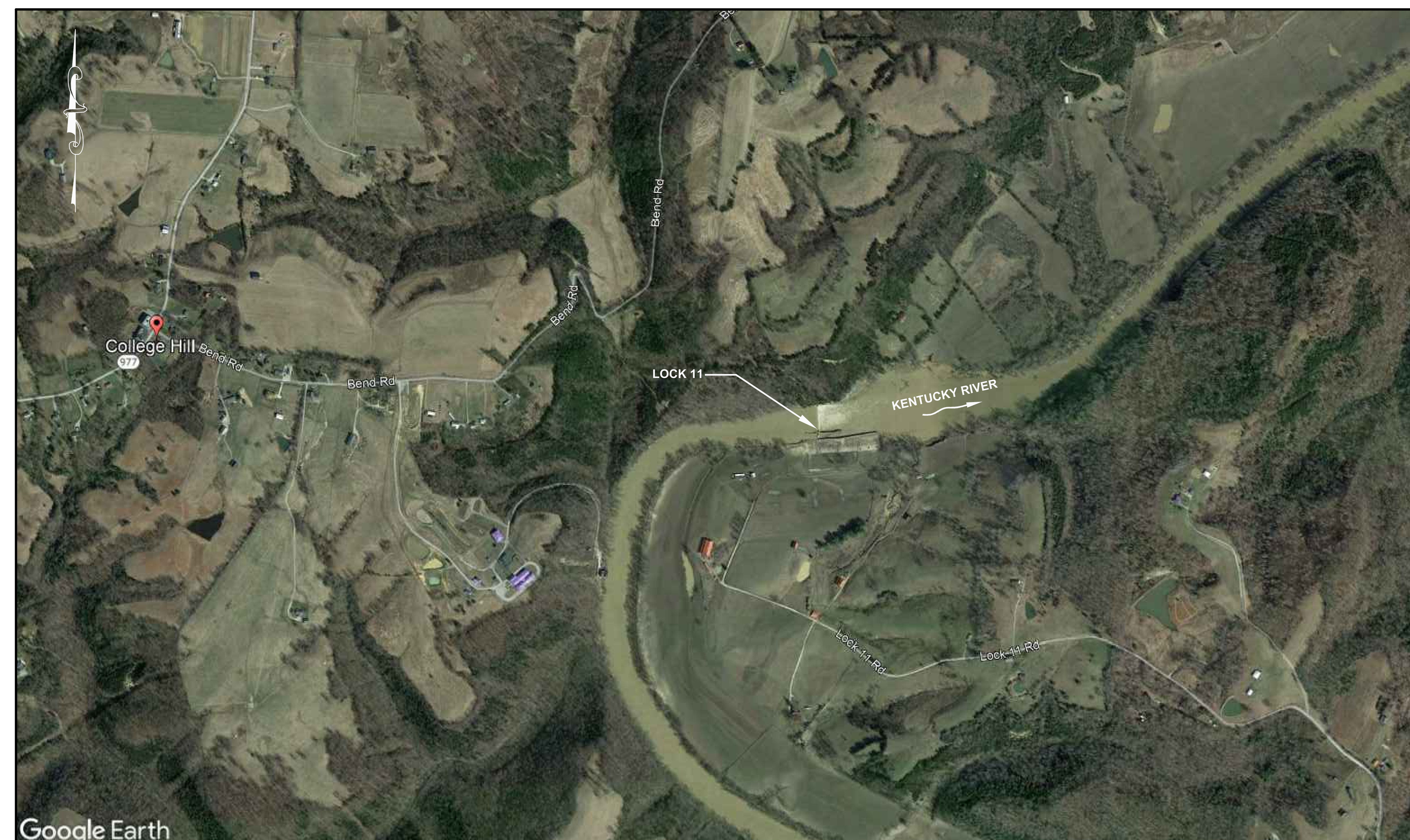
RFC PHASE 1 & FERC PHASE 2A SUBMITTAL
08-01-24



STATE MAP



VICINITY MAP



SITE MAP

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

Kleinschmidt

PRINTED Jul. 31, 2024 - 11:00 AM J:\1349\009\Drawings\CAD\Phase IIA\1349009 100-00.dwg

DRAWING LIST ⚠1

SERIES	DRAWING NUMBER	DRAWING NAME	DATE	DRAWING STATUS	REVISION
100 SERIES - GENERAL DRAWINGS					
	100-00	COVER	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	100-01	DRAWING LIST	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	100-02	GENERAL NOMENCLATURE	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
110 SERIES - GENERAL NOTES					
	110-01	GENERAL NOTES I	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	110-02	GENERAL NOTES II	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	110-03	GENERAL NOTES III	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
200 SERIES - EXISTING CONDITIONS					
	200-01	SITE PLAN	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	200-02	LONGITUDNAL SECTION	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	200-03	LATERAL SECTION	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
210 SERIES - TEMPORARY CONDITIONS					
	210-01	EROSION & SEDIMENT CONTROL PLAN	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-02	EROSION & SEDIMENT CONTROL NOTES & DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-03	EROSION & SEDIMENT CONTROL DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-04	COFFERDAM AND DEMOLITION PLAN	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-05	COFFERDAM AND DEMOLITION SECTION THROUGH LOCK	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-06	DOWNSTREAM COFFERDAM PLAN	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	2
	210-07	DOWNSTREAM COFFERDAM DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	2
	210-08	COFFERDAM FILL GATE - PANEL 4 AND DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-09	DOWNSTREAM COFFERDAM MODIFICATION DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-10	UPSTREAM COFFERDAM DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-11	ROCK ANCHOR SECTIONS AND DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-12	ROCK ANCHOR NOTES	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	210-13	ROCK ANCHOR DETAILS	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
220 SERIES - NEW CONDITIONS					
	220-01	SITE PLAN	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	220-02	POWERHOUSE & LOCK LONGITUDINAL SECTION	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	220-03	LATERAL SECTION	8/1/2024	RFC PHASE 1-FERC REVIEW (PHASE 2A)	1
	220-04	MISCELLANEOUS DETAILS	8/1/2024	FERC REVIEW (PHASE 2A)	0
300 SERIES - POWERHOUSE - GENERAL ARRANGMENTS					
	300-01	PLAN	8/1/2024	FERC REVIEW (PHASE 2A)	0
	300-02	LONGITUDINAL SECTION 1490 UNIT	8/1/2024	FERC REVIEW (PHASE 2A)	0
	300-03	LONGITUDINAL SECTION 865 UNITS	8/1/2024	FERC REVIEW (PHASE 2A)	0
	300-04	SECTION LOOKING D/S @UNITS	8/1/2024	FERC REVIEW (PHASE 2A)	0
	300-05	SECTION LOOKING D/S @UNITS	8/1/2024	FERC REVIEW (PHASE 2A)	0
310 SERIES - POWERHOUSE - REINFORCED CONCRETE					
	310-01	PLAN AT FOUNDATION	8/1/2024	FERC REVIEW (PHASE 2A)	0
	310-02	PLAN AT CENTERLINES	8/1/2024	FERC REVIEW (PHASE 2A)	0
	310-04	SECTION THRU UNIT 1490 CENTERLINE	8/1/2024	FERC REVIEW (PHASE 2A)	0
	310-05	SECTION THRU UNIT 895 CENTERLINE	8/1/2024	FERC REVIEW (PHASE 2A)	0
	310-06	DOWNSTREAM SECTION VIEW	8/1/2024	FERC REVIEW (PHASE 2A)	0
320 SERIES - DRAFT TUBES					
	320-01	STEAM DRIVER 1490 - DRAFT TUBE SECTION AND DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
	320-02	STEAM DRIVER 1490 - DRAFT TUBE DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
	320-03	STEAM DRIVER 895 - DRAFT TUBE SECTION AND DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
	320-04	STEAM DRIVER 895 - DRAFT TUBE DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
	320-05	STEAM DRIVER 895 - DRAFT TUBE DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
	320-06	STEAM DRIVER - DRAFT TUBE DETAILS	6/12/2024	FERC REVIEW (PHASE 2A)	0
410 SERIES - CONTROL BUILDING - REINFORCED CONCRETE					
	410-01	FOOTING PLAN	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-02	WALL REINFORCEMENT PLAN	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-03	CONCRETE FLOOR PLAN @ EL 611.3'	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-04	CONCRETE FLOOR PLAN @ EL 622.3'	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-05	STRUCTURAL SECTIONS	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-06	STRUCTURAL SECTIONS	8/1/2024	RELEASED FOR CONSTRUCTION	1
	410-07	STRUCTURAL ELEVATIONS	8/1/2024	RELEASED FOR CONSTRUCTION	1
411 SERIES - CONTROL BUILDING - STRUCTURAL STEEL					
	411-01	STEEL FRAMING PLAN @ 621.68'	8/1/2024	RELEASED FOR CONSTRUCTION	1
	411-02	DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1
	411-03	DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1
412 SERIES - CONTROL BUILDING - MISCELLANEOUS					
	412-01	STAIR PLAN AND SECTION	8/1/2024	RELEASED FOR CONSTRUCTION	1
	412-02	STAIR SECTIONS AND DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1
	412-03	STAIR SECTIONS AND DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1
	412-04	TRANSFORMER SHIELD WALL	8/1/2024	RELEASED FOR CONSTRUCTION	1
	412-05	STEEL DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1
420 SERIES - CONTROL BUILDING - CONDUIT					
	420-01	CONDUIT PLAN AND PROFILE	8/1/2024	RELEASED FOR CONSTRUCTION	1
	420-02	CONDUIT DETAILS AND SECTIONS	8/1/2024	RELEASED FOR CONSTRUCTION	1
430 SERIES - CONTROL BUILDING - SUPER STRUCTURE					
	430-01	PLAN & ELEVATION	8/1/2024	RELEASED FOR CONSTRUCTION	1
	430-02	DETAILS	8/1/2024	RELEASED FOR CONSTRUCTION	1

PHASE SUBMITTALS

PHASE	FERC SUBMITTAL DATE	RELEASED FOR CONSTRUCTION
PHASE 1- SITE PREP, TEMPORARY CONDITIONS & CONTROL BUILDING	4/19/2024	8/1/2024
PHASE 2A - POWERHOUSE CONCRETE AND DRAFT TUBES	8/1/2024	T.B.D.
PHASE 2B - POWERHOUSE TRASHRACKS AND WATER CONTROL	T.B.D.	T.B.D.

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

DRAWING LIST

No.	Revision	Date	Drawn	Checked
⚠1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
-	BJL	JLD	1349-009	08-01-24	100-01

22x34 = FULL SCALE

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SECTION, DETAIL AND VIEW IDENTIFICATION SYMBOLS

SECTION ID
A

SECTION
1/4"= 1'-0"
A
SECTION ID
SCALE OF SECTION

THIS SECTION IS CUT AND SHOWN ON THE SAME SHEET.

SECTION ID
A
4
SHEET WHERE SECTION IS SHOWN ON

SECTION
1/4"= 1'-0"
A
1
SECTION ID
SHEET WHERE SECTION IS CUT ON

THIS SECTION IS CUT ON SHEET 1 AND SHOWN ON SHEET 4 WITHIN THE SAME DRAWING SERIES, SEE DRAWING AND SHEET NUMBER IDENTIFICATION THIS SHEET.

1
DETAIL ID
INDICATES AREA TO BE SHOWN IN GREATER DETAIL AS A SEPARATE DETAIL

DETAIL
1/4"= 1'-0"
1
DETAIL ID
SCALE OF DETAIL

THIS DETAIL IS TAKEN AND SHOWN ON THE SAME SHEET.

DETAIL ID
1
4
SHEET WHERE DETAIL IS SHOWN ON

DETAIL
1/4"= 1'-0"
1
1
DETAIL ID
SHEET WHERE DETAIL IS TAKEN FROM

THIS DETAIL IS TAKEN ON SHEET 1 AND SHOWN ON SHEET 4 WITHIN THE SAME DRAWING SERIES, SEE DRAWING AND SHEET NUMBER IDENTIFICATION THIS SHEET.

A-A
VIEW ID

VIEW
1/4"= 1'-0"
A-A
VIEW ID
SCALE OF VIEW

THIS VIEW IS TAKEN AND SHOWN ON THE SAME SHEET.

A-A
4
VIEW ID
SHEET WHERE VIEW IS SHOWN ON

VIEW
1/4"= 1'-0"
A-A
1
VIEW ID
SHEET WHERE VIEW IS TAKEN FROM

THIS VIEW IS TAKEN ON SHEET 1 AND SHOWN ON SHEET 4 WITHIN THE SAME DRAWING SERIES, SEE DRAWING AND SHEET NUMBER IDENTIFICATION THIS SHEET.

SECTION, DETAIL AND VIEW IDENTIFICATION SYMBOLS NOTES:

1. SECTIONS ARE ALPHABETICAL.
2. DETAILS ARE NUMERICAL.
3. VIEWS ARE DOUBLE ALPHABETICAL.
4. SHEET REFERENCE NUMBER FOR SECTIONS AND DETAILS OCCUR WITHIN THE SAME DRAWING SERIES.

SYMBOLS

- EXISTING CONCRETE
- NEW CONCRETE
- GROUT
- CONCRETE MASONRY UNIT
- GRATING
- GRAVEL
- RIP RAP
- EARTH/SOIL
- ROCK
- CENTERLINE ℄
- DIAMETER ø
- CRITICAL ELEVATION OR WORK POINT (W.P.)
- WATER LEVEL
- COLUMN LINE IDENTIFIER (A)
- REVISION NUMBER
- REVISION CLOUD

ABBREVIATIONS

APPROX.	APPROXIMATE
B.M.	BENCHMARK
BOTT.	BOTTOM
CLR.	CLEAR
CONC.	CONCRETE
C.J.	CONSTRUCTION JOINT
CTLJ.	CONTROL JOINT
D&T	DRILL AND TAP
EL.	ELEVATION
EMBED.	EMBEDMENT
E.W.S.	HYDROPHYLIC ELASTIC SEALING WATERTOP
EXIST.	EXISTING
GALV.	GALVANIZE
HORZ./H	HORIZONTAL
I.D.	INSIDE DIAMETER
MAX.	MAXIMUM
MFR.	MANUFACTURER
MIN.	MINIMUM
No.	NUMBER
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
P.C.	POINT OF CURVE
P.S.I.	POUNDS PER SQUARE INCH
RVC	POLYVINYL CHLORIDE
	RADIUS
REINF.	REINFORCEMENT
REQD.	REQUIRED
SCHED.	SCHEDULE
SQ.FT.	SQUARE FOOT/FEET
S.S.	STAINLESS STEEL
T&B	TOP & BOTTOM
T.O.C.	TOP OF CONCRETE
T.O.S.	TOP OF STEEL
T.O.W.	TOP OF WALL
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
VERT./V	VERTICAL
W/	WITH
W.S.	WATER STOP (PVC)

REVISION IDENTIFICATION

INDICATES THE REVISION NUMBER IN REFERENCE TO THE TITLE BLOCK REVISION DESCRIPTION

REVISION CLOUD INDICATES CHANGES TO AN AREA WITHIN THE CLOUD

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

22x34 = FULL SCALE

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No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

DRAWING NOMENCLATURE

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
-	BJL	JLD	1349-009	08-01-24	100-02

22x34 = FULL SCALE

PHASE 1 WORK SCOPE - SITE PREPARATION (RFC)

1. INSTALL SOIL AND EROSION CONTROL.
2. INSTALL TEMPORARY ACCESS ROAD.
3. INSTALL ALL ROCK ANCHORS.
4. INSTALL COFFERDAM.
5. DEWATER LOCK.
6. GROUT NORTH AND SOUTH LOCK WALLS AS NEEDED TO PREVENT WATER SEEPAGE.

PHASE 1B WORK SCOPE - CONTROL BUILDING (RFC)

1. CONTROL BUILDING EXCAVATION.
2. CONTROL BUILDING CONCRETE STRUCTURE.
3. BACKFILL AND GRADE AROUND CONTROL BUILDING.
4. FABRICATE AND INSTALL STRUCTURAL STEEL.
5. INSTALL PRE-FABRICATED METAL BUILDING.

PHASE 2A WORK SCOPE - POWERHOUSE CONCRETE AND DRAFT TUBES (FERC REVIEW)

1. INSTALL ROCK DOWELS ALONG THE POWERHOUSE BASE.
2. INSTALL FORMS AND REBAR FOR MASS CONCRETE PLACEMENTS.
3. PLACE MASS CONCRETE IN LIFTS UP TO EL. 565.0' TO ACCOMMODATE INSTALLATION OF EMBEDDED STEEL DRAFT TUBES, STOPLOG SLOTS AND CONDUITS.

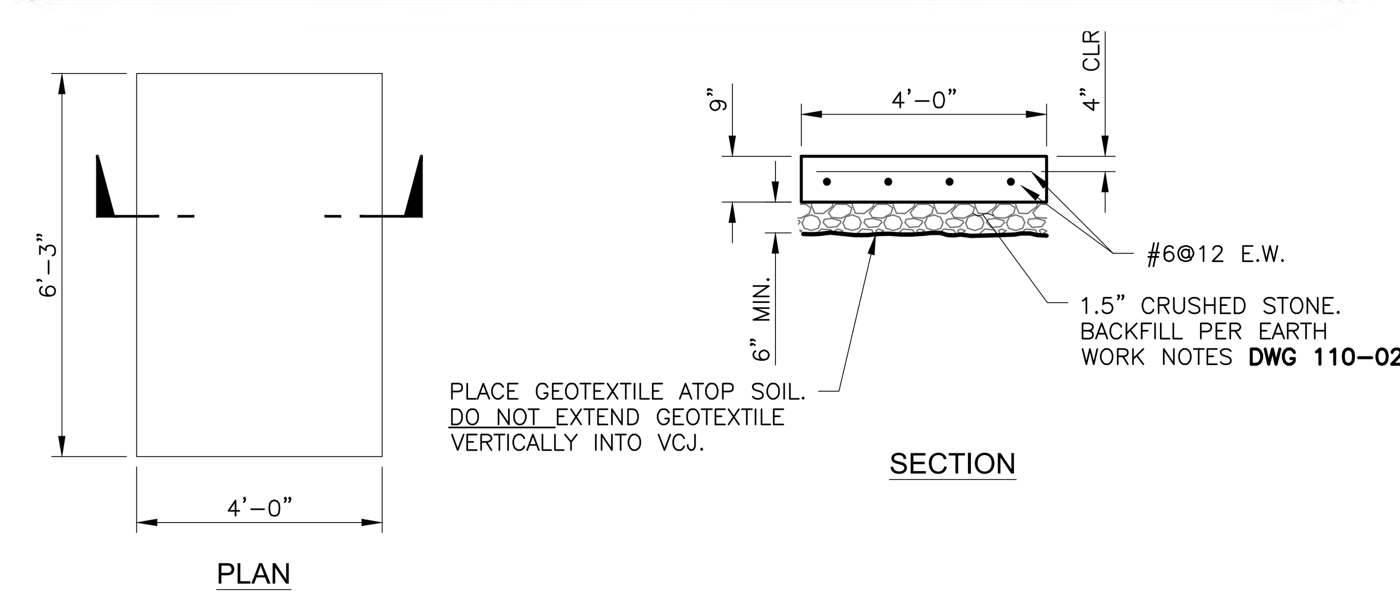
GENERAL NOTES

1. CONTRACTOR SHALL PERFORM ALL WORK IN ACCORDANCE WITH THESE DRAWINGS.
   A. FABRICATE AND CONSTRUCT USING ONLY DRAWINGS IDENTIFIED AS "RELEASED FOR CONSTRUCTION".
   B. "RELEASED FOR CONSTRUCTION" DRAWINGS ARE PROVIDED ELECTRONICALLY IN BOTH PDF AND AUTOCAD FORMATS. THE PDF FILE CONTAINS THE ENGINEER'S P.E. STAMP AND IS CONSIDERED TO BE THE FORMAL "SEALED HARD-COPY" DRAWING.
   C. THE AUTOCAD FILE IS PROVIDED FOR CONTRACTOR'S CONVENIENCE AND USE IN THE PREPARATION OF SHOP DRAWINGS.
      i. KLEINSCHMIDT MAKES NO REPRESENTATION REGARDING THE ACCURACY OF THE ELECTRONICALLY SCALED DIMENSIONS OF THE AUTOCAD DRAWING; USE OF ELECTRONICALLY SCALED DIMENSIONS IS AT CONTRACTOR'S RISK.
      ii. WRITTEN DIMENSIONS SHOWN ON THE FORMAL DRAWINGS TAKE PRECEDENCE OVER ELECTRONICALLY SCALED DIMENSIONS.
      iii. IN USING THE AUTOCAD DRAWING, CONTRACTOR IS NOT RELIEVED OF THE DUTY TO FULLY COMPLY WITH THE CONTRACT DOCUMENTS, INCLUDING, AND WITHOUT LIMITATION: THE NEED TO CHECK, CONFIRM AND COORDINATE ALL DIMENSIONS AND DETAILS; TAKING OF FIELD MEASUREMENTS, VERIFYING FIELD CONDITIONS AND COORDINATION OF THE WORK WITH OTHER ELEMENTS OF THE PROJECT OR WORK BEING PERFORMED BY OTHERS.
   D. WHERE DIMENSIONS ARE NOT SHOWN, CONTACT ENGINEER FOR CLARIFICATION.
   E. DO NOT SCALE DIMENSIONS.
2. ALL DRAWING NOTES ON THE FIRST DRAWING OF A SERIES ARE APPLICABLE TO ALL DRAWINGS WITHIN THAT SERIES.
3. VERTICAL DATUM FROM EXISTING STATION DRAWINGS WAS USED FOR PREPARATION OF THESE DRAWINGS. VERTICAL DATUM FOR THIS DRAWING SET SHALL BE NAVD88.
4. DATUM CONVERSIONS
   - ORIGINAL CONSTRUCTION DRAWINGS ARE IN USACE DATUM.
   - NGVD29 = UASCE MINUS 2.58 FT
   - NAVD88 = USACE MINUS 3.13 FT
   - NAVD88 = NGVD29 MINUS .55 FT
5. CONTRACTOR SHALL SCHEDULE WORK IN COOPERATION WITH THE OWNER.
6. DETERMINE LOCATIONS, EXISTING CONDITIONS AND DIMENSIONS BY VISITING THE SITE. VERIFY ALL DIMENSIONS IN THE FIELD BEFORE ORDERING OR FABRICATING MATERIAL.
7. CONTRACTOR SHALL CLEAN ANY SPILLS OR DEBRIS CAUSED BY CONSTRUCTION.
8. SUBMITTALS:
   A. SHOP DRAWINGS – THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR FABRICATION AND ERECTION OF ALL STRUCTURAL STEEL, MISCELLANEOUS METAL FABRICATIONS INCLUDING METAL BUILDING, AND CONCRETE REINFORCEMENT. SUBMIT ONE ELECTRONIC COPY OF SHOP DRAWINGS TO OWNER FOR REVIEW AND APPROVAL. SHOP DRAWINGS SHALL INCLUDE:
      I. PLANS, ELEVATIONS, SECTIONS AND DETAILS OF ALL MEMBERS AND CONNECTIONS.
      II. INDICATION OF SIZES, SPACING, LOCATIONS OF STRUCTURAL MEMBERS, OPENINGS, ATTACHMENTS, AND FASTENERS.
      III. INDICATION OF WELDED CONNECTIONS WITH AWS A2.0 WELDING SYMBOLS. INDICATE NET WELD LENGTHS.
      IV. DETAILS OF ANCHORAGE AND ACCESSORY ITEMS.
      V. TEMPLATES FOR ANCHOR AND BOLT INSTALLATION.
      VI. BAR SCHEDULES, SPACING, ARRANGEMENT, PLACEMENT, AND BENDING OF CONCRETE REINFORCEMENT.
   B. PRODUCT DATA – THE CONTRACTOR SHALL SUBMIT DATA FOR PROPRIETARY MATERIALS AND ITEMS INCLUDING: MECHANICAL EQUIPMENT, ELECTRICAL EQUIPMENT, ELECTRICAL FIXTURES, INSTALLATION INSTRUCTIONS FOR PRODUCTS USED IN STRUCTURAL STEEL AND MISCELLANEOUS METAL FABRICATIONS, ANCHOR DETAILS, COATING PRODUCTS, GROUT, CONCRETE FORMING ACCESSORIES, ADMIXTURES, PATCHING COMPOUNDS, JOINT SYSTEMS, CURING COMPOUNDS, AND OTHERS IF REQUESTED BY ENGINEER/OWNER. INCLUDE MANUFACTURER'S SPECIFICATIONS AND CERTIFICATION AS MAY BE REQUIRED TO SHOW COMPLIANCE WITH DESIGN DRAWINGS.
   C. RECORD DRAWINGS – THE CONTRACTOR SHALL MAINTAIN A SET OF DESIGN DRAWINGS ON SITE THAT IS MARKED-UP THROUGHOUT THE CONSTRUCTION PROCESS TO IDENTIFY ANY AREAS WHERE ACTUAL CONSTRUCTION DEVIATED FROM WHAT IS SHOWN ON THE DESIGN DRAWINGS. THIS "RED-LINED" DRAWING SET WILL SERVE AS THE RECORD OF CONSTRUCTION AND WILL BE PROVIDED TO THE OWNER AND ENGINEER AT THE COMPLETION OF THE PROJECT TO BE USED IN PREPARATION OF THE RECORD DRAWINGS.
9. INFORMATION SHOWN ON THESE DESIGN DRAWINGS ARE BASED ON THE ORIGINAL CONSTRUCTION DRAWINGS AND LIMITED FIELD MEASUREMENTS. WHERE DIMENSIONS ARE NOT SHOWN, CONTACT ENGINEER FOR CLARIFICATION. FIELD VERIFY ALL DIMENSIONS PRIOR TO START OF WORK.
10. CONTRACTOR SHALL REPAIR ANY PORTIONS OF THE SITE THAT ARE DAMAGED DURING CONSTRUCTION, AND PERFORM LANDSCAPING AND SITE REMEDIATION AS NECESSARY TO LEAVE THE WORK AREA AS CLOSE TO THE ORIGINAL CONDITION AS POSSIBLE.
11. DEMOLITION:
   A. REMOVE EXISTING CONCRETE AND PAVERS TO EXTENT SHOWN ON THE DRAWINGS. DO NOT DAMAGE REMAINING CONCRETE.
   B. MAINTAIN EXISTING REINFORCEMENT.
   C. REMOVE ALL UNSOUND CONCRETE AND LOOSE ROCK AS REQUIRED. THE OWNER SHALL EXAMINE THESE AREAS BEFORE NEW CONCRETE IS PLACED.
   D. SHORE AND SUPPORT EXISTING CONSTRUCTION, WHICH IS NOT REMOVED, AS REQUIRED.
   E. ANY SILT, DEBRIS OR OTHER EXCAVATED MATERIAL THAT IS REMOVED FROM THE CONSTRUCTION AREA SHALL BE DISPOSED OF BY THE CONTRACTOR OFF-SITE IN CONFORMANCE WITH THE APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
12. FLOOD ELEVATION TABLE:

FLOOD ELEVATIONS (NAVD88)

FLOOD CONDITION	HEADPOND ELEV.	TAILWATER ELEV.	FLOW (CFS)	NOTES	WATER DEPTH OVER LOCK WALLS ELEV. 592.5
Normal Headpond (upper pool), crest of spillway	582.5	564.5	0	1	-10.0
Max. Turbine Capacity	582.5	564.5	2,636	1	-10.0
Spillway Capacity	592.5	573.1	20,000	1, 2, 3	0.0
Mean Annual Peak Flow	597.7	581.1	45,233	3, 4	5.2
Annual (1-Year)	589.7	571.6	15,132	3, 4	-2.8
2-Year	597.7	580.1	44,743	3, 4	5.2
10-Year	609.0	607.5	77,000	5, 6	14.8
Flood of Record (1978)	611.9	610.5	82,204	4, 6, 7	19.4
50-Year	613.0	612.5	98,200	5, 6	19.9
100-Year	615.5	614.6	106,800	5, 6	22.3
500-Year	619.0	618.5	126,200	5, 6	25.4

1) Elevations from KRA Reference Drawings
2) Flow values obtained from rating curve of USGS Gage No. 03282290 - Kentucky River at Lock 11 near College Hill, KY
3) Elevations from the USGS Rating Curve for Kentucky River Lock and Dam 10, and Kentucky River Lock and Dam 11.
4) Flow Values from a Bulletin 17C/HEC-SSP Analysis of Lock 10 USGS Gage, prorated to Lock 11 via drainage area.
5) Flow values from Discharge tables in Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) – Estill County, Kentucky, effective May 2011.
6) Elevations from Cross Sections L (headpond) and K (tailwater) in Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) – Estill County, Kentucky, effective May 2011
7) Elevation from Kentucky River Navigation Charts (2014) – reported to be based on profile data



CONCRETE PANEL REPLACEMENT DETAIL

3/8"= 1'-0"

NOTES:

1. WHEN DEMOLISHING EXISTING PANELS, NOTE KEYS, DOWELS, EXPANSION JOINTS, OR OTHER MEANS OF TIE-IN AND INCORPORATE SAME INTO REPLACEMENT PANEL.
2. CAST EACH CONCRETE SLAB MONOLITHICALLY.
3. CONCRETE PANELS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ACI 302.IR-04 "GUIDE FOR CONCRETE".
4. PROVIDE 6 MIL POLYETHYLENE VAPOR BARRIER BETWEEN SUBGRADE & CONCRETE PANEL.
5. PREPARE SITE BY REMOVING ORGANIC/EXPANSIVE SOILS AND COMPACTING TO 95% PROCTOR DRY DENSITY.
6. PANEL FINISH: ROUGH NON-SKID SURFACE (BROOM FINISH). BRUSH LINES IN THE FINISH SHALL BE PARALLEL TO DIRECTION OF SLOPE.
7. PANELS SHALL BE CLASS II, 4,500PSI CONCRETE.

CONTROL BUILDING NOTES

1. BUILDING GOVERNING CODE:
   INTERNATIONAL BUILDING CODE 2018 KY BUILDING CODE
   BUILDING CATEGORY II
2. WIND DESIGN PARAMETERS IN ACCORDANCE WITH ASCE 7-10
   A. BASIC WIND SPEED = 115 MPH
   B. INTERNAL PRESSURE COFFICIENT FOR ENCLOSED STRUCTURE qi=+/- 0.18
   C. WIND EXPOSURE = EXPOSURE C
   D. VELOCITY WIND PRESSURE: 28.2 PSF
   E. WIND LOAD IMPORTANCE FACTOR = 1.0
   F. MEAN ROOF HT.: +/-27'-0"
   G. ROOF UPLIFT: -24 PSF
3. SEISMIC DESIGN PARAMETERS FOR HEIDELBERG, KY:
   A. DESIGN SPECTRAL ACCELERATION PARAMETERS
   B. Sds=0.21 Sd1=0.14
   C. SEISMIC RISK GATEGORY II
   D. SITE CLASS D
   E. RESPONSE MODIFICATION FACTOR (R) = 3.25
   F. ANALYSIS PROCEDURE – EQUIVALENT LATERAL FORCE
4. LOADING:
   A. ROOF DEAD LOAD 16.0 PSF
   B. ROOF LIVE LOAD 20 PSF
   C. FLOOR DEAD LOAD 44 PSF
   D. FLOOR LIVE LOAD 200 PSF
   E. FLOOR POINT LOAD 2000 LBS
   F. GROUND SNOW LOAD 15 PSF
   G. COLLATERAL LOAD 10 PSF
5. REINFORCED CONCRETE
   A. SPECIFICATIONS: IN GENERAL, COMPLY WITH ACI 318-14 "SPECIFICATIONS FOR STRUCTURAL CONCRETE"
   B. MISC. CONCRETE FILL: 3,000 PSI – CLASS I
   C. FOOTINGS AND STRUCTURAL CONCRETE: 4,500 PSI – CLASS II
   D. SLABS: 4,500 PSI – CLASS II
   E. BACKFILL BELOW FOOTINGS: 4,500 PSI – CLASS II
   F. SUBSTRUCTURE: 4,500 PSI – CLASS II
6. SLABS:
   A. CONCRETE SLABS ON GRADE SHALL BE CONSTRUCTED IN ACCORDANCE WITH ACI 302.IR-04 "GUIDE FOR CONCRETE"
   B. CONTROL JOINTS SHALL BE SPACED IN INTERIOR SLABS ON GRADE AT A MAXIMUM OF 20 FEET ON CENTER, AND IN EXTERIOR SLABS, ON GRADE AT A MAXIMUM OF 10 FEET ON CENTER UNLESS NOTED.
   C. CONTROL JOINTS SHALL BE PRODUCED USING CONVENTIONAL PROCESSES WITHIN 4 TO 12 HOURS AFTER THE SLAB HAS BEEN FINISHED. REINFORCING SHALL NOT EXTEND THROUGH THE CONTROL JOINT.
   D. CONSTRUCTION JOINTS PERMITTED ONLY WHERE SHOWN OR AS APPROVED BY ENGINEER OF RECORD. ALL CONSTRUCTION JOINTS ARE TO BE KEYED. KEYWAYS SHALL BE 1-1/2 INCHES DEEP X 1/3 MEMBER THICKNESS.
   E. PROVIDE 6 MIL POLYETHYLENE VAPOR BARRIER BETWEEN SUBGRADE & CONCRETE SLAB
   F. PREPARE SITE BY REMOVING ORGANIC/EXPANSIVE SOILS AND COMPACTING TO 95% PROCTOR DRY DENSITY
   G. SLAB FINISHES: INTERIOR SLAB SHALL HAVE A SMOOTH FINISH WITH 1/8" PER 10'-0" TOLERANCE. ALL EXTERIOR, WET SURFACE, DRIVEWAYS, SIDEWALKS AND SIMILAR SLABS SHALL BE FINISHED WITH ROUGH NON-SKID SURFACE (BROOM FINISH). BRUSH LINES IN THE FINISH SHALL BE PARALLEL TO DIRECTION OF SLOPE
   H. THE CONCRETE SLAB-ON-GRADE HAS BEEN DESIGNED USING A SUBGRADE MODULUS OF K=290 PCI. THE ENGINEER IS NOT RESPONSIBLE FOR DIFFERENTIAL SETTLEMENT, SLAB CRACKING OR OTHER FUTURE DEFECTS RESULTING FROM UNREPORTED CONDITIONS MITIGATING THE ABOVE ASSUMPTIONS.
7. GROUNDING REQUIREMENTS TO BE DETERMINED & CONSTRUCTED AS DIRECTED BY OWNER.
8. BUILDING LIGHTING & ELECTRICAL TO BE DETERMINED AND INSTALLED AS DIRECTED BY OWNER.

STATE OF KENTUCKY
JILLIAN L. DAVIS
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LICENSED PROFESSIONAL ENGINEER
8/1/24

PHASE 1 - RELEASED FOR CONSTRUCTION
PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

GENERAL NOTES I

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	110-01

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METAL NOTES

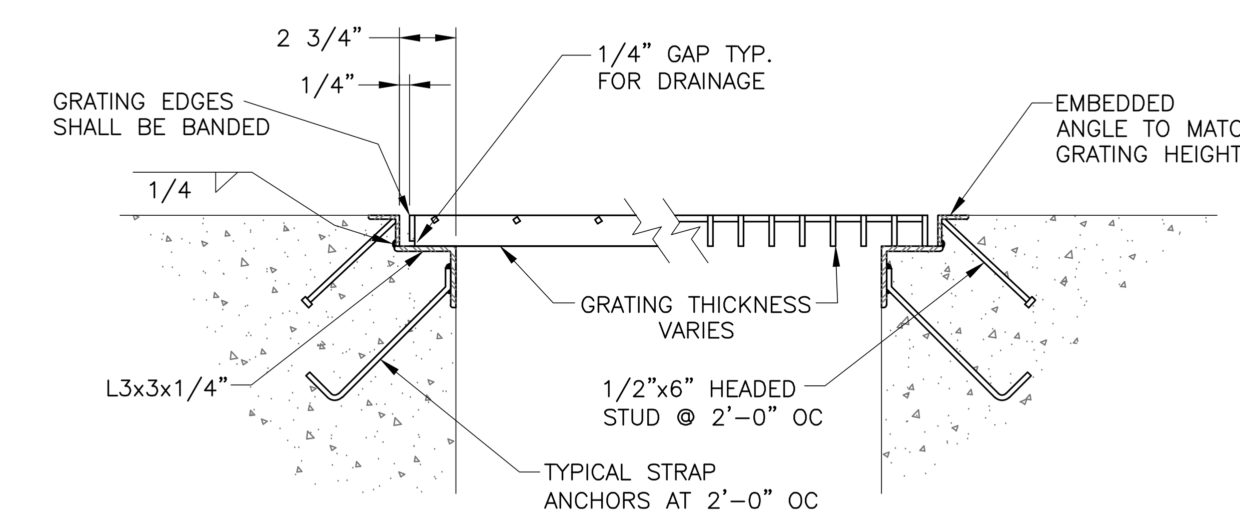
1. STRUCTURAL STEEL DESIGN STANDARD – AISC SPECIFICATION FOR DESIGN AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, 15th EDITION, LRFD DESIGN METHOD.
   - A. FABRICATE ALL STRUCTURAL STEEL AND WELDED STEEL IN ACCORDANCE WITH THE LATEST MANUAL OF STEEL CONSTRUCTION AND OTHER APPLICABLE CODES OF STANDARD PRACTICE.
   - B. CONNECTIONS SHALL BE SHOP WELDED AND FIELD BOLTED UNLESS NOTED OTHERWISE.
   - C. BOLTED CONNECTIONS SHALL HAVE A MINIMUM OF 2 BOLTS, MINIMUM BOLT SIZE 3/4" DIA. UNLESS NOTED OTHERWISE. PROVIDE NUTS & WASHERS UNLESS NOTED OTHERWISE. BOLTS, NUTS & WASHERS SHALL BE GALVANIZED UNLESS OTHERWISE NOTED.
   - D. ALL STRUCTURAL AND MISCELLANEOUS STEEL MEMBERS EXPOSED TO WEATHER SHALL BE HOT DIPPED GALVANIZED.
   - E. ALL FASTENERS AND HARDWARE SHALL BE GALVANIZED PER ASTM–A153, UNLESS NOTED OTHERWISE.
2. MATERIAL PROPERTIES:
   - A. STEEL BARS, PLATES, ANGLES AND CHANNELS AND OTHER SHAPES, UNLESS NOTED OTHERWISE – ASTM A36.
   - B. STRUCTURAL STEEL W SHAPES – ASTM A992, GRADE 50 STEEL.
   - C. ALUMINUM – 6061–T6
   - D. BOLTS – 3/4" ASTM A325 OR 304 S.S.
   - E. PIPING – ASTM A53, GRADE B. (UP TO 26"ø)
     ASTM A139 GRADE C. MINIMUM Fy=36, Fu=58 (GREATER THAN 26"ø)
   - F. STRUCTURAL TUBING:
     - I. HSS RECTANGULAR: ASTM A500 GR 46
     - II. HSS ROUND: ASTM A500 GR 42
   - G. WELD:
     - I. STEEL PER AWS D1.1 MATCHING ELECTRODES TO STRENGTH OF BASE METALS.
     - II. ALUMINUM PER AWS D1.2 USING 5356 FILLER ALLOY.
     - III. ALL WELDS CONTINUOUS U.N.O.
   - H. ADHESIVE ANCHOR BOLTS – HILTI, INC. HAS–E–55 ROD (OR EQUIV) WITH HIT–HY 200 EPOXY ADHESIVE OR APPROVED EQUAL, UNLESS NOTED OTHERWISE. INSTALLED PER MANUFACTURERS INSTRUCTIONS, MINIMUM EMBEDMENT, AS SHOWN IN DETAILS.
   - I. GRATING 19–W–4 HEAVY DUTY GALVANIZED STEEL GRATING AS NOTED ON DRAWINGS, BAND ALL ENDS.
   - J. GROUT – NON–SHRINK TYPE, PRE–MIXED COMPOUND CONSISTING OF NON–METALLIC AGGREGATE, CEMENT, WATER REDUCING AND PLASTICIZING ADDITIVES, CAPABLE OF DEVELOPING A MINIMUM COMPRESSIVE STRENGTH OF 6,000 PSI AT 28 DAYS. FOR AREAS UNDERWATER USE SUBEC HYDRAULIC CEMENT OR APPROVED EQUAL.
   - K. HEADED ANCHORS SHALL BE NELSON SHEAR STUDS, FLUX FILLED WELDING TO PLATES/FLANGES AS SHOWN ON DRAWINGS. STUDS SHALL BE MADE FROM COLD DRAWN STEEL GRADES TO I C –1010 THROUGH C –1020 PER ASTM A–108 AND SHALL BE WELDED PER MANUFACTURES RECOMMENDATION. THRU WELD ON COMPOSITE DECKING.
3. COATINGS:
   - A. ALL STRUCTURAL STEEL AND MISCELLANEOUS METAL ASSOCIATED WITH THE POWERHOUSE AND CONTROL BUILDING SHALL USE THE FOLLOWING COATING SYSTEM UNLESS NOTED OTHERWISE:
     - I. SURFACE PREPARATION: SSPC– SP 10 NEAR WHITE BLAST CLEANING 1.0 MILL PROFILE.
     - II. POWERHOUSE: POLYSET WB HRZS SINGLE COAT SYSTEM BY POLYSET, 6–8 MILS DFT.
     - III. EXTERIOR CONTROL BUILDING: POLYSET WB HRZS SINGLE COAT SYSTEM, 5–7 MILS DFT.
   - IV. INTERIOR CONTROL BUILDING: SHALL BE COATED WITH PRIMER PER OWNER'S INSTRUCTIONS.
     - V. IF EMBEDDED IN CONCRETE: PLYSET WB HRZS SINGLE COAT SYSTEM, 3–4 MILS DFT.
       - a. FOR STEEL AND MISCELLANEOUS METAL EMBEDDED IN CONCRETE: TO ACCELERATE THE FORMATION OF THE PAINT'S CERAMIC TYPE BARRIER ON THE STEEL, SPRAY PAINTED STEEL SURFACE IN CONTACT WITH CONCRETE WITH VINEGAR TO A WET SURFACE AND ALLOW TO DRY.
     - VI. COATING SHALL BE APPLIED PER MANUFACTURERS INSTRUCTIONS.
   - B. ALL STOPLOGS, GUIDES, TRASHRACKS, AND RACK SUPPORT STEEL SHALL BE WB HRZS SINGLE COAT SYSTEM BY POLYSET, 6–8 MILS DFT APPLIED PER MANUFACTURERS INSTRUCTIONS.
   - C. MASK OFF AND DO NOT PAINT WITHIN 3 INCHES OF A FIELD WELDED JOINT.
   - D. PREP AND FIELD PAINT FIELD WELDS PER MANUFACTURERS RECOMMENDATIONS.
   - E. GENERAL CONTRACTOR SHALL PROVIDE POLYSET WB HRZS SINGLE COAT SYSTEM FOR TOUCH UP PAINT.
4. METAL BUILDING DESIGN BY OTHERS. BUILDING COMPONENTS, CONNECTIONS, BASE PLATES, ANCHOR BOLTS SIZE AND EMBEDMENT DEPTH PROVIDED BY OTHERS. CONTRACTOR TO SUBMIT A COPY OF METAL BUILDING PACKAGE TO ENGINEER OF RECORD. METAL BUILDING COLUMN REACTION NOT TO EXCEED 36 KIPS & 7 KIPS OF SHEAR ON AN INTERIOR COLUMN AND NOT TO EXCEED 18 KIPS AND 3.5 KIPS OF SHEAR ON AN EXTERIOR COLUMN.
5. ERECTION:
   - I. ERECTION OF STRUCTURAL STEEL MUST BE IN ACCORDANCE WITH THE AISC CODE OF STANDARD PRACTICE, CHAPTER 7.
   - J. COLUMN BASES SHALL BE SET LEVEL TO CORRECT ELEVATION WITH FULL BEARING ON CONCRETE AS DEFINED IN CHAPTER 7 OF THE CODE OF STANDARD PRACTICE.
   - K. FIT OF COLUMN COMPRESSION JOINTS AND BASE PLATES – LACK OF CONTACT BEARING NOT EXCEEDING A GAP OF 1/16", REGARDLESS OF THE TYPE OF SPLICE USED, IS PERMITTED. IF THE GAP EXCEEDS 1/16", BUT IS EQUAL TO OR LESS THAN 1/4", AND IF AN ENGINEERING INVESTIGATION SHOWS THAT SUFFICIENT CONTACT AREA DOES NOT EXIST, THE GAP SHALL BE PACKED WITH NONTAPERED STEEL SHIMS.
   - L. THE FRAME OF STRUCTURE SHALL BE CARRIED TRUE AND PLUMB WITHIN THE LIMITS DEFINED IN SECTION 7 OF THE CODE OF STANDARD PRACTICE. AS ERECTION PROGRESSES, THE STRUCTURE SHALL BE SECURED TO SUPPORT DEAD, ERECTION, AND OTHER LOADS ANTICIPATED TO OCCUR DURING THE PERIOD OF ERECTION. TEMPORARY BRACING SHALL BE PROVIDED AS NEEDED.
   - M. NO PERMANENT BOLTING OR WELDING SHALL BE PERFORMED UNTIL THE ADJACENT AFFECTED PORTIONS OF THE STRUCTURE HAVE BEEN PROPERLY ALIGNED.
   - N. TOLERANCES:
     - I. FOR AN INDIVIDUAL COLUMN, THE ANGULAR VARIATION OF THE WORKING LINE FROM PLUMB LINE SHALL BE EQUAL TO OR LESS THAN L/500, WHERE L IS THE DISTANCE BETWEEN WORKING POINTS.
     - II. FOR A MEMBER THAT CONSISTS OF AN INDIVIDUAL, STRAIGHT SHIPPING PIECE THAT CONNECTS TO A COLUMN, THE VARIATION IN DISTANCE FROM THE MEMBER WORKING POINT TO THE UPPER FINISHED SPLICE LINE OF THE COLUMN SHALL BE EQUAL TO OR LESS THAN +3/16" AND –5/16".

EARTHWORK NOTES

1. DEFINITIONS:
   - A. UNSUITABLE MATERIAL: EARTH MATERIAL UNSATISFACTORY FOR ITS INTENDED USE AND AS CLASSIFIED BY THE SOILS TECHNICIANS. IN ADDITION TO ORGANIC MATTER, SOD, MUCK, ROOTS, AND RUBBISH, HIGHLY PLASTIC CLAY SOILS OF THE CH AND MH DESCRIPTIONS, AND ORGANIC SOILS OF THE OL AND OH DESCRIPTIONS, AS DEFINED IN THE UNIFIED SOIL CLASSIFICATION SYSTEM SHALL BE CONSIDERED AS UNSUITABLE MATERIAL.
   - B. SUITABLE MATERIAL: EARTH OR MATERIALS DESIGNATED AS BEING SUITABLE FOR THEIR INTENDED USE BY THE ENGINEER. SUITABLE MATERIAL SHALL BE DESIGNATED AS MEETING THE REQUIREMENTS OF THE UNIFIED BY SOIL CLASSIFICATION SYSTEM TYPES SW, GW, GC, SC, SM, ML, CI OR AS DESIGNATED IN THESE SPECIFICATIONS.
   - C. SELECT MATERIAL: GRANULAR MATERIAL TO BE USED WHERE INDICATED ON THE DRAWINGS OR WHERE SPECIFIED HEREIN CONSISTING OF SOILS CONFORMING TO THE UNIFIED SOIL CLASSIFICATION TYPES SW, SM, GW, OR GM OR AS OTHERWISE APPROVED BY THE ENGINEER AS SELECT FILL. SELECT MATERIAL SHALL CONTAIN NO STONES OR RUBBLE LARGER THAN 1.5" IN DIAMETER.
   - D. CRUSHED STONE (GRAVEL): NO. 57 AGGREGATE OR EQUAL CONFORMING TO ASTM C–33.
   - E. EXCAVATION: EXCAVATION OF EVERY DESCRIPTION REGARDLESS OF MATERIALS ENCOUNTERED.
2. UTILITIES:
   - A. EXCAVATE FOR UTILITIES BY OPEN CUT.
   - B. REMOVE BOULDERS AND OTHER INTERFERING OBJECTS, AND BACKFILL VOIDS LEFT BY SUCH REMOVALS.
   - C. REMOVE WET, OR OTHER MATERIAL UNSUITABLE FOR FOUNDATION OR SUB–GRADE AND REPLACE WITH ACCEPTABLE PIPE FOUNDATION MATERIAL.
   - D. NATIVE SOILS SHOULD BE A LOOSE ALLUVIAL DEPOSIT. THIS IS SUITABLE MATERIAL FOR TRENCH BEDDING.
   - E. PROVIDE MINIMUM CLEARANCE OF 6" BETWEEN PIPE WALLS AND TRENCH WALLS OR SHEETING AND BRACING LINES.
   - F. FLOWABLE FILL – SEE CONCRETE NOTES.
3. STRUCTURES:
   - A. CONFORM TO ELEVATIONS AND DIMENSIONS SHOWN WITHIN A TOLERANCE OF 0.10', AND EXTENDING A SUFFICIENT DISTANCE FROM FOOTINGS AND FOUNDATIONS TO PERMIT PLACING AND REMOVING CONCRETE FORMWORK, INSTALLATION OF SERVICES, OTHER CONSTRUCTION REQUIRED AND FOR INSPECTION.
   - B. SEPARATE SUITABLE MATERIALS AND STOCKPILE FOR FUTURE USE.
   - C. DISPOSE OF UNSUITABLE MATERIAL AND EXCESS SUITABLE MATERIAL.
   - D. FOUNDATION SUBGRADES:
     - I. EXCAVATE FOUNDATIONS AND FOOTINGS TO A LEVEL BOTTOM IN FIRM, SOLID, SUITABLE MATERIAL.
     - II. TAKE CARE NOT TO DISTURB THE BOTTOM OF THE EXCAVATION UNLESS FURTHER COMPACTION OF THE SUBGRADE IS REQUIRED.
     - III. THE OWNER OR OWNER'S REPRESENTATIVE SHALL INSPECT THE COMPLETED EXCAVATION PRIOR TO WORK BEING PERFORMED ON THE FOUNDATION SUBGRADE.
     - IV. SHOULD UNSUITABLE OR SOFT MATERIAL BE ENCOUNTERED AT SUBGRADE ELEVATION, REMOVE SUCH MATERIAL AND REPLACE WITH COMPACTED SUITABLE MATERIAL OR CRUSHED STONE FROM FIRM EARTH UP TO THE INDICATED ELEVATION.
     - V. EXCAVATE 4'–0" BELOW GRADE FOR ALL CONTROL BUILDING FOOTINGS.
     - VI. PROVIDE DRAINAGE AND CONTROL GRADING IN THE VICINITY OF THE WORK TO PREVENT DRAINAGE INTO THE EXCAVATION.
     - VII. EXCAVATION OF MATERIAL TO DEPTHS BELOW THE GRADES INDICATED WILL BE DEEMED UNAUTHORIZED EXCAVATION.
   - E. BACKFILLING AND COMPACTION:
     - I. COMPACT SUBSTRATE WITH STATIC ROLLER.
     - II. USE SUITABLE MATERIAL FOR ALL FILLING AND BACKFILLING OPERATIONS.
       - PROVIDE SUITABLE MATERIAL FREE FROM ORGANIC MATTER AND DELETERIOUS SUBSTANCES, CONTAINING NO ROCKS OR LUMPS OVER 6" IN GREATEST DIMENSION, AND WITH NOT MORE THAN 15% OF THE ROCKS OR LUMPS LARGER THAN 2 1/2" IN THEIR GREATEST DIMENSION.
       - PLACE GEOTEXTILE BETWEEN NATIVE SOIL AND BACKFILL. GEOTEXTILE SHALL BE MIRAFI 140N OR EQUIVALENT.
       - PLACE A 1'–0" LAYER OF COMPACTED 1.5" CRUSHED STONE BETWEEN GEOTEXTILE AND FOUNDATIONS/BACKFILL.
     - III. BACKFILL SHALL BE:

SIEVE SIZE	SELECT GRANULAR FILL - % PASSING BY WEIGHT
4IN	100
NO. 40	0-70
NO. 200	0-15

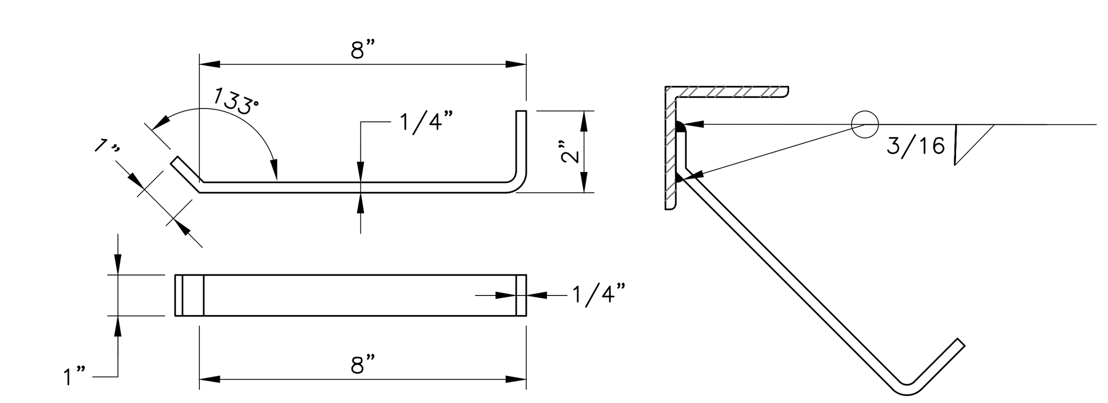
   - F. FILL UNDER STRUCTURES: DEPOSIT SUITABLE MATERIALS IN LAYERS NOT EXCEEDING 8" IN DEPTH AND COMPACT EACH LAYER USING PROPER EQUIPMENT.
     - I. DO NOT PLACE ROCK THAT WILL NOT PASS THROUGH A 6" DIAMETER RING WITHIN THE TOP 12" OF THE SURFACE OF THE COMPLETED FILL OR ROCK THAT WILL NOT PASS THROUGH A 3" DIAMETER RING WITHIN THE TOP 6" OF THE COMPLETED FILL.
     - II. DO NOT PLACE BROKEN CONCRETE, BRICKS, OR ASPHALTIC PAVEMENT IN FILLS.
   - G. BACKFILL EXCAVATIONS AS PROMPTLY AS PROGRESS OF THE WORK PERMITS, BUT NOT UNTIL COMPLETION OF THE FOLLOWING:
     - I. INSPECTION AND ACCEPTANCE OF CONSTRUCTION BELOW FINISH GRADE INCLUDING, WHERE APPLICABLE, DAMPPROOFING AND WATERPROOFING.
     - II. INSPECTING, TESTING, APPROVING AND RECORDING LOCATIONS OF UNDERGROUND UTILITIES.
     - III. REMOVING CONCRETE FORMWORK.
     - IV. REMOVING SHORING AND BRACING, AND BACKFILLING OF VOIDS WITH SATISFACTORY MATERIALS.
     - V. REMOVING TRASH AND DEBRIS
     - VI. CAST–IN–PLACE FOUNDATION WALLS HAVE BEEN IN PLACE SEVEN DAYS.
   - H. PLACING AND COMPACTING:
     - I. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 8" IN LOOSE DEPTH.
     - II. BEFORE COMPACTING, MOISTEN OR AERATE EACH LAYER AS NECESSARY TO PROVIDE THE OPTIMUM MOISTURE CONTENT WITH ±2%.
     - III. COMPACT EACH LAYER TO REQUIRED PERCENTAGE OF MAXIMUM DENSITY FOR AREA.
     - IV. DO NOT PLACE BACKFILL OR FILL MATERIAL ON SURFACES THAT ARE MUDDY, FROZEN, OR CONTAINING FROST OR ICE.
     - V. PLACE BACKFILL AND FILL MATERIALS EVENLY ADJACENT TO STRUCTURES, TO REQUIRED ELEVATIONS.
     - VI. TAKE CARE TO PREVENT WEDGING ACTION OF BACKFILL AGAINST STRUCTURES BY CARRYING THE MATERIAL UNIFORMLY AROUND THE STRUCTURE TO APPROXIMATELY THE SAME ELEVATION IN EACH LIFT.
     - VII. DO NOT OPERATE HEAVY EQUIPMENT CLOSER TO FOUNDATION OR RETAINING WALLS THAN A DISTANCE EQUAL TO HEIGHT TO BACKFILL ABOVE THE FOOTING. COMPACT REMAINING AREA USING POWER DRIVEN HAND TAMPERS.
     - VIII. WHERE THE CONSTRUCTION INCLUDES BASEMENT OR OTHER UNDERGROUND WALLS HAVING STRUCTURAL FLOORS OVER THEM, DO NOT BACKFILL SUCH WALLS UNTIL THE STRUCTURAL FLOORS ARE IN PLACE AND HAVE ATTAINED SUFFICIENT STRENGTH TO SUPPORT THE WALLS.
   - I. COMPACTION REQUIREMENTS:
     - I. COMPACT SOILS TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM D698, METHOD A (STANDARD PROCTOR).
     - II. EXISTING IN PLACE SUBGRADE BELOW STRUCTURES WHERE SUBGRADE HAS BEEN DISTURBED BY WATER, IMPROPER DEWATERING, OR CONSTRUCTION TRAFFIC:
       - TOP 12" OF SUBGRADE 100%
       - BELOW TOP 12" OF SUBGRADE 98%
     - III. FILL BENEATH STRUCTURES AND BENEATH AN AREA EXTENDING 10 FEET BEYOND THE LIMITS OF THE FOUNDATION:
       - TOP 12" OF SUBGRADE 100%
     - IV. COMPACTION OF SUITABLE MATERIAL USED TO REPLACE UNSUITABLE MATERIAL BELOW FOUNDATION SUBGRADES:
       - TOP 12" OF SUBGRADE 100%
       - BELOW TOP 12" OF SUBGRADE 98%



TYPICAL EMBEDDED GRATING SEAT DETAIL

1 1/2"= 1'-0"

NOTE:
EMBEDDED STEEL ANGLES GALVANIZE AFTER FABRICATION.



TYPICAL STRAP ANCHOR DETAIL

3"=1'-0"

ALTERNATIVELY USE NELSON STUD #H4L 1/2x6–1/8 MS CONCRETE ANCHORS

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1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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GENERAL NOTES II

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	110-02

22x34 = FULL SCALE

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3"
2"
1"
0
22x34 = FULL SCALE

CONCRETE NOTES

1. SURFACE PREPARATION:

   A. ALL LOOSE ROCK, CONCRETE, AND SOIL SHALL BE REMOVED PRIOR TO CONSTRUCTION. REMOVE ANY GREASE, OIL OR OTHER COATINGS ON ANY EXISTING SURFACE.

   B. WHEN CONCRETE IS PLACED DIRECTLY AGAINST ROCK SURFACES OR SURFACES, THE SURFACE SHALL BE CLEANED WITH HIGH-PRESSURE WATER TO REMOVE ALL DIRT OR LOOSE MATERIAL.

   C. SURFACE PREPARATION OF EXISTING CONCRETE AND MASONRY SURFACES SHALL REMOVE ALL LOOSE OR DETERIORATED MATERIAL AND VEGETATION. ACCEPTABLE METHODS INCLUDE SANDBLASTING, MECHANICAL CHIPPING, OR HIGH-PRESSURE WATER BLAST (5,000 PSI MINIMUM PRESSURE).

2. CONCRETE DEMOLITION:

   A. SAWCUT PERIMETER OF AREAS DESIGNATED FOR CONCRETE REMOVAL TO A MINIMUM DEPTH OF 1 INCH.

   B. PRIMARY MEANS OF CONCRETE DEMOLITION IS UP TO CONTRACTOR; HOWEVER, FINAL 1/4 INCH OF CONCRETE REMOVAL SHALL USE ABRASIVE SHOT-BLASTING, WATER-BLASTING, OR HYDRO-DEMOLITION TO MINIMIZE CONCRETE BRUISING TO EXPOSED SURFACE IN ACCORDANCE WITH ACI 364T-02 (TECH NOTE).

   C. PREPARE EXPOSED CONCRETE SURFACES, AS INDICATED ON THE DRAWINGS, TO THE CONCRETE SURFACE PROFILES (csp) IN ACCORDANCE WITH THE INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI) TECHNICAL GUIDELINE No. 310.2R-2013 BUT NO LESS THAN SURFACE ROUGHNESS WITH 1/8" AMPLITUDE

   D. CLEAN CONCRETE SURFACES TO REMOVE ALL DELETERIOUS MATERIAL INCLUDING DIRT, SILT, LAITANCE, AND LOOSE CONCRETE AND AGREGATE. CLEANING WITH SANDBLASTING OR HIGH PRESSURE WASH NO LESS THAN 3,000 PSI IS PERMITTED.

3. CONCRETE:

   A. SPECIFICATIONS:

   I. CLASS I – 3,500PSI CONCRETE

   i. MASS CONCRETE USED IN POWERHOUSE AND CONCRETE PLACED IN THE CONDUIT BONDOUTS.
   ii. THE CONCRETE FOR THE POWERHOUSE WAS DESIGNED PER ACI 350, LATEST EDITION. ALL CONCRETE WORK ON THE POWERHOUSE SHALL CONFORM TO ACI 350.5 SPECIFICATION FOR ENVIRONMENTAL CONCRETE STRUCTURES, LATEST EDITION, AS MODIFIED BY THESE PROJECT SPECIFICATIONS.
   iii. MAXIMUM WATER/CEMENT RATIO = 0.55.
   iv. DO NOT USE ASTM C150 TYPE III CEMENT. USE MODERATE HEAT-OF-HYDRATION PORTLAND CEMENT; BLENDED HYDRAULIC CEMENT WITH MODERATE OR LOW HEAT-OF-HYDRATION PROPERTIES; OR PORTLAND CEMENT WITH CLASS F FLY ASH. THE MAXIMUM TOTAL SUBSTITUTION OF PORTLAND CEMENT SHALL NOT EXCEED 50%, INCLUDING THE AMOUNT OF BLENDED CEMENT.
   v. TO HELP REDUCE THE HEAT OF HYDRATION FOR THE CONCRETE MIXTURE, THE MIXTURE MAY BE PROPORTIONED TO REACH A MINIMUM STRENGTH OF 3500 PSI AT 56 DAYS POST PLACEMENT. IF THE CONCRETE MIXTURE IS BASED ON A 56-DAY COMPRESSIVE STRENGTH, WET CURE CONCRETE FOR 14 DAYS MINIMUM AND DO NOT APPLY LOADS TO NEW CONCRETE FOR AT LEAST 14 DAYS UNLESS APPROVED BY THE ENGINEER. USE WATER WITH A TEMPERATURE NO MORE THAN 20°F COOLER THAN CONCRETE TEMPERATURE TO AVOID THERMAL SHOCK.
   vi. AIR CONTENT PROVIDED BY AIR ENTRAINMENT ADMIXTURE 4% TO 5% AS MEASURED BY ASTM C231.
   vii. 2" STONE AGGREGATE MIX ACCEPTABLE.
   viii. SLUMP 3" TO 4".
   ix. WATER REDUCING ADMIXTURE MAY BE USED AT THE OPTION OF THE CONTRACTOR.
   x. ADMIXTURES CONTAINING CALCIUM CHLORIDE SHALL NOT BE USED.
   xi. MASS CONCRETE PLACEMENT REQUIREMENTS:

   a. DEVELOP AND SUBMIT A THERMAL CONTROL PLAN TO THE ENGINEER COVERING THE MASS CONCRETE PLACEMENTS INCLUDED IN THE POWERHOUSE CONSTRUCTION. GIVEN THE FREQUENCY OF PLACEMENTS, THE POWERHOUSE SHALL BE CONSIDERED MASS CONCRETE DUE TO THE ADDITIVE THERMAL PROPOERTIES OF HEAT OF HYDRATION DEVELOPING CONCURRENTLY IN MULTIPLE LIFTS OF LIMITED DEPTH. THE THERMAL CONTROL PLAN SHALL PROVIDE SUFFICIENT DETAIL TO DEMONSTRATE THE CONTRACTOR HAS PERFORMED ADEQUATE PLANNING TO IDENTIFY AND CONTROL CONCRETE TEMPERATURES FOR THE FULL DURATION OF THERMAL CONTROL. SUBMIT THE THERMAL CONTROL PLAN AT LEAST 30 DAYS BEFORE THE FIRST INTENDED MASS CONCRETE PLACEMENT. THE CONTRACTOR SHALL PROVIDE A THERMAL CONTROL PLAN THAT INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING:
      – A CONCRETE LIFT PLAN WITH A LISTING OF THE MASS CONCRETE PLACEMENTS ADDRESSED BY THE THERMAL CONTROL PLAN, INCLUDING DIMENSIONS OF EACH PLACEMENT. MULTIPLE SEQUENTIAL PLACEMENTS, EACH OF LIMITED DEPTH, SHALL BE CONSIDERED MASS CONCRETE PLACEMENTS SINCE THE TEMPERATURE GAIN OF THE INDIVIDUAL PLACEMENTS BECOMES ADDITIVE AND THERFORE REQUIRES THERMAL CONTROL. THESE MULTIPLE SEQUENTIAL PLACEMENTS SHALL BE ADDRESSED IN THE THERMAL CONTROL PLAN.
      – THE APPROVED CONCRETE MIX.
      – PROCEDURES TO MAINTAIN THE INITIAL CONCRETE PLACEMENT TEMPERATURE. THIS MAY INCLUDE PRE-COOLING OF MIX COMPONENTS, SCHEDULING OF PLACEMENTS TO OPTIMIZE AMBIENT WEATHER CONDITIONS, OR OTHER APPROVED MEANS.
      – PROCEDURES TO MANAGE CONCRETE TEMPERATURE AND TEMPERATURE DIFFERENTIAL AFTER PLACEMENT, AS MAY BE NECESSARY. THIS MAY INCLUDE INSULATION OF FORMWORK AND FINISHED SURFACES, EXTERNAL HEATING, OR OTHER APPROVED MEANS.
      – PROCEDURES AND EQUIPMENT USED TO MONITOR CONCRETE TEMPERATURE AND TEMPERATURE DIFFERENTIAL, INCLUDING THE LOCATION, QUANTITY, AND MANUFACTURER'S PRODUCT DATA FOR THE TEMPERATURE SENSORS.
      – PROCEDURES FOR CORRECTIVE INTERVENTION DURING THE THERMAL CONTROL PERIOD (ADDITION OR EXTRACTION OF HEAT, AS FEASIBLE) SHOULD TEMPERATURE MONITORING INDICATE POTENTIAL OR CONFIRMED NON-COMPLIANCE WITH THE TEMPERATURE LIMITS SET BELOW
   b. UNLESS OTHERWISE PERMITTED OR SPECIFIED, THE TEMPERATURE OF THE CONCRETE WHEN DEPOSITED AT THE POINT OF PLACEMENT SHALL NOT EXCEED 70°F, OR BE LESS THAT 35°F. LOCK 14 ONLY – POINT OF DELIVERY ALLOWED TO BE 95°F MAX.
   c. KEEP FORMS AND EXPOSED CONCRETE CONTINUOUSLY WET DURING THE CURING PERIOD WHENEVER THE SURROUNDING AIR TEMPERATURE IS ABOVE 90°F.
   d. COOL THE CONCRETE GRADUALLY SO THAT THE DROP IN CONCRETE SURFACE TEMPERATURE DURING AND AT THE CONCLUSION OF THE SPECIFIED CURING PERIOD DOES NOT EXCEED 20°F IN ANY 24-HOUR PERIOD.
   e. THE MAXIMUM IN-PLACE CONCRETE TEMPERATURE LIMIT FOR MASS CONCRETE SHALL BE 160°F. WHEN THE ADIABATIC TEMPERATURE RISE INDICATES THAT THE EXPECTED INTERNAL TEMPERATURE WILL EXCEED 160°F AND WHEN REQUIRED, PROVIDE THERMAL INSTRUMENTATION. TAKE TEMPERATURE READINGS AT THE CENTER OF THE PLACEMENT AND WITHIN 4 INCHES OF EACH PLANE SURFACE.
   f. CONCRETE TEMPERATURE DIFFERENTIAL IS DEFINED AS THE DIFFERENCE IN MEASURED TEMPERATURE AT THE CORE OF THE MEMBER AND THE MEASURED TEMPERATURE AT THE SURFACE. NO MAXIMUM IN-PLACE CONCRETE TEMPERATURE DIFFERENTIAL IS REQUIRED; HOWEVER, THE CONTRACTOR SHALL TAKE CARE TO PRODUCE A MASS CONCRETE PLACEMENT FREE OF CRACKS CAUSED OR WORSENED BY CONCRETE HEAT OF HYDRATION. ACCOMPLISH THIS THROUGH APPROPRIATE CONCRETE MIX DESIGN AND CONTROL OF CONCRETE TEMPERATURES AND TEMPERATURE DIFFERENTIAL (RECOMMEND MAX. DIFFERENTIAL OF 35 DEG.). USE OF CONCRETE PRE-COOLING, CONCRETE POST-COOLING, APPLICATION OF INSULATION OR EXTERNAL HEAT, AND/OR SELECTION OF REDUCED HEAT OF HYDRATION CONCRETE MAY BE APPROPRIATE FOR THIS PURPOSE. THE CONTRACTOR SHALL MONITOR THE CONCRETE TEMPERATURE DIFFERENTIAL AND REPORT ANY EXCEEDING OF 35 DEG.

   II. CLASS II – 4,500PSI CONCRETE

   i. STRUCTURAL CONCRETE USED IN CONTROL BUILDING (U.N.O.) AND AS NOTED IN THE POWERHOUSE.
   ii. THE CONCRETE FOR THE CONTROL BUILDING WAS DESIGNED PER ACI 318, LATEST EDITION. ALL CONCRETE WORK ON THE CONTROL BUILDING SHALL CONFORM TO ACI 301 SPECIFICATION FOR STRUCTURAL CONCRETE, LATEST EDITION, AS MODIFIED BY THESE PROJECT SPECIFICATIONS.
   iii. MAXIMUM WATER/CEMENT RATIO = 0.45.
   iv. AIR CONTENT PROVIDED BY AIR ENTRAINMENT ADMIXTURE 5% TO 7% AS MEASURED BY ASTM C231.
   v. SLUMP 3" TO 4".
   vi. WATER REDUCING ADMIXTURE MAY BE USED AT THE OPTION OF THE CONTRACTOR.
   vii. FLYASH MAY BE USED AT THE OPTION OF THE CONTRACTOR.
   viii. ADMIXTURES CONTAINING CALCIUM CHLORIDE SHALL NOT BE USED.
   iv. 3/4" MIX STONE AGGREGATE.

   C. DO NOT PLACE CONCRETE AGAINST ACTIVE LEAKS OR SEAMS WITH FLOWING WATER. STOP FLOW OR INSTALL DRAINAGE TO DIVERT FLOW AWAY FROM FRESH CONCRETE.

   D. WET CURE CONCRETE FOR 7 DAYS MINIMUM. USE WATER WITH A TEMPERATURE NO MORE THAN 20°F COOLER THAN CONCRETE TEMPERATURE TO AVOID THERMAL SHOCK. DO NOT APPLY LOADS TO NEW CONCRETE FOR AT LEAST 7 DAYS UNLESS APPROVED BY THE ENGINEER.

4. CONCRETE REINFORCEMENT:

   A. UNLESS REBAR EMBEDMENT OR SPLICE DIMENSIONS ARE LABELED ON DRAWINGS, ALL REBAR DETAILING TO MEET ACI 318 REQUIREMENTS AND NOTES ON THIS SHEET. DO NOT SCALE REBAR DETAILS FROM DRAWINGS.

   B. ASTM A615 GRADE 60, SUBMIT SHOP DRAWINGS.

   C. FIELD BEND REINFORCING BARS TO CLEAR BOXOUTS AND PIPES WHERE REQUIRED. NO CUTTING OF REINFORCEMENT BARS SHALL BE DONE WITHOUT PRIOR APPROVAL OF ENGINEER.

   I. SPLICES: LENGTH SHALL BE PER REINFORCEMENT DEVELOPMENT SCHEDULE. SPLICES SHALL BE ACI CLASS B UNLESS NOTED OTHERWISE.

   II. DOWELS: PER REINFORCEMENT DEVELOPMENT SCHEDULE. PROVIDE DOWELS OF SIZE AND DIMENSION SHOWN.

   III. HOOKS: SHALL BE DIMENSIONED AND BENT PER ACI STANDARD HOOKS.

   IV. REBAR COVER: 3" UNLESS NOTED OTHERWISE.

   V. CONTRACTOR MAY PROPOSE ADDITIONAL SPLICE LOCATIONS TO BE APPROVED BY OWNER.

5. FORMWORK AND CONSTRUCTION JOINTS:

   A. CONSTRUCT FORMS TRUE TO LINE AND GRADE, ADEQUATELY BRACED TO MAINTAIN POSITION DURING PLACEMENT OF CONCRETE. WELDING OF FORM TIES TO STRUCTURAL DOWELS IS NOT PERMITTED, THOUGH ADDITIONAL DOWELS MAY BE INSTALLED FOR THAT PURPOSE.

   B. PROVIDE 3/4" CHAMFER ON ALL EXPOSED EDGES UNLESS NOTED OTHERWISE.

   C. REPAIR ALL AIR HOLES AND VOIDS LARGER THAN 1/4" AND FILL ALL TIE HOLES. REMOVE FINS AND PROJECTIONS.

   D. CONSTRUCTION JOINTS SHOWN SHALL BE LOCATED AS SHOWN UNLESS OTHERWISE APPROVED BY THE ENGINEER. ADDITIONAL JOINTS MAY BE USED, WHERE THE STRENGTH AND DURABILITY OF THE STRUCTURE IS NOT AFFECTED AND ARE SUBJECT TO THE REVIEW OF THE ENGINEER. IF CONTRACTOR PROPOSES CONSTRUCTION JOINT LOCATIONS DIFFERENT FROM THOSE SHOWN ON DRAWINGS, CONTRACTOR SHALL SUBMIT LOCATION OF ANY PROPOSED CONSTRUCTION JOINT TO ENGINEER FOR REVIEW.

   E. REINFORCEMENT SHALL BE CONTINUOUS THROUGH JOINT, UNLESS NOTED OTHERWISE AND BE FULLY DEVELOPED ON BOTH SIDES OF CONSTRUCTION JOINTS.

   F. WATERSTOP SHALL BE INSTALLED AT UPSTREAM AND DOWNSTREAM FACES OF ALL POWERHOUSE JOINTS, UNLESS NOTED OTHERWISE.

   G. CLEAN ALL JOINTS OF GREEN CONCRETE WITHIN 30 HOURS TO REMOVE LAITANCE WITH MIN. 5,000 PSI WATER BLAST OR SANDBLASTING PRIOR TO NEXT CONCRETE PLACEMENT. MECHANICAL ROUGHENING IS AN ACCEPTABLE ALTERNATE FOR LAITANCE REMOVAL. ACID CLEANING/REMOVAL OF LAITANCE IS NOT ACCEPTABLE.

   H. SATURATE JOINT IMMEDIATELY PRECEDING AND 12 HOURS PRIOR TO NEXT CONCRETE PLACEMENT. REMOVE ALL STANDING WATER.

   I. MAXIMUM HORIZONTAL C.J. SPACING IS 12 FEET (U.N.O.).

6. VERTICAL CONCRETE SURFACES SHALL HAVE A SMOOTH FORMED FINISH. HORIZONTAL CONCRETE SURFACES SHALL HAVE A FLOAT FINISH (U.N.O.), EXCEPT WALKING SURFACE SHALL HAVE BROOM FINISH.

7. CONTROL BUILDING COMPOSITE DECKING –

   A. 22 GA 3VL COMPOSITE DECK.
   B. W1.4xW1.4 WWR AS PER VULCRAFT STEEL DECK MANUAL OR EQUIVALENT PRODUCT.
   C. LOCATE 3/4"ø x 3.5" STUDS AT 24" O.C. WHERE DECKING IS SUPPORTED BY STRUCTURAL STEEL.
   D. 4" MIN. BEARING OVER SUPPORTING BEAMS.
   E. 1.5" MIN. BEARING OVER END SUPPORT ANGLES.
   F. MAX SPAN = 5'-0"
   G. CLASS II CONCRETE

3,500 PSI Concrete - Rebar Development Table				
Bar	Diameter (in)	Straight Bar Development Length l_d (top bars)	Standard Hook l_{dh} ($\psi_c = 0.7$)	Class B Splice
3	0.38	12	6	15
4	0.50	16	7	26
5	0.63	21	9	38
6	0.75	30	11	51
7	0.88	51	13	83
8	1.00	66	14	103
9	1.13	84	16	124
10	1.27	106	18	150
For other bars (not top bars), multiply straight bar development lengths by 0.7				
For Class A lap splices, divide Class B splice lengths by 1.3				

Table assumes 2" of cover and >2d_b bar spacing, no supplementary reinforcement
Hooks assume side cover (normal to plane of hook) =>2.5" and 2" cover on 90 deg bar extension

4,500 PSI Concrete - Rebar Development Table				
Bar	Diameter (in)	Straight Bar Development Length l_d (top bars)	Standard Hook l_{dh} ($\psi_c = 0.7$)	Class B Splice
3	0.38	11	6	14
4	0.50	14	6	23
5	0.63	18	8	33
6	0.75	26	9	45
7	0.88	45	11	73
8	1.00	58	13	91
9	1.13	74	14	110
10	1.27	94	16	132
For other bars (not top bars), multiply straight bar development lengths by 0.7				
For Class A lap splices, divide Class B splice lengths by 1.3				

Table assumes 2" of cover and >2d_b bar spacing, no supplementary reinforcement
Hooks assume side cover (normal to plane of hook) =>2.5" and 2" cover on 90 deg bar extension

*UNLESS OTHERWISE NOTED ON DRAWING. (NOT FOR EPOXY COATED REINFORCEMENT)

WATERSTOP NOTES

1. PROVIDE PVC WATERSTOPS EMBEDDED IN CONCRETE, SPANNING CONTROL AND CONSTRUCTION JOINTS, AND AT JOINTS BETWEEN EXISTING AND NEW CONCRETE TO CREATE A CONTINUOUS DIAPHRAGM TO PREVENT WATER MIGRATION. PROVIDE WATERSTOPS IN ALL JOINTS REACHING THE EXTERIOR OF THE BUILDING BELOW FLOOD LEVELS, BEDROCK SURFACES, OR THE WATER PASSAGES OF THE POWERSTATION AND OTHER AREAS WHERE SHOWN. PROVIDE THOROUGH CONSOLIDATION OF CONCRETE AROUND WATERSTOP AND PREVENT FORMATION OF AIR POCKETS AND VOIDS.

2. THE DRAWINGS DO NOT DEPICT ALL LOCATIONS OF WATERSTOP.
   A. WS = PVC WATERSTOP
   B. WR = PVC RETROFIT WATERSTOP

3. ALL WATERSTOP SHALL BE INSTALLED AND APPROVED BY OWNER'S REPRESENTATIVE PRIOR TO PLACEMENT OF CONCRETE.

4. WALLS OR COMPONENTS WITH WATER OR BUILDING EXTERIOR ON TWO SIDES, AND LESS THAN OR EQUAL TO 3'-0" THICKNESS, REQUIRE ONE DIAPHRAGM OF WATERSTOP, LOCATED APPROXIMATELY AT THE CENTER OF THE WALL.

5. WALLS OR COMPONENTS WITH WATER OR BUILDING EXTERIOR ON TWO SIDES, AND MORE THAN 3'-0" THICK SHALL REQUIRE TWO DIAPHRAGMS OF WATERSTOP, WITH ONE AT EACH FACE OF THE CONCRETE.

6. WATERSTOPS SHALL MEET US ARMY CORPS OF ENGINEERS CRD-C 572-74.

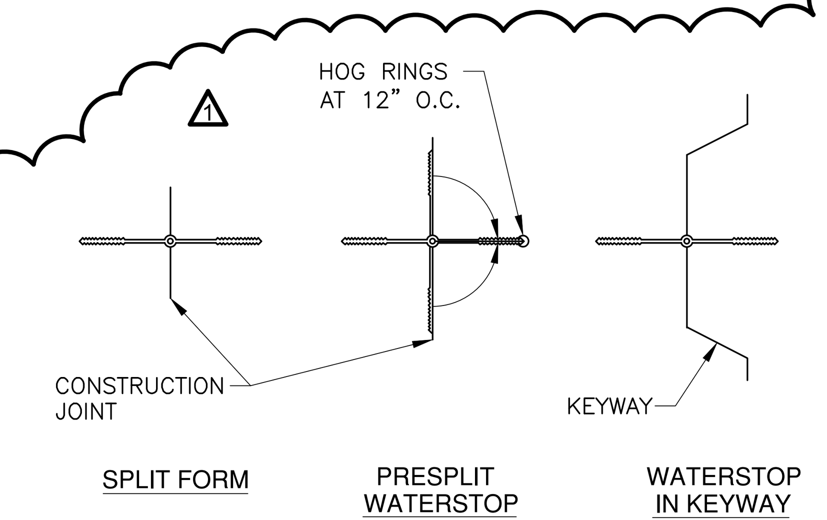
7. PVC WATERSTOPS SHALL BE PAUL MURHPYS PLASTICS COMPANY'S WIRESTOP OR AN APPROVED EQUAL.

8. THE PVC WATERSTOP SHALL BE EXTRUDED FROM AN ELASTOMERIC PLASTIC MATERIAL OF WHICH THE BASIC RESIN IS PRIME VIRGIN POLYVINYL CHLORIDE. THE PVC COMPOUND SHALL NOT CONTAIN ANY SCRAPPED OR RECLAIMED MATERIAL OR PIGMENT WHATSOEVER.

9. PROVIDE FACTORY-MADE WATERSTOP FABRICATIONS FOR ALL CHANGES OF DIRECTION, INTERSECTIONS, AND TRANSITIONS, LEAVING ONLY STRAIGHT BUTT JOINT SPLICES TO BE MADE IN THE FIELD.

10. FIELD BUTT SPLICES SHALL BE HEAT FUSED/WELDED USING TEFLON COATED THERMOSTATICALLY CONTROLLED WATERSTOP SPLICING IRON AT APPROXIMATELY 380 DEGREES. FOLLOW APPROVED MANUFACTURERS RECOMMENDATIONS. LAPPING OF WATERSTOP, USE OF ADHESIVES, OR SOLVENTS SHALL NOT BE ALLOWED.

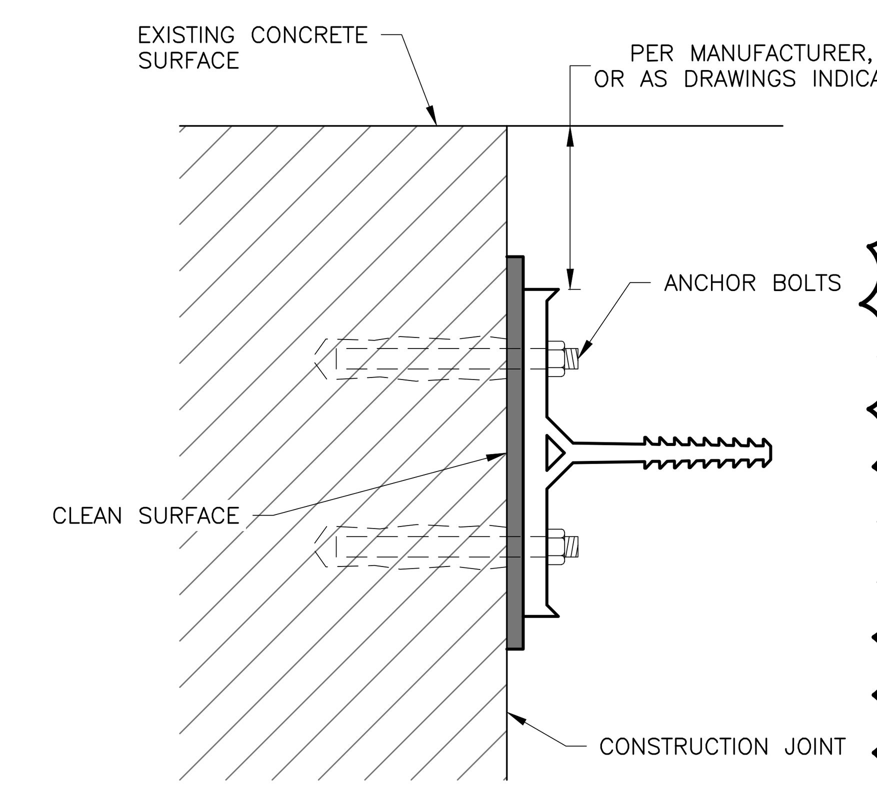
11. WATERSTOP SPLICING DEFECTS WHICH ARE UNACCEPTABLE INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   A. TENSILE STRENGTH LESS THAN 80 PERCENT OF PARENT SECTION.
   B. MISALIGNMENT OF CENTER BULB, AND RIBS, GREATER THAN 1/16 INCH.
   C. BOND FAILURE AT JOINT DEEPER THAN 1/16 INCH OR 15 PERCENT OF MATERIAL THICKNESS.
   D. MISALIGNMENT WHICH REDUCES WATERSTOP CROSS SECTION MORE THAN 15 PERCENT.
   E. VISIBLE POROSITY IN THE WELD.
   F. BUBBLES OR INADEQUATE BONDING.
   G. VISIBLE SIGNS OF SPLICE SEPARATION WHEN COOLED SPLICE IS BENT BY HAND AT A SHARP ANGLE.
   H. CHARRED OR BURNT MATERIAL.



WATERSTOP INSTALLATION IN FORMED CONSTRUCTION JOINTS
NOT TO SCALE

WATERSTOP INSTALLATION NOTES

1. INSTALL WATERSTOP BY ONE OF THE METHODS SHOWN ABOVE.
2. SECURE WATERSTOP IN FORM TO PREVENT MOVEMENT OR FOLDING DURING CONCRETE PLACEMENT.
3. SYSTEMATICALLY AND THOROUGHLY VIBRATE CONCRETE AROUND WATERSTOP TO PREVENT VOIDS.
4. SPLICE WATERSTOP AT ALL CORNERS AND JOINTS BY HEAT FUSION WELDING PER MANUFACTURER'S APPROVED METHOD, SO THAT CONTINUOUS BARRIER IS FORMED.
5. DO NOT LAP SPLICE.



WATERSTOP INSTALLATION FOR PLACEMENT AGAINST EXISTING CONCRETE
NOT TO SCALE
NOTE:
APPLY MATERIALS PER MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

PHASE 1 - RELEASED FOR CONSTRUCTION
PHASE 2A - NOT FOR CONSTRUCTION

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

GENERAL NOTES III

No.	Revision	Date	Drawn	Checked
⚠	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	110-03

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SITE PLAN

1"= 40'

40 0 40 80

SCALE IN FEET

NOTE:
DRAWING ELEVATIONS ARE IN NAVD88 DATUM.
USACE DATUM = PLANT DATUM
NAVD88 = USACE − 3.13'

22x34 = FULL SCALE

0 1" 2" 3"

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APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

EXISTING CONDITIONS
SITE PLAN

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	200-01

SECTION A/01
1/8"= 1'-0"

8 0 8 16
SCALE IN FEET

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

EXISTING CONDITIONS
LONGITUDINAL SECTION

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No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	200-02

22x34 = FULL SCALE

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SECTION B/01
1/8"= 1'-0"

8 0 8 16
SCALE IN FEET

22x34 = FULL SCALE

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STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

EXISTING CONDITIONS
LATERAL SECTION

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	200-03

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SITE PLAN

1"= 40'

80'-0"

40 0 40 80

SCALE IN FEET

NOTES

1. FOR DETAILS OF EROSION & SEDIMENT CONTROL MEASURES SEE DWG 210-02 & 210-03.
2. STAGING AREA:
   A. REMOVE TOP SOIL AS NEEDED
   B. PROVIDE SUITABLE GRAVEL FILL TO DEPTH AS NEEDED TO SUPPORT CONSTRUCTION EQUIPMENT; GRADE SURFACE TO MINIMIZE EROSION
   C. UPON COMPLETION OF CONSTRUCTION, REGRADE AREA, COVER WITH TOPSOIL AND RESEED.
3. EXISTING ACCESS ROAD:
   A. PROVIDE SUITABLE GRAVEL FILL TO DEPTH AS NEEDED TO SUPPORT CONSTRUCTION EQUIPMENT; GRADE SURFACE TO MINIMIZE EROSION.
   B. UPON COMPLETION OF CONSTRUCTION, SHIM AND REGRADE ROAD; REPLACE CULVERTS AS NEEDED TO DRAIN UPSLOPE AREAS.
   C. LEAVE ROCK CONSTRUCTION ENTRANCES IN PLACE.

NOTE:
ELEVATIONS ARE IN NAVD88 DATUM.
USACE DATUM = PLANT DATUM
NAVD88 = USACE − 3.13'

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JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER STATE OF KENTUCKY 8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
EROSION & SEDIMENT CONTROL PLAN

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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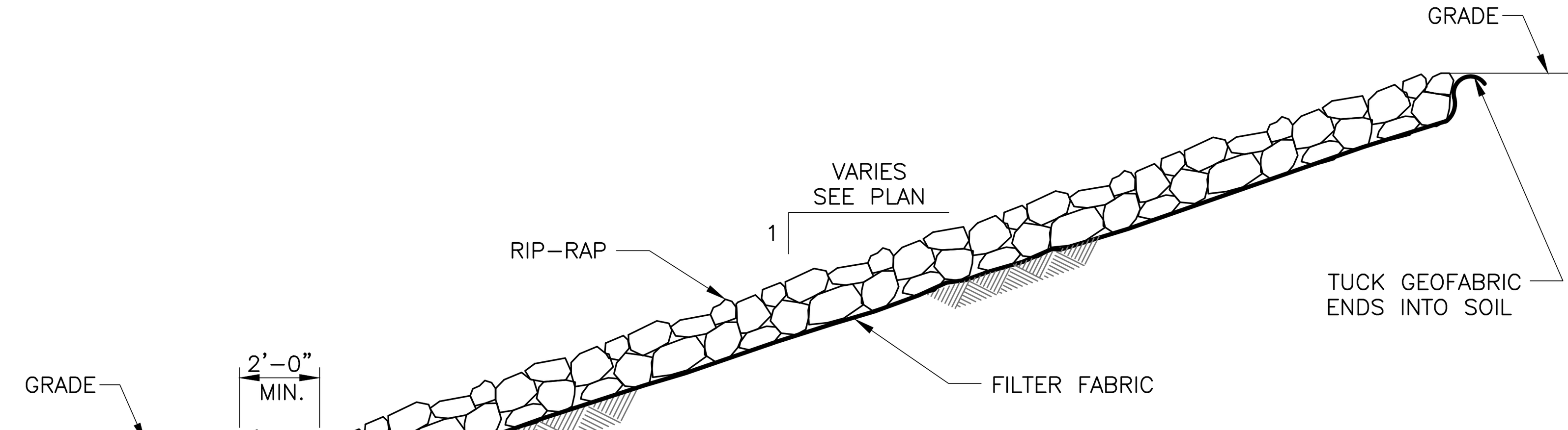
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-01

22x34 = FULL SCALE

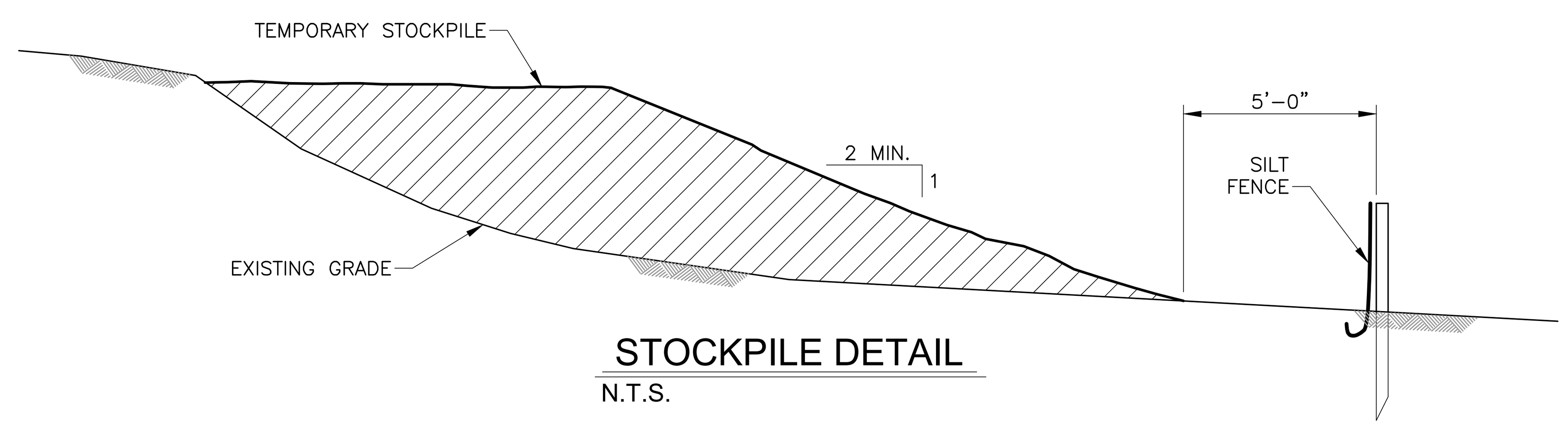
E&S CONTROL & MAINTENANCE

1. THE PERMITTEE WILL BE RESPONSIBLE FOR THE PROPER CONSTRUCTION, STABILIZATION AND MAINTENANCE OF ALL EROSION AND SEDIMENTATION CONTROLS AND RELATED ITEMS INCLUDED WITHIN THIS PLAN. THE CONTRACTOR SHALL SCHEDULE AND CONDUCT HIS OPERATIONS TO MINIMIZE EROSION OF SOILS AND TO PREVENT SILTING AND MUDDYING OF STREAMS, RIVERS AND DRAINAGE SYSTEMS.
2. CONTRACTOR SHALL COMPLY WITH GENERAL CONDITIONS OF THE PROJECT'S 401 WATER QUALITY CERTIFICATION AND THE KPDES GENERAL STORMWATER PERMIT
3. ALL EARTH DISTURBANCES, INCLUDING CLEARING AND GRUBBING AS WELL AS CUTS AND FILLS SHALL BE DONE IN ACCORDANCE WITH THE APPROVED E&S PLAN. A COPY OF THE APPROVED DRAWINGS (STAMPED, SIGNED AND DATED BY THE REVIEWING AGENCY) MUST BE AVAILABLE AT THE PROJECT SITE AT ALL TIMES. THE REVIEWING AGENCY SHALL BE NOTIFIED OF ANY CHANGES TO THE APPROVED PLAN PRIOR TO IMPLEMENTATION OF THOSE CHANGES. THE REVIEWING AGENCY MAY REQUIRE A WRITTEN SUBMITTAL OF THOSE CHANGES FOR REVIEW AND APPROVAL AT ITS DISCRETION.
4. AT LEAST 2 WEEKS PRIOR TO THE START OF ONSITE CONSTRUCTION, OWNER SHALL NOTIFY THE KENTUCKY DIVISION OF WATER OF THE PROPOSED DATE FOR THE START OF ONSITE WORK.
5. AT LEAST 7 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, OR EXPANDING INTO AN AREA PREVIOUSLY UNMARKED. CONTACT KENTUCKY811.COM OR CALL 811 OR 800-752-6007 FOR THE LOCATION OF EXISTING UNDERGROUND UTILITIES.
6. AREAS TO BE FILLED ARE TO BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL.
7. CLEARING, GRUBBING, AND TOPSOIL STRIPPING SHALL BE LIMITED TO ACCESS ROAD(S), BUILDING PLAZA, AND STAGING AREAS. SITE CLEARING, GRUBBING AND TOPSOIL STRIPPING MAY NOT COMMENCE UNTIL THE E&S BMPS SPECIFIED HAVE BEEN INSTALLED AND ARE FUNCTIONING AS DESCRIBED IN THIS E&S PLAN.
8. AT NO TIME SHALL CONSTRUCTION VEHICLES BE ALLOWED TO ENTER AREAS OUTSIDE THE LIMIT OF DISTURBANCE BOUNDARIES SHOWN ON THE PLAN MAPS. THESE AREAS MUST BE CLEARLY MARKED AND FENCED OFF BEFORE CLEARING AND GRUBBING OPERATIONS BEGIN.
9. TOPSOIL REQUIRED FOR THE ESTABLISHMENT OF VEGETATION SHALL BE STOCKPILED AT THE LOCATION(S) SHOWN ON THE PLAN MAPS(S) IN THE AMOUNT NECESSARY TO COMPLETE THE FINISH GRADING OF ALL EXPOSED AREAS THAT ARE TO BE STABILIZED BY VEGETATION. EACH STOCKPILE SHALL BE ENCLOSED BY A SILT FENCE. STOCKPILE HEIGHTS SHALL NOT EXCEED 35 FEET. STOCKPILE SLOPES SHALL BE 2H:1V OR FLATTER.
10. ALL BUILDING MATERIALS AND WASTES SHALL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH THE KENTUCKY'S SOLID WASTE MANAGEMENT REGULATIONS. NO BUILDING MATERIALS OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE.
11. ALL OFF-SITE WASTE AND BORROW AREAS MUST HAVE AN E&S PLAN APPROVED BY KENTUCKY DIVISION OF WATER DISTRICT AND FULLY IMPLEMENTED PRIOR TO BEING ACTIVATED.
12. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ANY MATERIAL BROUGHT ON SITE IS CLEAN, UNCONTAMINATED FILL.
13. ALL PUMPING OF WATER OVERLAND FROM ANY WORK AREA SHALL BE DISCHARGED ONTO STONE FILL (AASHTO #1) AND THEN OVER UNDISTURBED VEGETATED AREAS.
14. ALL WATER AND SMALL AMOUNTS OF SUSPENDED AND RESIDUAL SEDIMENTS REMAINING IN THE LOCK AFTER REMOVAL OF DEBRIS AND SOILS/SEDIMENTS FROM THE LOCK MAY BE PUMPED DRIECTLY INTO THE RIVER WITHOUT NEED OF REMOVAL OF SEDIMENT.
15. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMPS SHALL BE MAINTAINED PROPERLY. MAINTENANCE SHALL INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENT BMPS AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING AND RENETTING MUST BE PERFORMED IMMEDIATELY. IF THE E&S BMPS FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMPS, OR MODIFICATIONS OF THOSE INSTALLED WILL BE REQUIRED.
16. A LOG SHOWING DATES THAT E&S BMPS WERE INSPECTED AS WELL AS ANY DEFICIENCIES FOUND AND THE DATE THEY WERE CORRECTED SHALL BE MAINTAINED ON THE SITE AND BE MADE AVAILABLE TO REGULATORY AGENCY OFFICIALS AT THE TIME OF INSPECTION.
17. SEDIMENT TRACKED ONTO ANY PUBLIC ROADWAY SHALL BE RETURNED TO THE CONSTRUCTION SITE BY THE END OF EACH WORK DAY AND DISPOSED OF ON SITE AS PART OF FINAL GRADING. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED, OR SWEPT INTO ANY ROADSIDE DITCH, STORM SEWER, OR SURFACE WATER.
18. ALL SEDIMENT REMOVED FROM BMPS SHALL BE DISPOSED OF ON SITE AS PART OF FINAL GRADING.
19. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3 TO 5 INCHES AND TOPPED WITH 6 TO 12 INCHES ON COMPACTED SOILS PRIOR TO PLACEMENT OF TOPSOIL. AREAS TO BE VEGETATED SHALL HAVE A MINIMUM 4 INCHES OF TOPSOIL IN PLACE PRIOR TO SEEDING AND MULCHING. FILL OUTSLOPES SHALL HAVE A MINIMUM OF 2 INCHES OF TOPSOIL.
20. ALL FILLS SHALL BE COMPACTED AS NEEDED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES OR AS DETAILED ON THE CONSTRUCTION DRAWINGS.
21. ALL EARTHEN FILLS SHALL BE PLACED IN COMPACTED LAYERS NOT TO EXCEED 9 INCHES IN THICKNESS.
22. FILL MATERIALS SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOD, OR OTHER FOREIGN OR OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
23. FROZEN MATERIALS OR SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED INTO FILLS.
24. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.
25. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED BY DITCHING OR PIPING THE FLOW TO THE RIVER, TREAT THE FLOW AS WATER PUMPED OVERLAND AS DESCRIBED ABOVE IN #13.
26. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY UPON REACHING FINISHED GRADE. CUT SLOPES IN COMPETENT BEDROCK AND ROCK FILLS NEED NOT BE VEGETATED. SEED AREAS WITHIN 50 FEET OF A SURFACE WATER.
27. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE, THE CONTRACTOR SHALL PERMANENTLY STABILIZE ALL DISTURBED AREAS. DURING NON-GERMINATING MONTHS, MULCH OR PROTECTIVE BLANKETING SHALL BE APPLIED.
28. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.
29. E&S BMPS SHALL REMAIN FUNCTIONAL AS SUCH UNTIL ALL AREAS TRIBUTARY TO THEM ARE PERMANENTLY STABILIZED OR UNTIL THEY ARE REPLACED BY ANOTHER BMP APPROVED BY THE KENTUCKY DIVISION OF WATER.
30. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR CONTRACTOR SHALL CONTACT THE KENTUCKY DIVISION OF WATER FOR AN INSPECTION PRIOR TO REMOVAL/CONVERSION OF THE E&S BMPS.
31. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENT BMPS MUST BE REMOVED OR CONVERTED TO PERMANENT POST CONSTRUCTION STORMWATER MANAGEMENT BMPS. AREAS DISTURBED DURING REMOVAL OR CONVERSION OF THE BMPS SHALL BE STABILIZED IMMEDIATELY. IN ORDER TO ENSURE RAPID REVEGETATION OF DISTURBED AREAS, SUCH REMOVAL/CONVERSIONS ARE TO BE DONE ONLY DURING THE GERMINATING SEASON.
32. NOT LESS THAN 2 WEEKS AFTER THE COMPLETION OF ONSITE CONSTRUCTION, OWNER SHALL NOTIFY THE KENTUCKY DIVISION OF WATER THAT ONSITE CONSTRUCTION HAS BEEN COMPLETED.
33. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION AND/OR VIOLATIONS OF WATER QUALITY STANDARDS OCCUR AS A RESULT OF CONSTRUCTION ACTIVITIES (EITHER FROM A SPILL OR OTHER FORMS OF WATER POLLUTION), THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION OR VIOLATION AND EITHER NOTIFY THE KENTUCKY DIVISION OF WATER IMMEDIATELY BY CALLING 800-928-2380.
34. FAILURE TO CORRECTLY INSTALL E&S BMPS, FAILURE TO PREVENT SEDIMENT-LADEN RUNOFF FROM LEAVING THE CONSTRUCTION SITE, OR FAILURE TO TAKE IMMEDIATE CORRECTIVE ACTION TO RESOLVE FAILURE OF E&S BMPS MAY RESULT IN ADMINISTRATIVE, CIVIL, AND/OR CRIMINAL PENALTIES INSTITUTED BY THE STATE OF KENTUCKY.

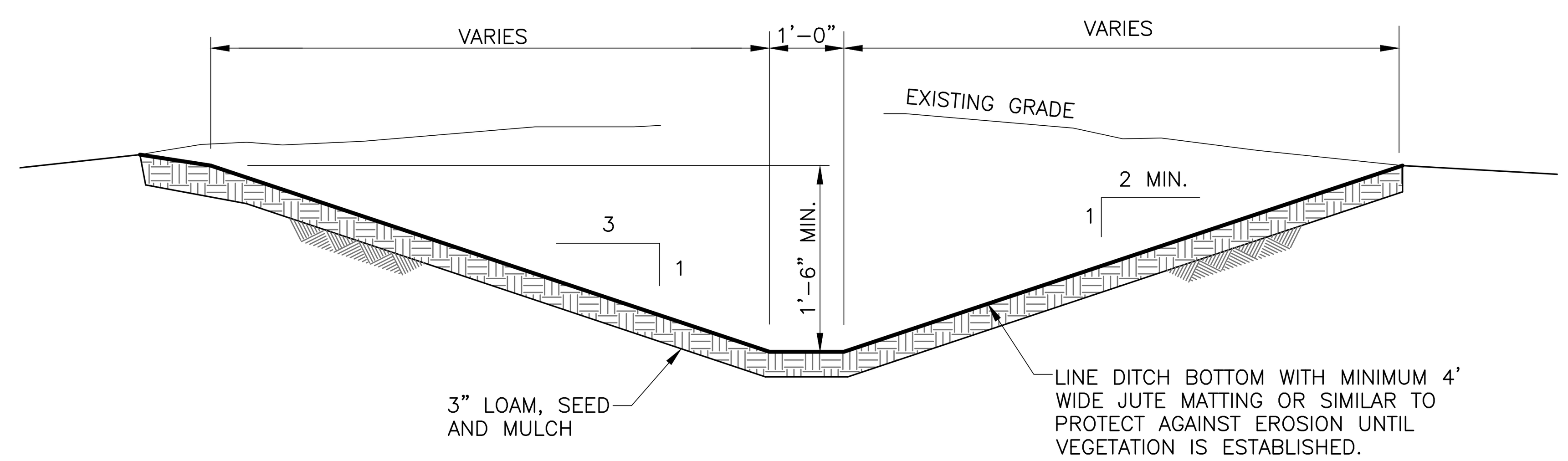


TYPICAL RIP-RAP DETAIL
N.T.S.

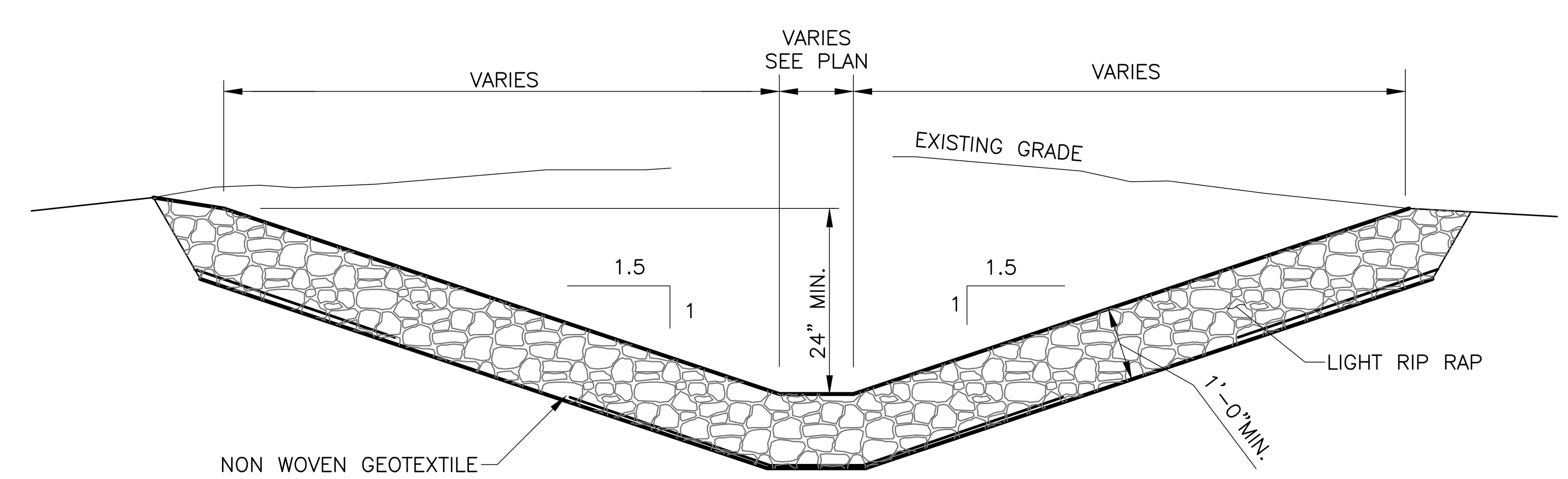
NOTE:
RIP-RAP TO BE TYPE NSA No. R-4 PER PENN. DEP EROSION AND SEDIMENT CONTROL PROGRAM MANUAL. (DMIN = 3", D50 = 6", DMAX = 12") UNDERSIDE OF RIP-RAP TO BE LINED WITH MIRIFI FILTERWEAVE 402 OR APPROVED EQUAL.



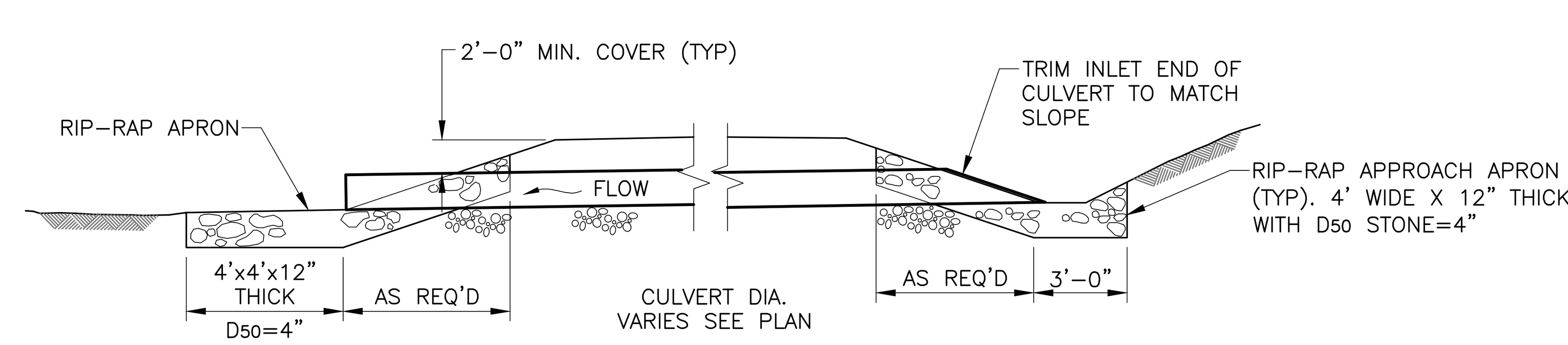
STOCKPILE DETAIL
N.T.S.



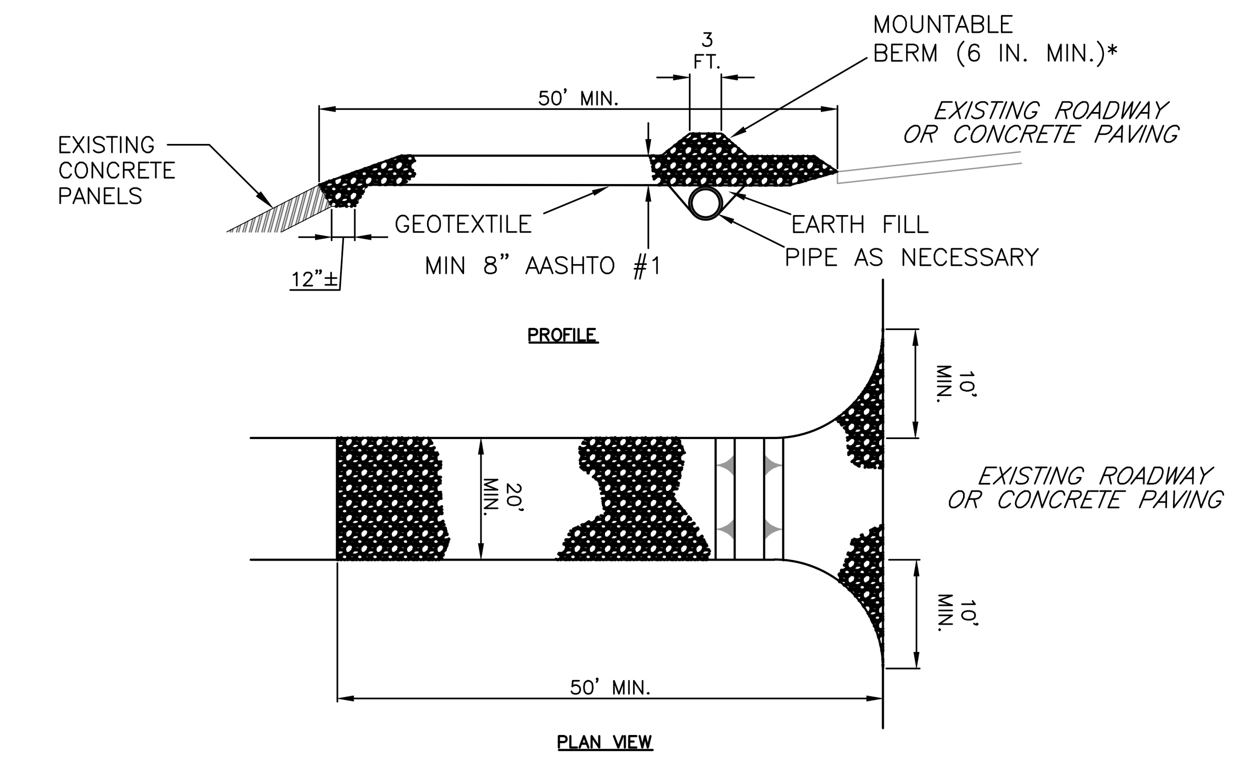
TYPICAL DITCH SECTION
N.T.S.



TYPICAL LIGHT RIP RAP DITCH SECTION
N.T.S.



TYPICAL CULVERT DETAIL
N.T.S.



* MOUNTABLE BERM USED TO PROVIDE PROPER COVER FOR PIPE

NOTES:

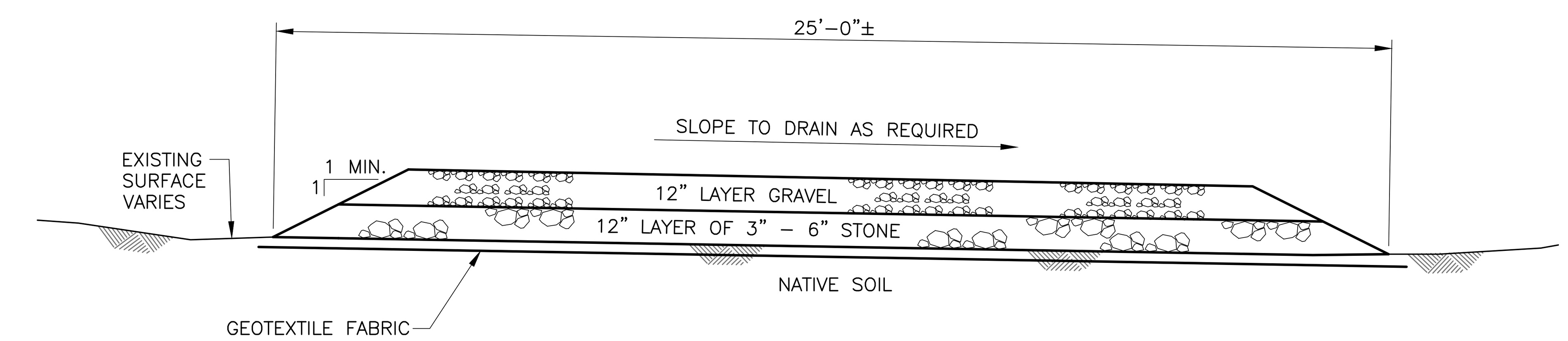
REMOVE TOPSOIL PRIOR TO INSTALLATION OF ROCK CONSTRUCTION ENTRANCE. EXTEND ROCK OVER FULL WIDTH OF ENTRANCE.

RUNOFF SHALL BE DIVERTED FROM ROADWAY TO A SUITABLE SEDIMENT REMOVAL BMP PRIOR TO ENTERING ROCK CONSTRUCTION ENTRANCE.

MOUNTABLE BERM SHALL BE INSTALLED WHEREVER OPTIONAL CULVERT PIPE IS USED AND PROPER PIPE COVER AS SPECIFIED BY MANUFACTURER IS NOT OTHERWISE PROVIDED. PIPE SHALL BE SIZED APPROPRIATELY FOR SIZE OF DITCH BEING CROSSED.

MAINTENANCE: ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY. IF EXCESSIVE AMOUNTS OF SEDIMENT ARE BEING DEPOSITED ON ROADWAY, EXTEND LENGTH OF ROCK CONSTRUCTION ENTRANCE BY 50 FOOT INCREMENTS UNTIL CONDITION IS ALLEVIATED OR INSTALL WASH RACK. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER DRAINAGE COURSES IS NOT ACCEPTABLE.

ROCK CONSTRUCTION ENTRANCE
N.T.S.



TYPICAL TEMPORARY ACCESS ROAD CROSS SECTION
N.T.S.

NOTES:

1. FINAL ACCESS ROAD DETAILS PER CONTRACTOR DESIGN.
2. OVERALL CONFIGURATION AND SIZING OF ACCESS ROAD TO BE WITHIN THE REQUIREMENTS OF THE PERMIT.
3. CONTRACTOR SHALL SELECT A GEOTEXTILE FABRIC SUITABLE FOR THE EXISTING SITE CONDITIONS AND THE PROPOSED ACCESS ROAD DESIGN AND SUBMIT IT FOR APPROVAL BY OWNER. GEOTEXTILE FABRIC SHALL BE STRONG ENOUGH TO ALLOW FOR COMPLETE REMOVAL AFTER COMPLETION OF THE WORK. GEOTEXTILE FABRIC SHALL BE STRONG ENOUGH TO AVOID TEARING AND LOSS OF ROAD MATERIAL INTO THE NATIVE SOIL. REGARDLESS OF SUBMITTAL ACCEPTANCE BY OWNER, CONTRACTOR SHALL BE RESPONSIBLE TO APPROPRIATELY RESTORE SITE (AS DIRECTED BY THE RESOURCE AGENCIES) IF THE GEOTEXTILE ALLOWS ROAD MATERIALS TO MIX WITH THE NATIVE SOIL CONTRACTOR SHALL REMOVE ALL ROAD MATERIALS (INCLUDING GEOTEXTILE FABRIC) IN THEIR ENTIRETY AFTER CONSTRUCTION IS COMPLETE.
4. **CONTRACTOR TO REPAIR/REPLACE DAMAGED CONCRETE PANELS ON ESPLANADE.**

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
EROSION & SEDIMENT CONTROL NOTES & DETAILS

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No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-02

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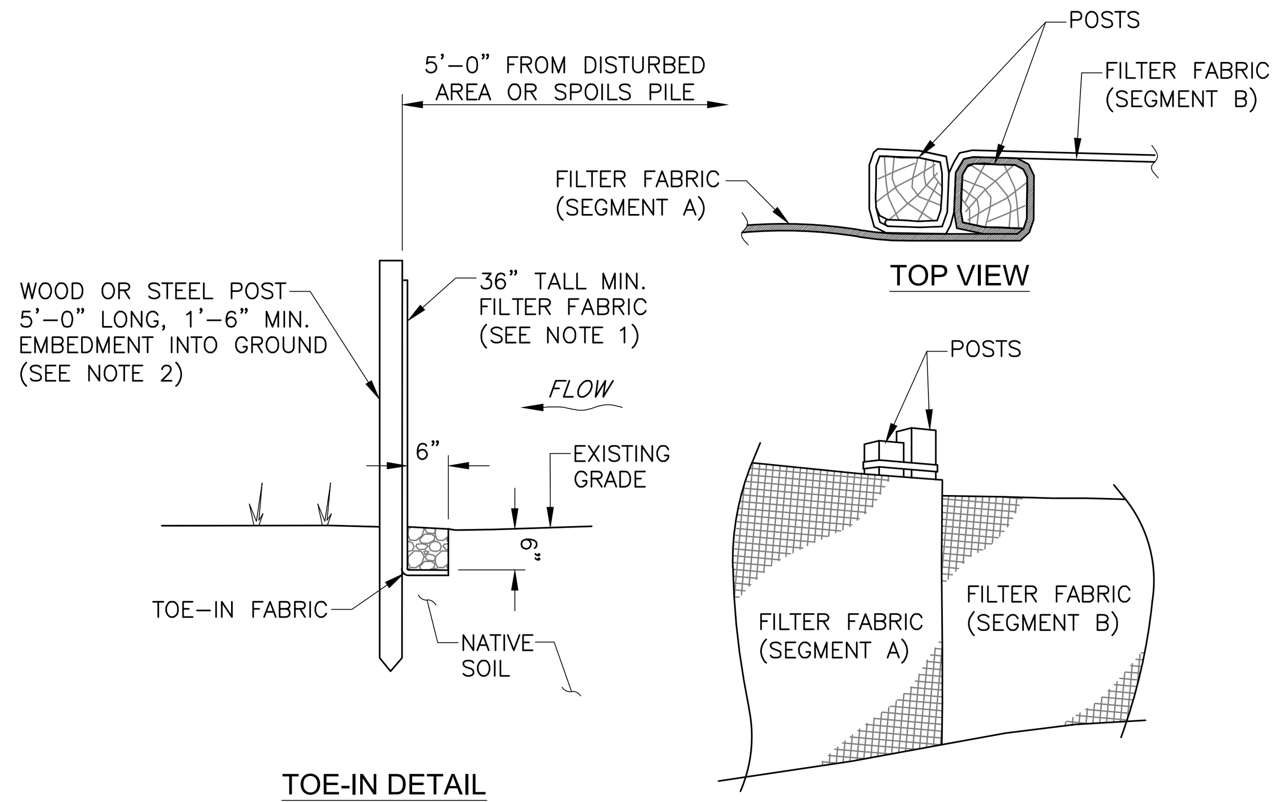
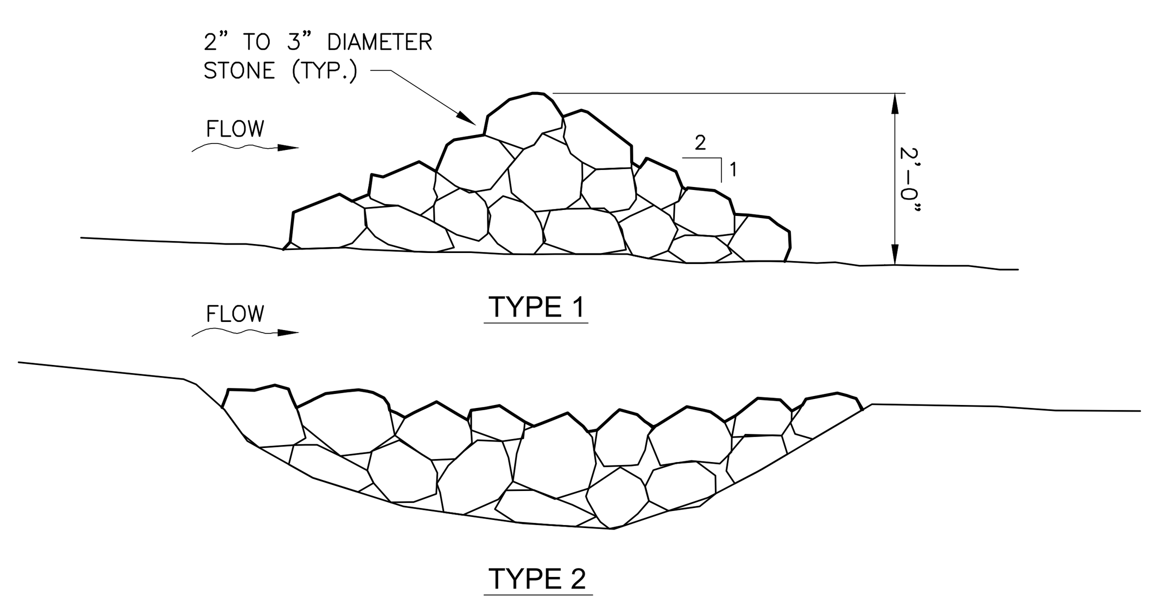
22x34 = FULL SCALE



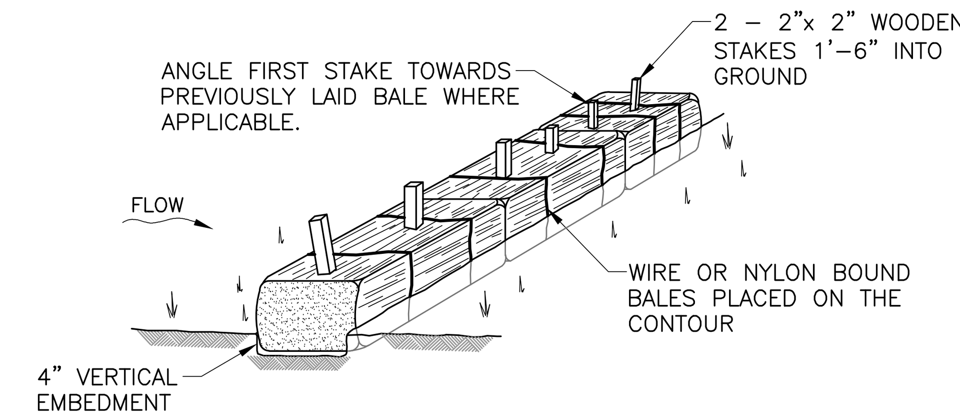
NOTES:

1. SILT FENCE SHALL BE ENVIROFENCE AS MANUFACTURED BY MIRAFI INC, PROPEX SILT STOP AS MANUFACTURED BY AMOCO FABRICS CO. OR EQUAL.
2. POST SPACING SHALL BE 10 FT. CENTER TO CENTER IF WIRE REINFORCED SILT FENCE IS USED OR 6 FT CENTER TO CENTER IF NO WIRE REINFORCEMENT IS USED.
3. LOCATE DOWN-GRADIENT OF ALL DISTURBED AREAS AND TEMPORARY STOCKPILES. PLACE ALONG CONTOURS AT UNIFORM ELEVATION. BOTH ENDS OF EACH FENCE SECTION MUST BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT
4. SEDIMENT MUST BE REMOVED WHERE ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE FENCE.
5. SILT FENCE TO BE INSPECTED AFTER EACH RUNOFF EVENT AND AT LEAST WEEKLY AND REPAIRED/MAINTAINED AS NEEDED.

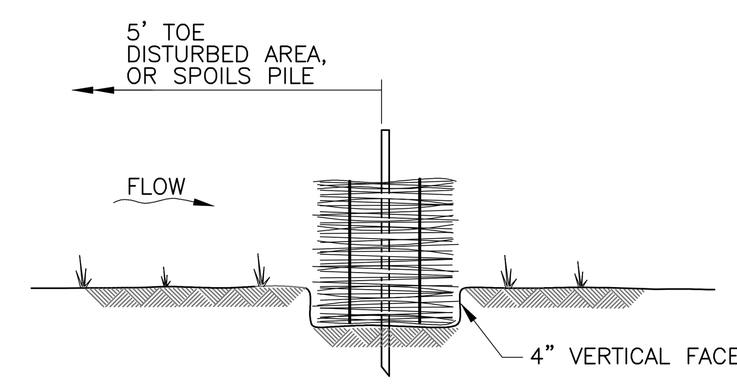
SILT FENCE DETAIL
N.T.S.



TYPICAL STONE CHECKDAM
1/2"= 1'-0"



TYPICAL STRAW OR HAY BALE DIKE
N.T.S



HAY BALE EMBEDDING DETAIL
N.T.S.

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
EROSION & SEDIMENT CONTROL DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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RJC	BJL	JLD	1349-009	08-01-24	210-03

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SITE PLAN

1"= 20'

20 0 20 40

SCALE IN FEET

22x34 = FULL SCALE

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LEGEND

DEMO AREA

COFFERDAM

ROCK ANCHOR (SEE DRAWING **210-10 & 11**)

NOTES:

1.) DRAWING ELEVATIONS ARE IN NAVD88 DATUM. USACE DATUM = PLANT DATUM NAVD88 = USACE – 3.13'

2.) EXISTING MITER GATE ARM SLOTS: CLEAN SLOTS OF DEBRIS & LOOSE MATERIAL. FILL WITH CLASS I CONCRETE REINFORCED WITH #5 @ 12 E.W.

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-04

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LOCK No. 11

TEMPORARY CONDITIONS
COFFERDAM AND DEMOLITION PLAN

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22x34 = FULL SCALE

LEGEND

- DEMO AREA
- COFFERDAM
- EXISTING CONCRETE

NOTE:
1. DRAWING ELEVATIONS ARE IN NAVD 88. NAVD88 = USACE − 3.1'
2. UPSTREAM COFFERDAM WILL OVERTOP AT EL. 589.7' AT A RIVER FLOW OF APPROX. 15,132 CFS.
3. DOWNSTREAM COFFERDAM WILL OVERTOP AT EL. 570.5' AT A RIVER FLOW OF APPROX. TBD CFS.
4. DO NOT OBSTRUCT OR OTHERWISE IMPEDE THE OPERATION OF THE 4 BACK FLOW GATES IN THE DOWNSTREAM COFFERDAM.

DEWATERING OF LOCK SHALL NOT BE PERFORMED UNTIL ANCHORS IN LOCK WALL ARE INSTALLED

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

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LOCK No. 11

TEMPORARY CONDITIONS
COFFERDAMS AND DEMOLITION SECTION THROUGH LOCK

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-05

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PLAN
1/2"= 1'-0"

SCALE IN FEET

NOTES:

1. **REUSE COFFERDAM MATERIAL FROM HEIDELBURG (LOCK 14) WHERE POSSIBLE.**
2. COFFERDAM BEAM POCKETS SHOWN ON **CORP DWG K11-200 1/1.** DIMENSIONS ARE UNKNOWN AS THEY WERE MODIFIED AFTER ORIGINAL CONSTRUCTION. FIELD CONFIRM FIT OF W18x86 PRIOR TO FINALIZING ANY NEW FABRICATION OR INSTALLATION PLANS.
3. NO PAINTING REQUIRED.
4. PANEL WEIGHTS
   8' WIDE PANEL (No. 1, 2, 3, 5, 6, 7): ~2,240 LBS.
   4' WIDE PANEL (No. 4): ~1,120 LBS.
   NEW PANEL (No. 8): FIELD CUT TO FIT ~1,340 LBS.
- FILLER GATE LOCATED IN PANEL 4, **SEE SHEET 210-08.**
6. DRAWING ELEVATIONS ARE IN NAVD 88. NAVD 88 = USACE − 3.1'

LEGEND

NEW STEEL FABRICATION

STATE OF KENTUCKY
JULIAN L. DAVIS
32587
LICENSED
PROFESSIONAL ENGINEER
8/1/24

No.	Revision	Date	Drawn	Checked
2	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
1	UPDATED COFFERDAM INFORMATION	05-03-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
DOWNSTREAM COFFERDAM PLAN VIEW

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-06

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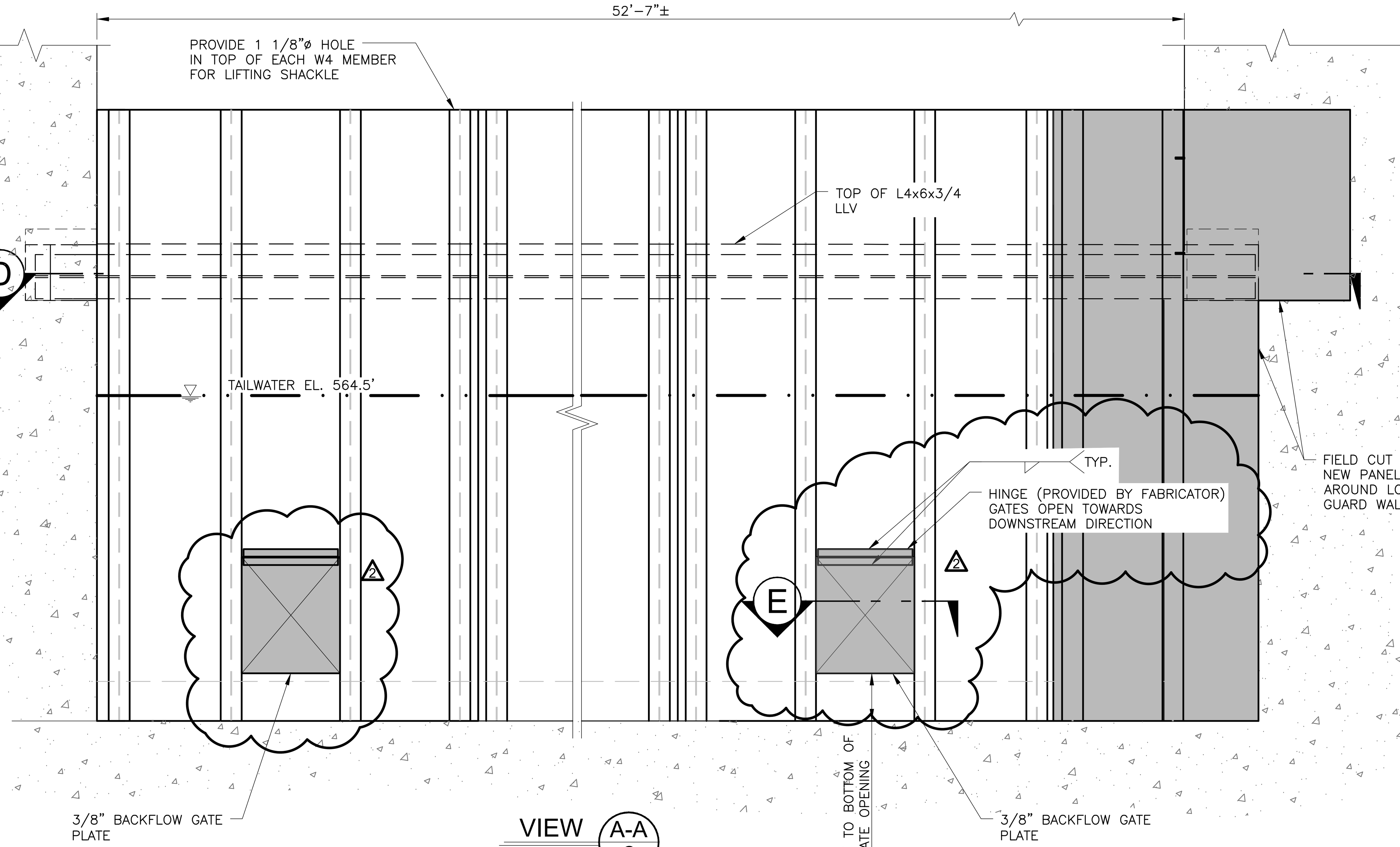
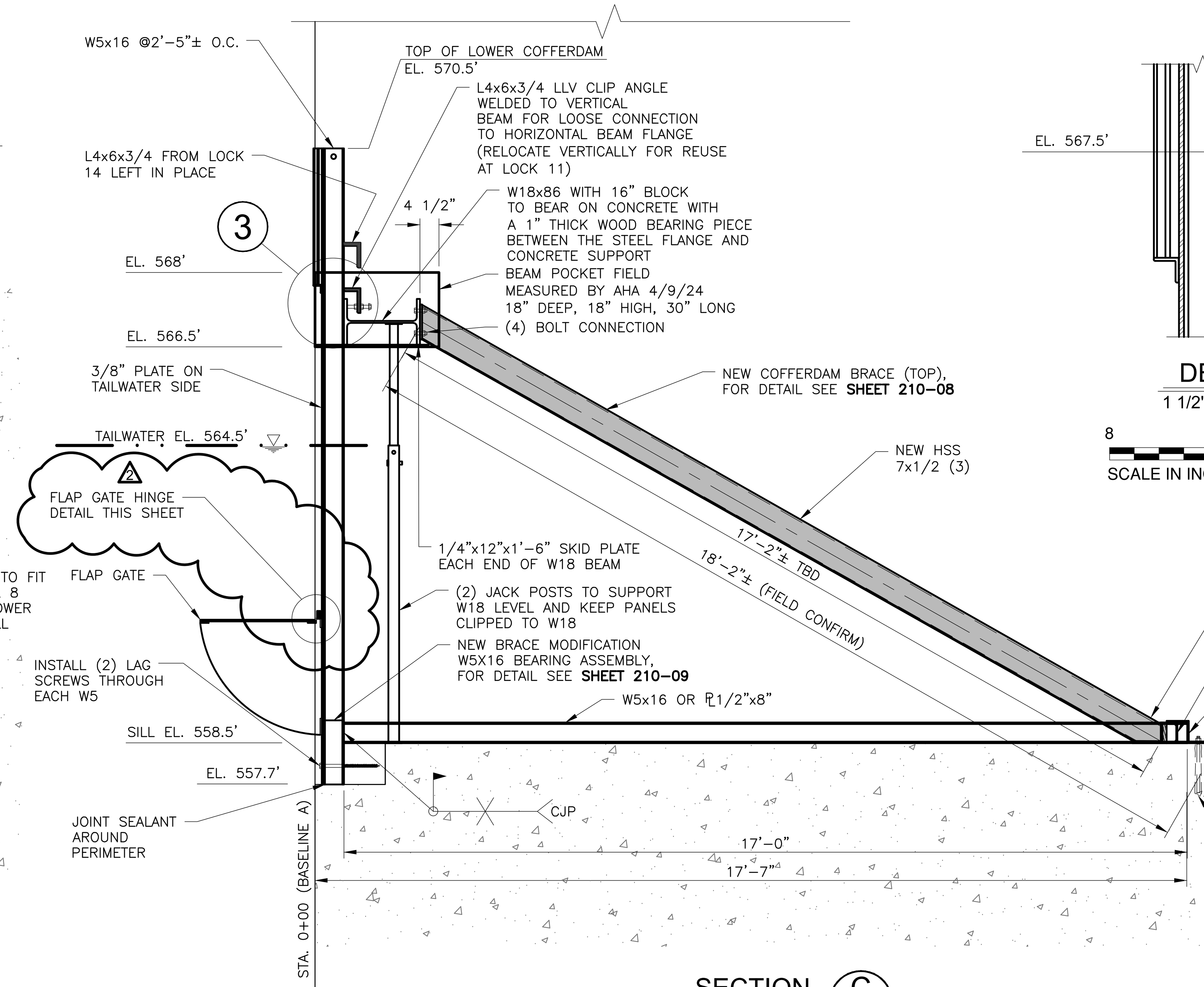
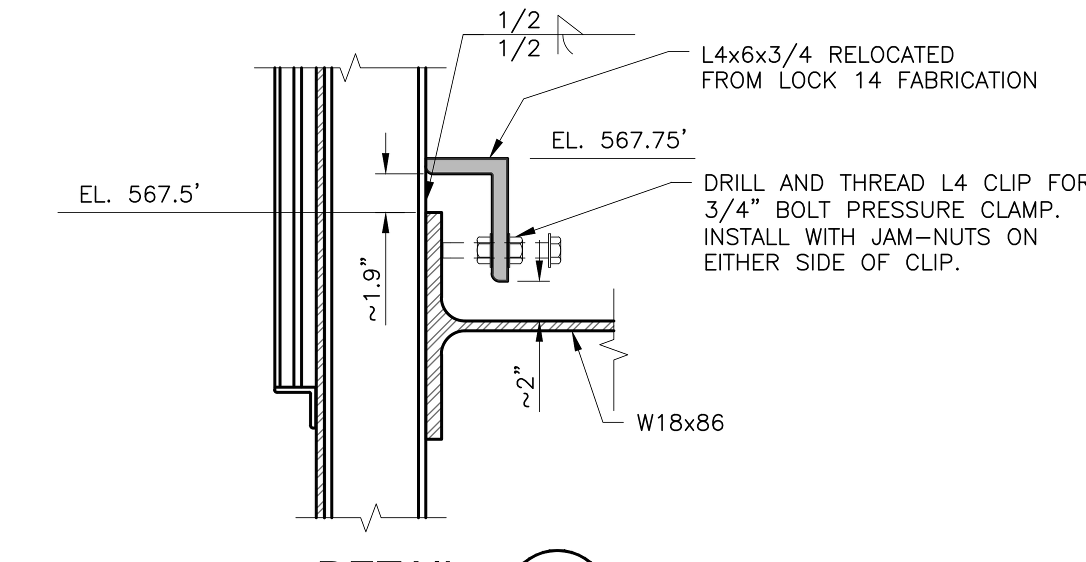
3"
2"
1"
0
22x34 = FULL SCALE



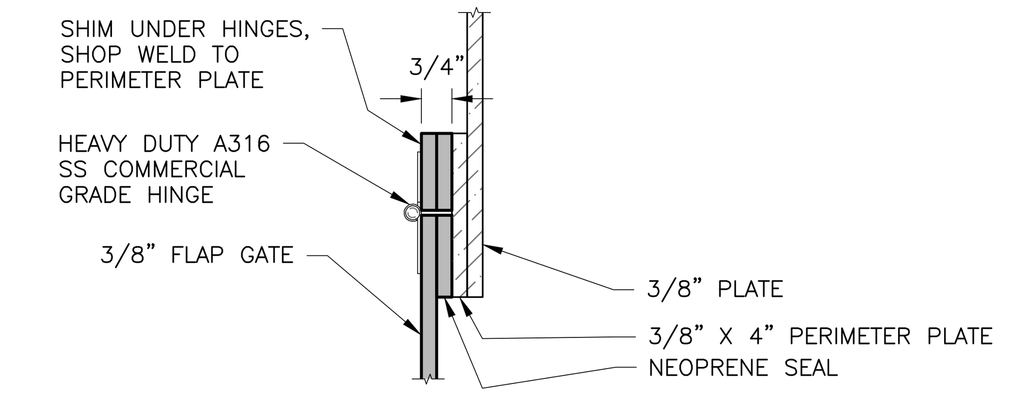
VIEW A-A / 6
1/2"= 1'-0"
NOTE: SKIN PLATE NOT SHOWN



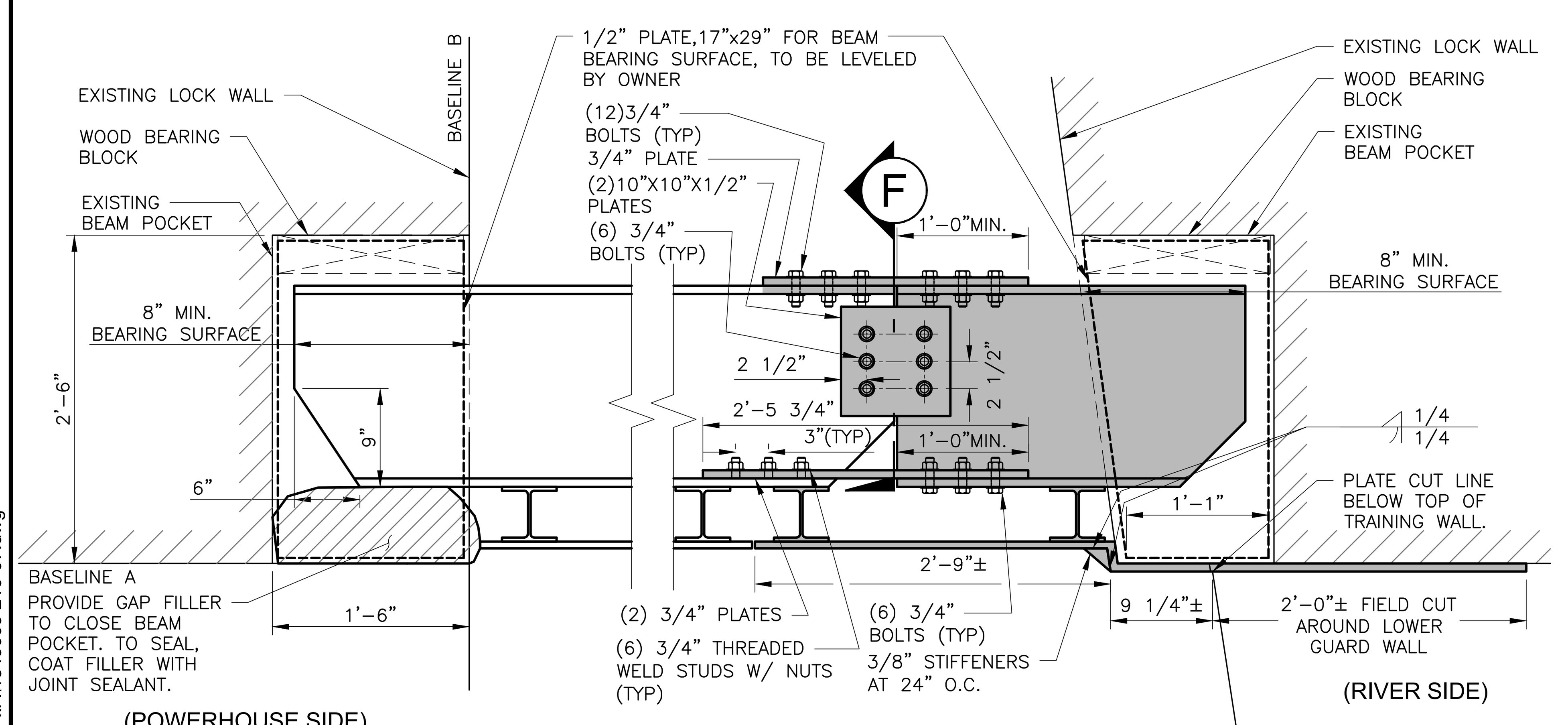
SECTION C / 6
1/2"= 1'-0"
2 0 2 4
SCALE IN FEET



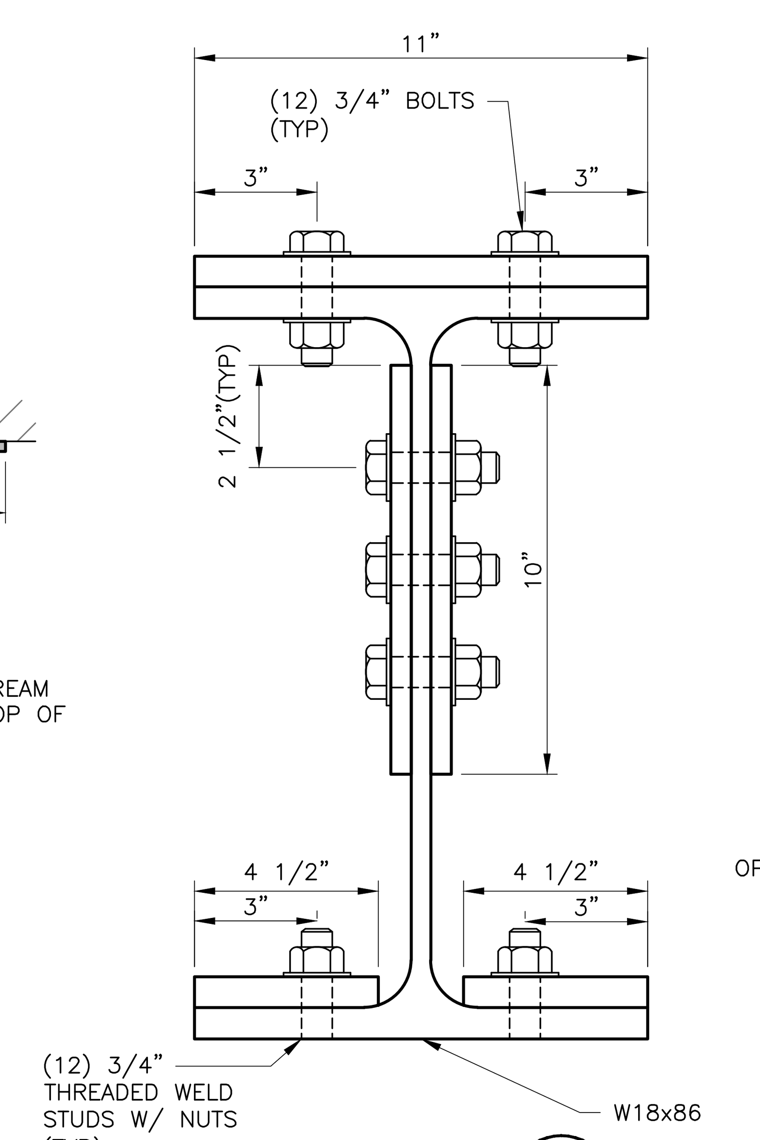
DETAIL 3
1 1/2"= 1'-0"
8 0 8 16
SCALE IN INCHES



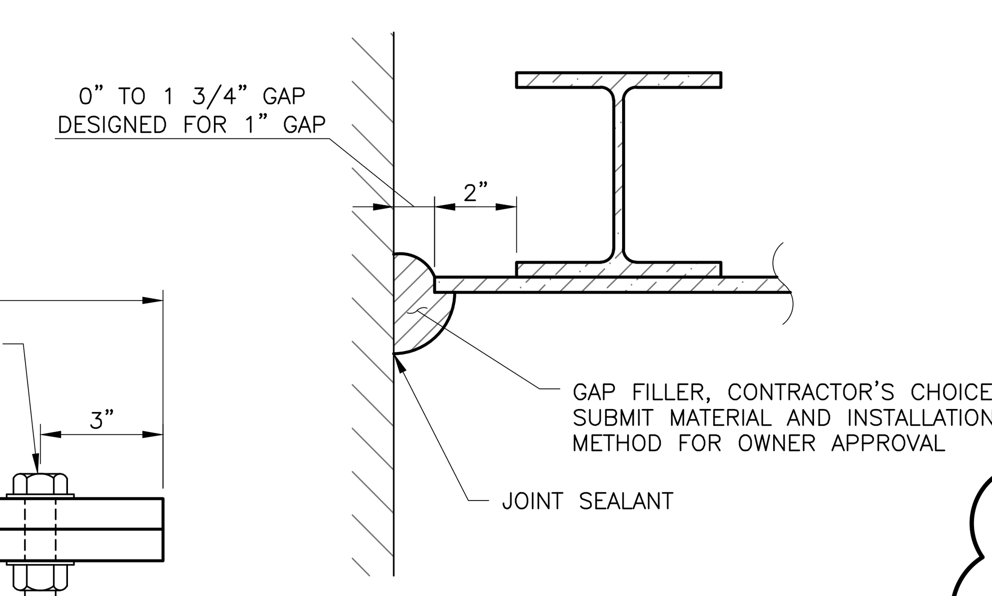
FLAP GATE HINGE DETAIL
3"= 1'-0"



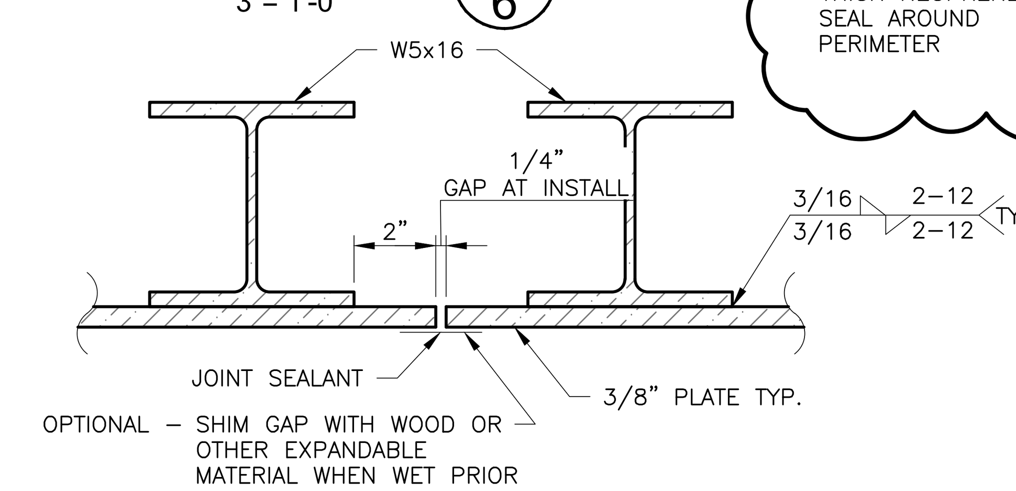
BEAM POCKET END SEAL SECTION D
1"= 1'-0"
1 0 1 2
SCALE IN FEET



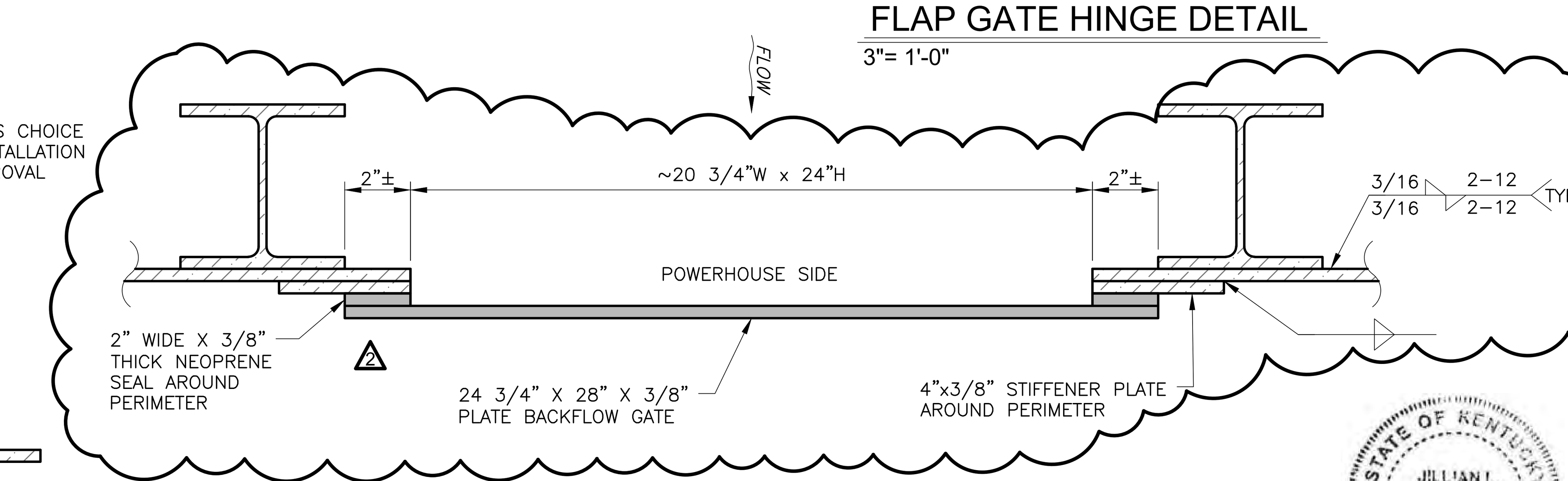
SECTION F
3"= 1'-0"



DETAIL 1 / 6
3"= 1'-0"



DETAIL 2 / 6
3"= 1'-0"



STEEL GATE SECTION E
3"= 1'-0"
3 0 3 6 9
SCALE IN INCHES

STATE OF KENTUCKY
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8/1/24

LEGEND

NEW STEEL FABRICATION

NOTES:
1. **REUSE COFFERDAM MATERIAL FROM HEIDELBURG (LOCK 14) WHERE POSSIBLE.**
2. PLYWOOD GATE:
   - 6 REQUIRED.
   - LOCATE 1 EACH IN EACH 8' WIDE PANEL.
3. JOINT SEALANT:
   - KOP-COAT A-788 SPLASHZONE BY CARBOLINE
   - SEASHIELD SPLASHZONE BY DENSO
   - FIELD INSTALLED
4. COFFERDAM DESIGN SHOWN FROM LOCK 12 AND 14 TO BE REUSED HERE AT LOCK 11. OWNER MAY MODIFY AS NEEDED WITH APPROVAL OF ENGINEER.
(4) BACKFLOW GATES MUST REMAIN LIGHT WEIGHT (PLYWOOD OR SIMILAR) FOR OPERATION.
5. DRAWING ELEVATIONS ARE IN NAVD 88. NAVD 88 = USACE - 3.1'

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
COFFERDAM DETAILS

No.	Revision	Date	Drawn	Checked
2	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
1	UPDATED COFFERDAM INFORMATION	05-03-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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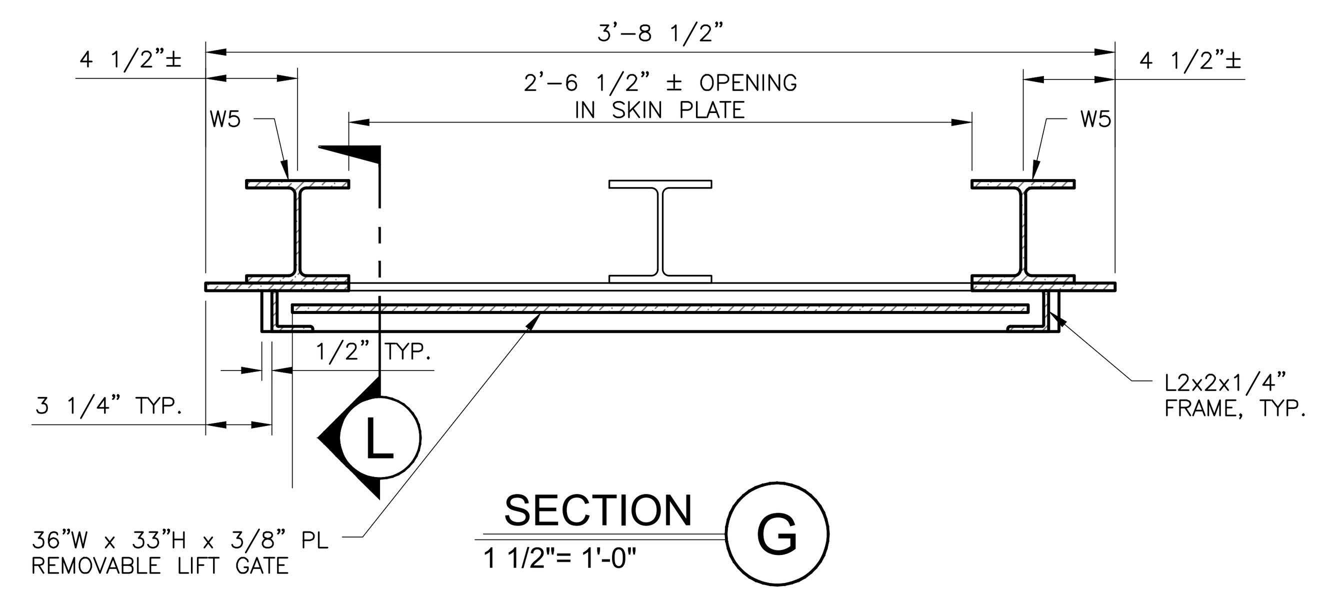
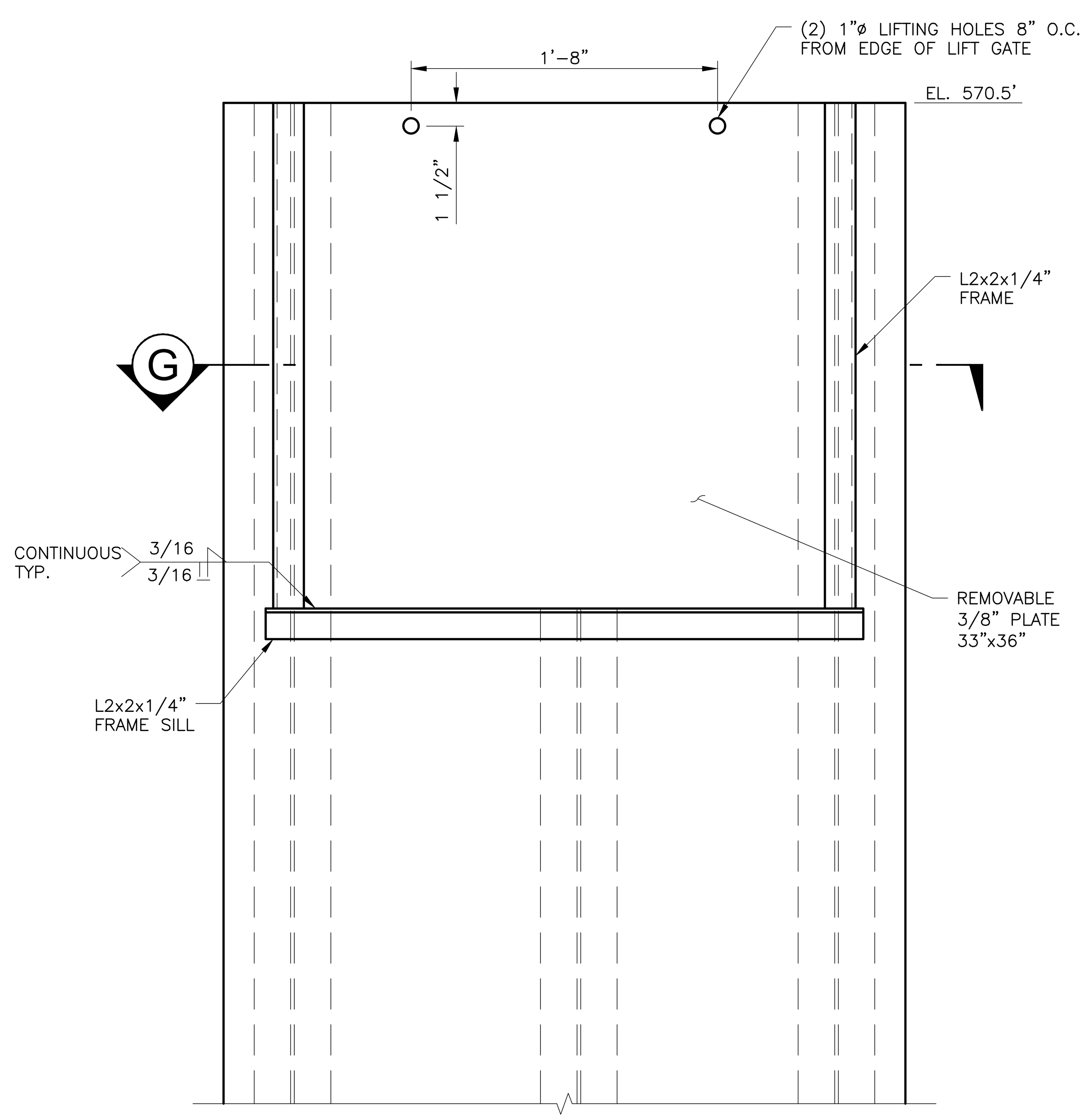
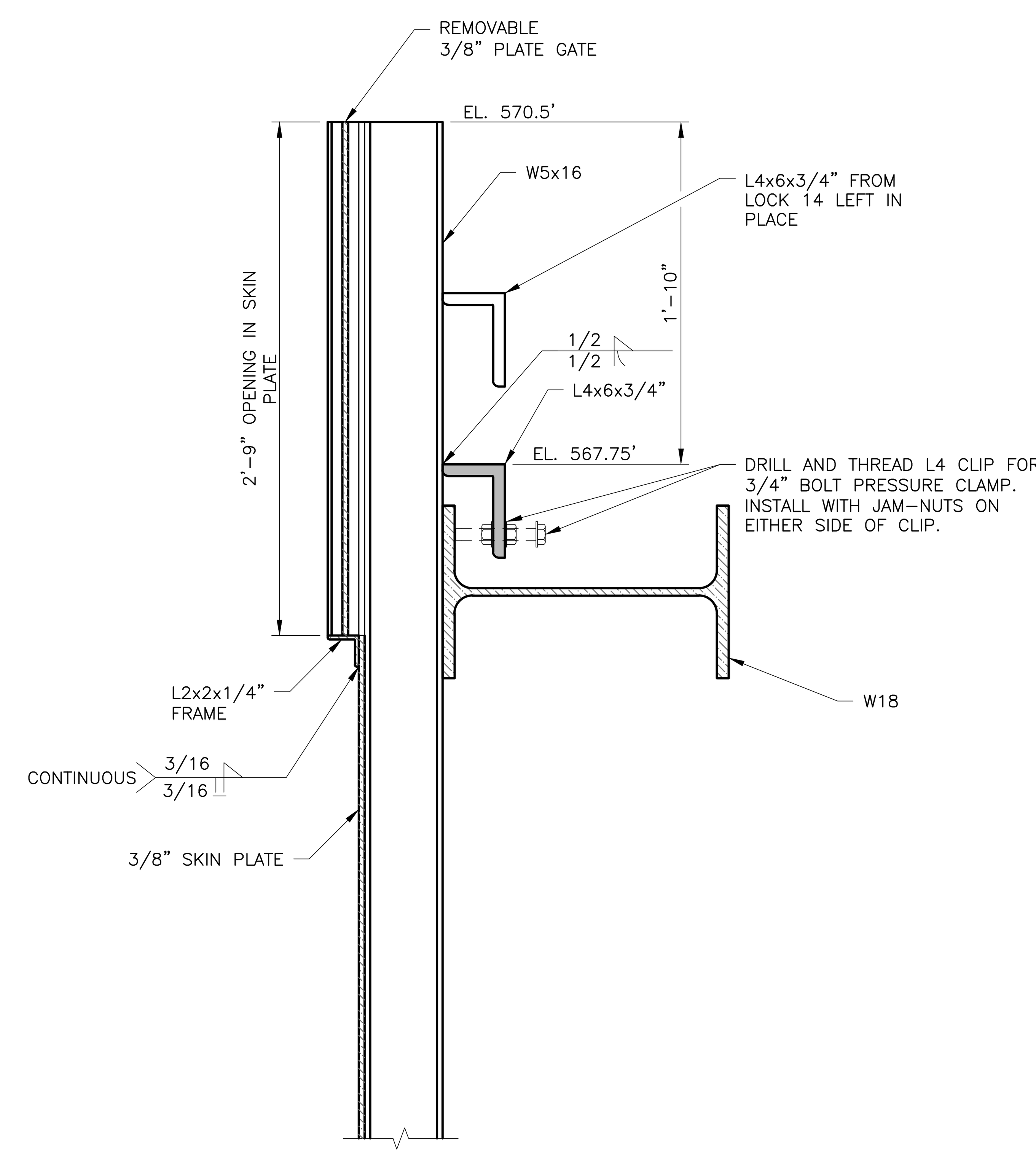
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-07



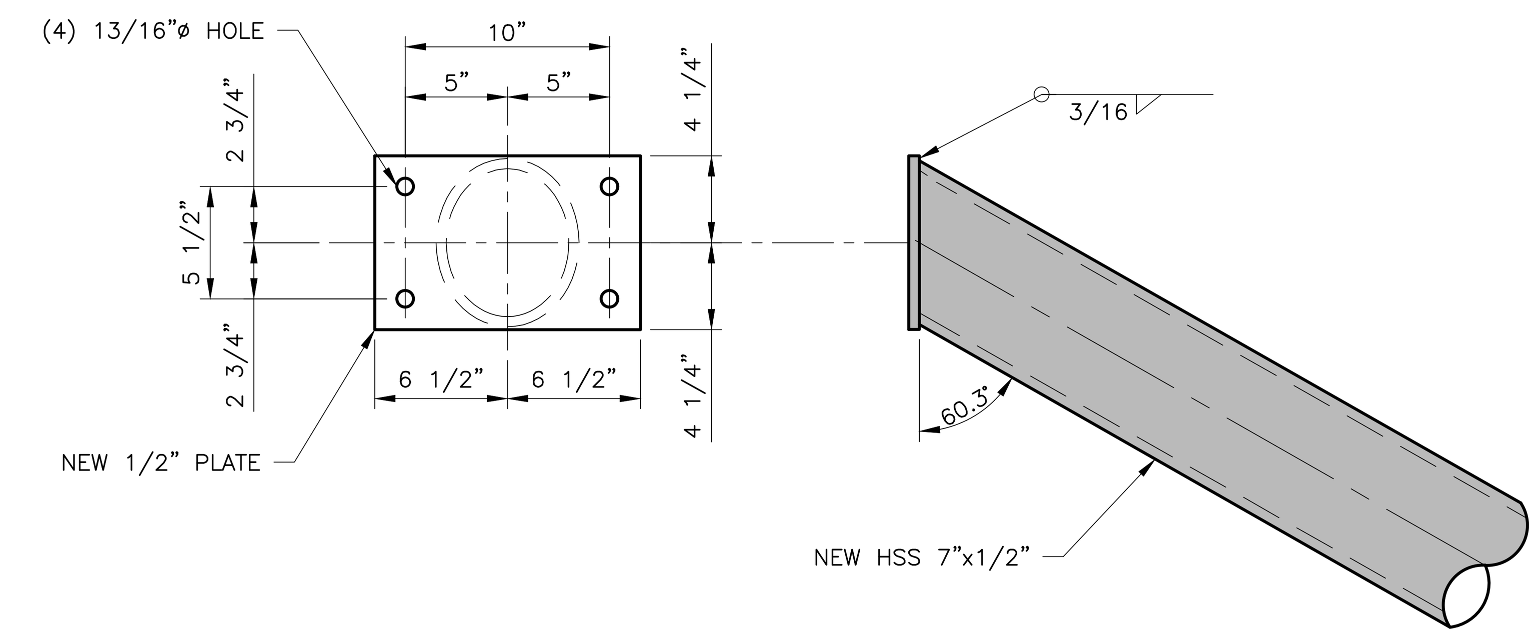
SECTION G
1 1/2"= 1'-0"



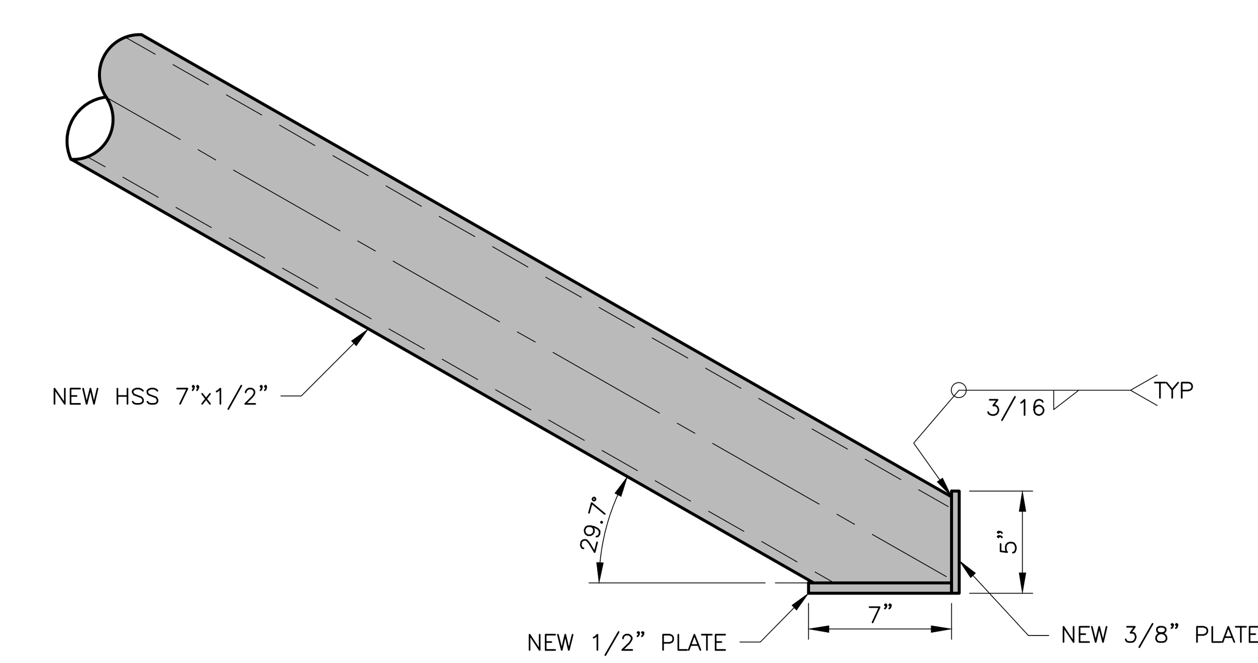
PANEL 4 ELEVATION
1 1/2"= 1'-0"



SECTION L
1 1/2"= 1'-0"



COFFERDAM BRACE EXTENSION (TOP) DETAIL
1 1/2"= 1'-0"



COFFERDAM BRACE EXTENSION (BOTTOM) DETAIL
1 1/2"= 1'-0"

LEGEND

NEW STEEL FABRICATION

NOTE:
1. **REUSE COFFERDAM MATERIAL FROM RAVENNA (LOCK 12) WHERE POSSIBLE.**
2. DRAWING ELEVATIONS ARE IN NAVD 88. NAVD 88 = USACE − 3.8'

8 0 8 16
SCALE IN INCHES

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
COFFERDAM FILL GATE - PANEL 4 AND DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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RJC	BJL	JLD	1349-009	08-01-24	210-08

22x34 = FULL SCALE

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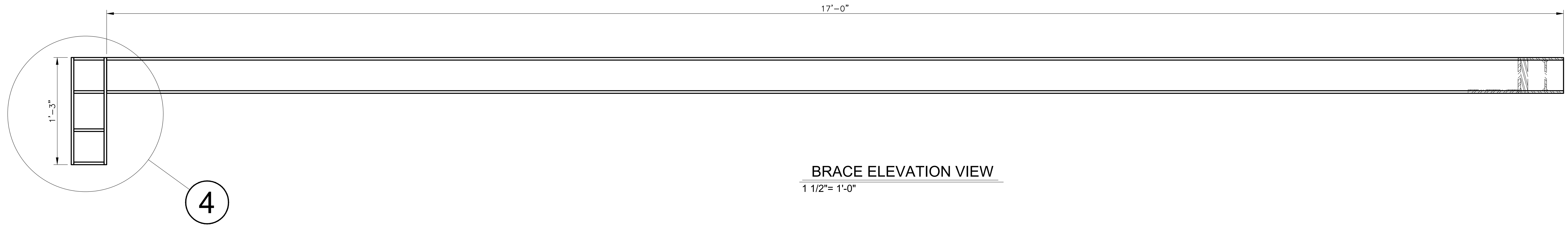
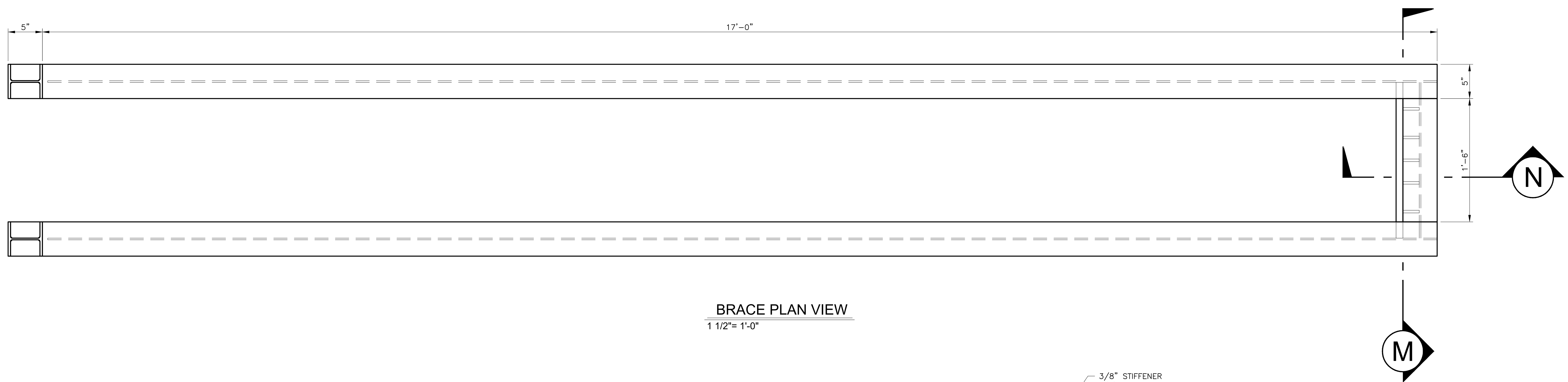
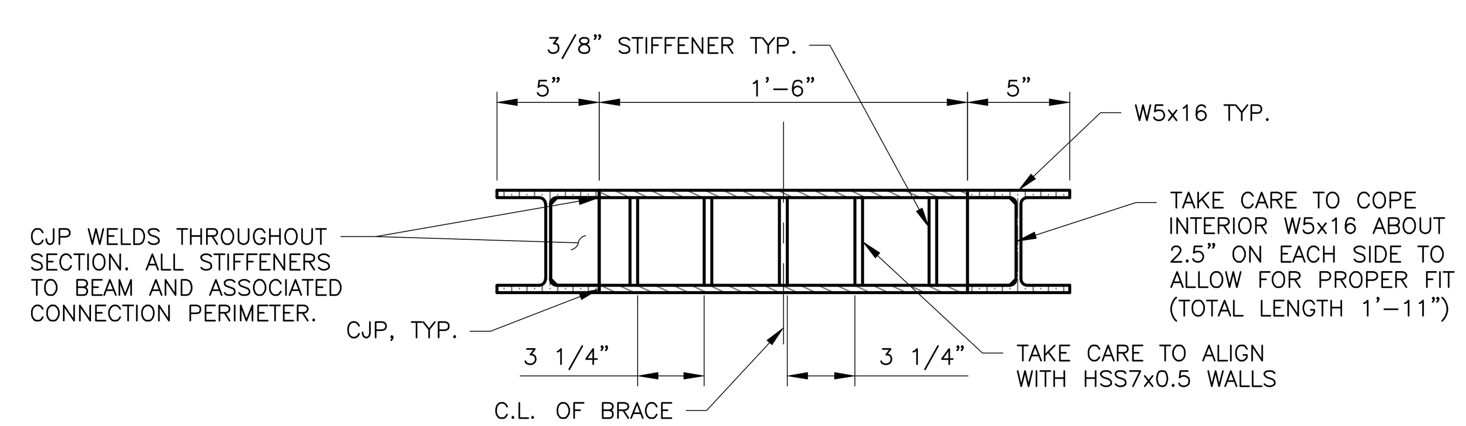


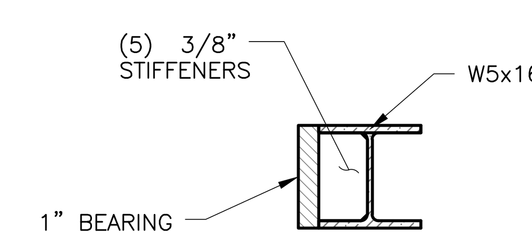
BRACE ELEVATION VIEW
1 1/2"= 1'-0"



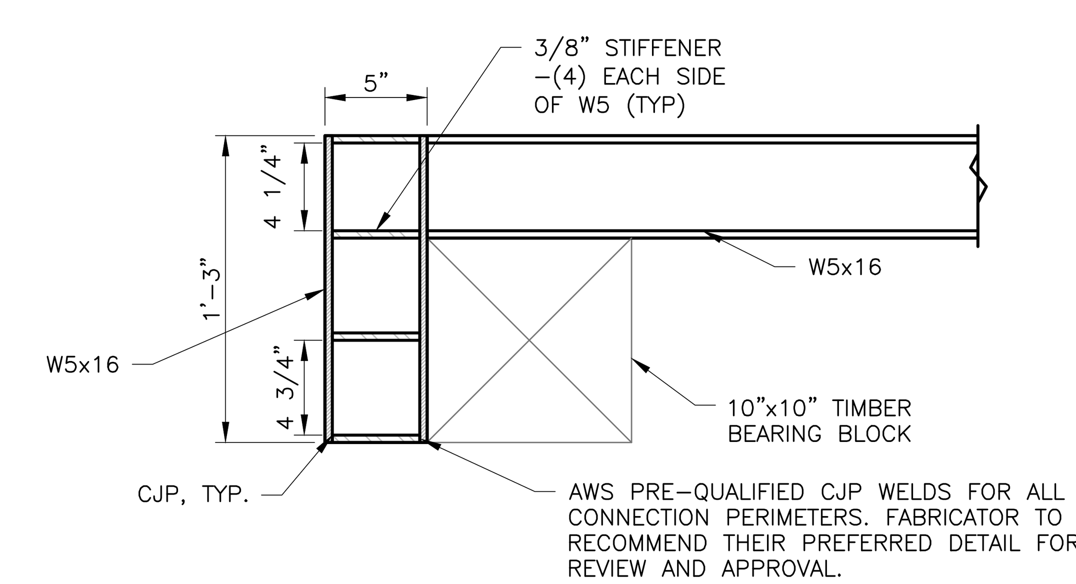
BRACE PLAN VIEW
1 1/2"= 1'-0"



SECTION M
1 1/2"= 1'-0"



SECTION N
1 1/2"= 1'-0"



DETAIL 4
1-1/2"= 1'-0"

LEGEND

NEW STEEL FABRICATION

NOTE:
1. **REUSE COFFERDAM MATERIAL FROM RAVENNA (LOCK 14) WHERE POSSIBLE.**
2. DRAWING ELEVATIONS ARE IN NAVD 88. NAVD 88 = USACE – 3.1'

8 0 8 16
SCALE IN INCHES

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
DOWNSTREAM COFFERDAM MODIFICATION DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-09

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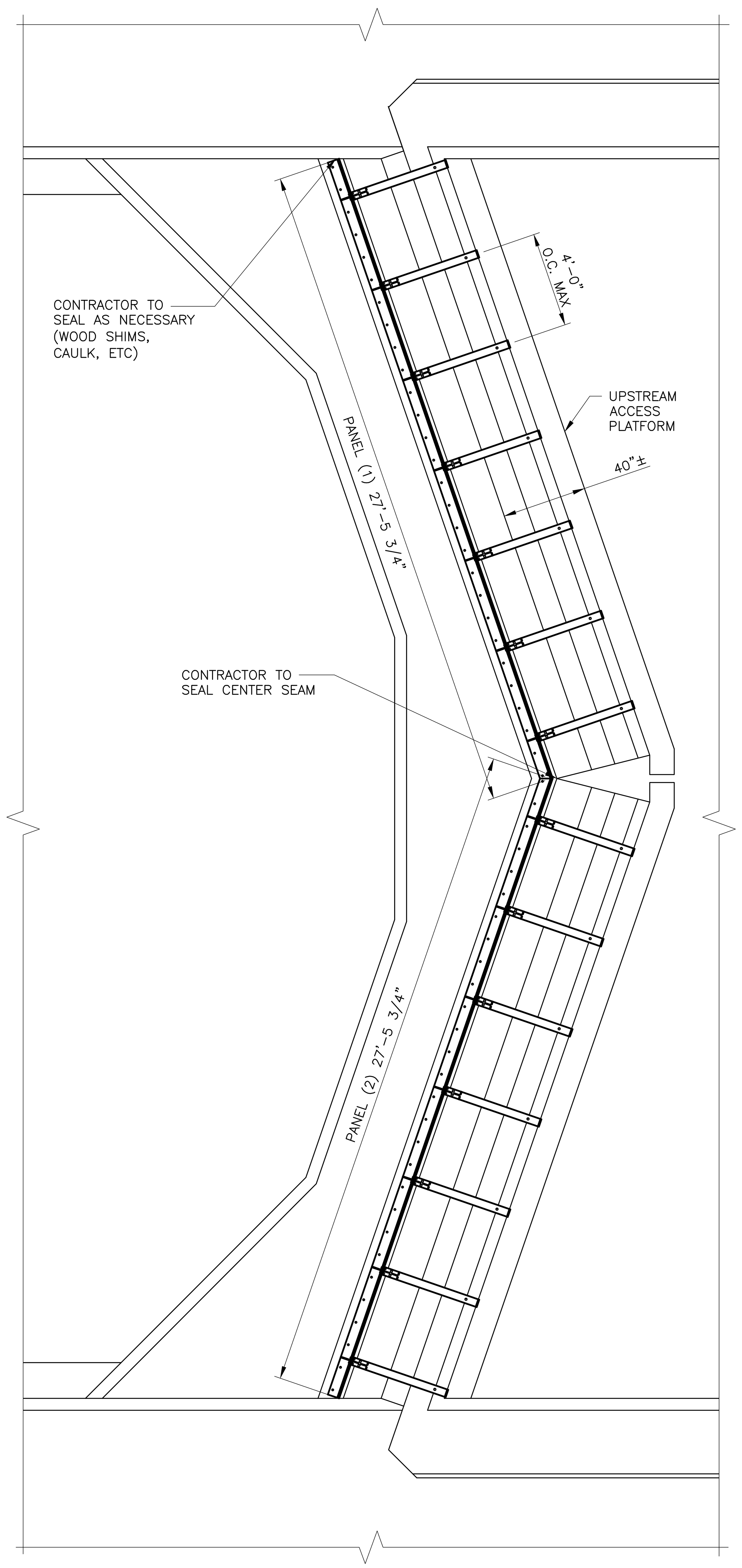
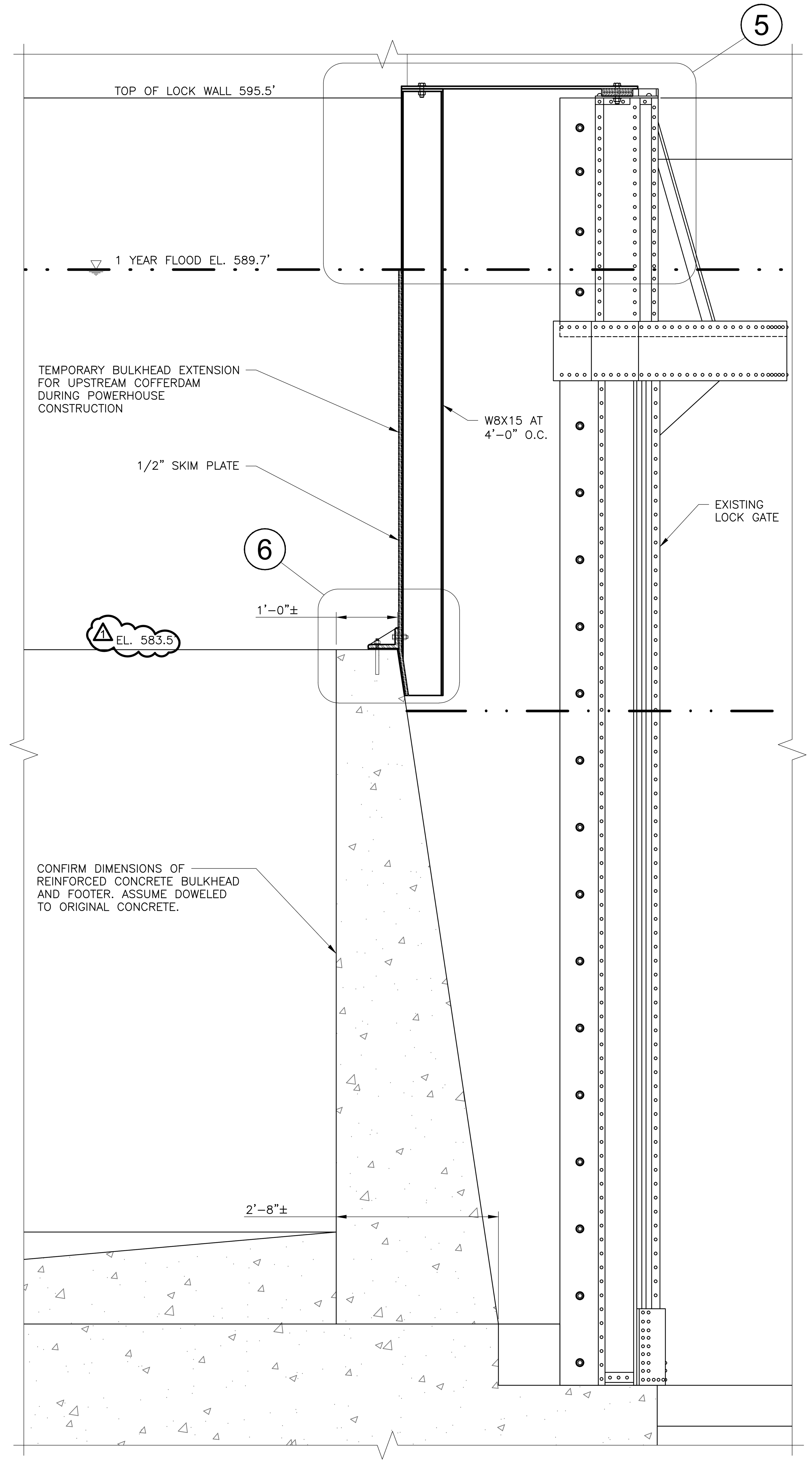
3"
2"
1"
0
22x34 = FULL SCALE



UPSTREAM BULKHEAD EXTENSION PLAN

1/4"= 1'-0"

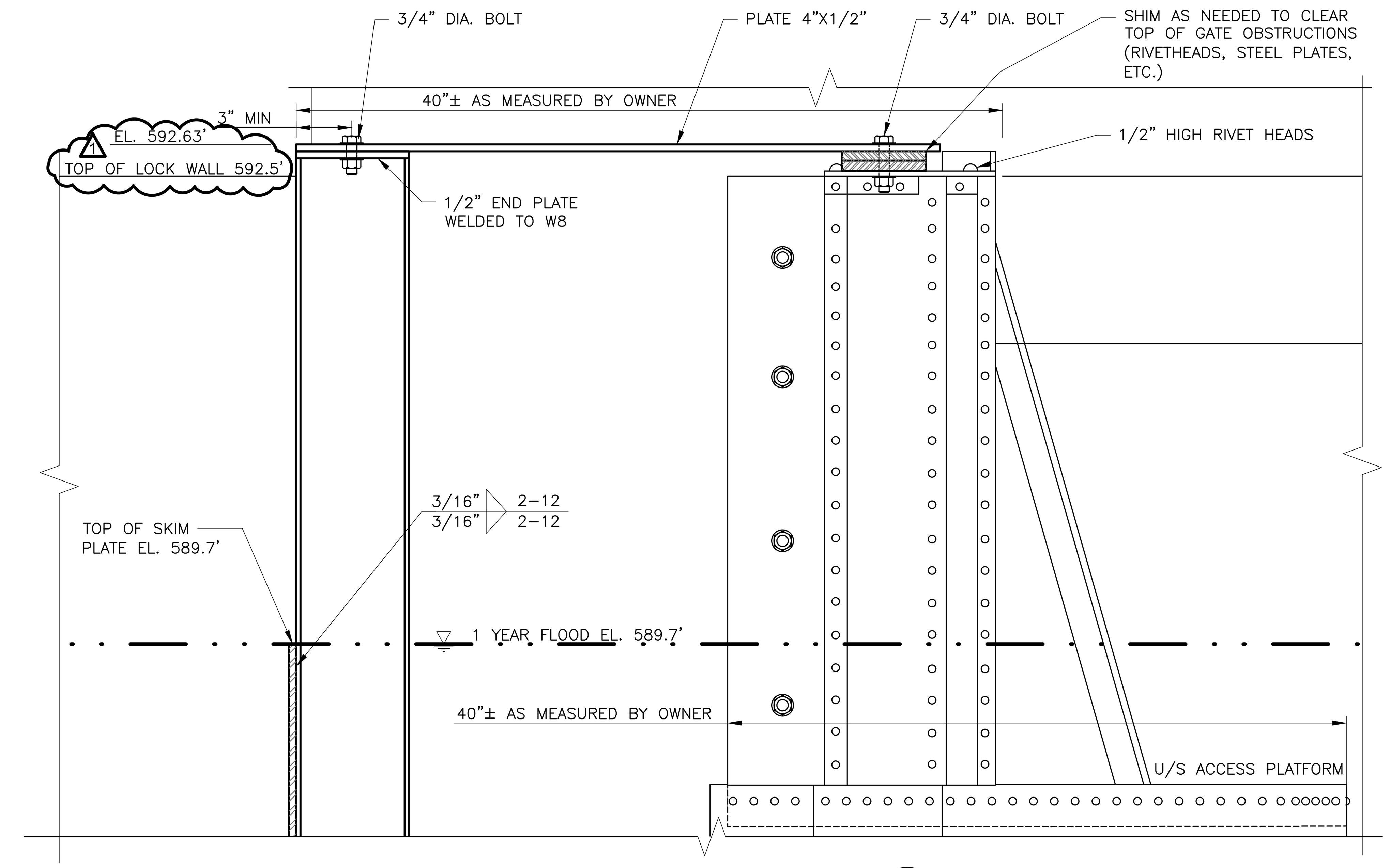
4 0 4 8
SCALE IN FEET



UPSTREAM BULKHEAD EXTENSION SECTION

3/4"= 1'-0"

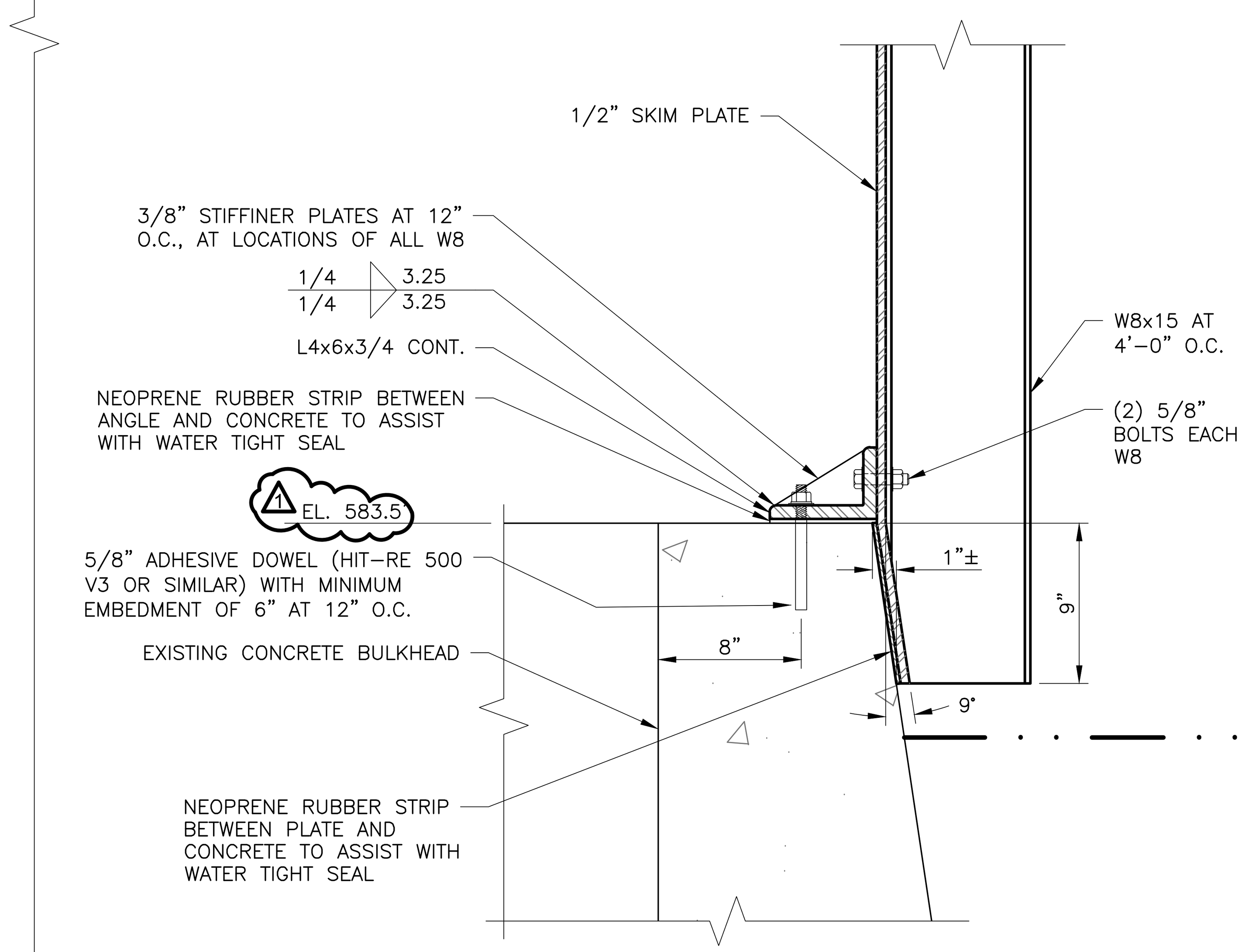
1 0 1 2 3
SCALE IN FEET



TYPICAL TOP CONNECTION DETAIL 5

1 1/2"= 1'-0"

NOTE:
MINIMUM GATE STEEL THICKNESS FOR CONNECTION TO TOP OF GATE IS 1/4", IF THINNER THAN 1/4" ADVISE ENGINEER.



TYPICAL BOTTOM CONNECTION DETAIL 6

1 1/2"= 1'-0"

8 0 8 16
SCALE IN INCHES

NOTES:
1. UPSTREAM COFFERDAM TO BE FABRCATED IN 2 PANEL SECTIONS.
2. FABRICATOR TO PROVIDE ASSEMBLED PANEL WEIGHTS.
3. CONTRACTOR TO INSTALL PANELS. SEAL BETWEEN GAPS BETWEEN PANELS AND GAS AT CONCRETE LOCK WALLS AS NEEDED.

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
UPSTREAM COFFERDAM DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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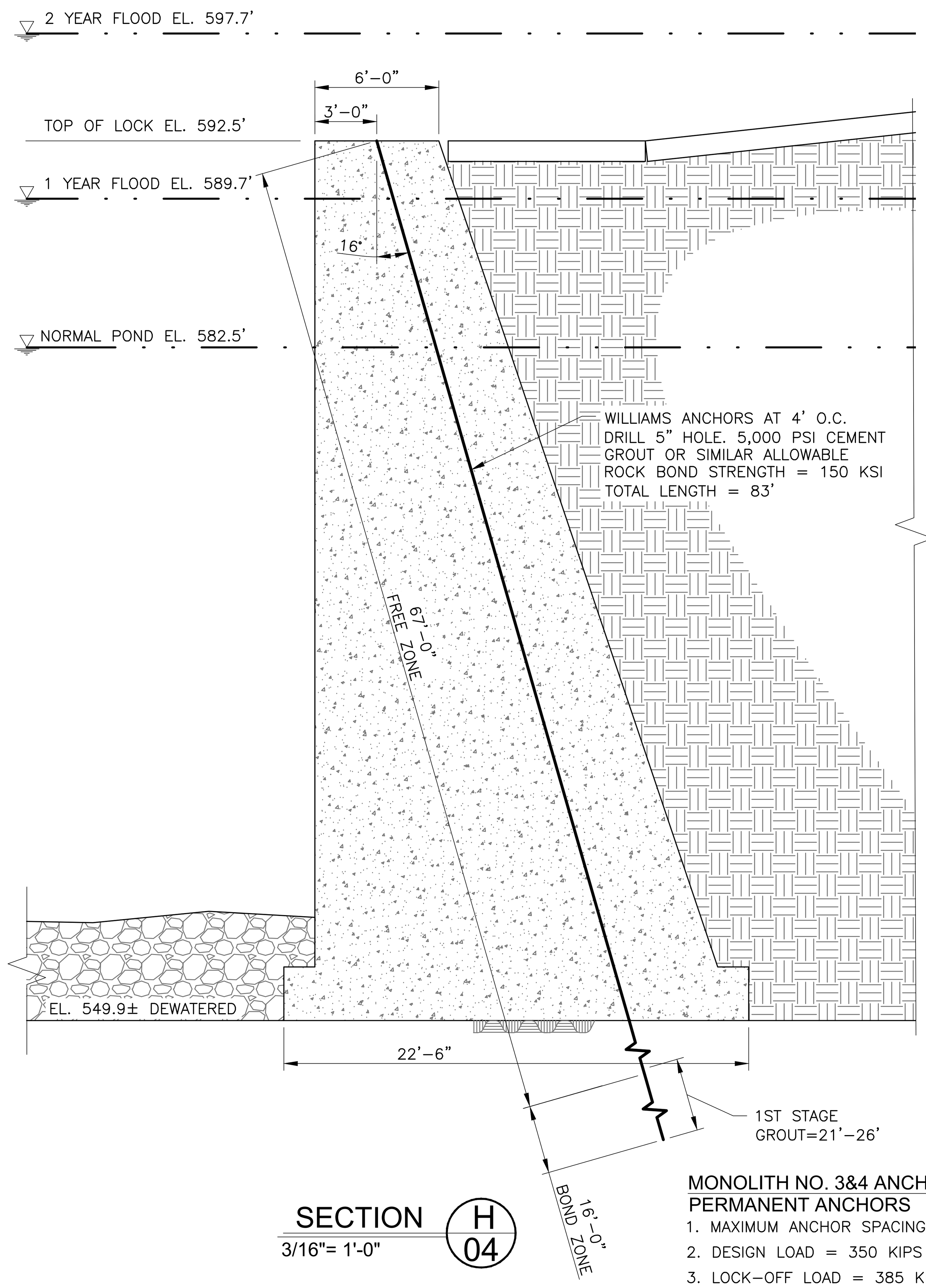
RJC	BJL	JLD	1349-009	08-01-24	210-10

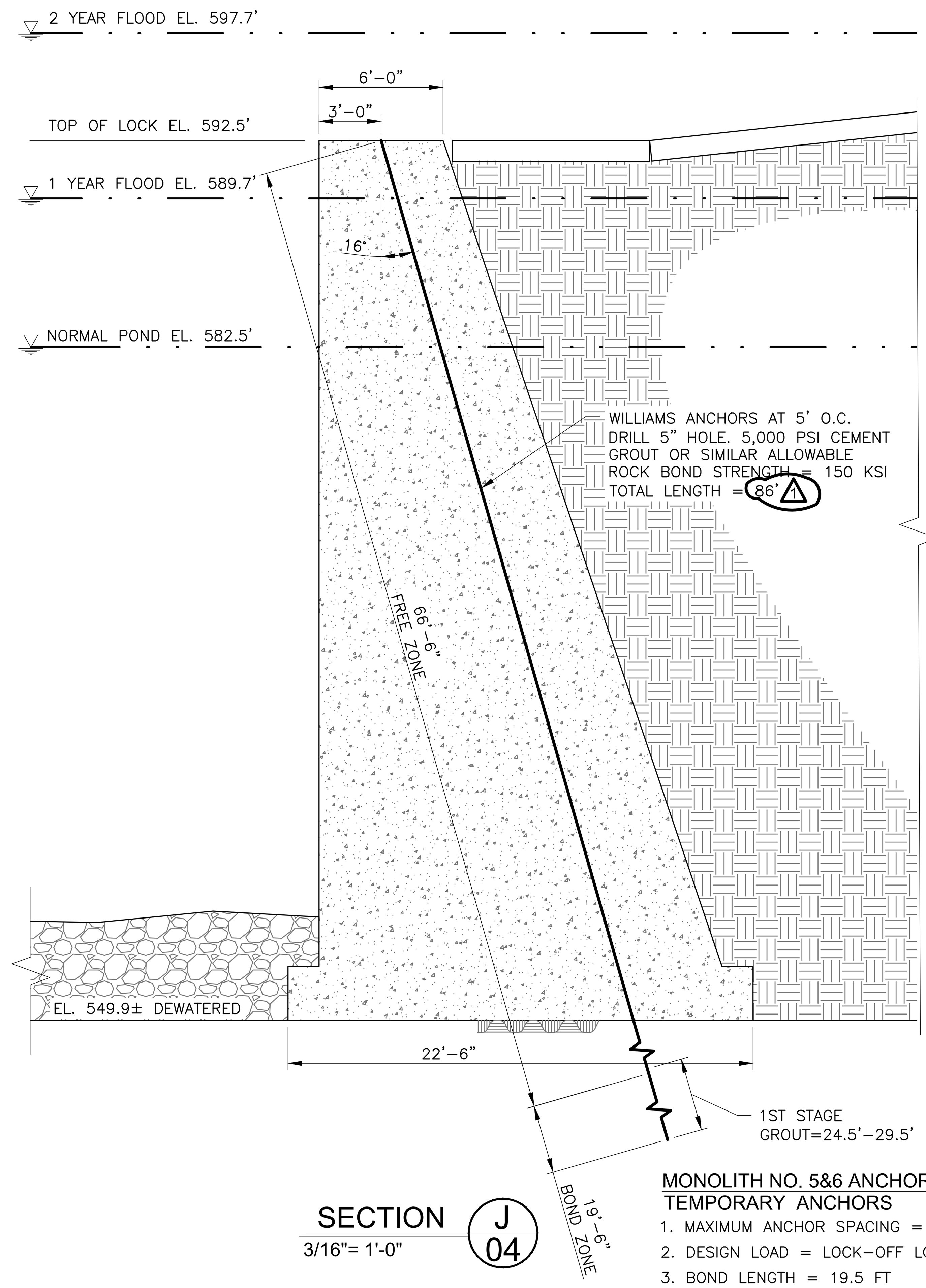
22x34 = FULL SCALE



SECTION H/04
3/16"= 1'-0"

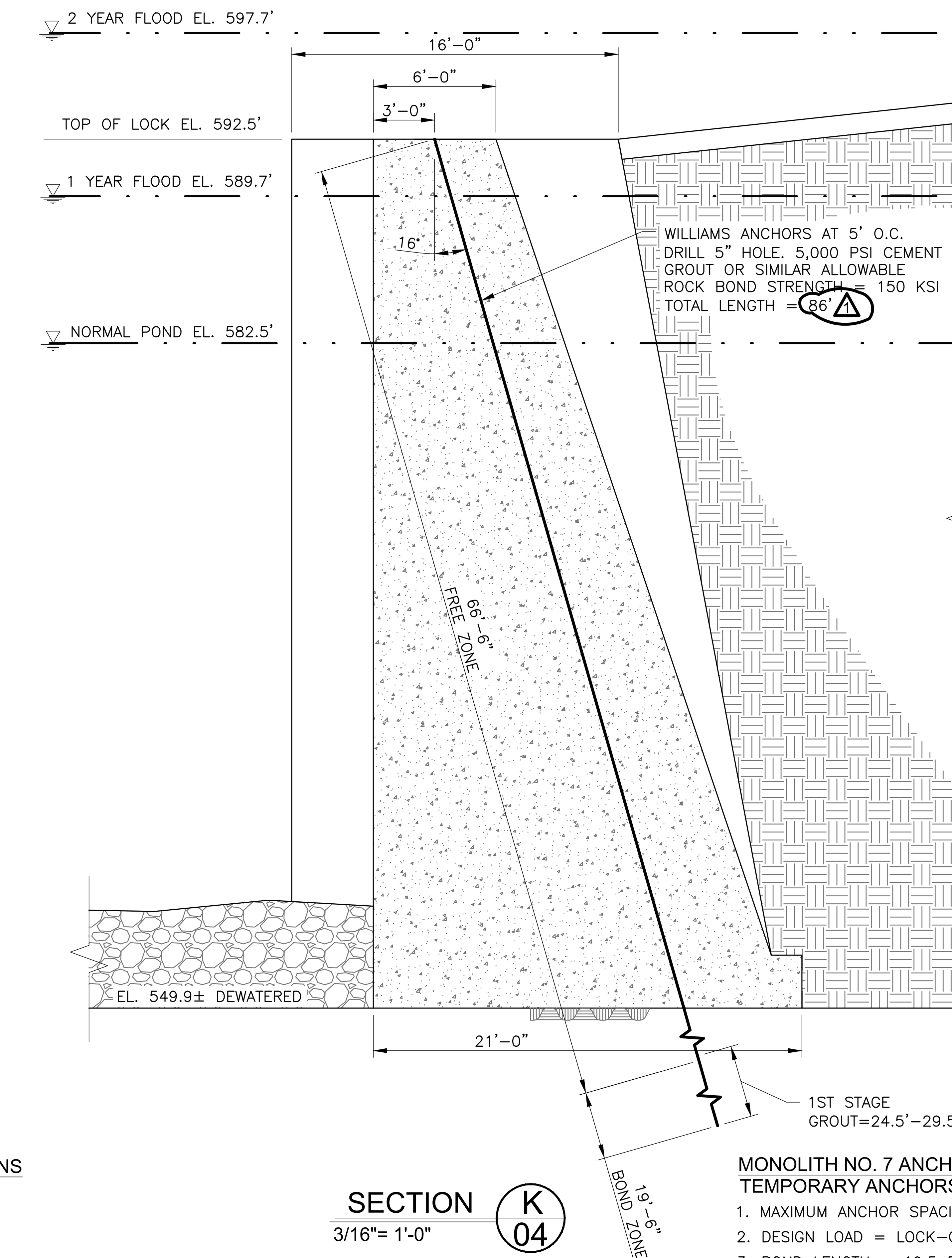
4 0 4 8 12
SCALE IN FEET

MONOLITH NO. 3&4 ANCHOR SPECIFICATIONS
PERMANENT ANCHORS
1. MAXIMUM ANCHOR SPACING = 4 FT
2. DESIGN LOAD = 350 KIPS
3. LOCK-OFF LOAD = 385 KIPS
3. BOND LENGTH = 16 FT
4. FREE LENGTH = 67 FT
5. TOTAL LENGTH = 83 FT



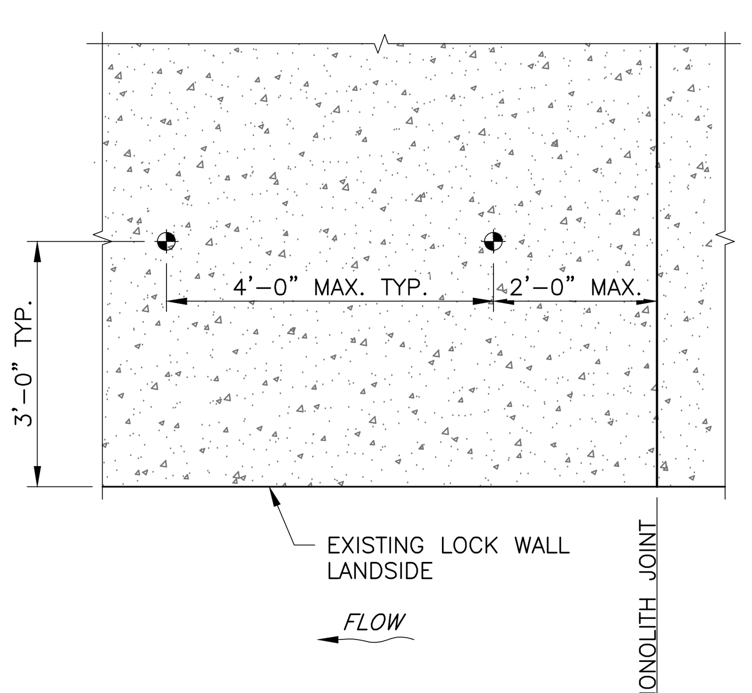
SECTION J/04
3/16"= 1'-0"

MONOLITH NO. 5&6 ANCHOR SPECIFICATIONS
TEMPORARY ANCHORS
1. MAXIMUM ANCHOR SPACING = 5 FT
2. DESIGN LOAD = LOCK-OFF LOAD = 437.5 KIPS
3. BOND LENGTH = 19.5 FT
4. FREE LENGTH = 66.5 FT
5. TOTAL LENGTH = 86 FT



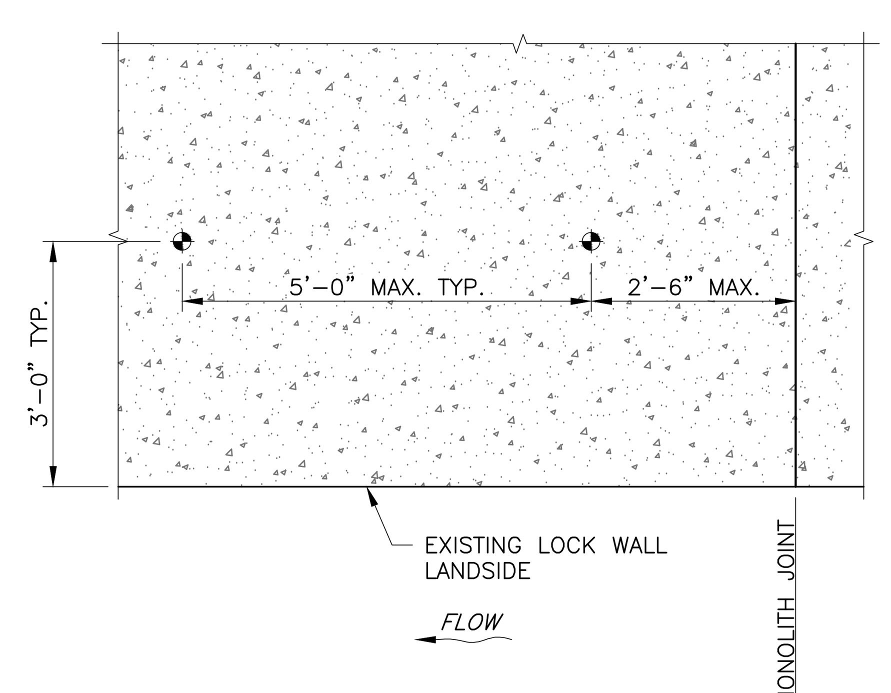
SECTION K/04
3/16"= 1'-0"

MONOLITH NO. 7 ANCHOR SPECIFICATIONS
TEMPORARY ANCHORS
1. MAXIMUM ANCHOR SPACING = 5 FT
2. DESIGN LOAD = LOCK-OFF LOAD = 437.5 KIPS
3. BOND LENGTH = 19.5 FT
4. FREE LENGTH = 66.5 FT
5. TOTAL LENGTH = 86 FT



TYPICAL PERMANENT ANCHOR SPACING PLAN DETAIL
1/2"= 1'-0"

2 0 2 4
SCALE IN FEET



TYPICAL TEMPORARY ANCHOR SPACING PLAN DETAIL
1/2"= 1'-0"

2 0 2 4
SCALE IN FEET

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
ROCK ANCHOR SECTIONS AND DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-11

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22x34 = FULL SCALE

GENERAL NOTES

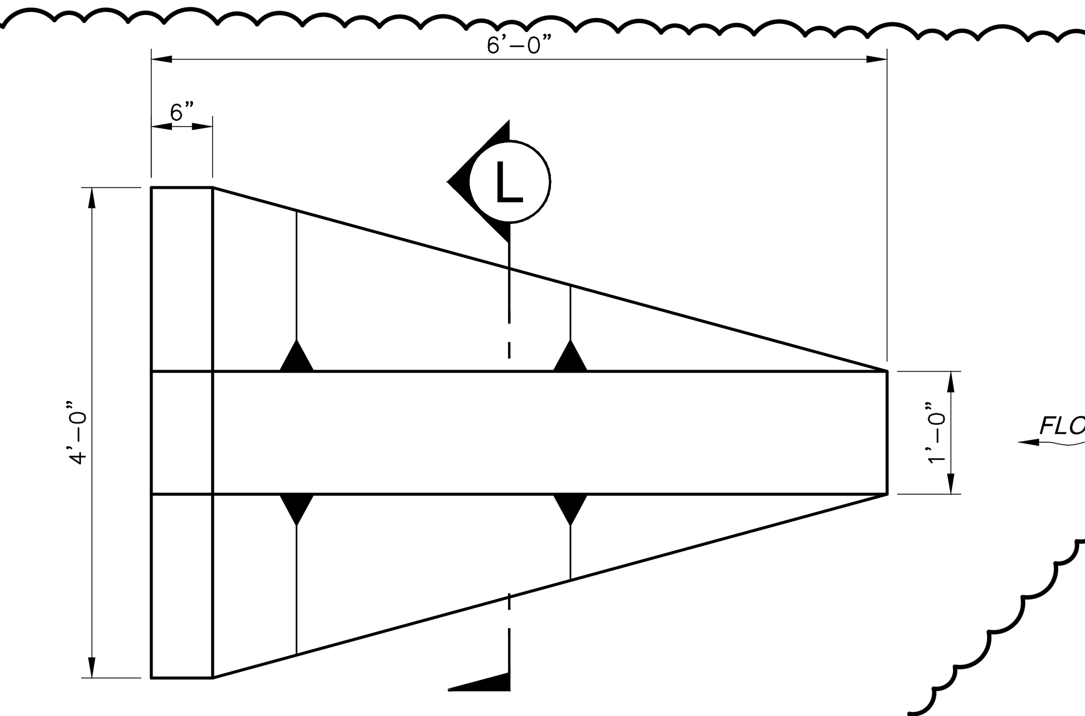
1. TYPE 1 AND 2 ANCHORS SHOWN ARE INTENDED FOR PERMANENT AND TEMPORARY (DURING THE CONSTRUCTION OF THE PROPOSED POWERHOUSE) CONDITIONS, RESPECTFULLY AND SHALL BE LOCATED AS SHOWN ON THE DRAWINGS. ADDITIONAL ANCHORS MAY BE REQUIRED DEPENDING UPON GROUND CONDITIONS AS THE WORK PROCEEDS. THE CONTRACTOR SHALL EVALUATE CONDITIONS ENCOUNTERED AND SHALL PROVIDE AND INSTALL ROCK SUPPORT AS NECESSARY TO PROVIDE A SAFE AND STABLE CONDITION FOR THE DEWATERED LOCK AT ALL TIMES DURING CONSTRUCTION AND LATER OPERATION.
2. BAR ANCHORS SHALL BE 150ksi ALL-THREAD, TENSIONED BARS. BARS MUST HAVE AN ULTIMATE LOAD (GUTS) AND LOCK-OFF LOAD OF:
   - A. PERMANENT ANCHORS (TYPE 1): 613 KIP GUTS& 385 KIP LOCK-OFF
   - B. TEMPORARY ANCHORS (TYPE 2): 613 KIP GUTS & 437.5 KIP LOCK-OFF
3. THE ANCHORS SHALL BE FABRICATED AND INSTALLED PER THESE NOTES AND THE REQUIREMENTS OF THE POST-TENSIONING INSTITUTE (PTI) "RECOMMENDATIONS FOR PRE-STRESSED ROCK AND SOIL ANCHORS".
4. ANCHOR CORROSION PROTECTION:
   - A. PERMANENT ANCHORS (TYPE 1): PTI CLASS 1 CORROSION PROTECTION.
   - B. TEMPORARY ANCHORS (TYPE 2): THE CONTRACTOR IS NOT REQUIRED TO PROVIDE PTI CLASS I OR II CORROSION PROTECTION
5. QUALITY ASSURANCE
   - A. **ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE NOTES ON THESE DRAWINGS AND SPECIFICTION 31 68 13 KA – ROCK ANCHOR. IN THE EVENT OF ADISCREPANCY BETWEEN THE SPECIFIATION AND THESE NOTES, NOTIFY ENGINEER.**
   - B. ALL WORK SHALL BE PERFORMED BY A CONTRACTOR WITH EXPERIENCE IN THE INSTALLATION OF ROCK ANCHORS AND ROCK DOWELS OF THE TYPE INTENDED.
   - C. PRIOR TO INSTALLATION OF ROCK ANCHORS CONFIRM THAT THE BORE HOLE IS WATERTIGHT.
   - D. EACH TENSIONED ROCK ANCHOR SHALL BE TESTED AS NOTED IN THE SPECIFICATION AND LOCKED-OFF AT THE SPECIFIED LOAD.
   - E. ALL ROCK ANCHOR PROOF TESTING SHALL BE CONDUCTED IN THE PRESENCE OF THE OWNER REPRESENTATIVE. WORK COMPLETED WITHOUT THE OWNER'S PRESENCE WILL NOT BE ACCEPTED.
   - F. THE CONTRACTOR SHALL MONITOR AND RECORD ALL DATA ASSOCIATED WITH THE TESTING, WITH COPIES SUBMITTED TO THE OWNER FOR RECORD PURPOSES.
6. SUBMITTALS
   - A. PRIOR TO THE ORDERING OF MATERIALS TO BE USED IN THE ANCHOR MANUFACTURE AND INSTALLATION, THE CONTRACTOR SHALL SUBMIT ONE ELECTRONIC (PDF) COPY OF THE FOLLOWING INFORMATION TO THE OWNER FOR REVIEW AND APPROVAL:
     - i. DETAILS OF THE ROCK ANCHOR SIZE, SIZE OF ANCHOR HOLE, EMBEDMENT LENGTH, ANCHOR HEAD, BEARING PLATES AND GROUT PADS, MATERIAL STRENGTH.
     - ii. DETAILS OF THE EQUIPMENT AND PROCEDURES THE CONTRACTOR PROPOSES TO USE FOR WATERTIGHTNESS CONFIRMATION OF THE BOREHOLE.
     - iii. DETAILS OF THE PROPOSED INSTALLATION PROCEDURES FOR THE ROCK ANCHORS, INCLUDING DESCRIPTION OF EQUIPMENT TO BE USED IN DRILLING HOLES, INSTALLING AND LOADING THE ROCK ANCHORS.
     - iv. DETAILS AND MANUFACTURER'S LITERATURE DESCRIBING THE PROPOSED GROUT MATERIAL AND ADDITIVES, GROUTING PROCESS, AND EQUIPMENT.
     - v. DETAILS OF PROPOSED GROUT MIX DESIGN INCLUDING ESTIMATED SETTING TIME, STRENGTH PROPERTIES, TEMPERATURE-SET TIME CURVE, AND RECOMMENDED INSTALLATION PROCEDURES.
     - vi. DETAILS AND PROPOSED METHOD, MATERIALS, AND EQUIPMENT FOR CONSOLIDATION GROUTING. PROVIDE THE DETAILS IF THE MEANS, METHODS, AND EQUIPMENT, DIFFER FROM THAT USED TO GROUT THE ANCHOR.
   - B. PRIOR TO TESTING THE ROCK ANCHORS, SUBMIT MANUFACTURER'S INFORMATION FOR THE EQUIPMENT TO BE USED TO CONDUCT PROOF TESTS ON THE ROCK ANCHORS. SUBMIT DIAGRAM(S) SHOWING THE GEOMETRY OF PROOF TEST EQUIPMENT RELATIVE TO ROCK ANCHOR, END HARDWARE, METHOD OF LOCKING OFF SPECIFIED PRETENSION LOAD AND CALIBRATION DATA FOR THE SYSTEM OF JACK AND GAUGES.
   - C. CONTRACTOR SHALL SUBMIT TO THE OWNER, BY INDIVIDUAL ROCK ANCHOR, FINAL DOCUMENTATION OF:
     - i. ELEVATION OF DAM-ROCK INTERFACE ENCOUNTERED WHEN DRILLING HOLES;
     - ii. BOTTOM (TIP) ELEVATION OF ANCHORS, LENGTH OF BOND ZONE, ANCHOR LENGTH (FROM TIP TO BOTTOM OF BASE PLATE) AND INSTALLATION ANGLE FROM VERTICAL;
     - iii. DIFFICULTIES IN DRILLING HOLES (IF ANY);
     - iv. REPAIRS TO THE CORROSION PROTECTION SYSTEM (IF ANY);
     - v. RESULTS OF WATER PRESSURE TEST;
     - vi. RESULT OF ALL ANCHOR PROOF TESTS AND ACTUAL LOCK-OFF LOAD;
     - vii. GROUT TAKE FOR CONSOLIDATION GROUTING (IF ANY) AND GALLONS OF WATER PER BAG OF CEMENT FOR THE CONSOLIDATION GROUT;
     - viii. FOR THOSE HOLES THAT WERE CONSOLIDATED WITH GROUT, LIST THE DEPTH OF HOLE REDRILLED; AND
     - ix. GROUT TAKE FOR ROCK ANCHOR GROUTING AND GALLONS OF WATER PER BAG OF CEMENT FOR THE GROUT.
7. PERMANENT (TYPE 1) ANCHOR GROUTING SEQUENCE – SEE SPECIFICATION.
8. TEMPORARY (TYPE 2) ANCHOR GROUTING SEQUENCE
   - A. AFTER FLUSHING THE BOREHOLE AND CONFIRMING RELATIVE WATER TIGHTNESS INSTALL ANCHOR AND PERFORM STAGE 1 GROUTING. PUMP GROUT FROM THE BOTTOM OF THE BOREHOLE TO DISPLACE ANY STANDING WATER AND/OR DRILL CUTTINGS. CONTINUE TO PUMP UNTIL PURE GROUT IS 5 TO 10 FEET ABOVE THE DESIGNATED BOND ZONE. THIS IS THE STAGE 1 GROUT LENGTH.
   - B. ALLOW STAGE 1 GROUT TO SET.
   - C. PERFORM COMPRESSIVE STRENGTH TESTING TO VERIFY STAGE 1 GROUT HAS MINIMUM 100% OF DESIGN STRENGTH (5,000 PSI).
   - D. SEE POST-LOCK DEWATERING NOTES THIS SHEET FOR STAGE 2 GROUTING REQUIREMENTS.
9. TESTING
   - A. ANCHORS SHALL NOT BE LOADED OR TESTED FOR A MINIMUM OF SEVEN (7) DAYS AFTER THE STAGE 1 GROUT HAS BEEN PLACED, OR UNTIL GROUT CUBES INDICATE THAT THE GROUT HAS REACHED THE SPECIFIED STRENGTH.
   - B. TESTING EQUIPMENT SHALL BE CAPABLE OF STRESSING THE WHOLE ANCHOR TO THE MAXIMUM SPECIFIED TEST LOAD IN ONE STROKE. THE EQUIPMENT SHALL PERMIT THE ANCHOR TO BE STRESSED IN INCREMENTS SO THAT THE LOAD IN THE ANCHOR CAN BE RAISED OR LOWERED IN ACCORDANCE WITH THE TEST SPECIFICATIONS AND ALLOW THE ANCHOR TO BE LIFT-OFF TESTED TO CONFIRM THE LOCK-OFF LOAD.
   - C. A CALIBRATION CHECK OF THE PRODUCTION GAUGE SHALL BE MADE DAILY AGAINST THE MASTER GAUGE TO VERIFY ACTUAL JACKING PRESSURES.
   - D. THE FIRST TEMPORARY ANCHOR AND THE FIRST PERMANENT ROCK ANCHOR INSTALLED SHALL BE PERFORMANCE TESTED. REMAINING ROCK ANCHORS SHALL BE PROOF TESTED. ALL TESTING SHALL BE CONDUCTED IN THE PRESENCE OF THE OWNER. TESTING SCHEDULES SHALL BE SUBMITTED TO THE OWNER TWO (2) WEEKS PRIOR TO TESTING, TO ENSURE OWNER'S PRESENCE. TESTS CONDUCTED WITHOUT OWNER'S PRESENCE WILL NOT BE ACCEPTED.
   - E. LIFT-OFF TESTS SHALL BE PERFORMED BETWEEN TWO (2) AND SEVEN (7) DAYS OF WHEN THE LOAD WAS LOCKED-OFF IN THE ANCHOR. THE ANCHORS SUBJECTED TO THE PERFORMANCE TESTS SHALL BE USED FOR THE LIFT-OFF TESTS.
10. GROUT
    - A. CEMENT GROUT FOR USE WITH ROCK ANCHORS AND CONSOLIDATION GROUTING SHALL BE CEMENT AND WATER, MADE USING TYPE II, PORTLAND CEMENT ASTM C-150 PLUS ADMIXTURES.
    - B. FOR GROUTING OF ROCK ANCHORS: WATER/CEMENT RATIO OF 0.35 TO 0.40 BY WEIGHT, AND A MINIMUM COMPRESSIVE STRENGTH OF 3,500 PSI AT SEVEN DAYS. COMPRESSIVE STRENGTH AT TIME OF TENSIONING SHALL BE A MINIMUM OF 5,000 PSI.
    - C. FOR CONSOLIDATION GROUTING: PROVIDE A WATER/CEMENT RATIO OF 0.50 TO 0.60 BY WEIGHT OR AS REQUIRED TO PROVIDE A WATERTIGHT ANCHOR HOLE.
    - D. GROUT SURFACE SHALL BE PREPARED SMOOTH & LEVEL WITHIN 2 DEG. NORMAL TO ROCK ANCHOR CENTERLINE. IF UNIFORM AND LEVEL CONCRETE SURFACE CONNOT BE ACHIEVED BY TRIMMING, AN EPOXY MORTAR PAD SHALL BE PROVIDED. REGULAR GROUT/MORTAR SHALL NOT BE USED.
11. DRILLING
    - A. DRILL HOLE SIZE AND LENGTH OF BOND ZONE SHALL BE IN ACCORDANCE WITH ROCK ANCHOR MANUFACTURER'S RECOMMENDATION.
    - B. CONTRACTOR SHALL CONTAIN ALL DRILL CUTTINGS, GROUT, FLUSHING MATERIALS AND SHALL PREVENT ANY AND ALL SUCH MATERIALS ASSOCIATED WITH THE WORK FROM ENTRANCE INTO THE WATERWAYS.
    - C. ROCK ANCHOR HOLES SHALL BE CONFIRMED TO BE WATERTIGHT BY THE CONTRACTOR. IF THE ANCHOR HOLE IS NOT WATERTIGHT, IT SHALL BE GROUTED, REDRILLED, AND RETESTED. THE CONTRACTOR MAY ALSO RELOCATE THE DRILL HOLE IF NEEDED, NEW LOCATION TO BE APPROVED BY THE OWNER.
    - D. CONTRACTOR SHALL UNDERTAKE MEANS TO PREVENT DEBRIS FROM ENTERING ROCK ANCHOR HOLES BEFORE AND AFTER GROUTING.
    - E. CONTRACTOR SHALL UNDERTAKE MEANS TO PREVENT WATER FROM FILLING AND FREEZING THE ANCHOR HOLES ESPECIALLY AFTER THE ANCHOR HAS BEEN INSTALLED AND PRIOR TO GROUTING OF THE ANCHOR.
    - F. ANCHORS SHALL BE INSTALLED TO AN ALIGNMENT TOLERANCE AS SPECIFIED BY PTI, SECTION 7.3.5, HOLE ALIGNMENT AND TOLERANCES.
12. ROCK ANCHORS
    - A. ROCK ANCHOR SHALL BE PLACED IN ACCORDANCE WITH APPROVED DETAILS OR THE RECOMMENDATIONS OF THE ANCHOR MANUFACTURER.
    - B. CENTRALIZERS SHALL BE USED TO ENSURE THAT THE ANCHOR BARS OR SHEATHS DO NOT CONTACT THE WALL OF THE DRILL HOLE.
    - C. THE ANCHOR SHALL BE INSTALLED IN THE ANCHOR HOLE JUST PRIOR TO WHEN IT WILL BE GROUTED INTO PLACE.
    - D. PRIOR TO INSTALLING THE ANCHOR, HOLES SHALL BE CLEARED OF DEBRIS AND ICE.
    - E. EACH ROCK ANCHOR DESIGNATED TO BE TENSIONED SHALL BE TESTED BY A PROOF TEST AFTER A MINIMUM OF 7 DAYS HAS PASSED SINCE INSTALLATION. ALL ANCHORS MUST BE PROOF TESTED.
    - F. REPLACE TESTED ANCHORS THAT FAIL OR DO NOT MEET CRITERIA FOR ACCEPTANCE AT NO ADDITIONAL COST TO THE OWNER.

POST-LOCK DEWATERING (TEMPORARY ROCK ANCHORS ONLY)

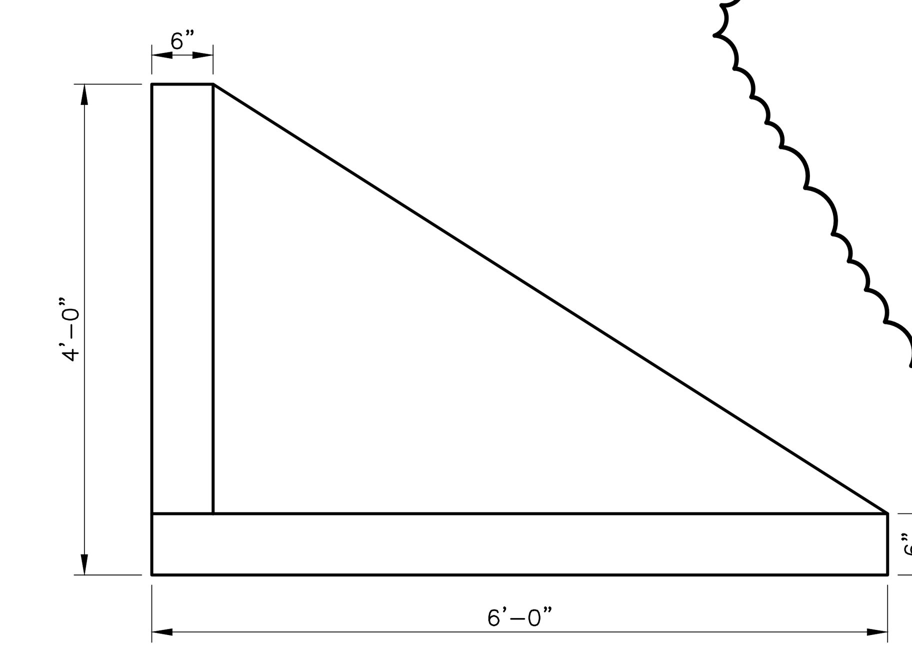
1. THE CONSTRUCTION JOINTS ON THE SOUTH LOCK WALL REQUIRE PINNING FOR OPERATIONAL CONDITIONS.
2. AFTER COMPLETION OF THE POWERHOUSE CONSTRUCTION, THE ANCHORS ARE TO BE UNLOADED AND THE TOPS CUT OFF 3 TO 6 INCHES BELOW THE TOP OF THE LOCK WALL.
3. PLACE STAGE 2 GROUT.
4. CAP THE OPENING WITH GROUT AND LEAVE THE ANCHORS IN PLACE.

CONCRETE DEBRIS DEFLECTOR 1

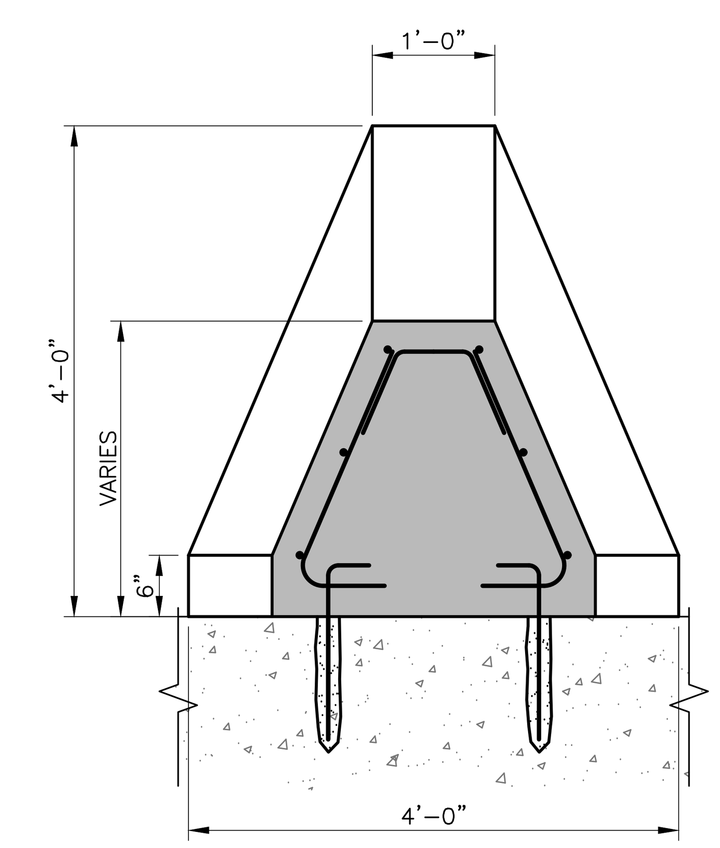
1. CONCRETE DEBRIS DEFLECTOR TO BE INSTALLED PRIOR TO INSTALLATION OF PERMANENT ROCK ANCHORS TO PROTECT THE ANCHOR CAPS FROM DEBRIS DURING RIVER FLOODING.
2. DETAILS PROVIDED THIS SHEET, SEE SHEET 210-04 FOR LOCATION.



1 PLAN
3/4"= 1'-0"



PROFILE
3/4"= 1'-0"



SECTION L
3/4"= 1'-0"

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD
No.	Revision	Date	Drawn	Checked

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
ROCK ANCHOR NOTES

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	210-12

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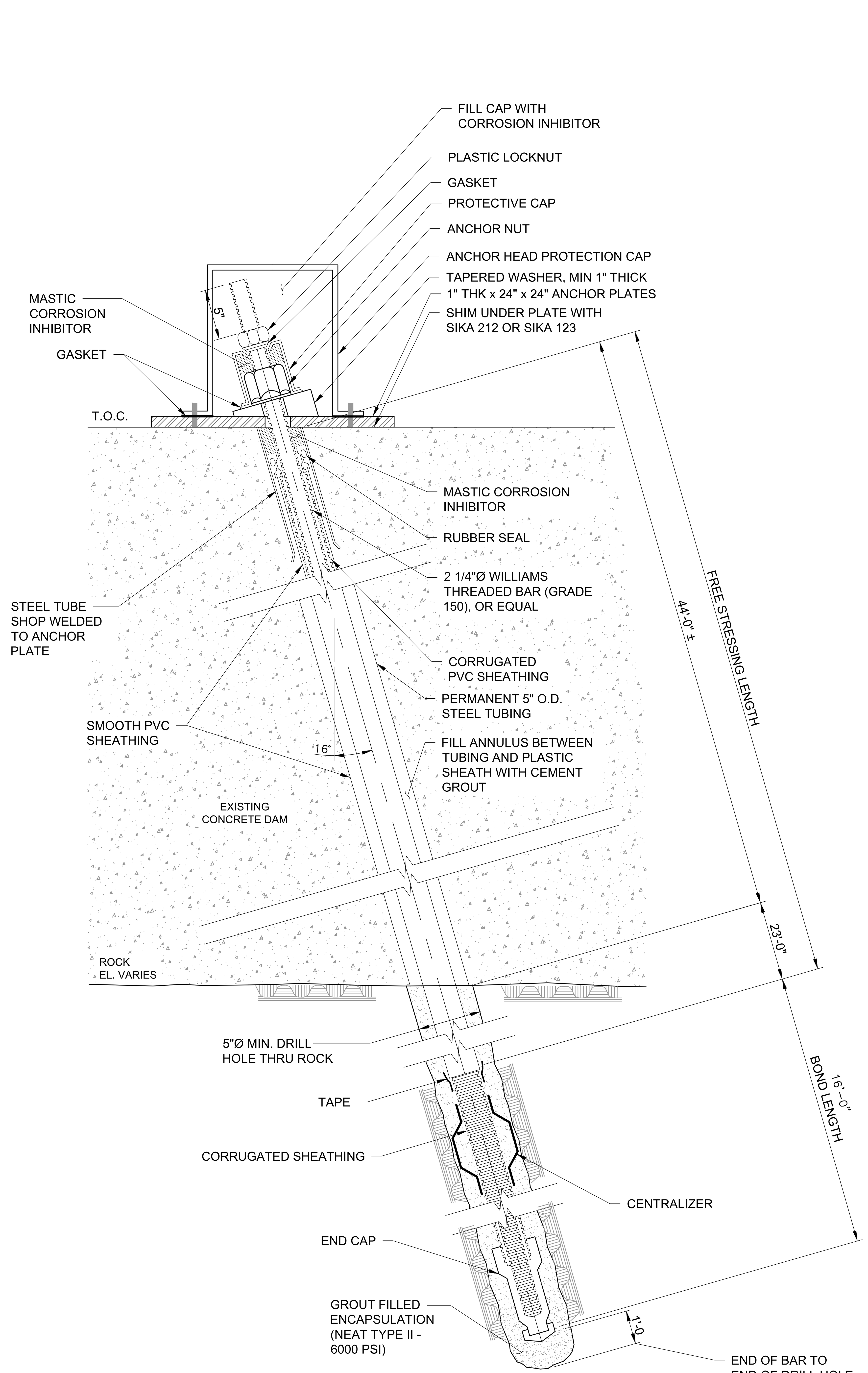
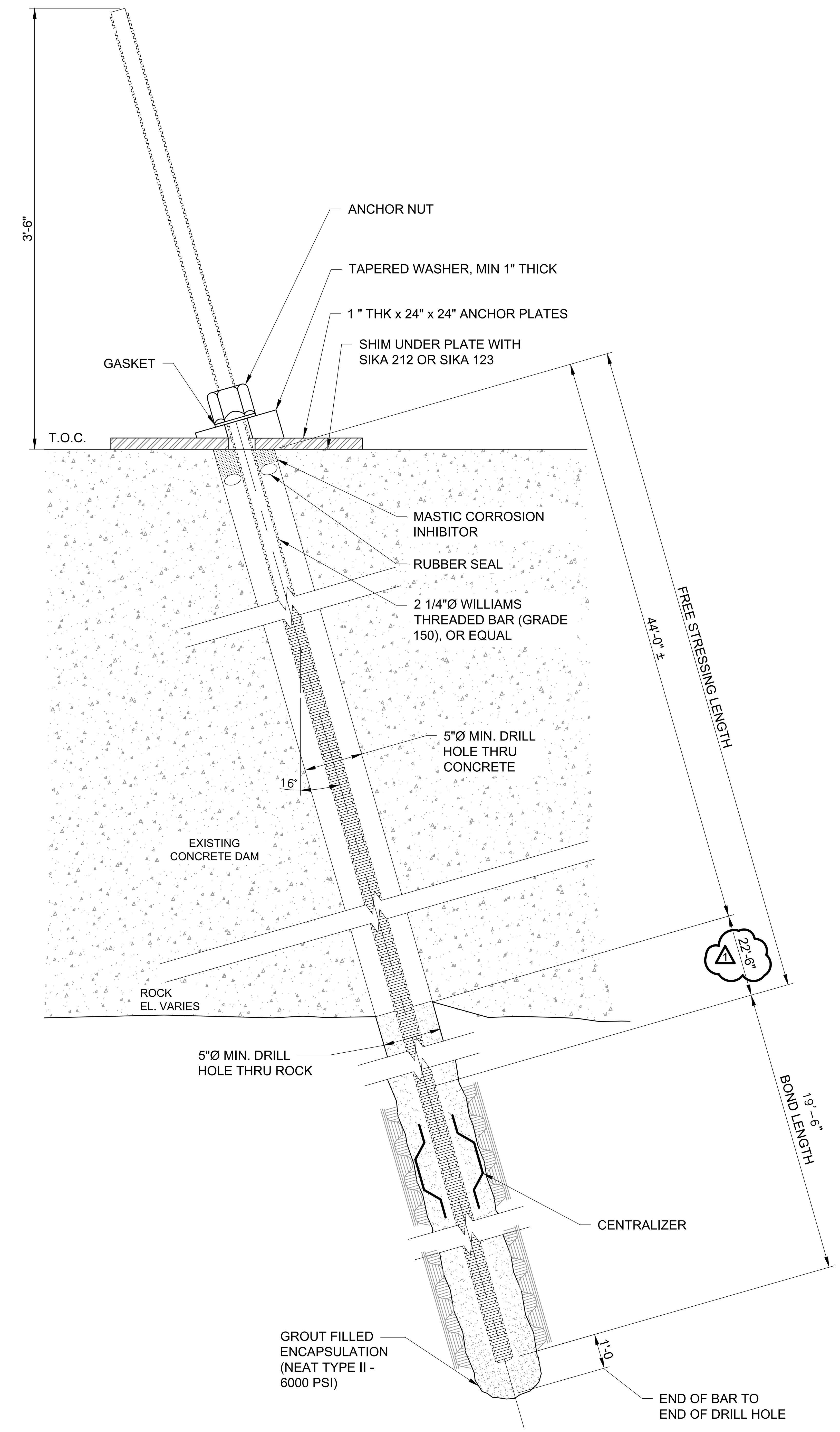
22x34 = FULL SCALE



PERMANENT ROCK ANCHOR DETAIL (TYPE 1)
N.T.S.



TEMPORARY ROCK ANCHOR DETAIL (TYPE 2)
N.T.S.

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

TEMPORARY CONDITIONS
ROCK ANCHOR DETAILS

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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RJC	BJL	JLD	1349-009	08-01-24	210-13

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22x34 = FULL SCALE

SITE PLAN

1"= 20'

20 0 20 40

SCALE IN FEET

NOTES:

1.) DRAWING ELEVATIONS ARE IN NAVD88 DATUM.
USACE DATUM = PLANT DATUM
NAVD88 = USACE − 3.13'

2.) EXISTING MITER GATE ARM SLOTS: CLEAN SLOTS OF DEBRIS & LOOSE MATERIAL. FILL WITH CLASS I CONCRETE REINFORCED WITH #5 @ 12 E.W.

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STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

PHASE 1 - RELEASED FOR CONSTRUCTION
PHASE 2A - NOT FOR CONSTRUCTION

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

NEW CONDITIONS
SITE PLAN

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	220-01

SECTION A/01
1/8"= 1'-0"

8 0 8 16
SCALE IN FEET

FUTURE STAGE CONCRETE

22x34 = FULL SCALE

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STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

PHASE 1 - RELEASED FOR CONSTRUCTION
PHASE 2A - NOT FOR CONSTRUCTION

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

NEW CONDITIONS
POWERHOUSE & LOCK LONGITUDINAL SECTION

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	220-02

SECTION B 01
1/8"= 1'-0"

8 0 8 16
SCALE IN FEET

JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER STATE OF KENTUCKY 8/1/24

PHASE 1 - RELEASED FOR CONSTRUCTION
PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
1	RFC PHASE 1 - FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	220-03

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

NEW CONDITIONS
LATERAL SECTION

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22x34 = FULL SCALE

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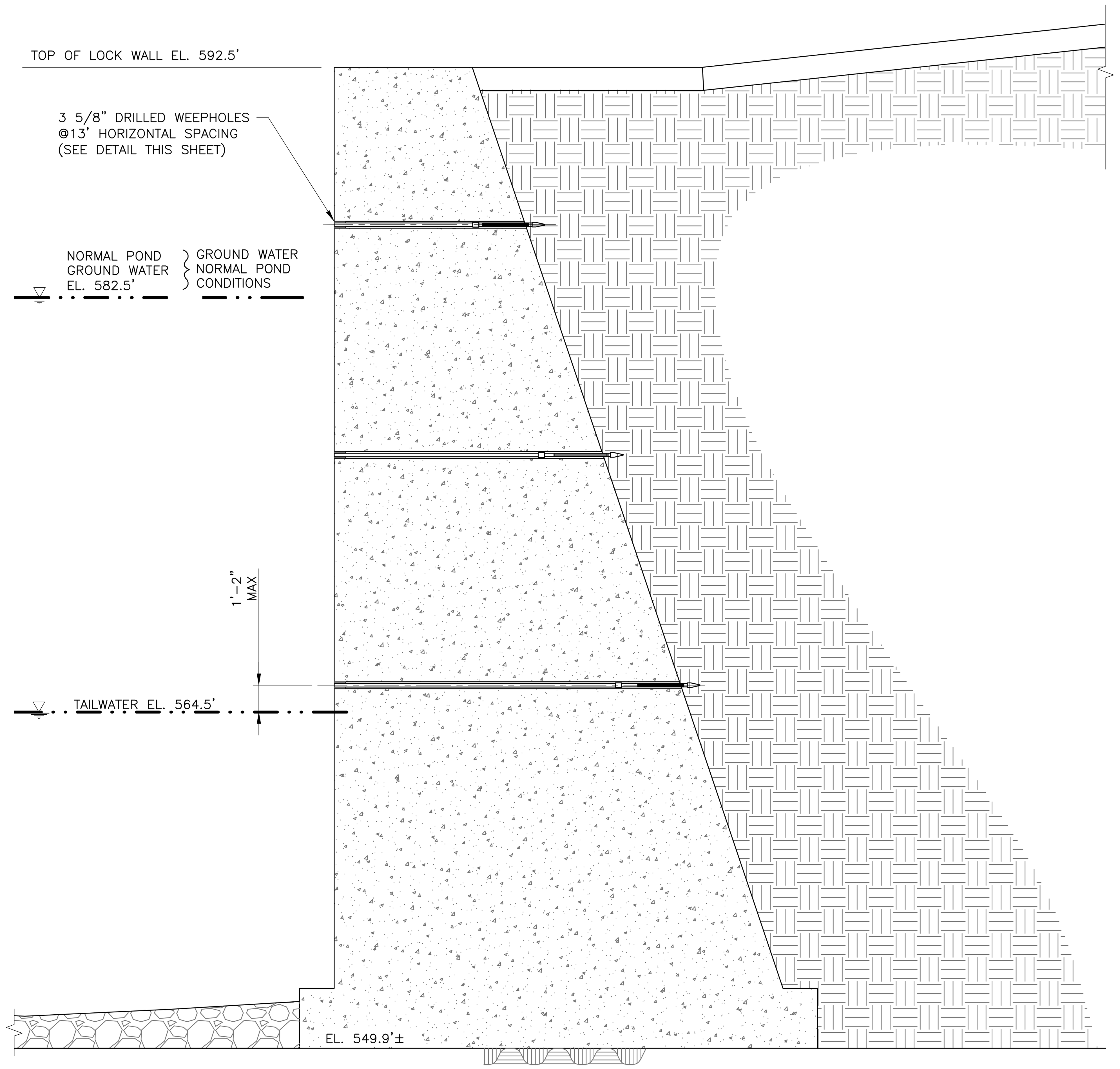
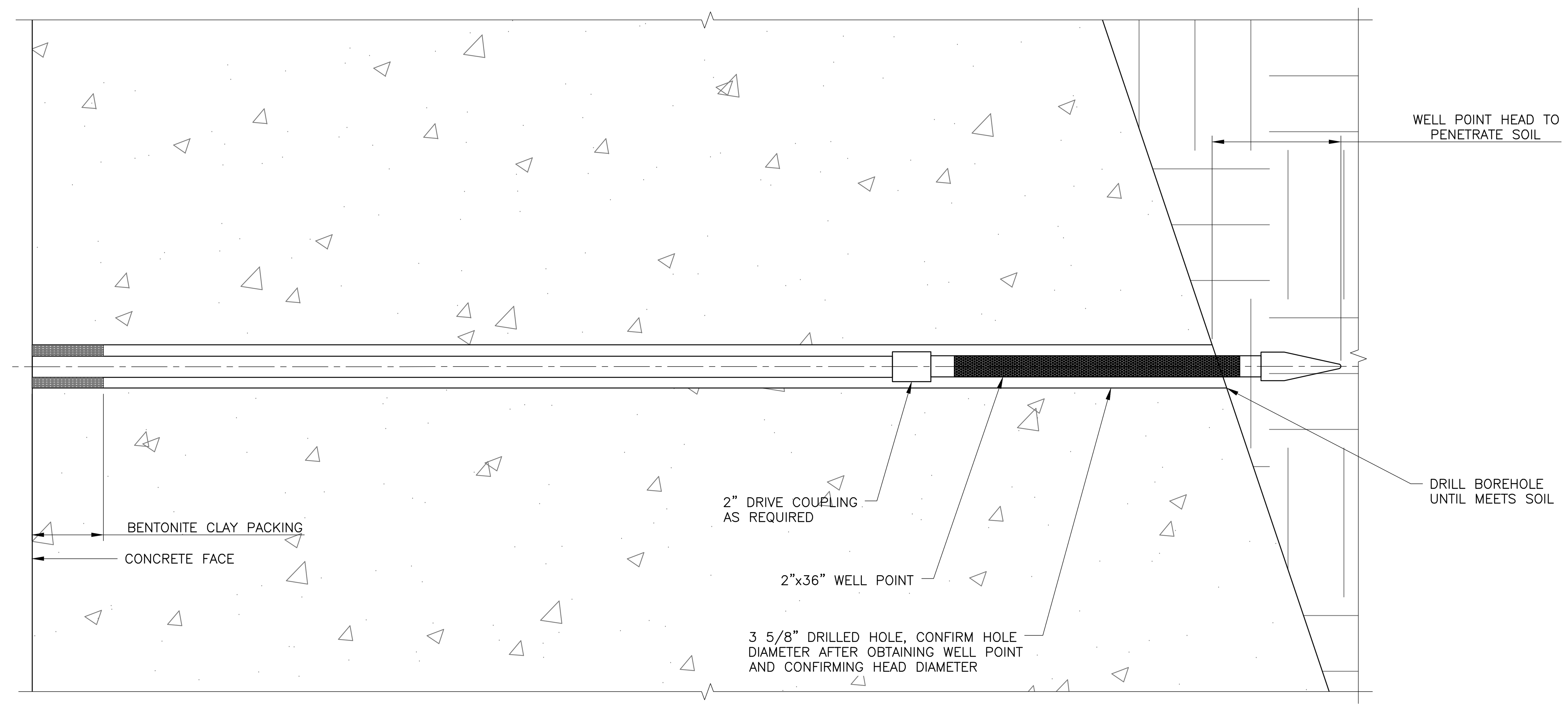


MONOLITH 6 WEEPHOLES

1/4"= 1'-0"

4 0 4 8

SCALE IN FEET



WEEP HOLE DETAIL

1 1/2"= 1'-0"

INSTALLATION NOTES:

- REQUIRED IN MONOLITH 6 FOR OPERATIONAL STABILITY.
- INSTALL WEEP HOLES IN WALL TO ALLOW FOR DRAINAGE AT END OF CONSTRUCTION AND ENSURE GROUND WATER LEVEL MATCHES TAILWATER.
  1. START INSTALL AT TOP OF MONOLITHS 6 AND 7 (ENSURES PRESSURE CAN'T GET SO HIGH AS TO BE DANGEROUS DURING DRILLING).
  2. DRILL BORE HOLE LARGE ENOUGH TO SUPPORT SIZE OF WELL POINT HEAD, BUT FIT SHOULD BE TIGHT.
  3. DRILL FULL DEPTH OF LOCK WALL, DEPTH VARIES, ANTICIPATE 10-FOOT MAX DEPTH. DO NOT DRILL INTO SOIL BEHIND LOCK WALL.
  4. CONFIRM NO WATER MOVING THROUGH.
  5. DRILL IN WELL POINT. 2"x36" WELL POINT CALL FOR IN DETAIL, CONTRACTOR MAY PROPOSE AN ALTERNATIVE. ALTERNATIVE TO BE APPROVED BY E.O.R. AND OWNER.
  6. WELL POINT HEAD TO PENETRATE SAND/SOIL BEHIND LOCK WALL. COLLAR TO REMAIN WITHIN CONCRETE BORE HOLE TO PREVENT MIGRATION OF FINES.
  7. USE COMPATIBLE DRIVE SHAFT. DRIVES ARE HOLLOW TO TRANSPORT GROUND WATER.
  8. PACK BENTONITE CLAY OR SIMILAR AROUND DRIVE SHAFT TO PREVENT TAILWATER IN BORE HOLE.
  9. CONTINUE INSTALL AT 8'-10' VERTICAL SPACING DOWN TO TAILWATER LEVEL (OR JUST ABOVE)

NOTE:
DRAWING ELEVATIONS ARE IN NAVD88 DATUM.
USACE DATUM = PLANT DATUM
NAVD88 = USACE − 3.1'

22x34 = FULL SCALE

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STATE OF KENTUCKY
JILLIAN L. DAVIS
32087
LICENSED PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

NEW CONDITIONS
MISCELLANEOUS DETAILS

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No.	Revision	Date	Drawn	Checked
1	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	220-04

PLAN AT EL. 592.5' (TOP OF LOCK)

3/16"= 1'-0"

4 0 4 8 12

SCALE IN FEET

PHASE 2A - NOT FOR CONSTRUCTION

22x34 = FULL SCALE

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No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

Designed	Drawn	Checked
RJC	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - GENERAL ARRANGEMENT
PLAN

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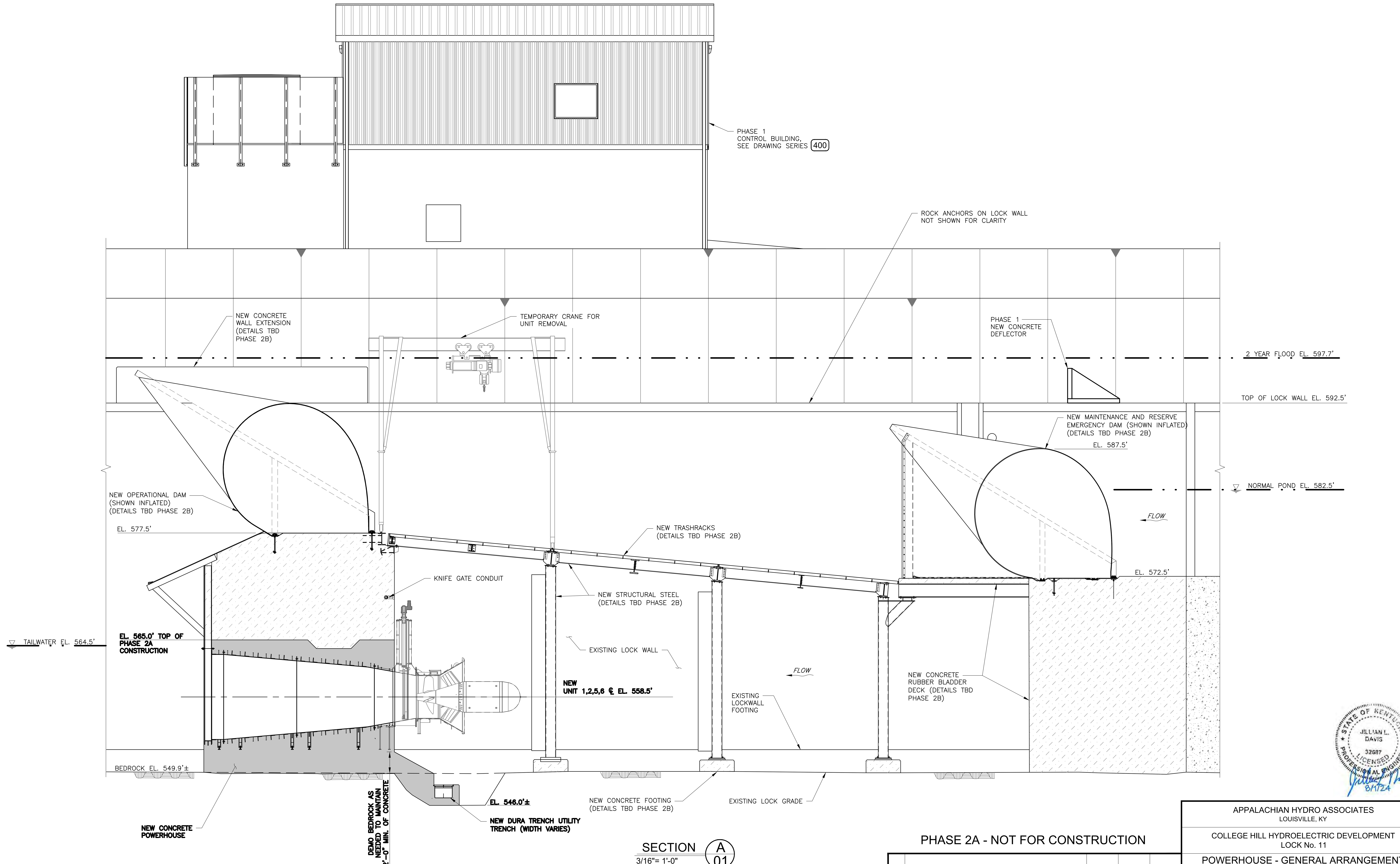
Project No.	Date Revised	Drawing No.
1349-009	08-01-24	300-01



SECTION A/01
3/16"= 1'-0"

4 0 4 8 12
SCALE IN FEET

FUTURE STAGE CONCRETE

22x34 = FULL SCALE

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PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - GENERAL ARRANGEMENT
LONGITUDINAL SECTION 1490 UNIT

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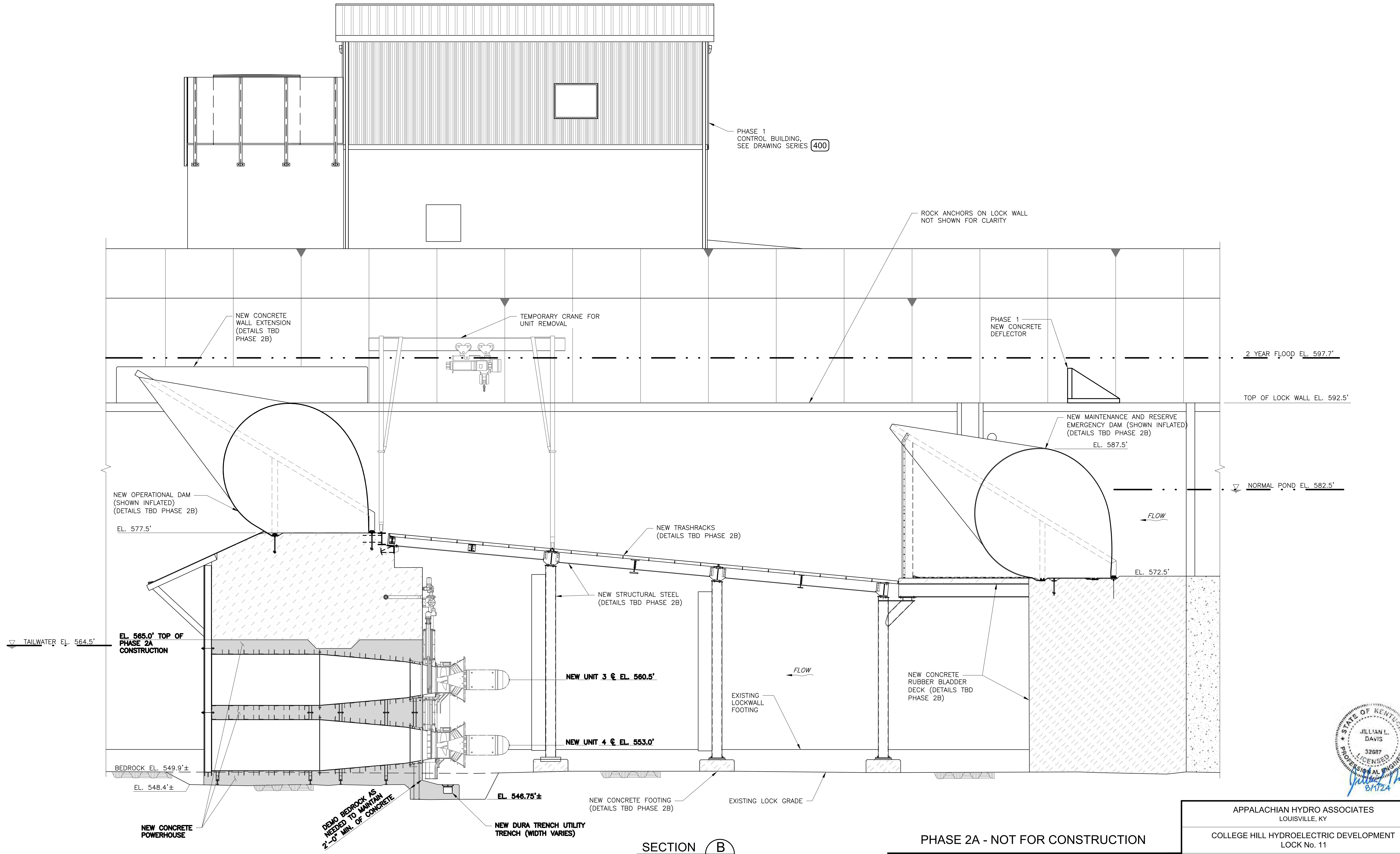
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	300-02

22x34 = FULL SCALE



SECTION B/01
3/16"= 1'-0"

4 0 4 8 12
SCALE IN FEET

FUTURE STAGE CONCRETE

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PHASE 2A - NOT FOR CONSTRUCTION

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - GENERAL ARRANGEMENT
LONGITUDINAL SECTION 895 UNITS

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	300-03

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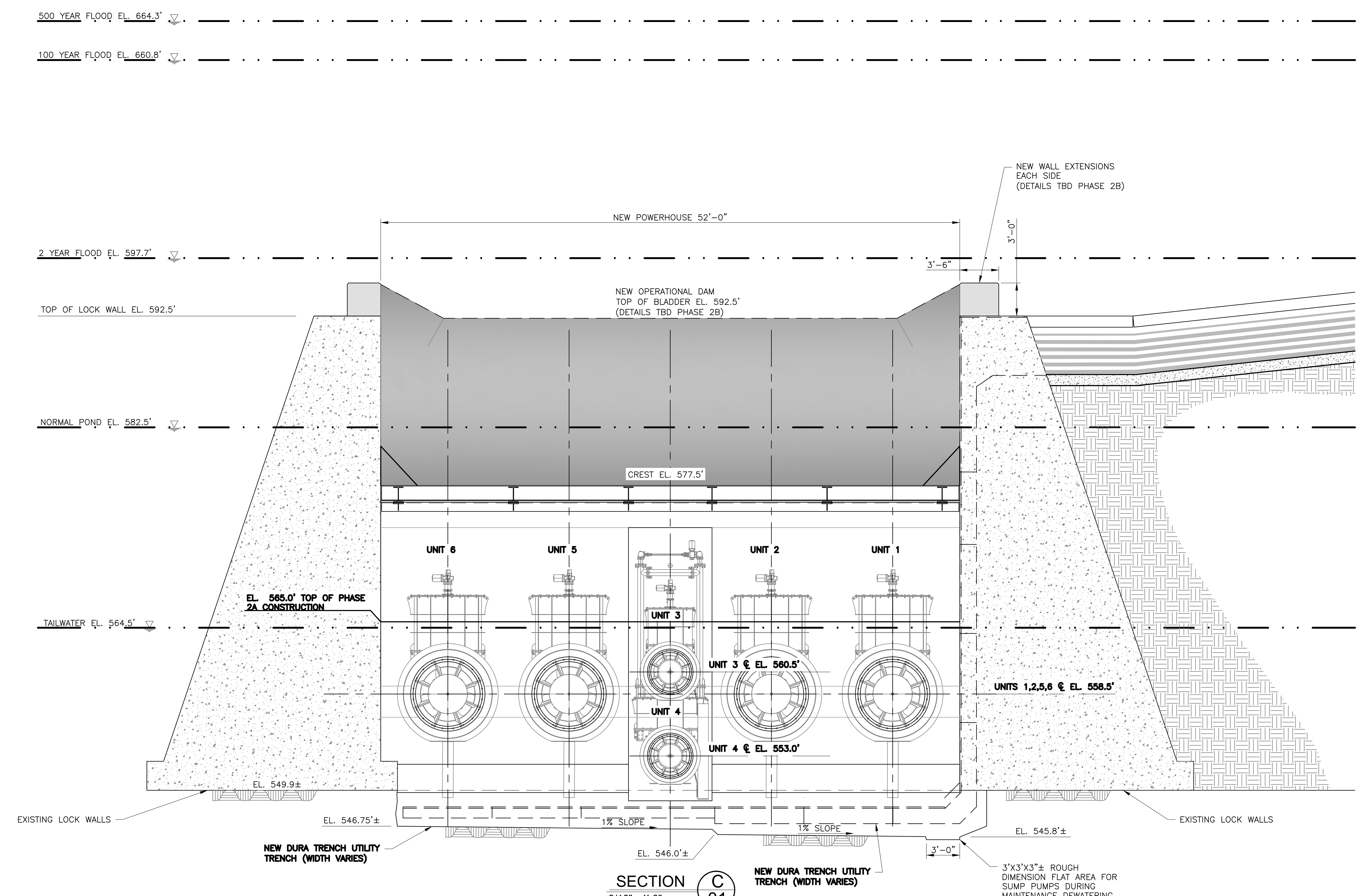
22x34 = FULL SCALE



SECTION C / 01
3/16"= 1'-0"

4 0 4 8 12
SCALE IN FEET

STATE OF KENTUCKY
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LICENSED PROFESSIONAL ENGINEER
8/1/24

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - GENERAL ARRANGEMENT
SECTION LOOKING D/S @ UNITS

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	300-04

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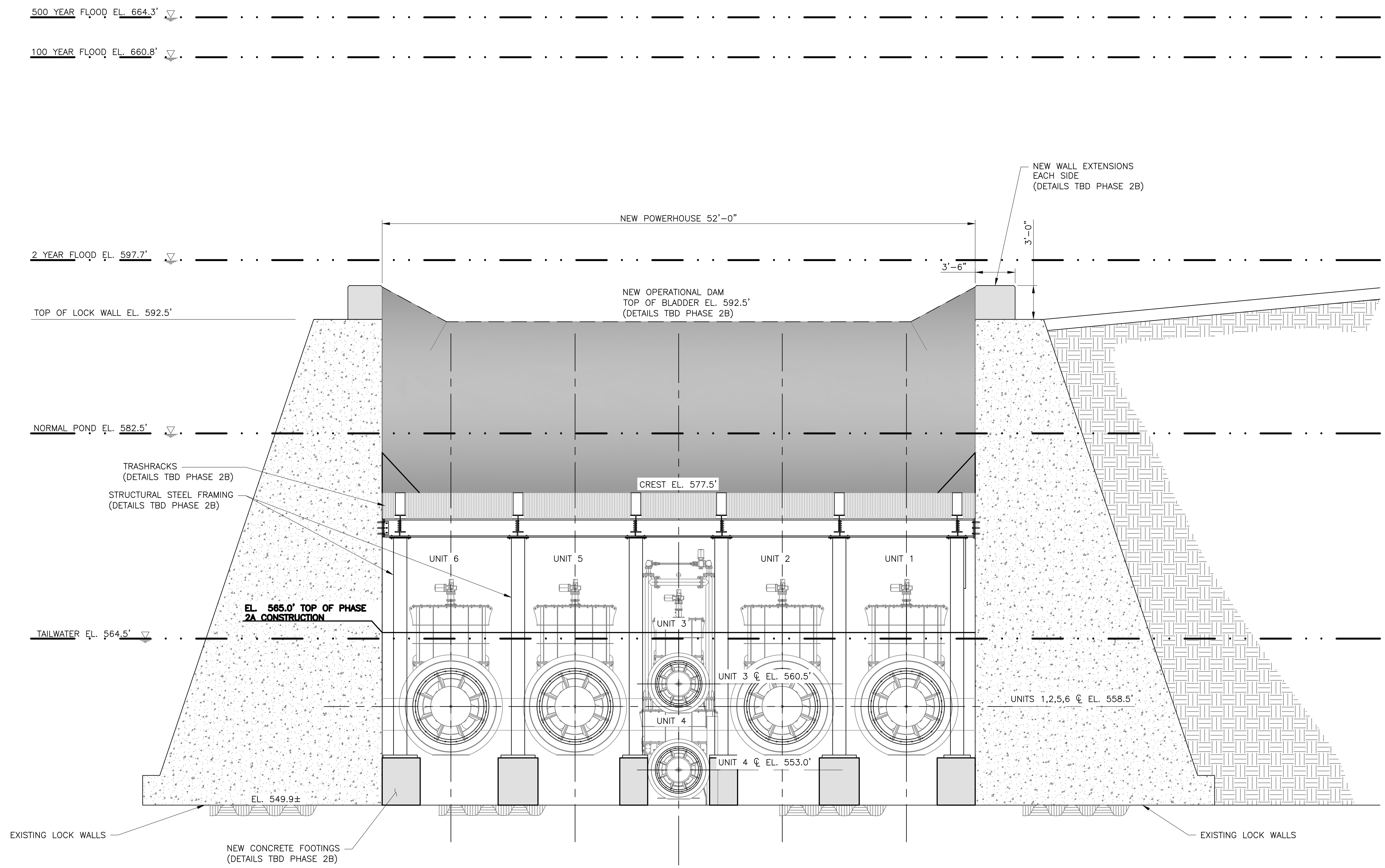

SECTION D 01
3/16"= 1'-0"

4 0 4 8 12
SCALE IN FEET

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - GENERAL ARRANGEMENT
SECTION LOOKING D/S @ UNITS

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	300-05

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PLAN

3/8"= 1'-0"

2 0 2 4 6

SCALE IN FEET

22x34 = FULL SCALE

PHASE 2A - NOT FOR CONSTRUCTION

LEGEND

EXISTING CONCRETE

CLASS I, 3,500 PSI CONCRETE

NOTES:
1. SEE MASS CONCRTE PLACEMENT SPECIFICATIONS ON SHEET 110-03.
2. ALL ELECTRICAL DETAILS (CONDUITS, GROUNDING, CABLE TRENCH, ETC.) ARE THE SOLE RESPONSIBILITY OF MOORE VENTURES, LLC. SEE 420 DRAWING SERIES FOR MORE INFO.

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - REINFORCED CONCRETE
PLAN AT FOUNDATION

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	310-01

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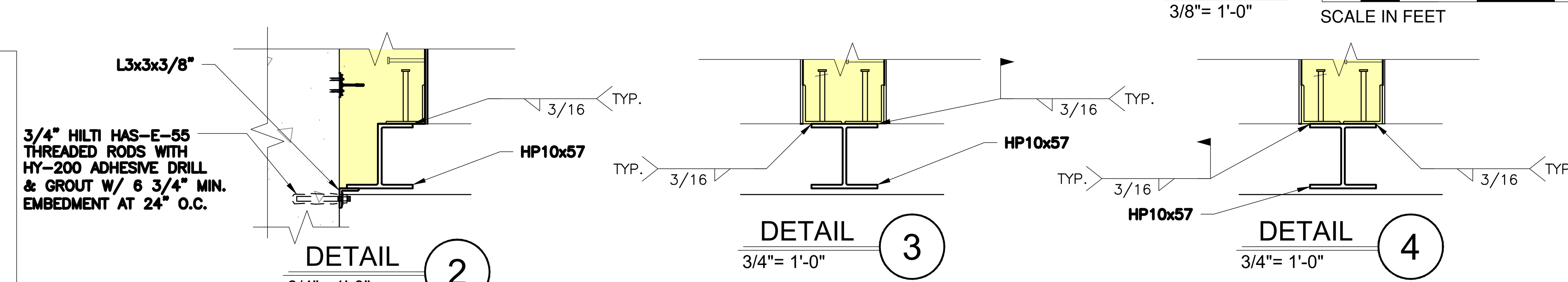
Aug. 1, 2024 - 8:14 AM

PLAN
3/8"= 1'-0"

SCALE IN FEET: 2 0 2 4 6



DETAIL 2
3/4"= 1'-0"

DETAIL 3
3/4"= 1'-0"

DETAIL 4
3/4"= 1'-0"

SCALE IN FEET: 1 0 1 2 3

22x34 = FULL SCALE

LEGEND

- EXISTING CONCRETE
- CLASS I, 3,500 PSI CONCRETE
- CLASS II, 4,500 PSI CONCRETE

NOTE: SEE MASS CONCRETE PLACEMENT SPECIFICATIONS ON SHEET 110-03.

PHASE 2A - NOT FOR CONSTRUCTION

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - REINFORCED CONCRETE
PLAN AT CENTERLINES

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	310-02

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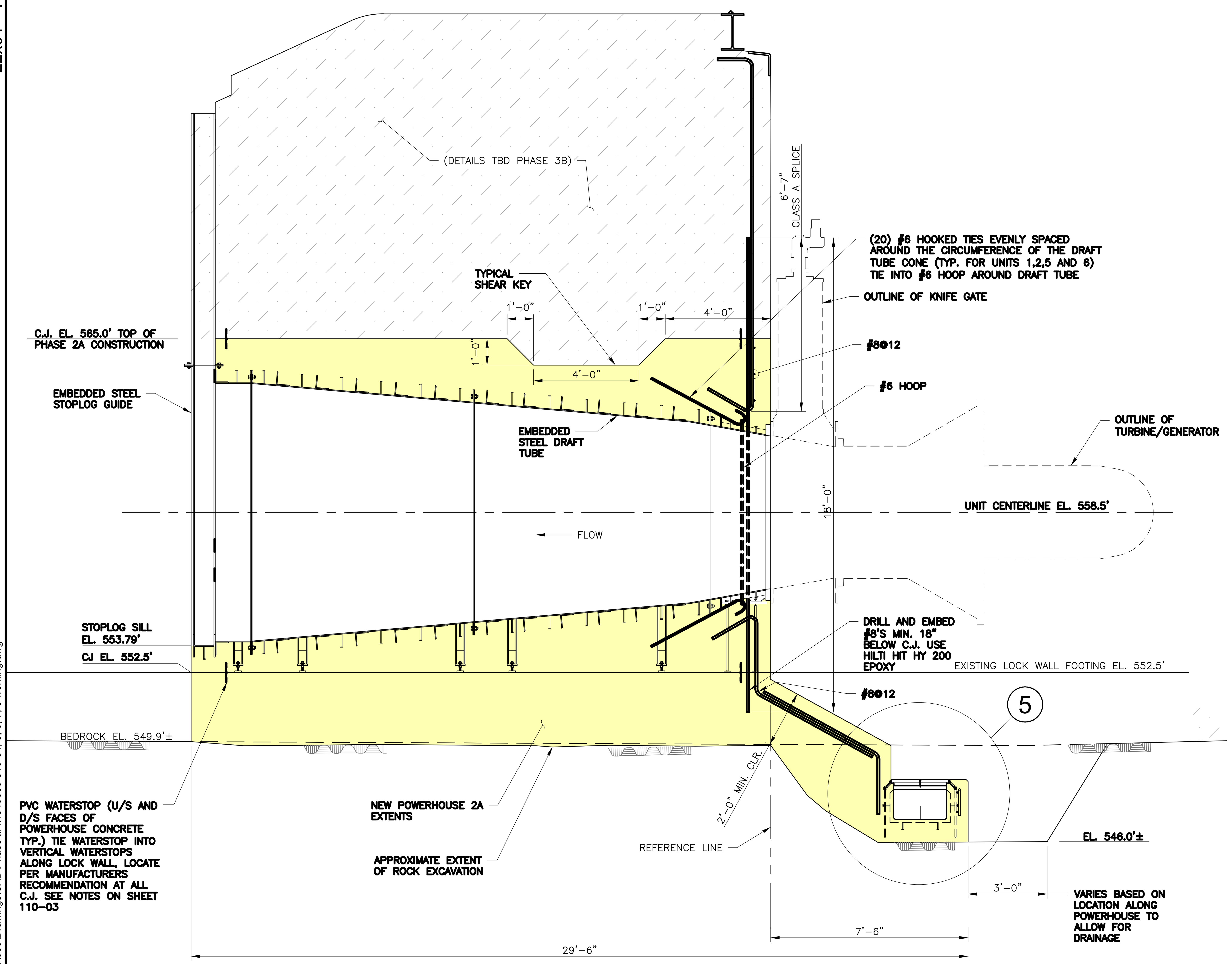
22x34 = FULL SCALE



SECTION A / 03
3/8"= 1'-0"
(TYPICAL SECTION THRU 1490 UNIT CENTERLINE)

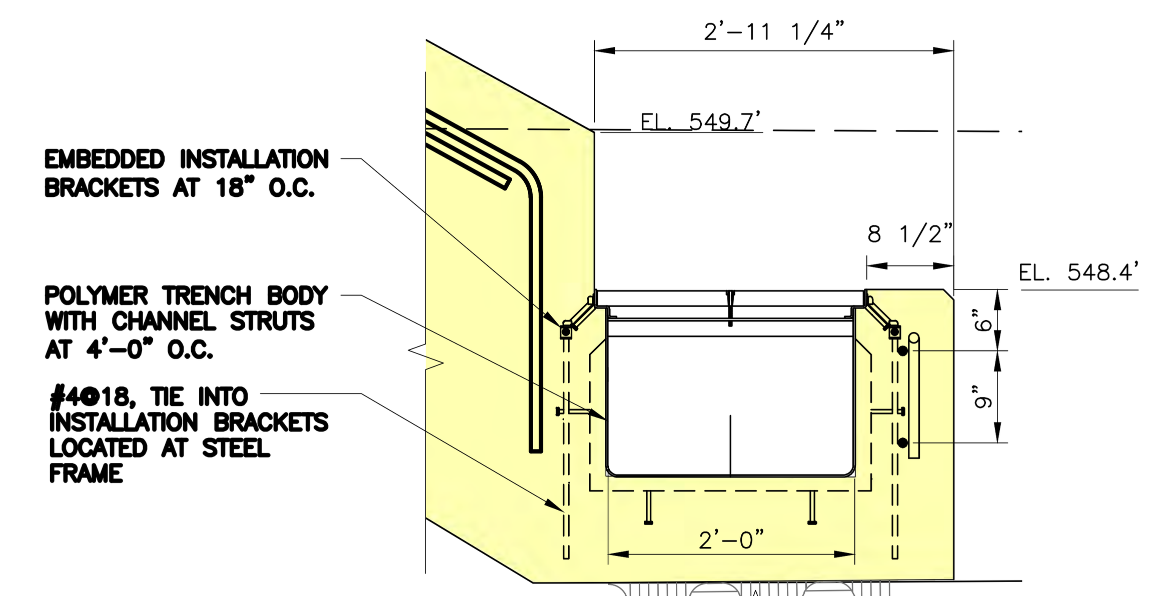
2 0 2 4 6
SCALE IN FEET

NOTES:

1. SEE MASS CONCRETE PLACEMENT SPECIFICATIONS ON SHEET 110-03.
2. ALL CONSTRUCTION JOINTS IN STAGE 1 AND STAGE 3 CONCRETE SHALL HAVE HORIZONTAL C.J. SHEAR KEY INCLUDED WITH A STAGGERED ALIGNMENT.
3. LD = BAR EMBEDMENT LENGTH, SEE TABLES DRAWING 110-03.

LEGEND

- FUTURE STAGE CONCRETE
- CLASS I, 3,500 PSI CONCRETE
- CLASS II, 4,500 PSI CONCRETE



DETAIL 5
3/4"= 1'-0"

NOTE:
1. STANDARD TRENCH SLOPE IS 0.5%, U.N.O.

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

PHASE 2A - NOT FOR CONSTRUCTION

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - REINFORCED CONCRETE
SECTION THRU UNIT 1490 CENTERLINE

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	310-04

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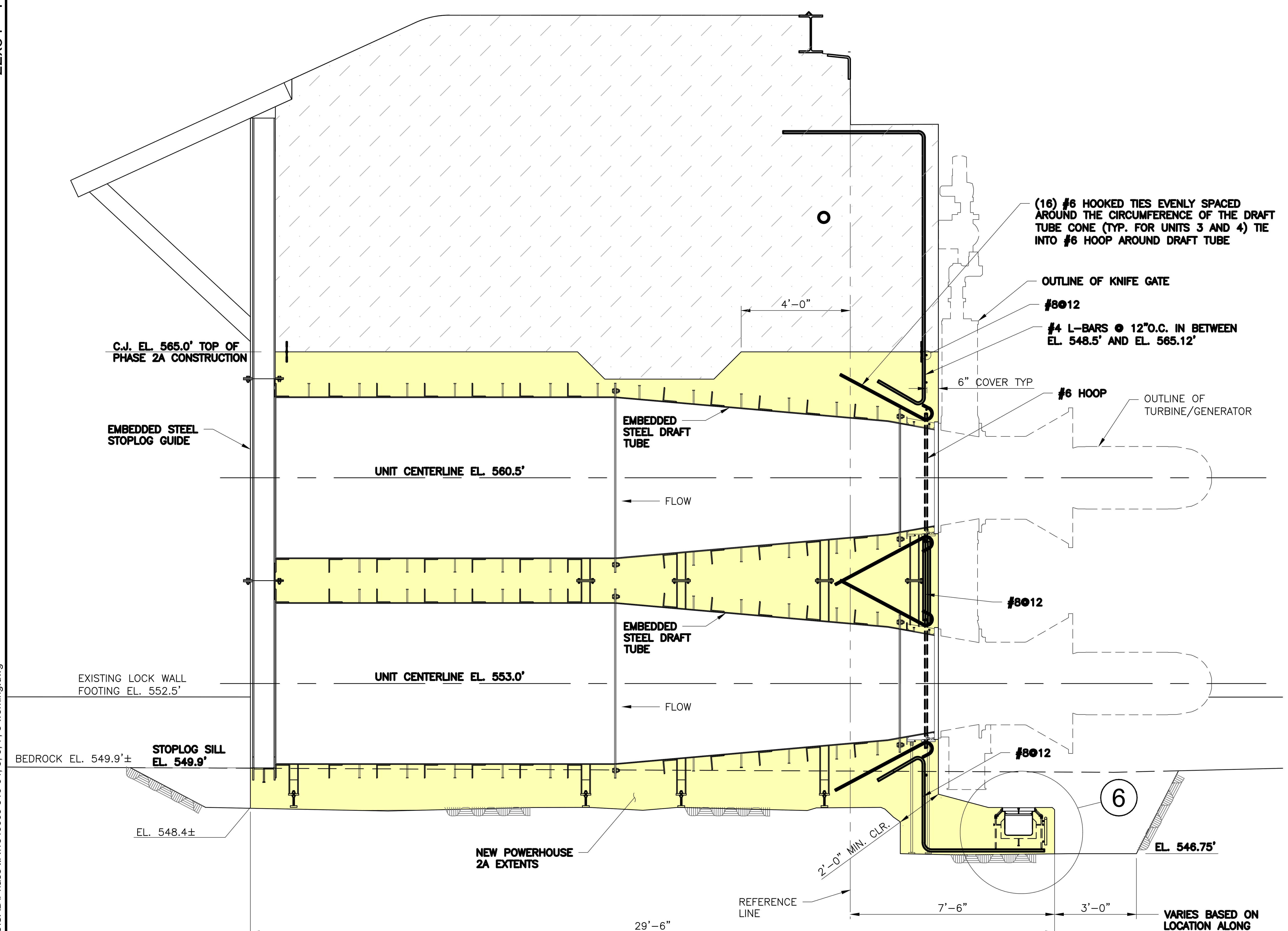
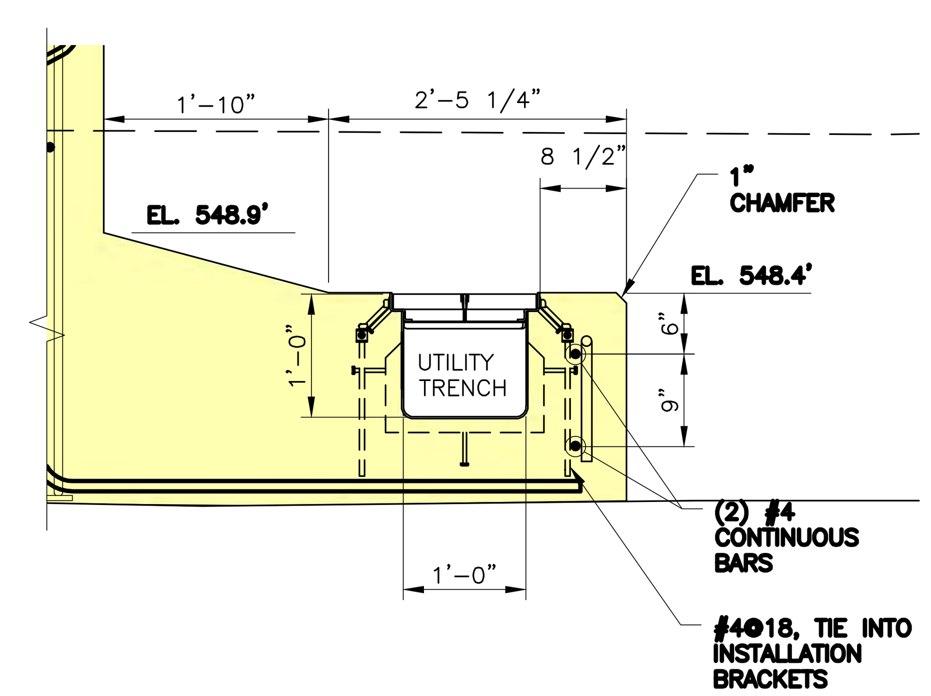
22x34 = FULL SCALE

FOR DIMENSIONAL INFORMATION AND REINFORCEMENT DETAIL NOT SHOWN HERE, REFER TO DRAWING 04



SECTION B/03
3/8"= 1'-0"
(TYPICAL SECTION THRU 895 UNIT CENTERLINE)

2 0 2 4 6
SCALE IN FEET



DETAIL 6
3/4" = 1'-0"
FOR ADDITIONAL DETAIL, SEE DETAIL 5/4

PHASE 2A - NOT FOR CONSTRUCTION

LEGEND

- FUTURE STAGE CONCRETE
- CLASS I, 3,500 PSI CONCRETE
- CLASS II, 4,500 PSI CONCRETE

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - REINFORCED CONCRETE
SECTION THRU UNIT 895 CENTERLINE

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No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	310-05

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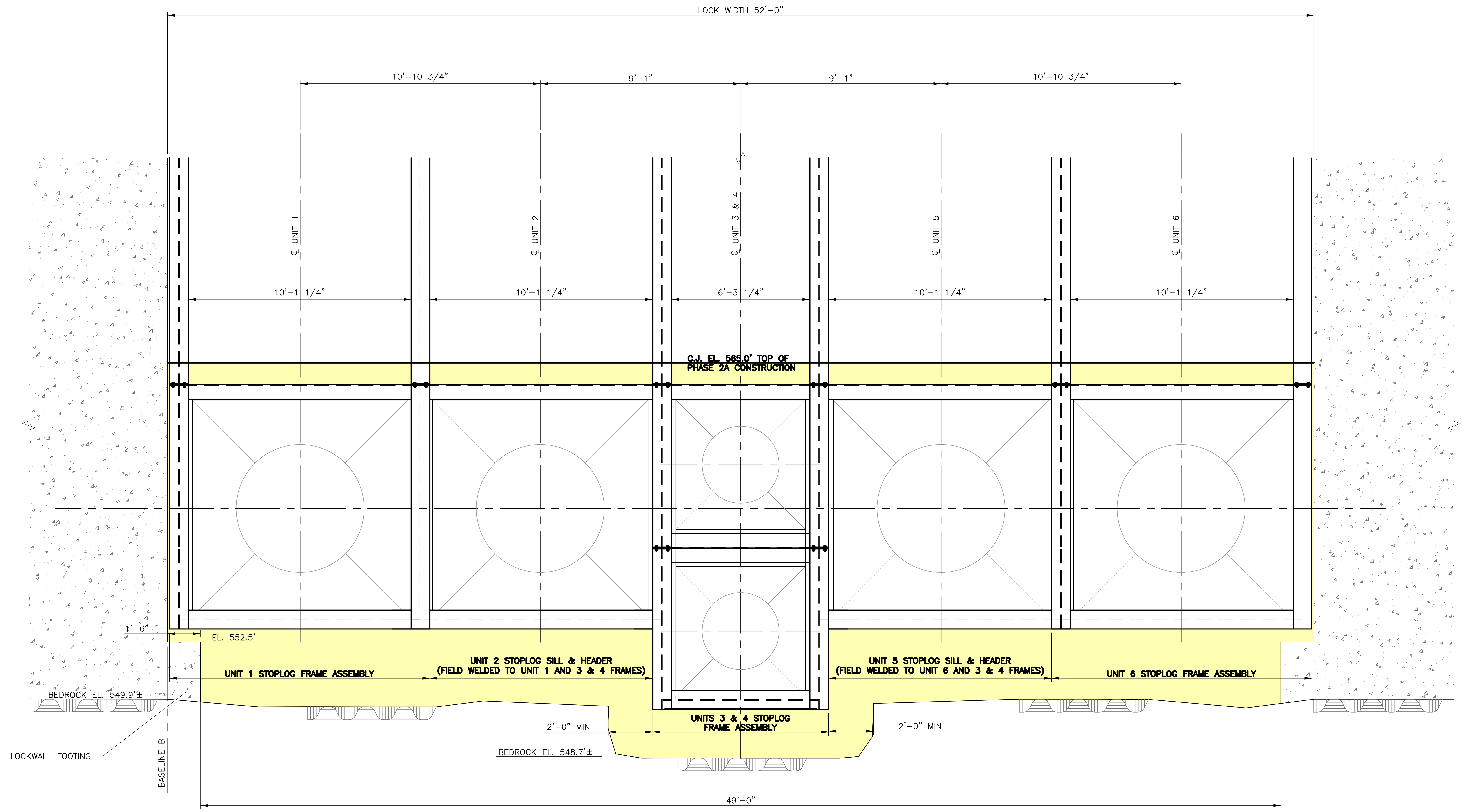
22x34 = FULL SCALE



SECTION E/03
3/8"= 1'-0"

2 0 2 4 6
SCALE IN FEET

LEGEND

	EXISTING CONCRETE
	CLASS I, 3,500 PSI CONCRETE
	CLASS II, 4,500 PSI CONCRETE

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
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PROFESSIONAL ENGINEER
8/1/24

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD

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LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

POWERHOUSE - REINFORCED CONCRETE
DOWNSTREAM SECTION VIEW

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	310-06

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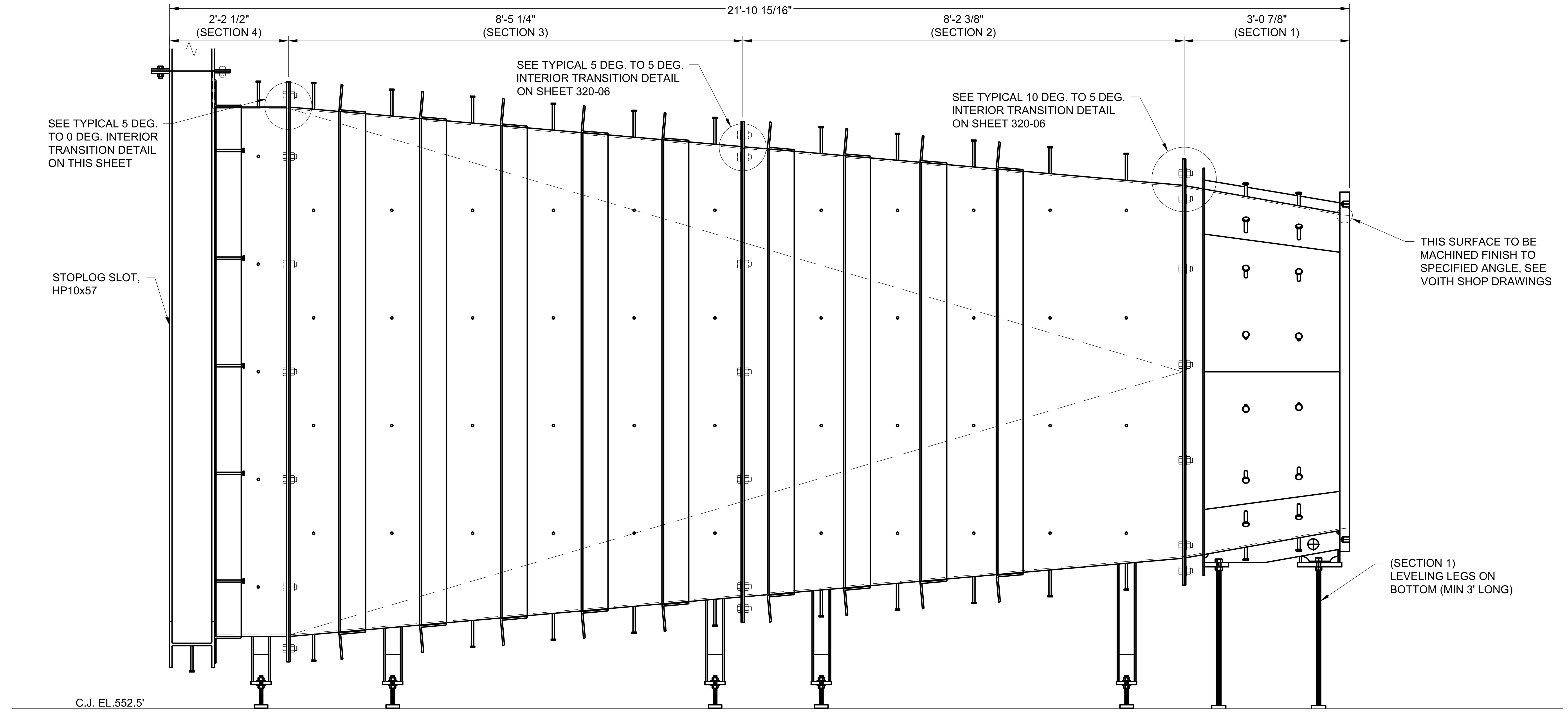
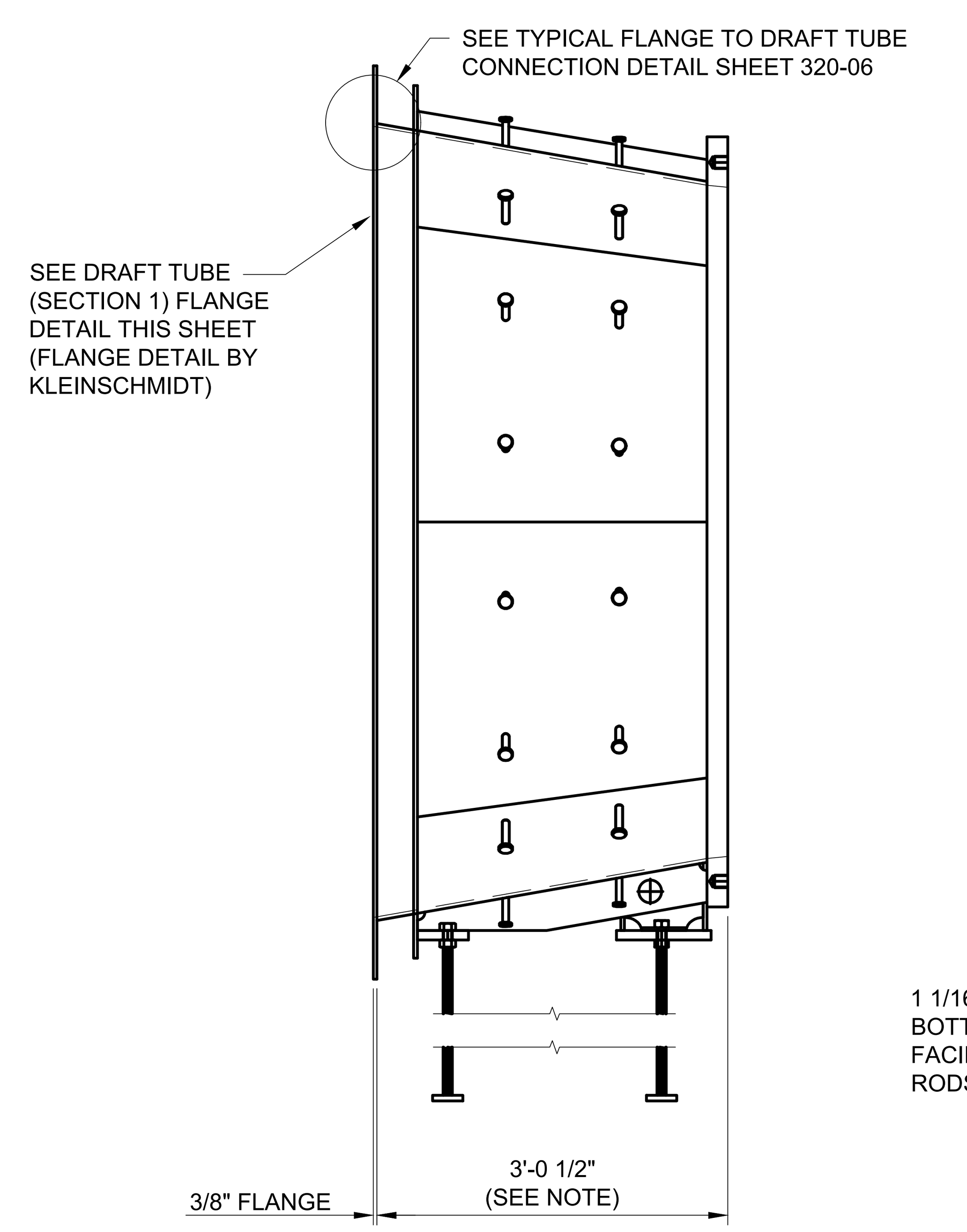


1490 DRAFT TUBE CONE ASSEMBLY
3/4"= 1'-0"
(4 REQUIRED)

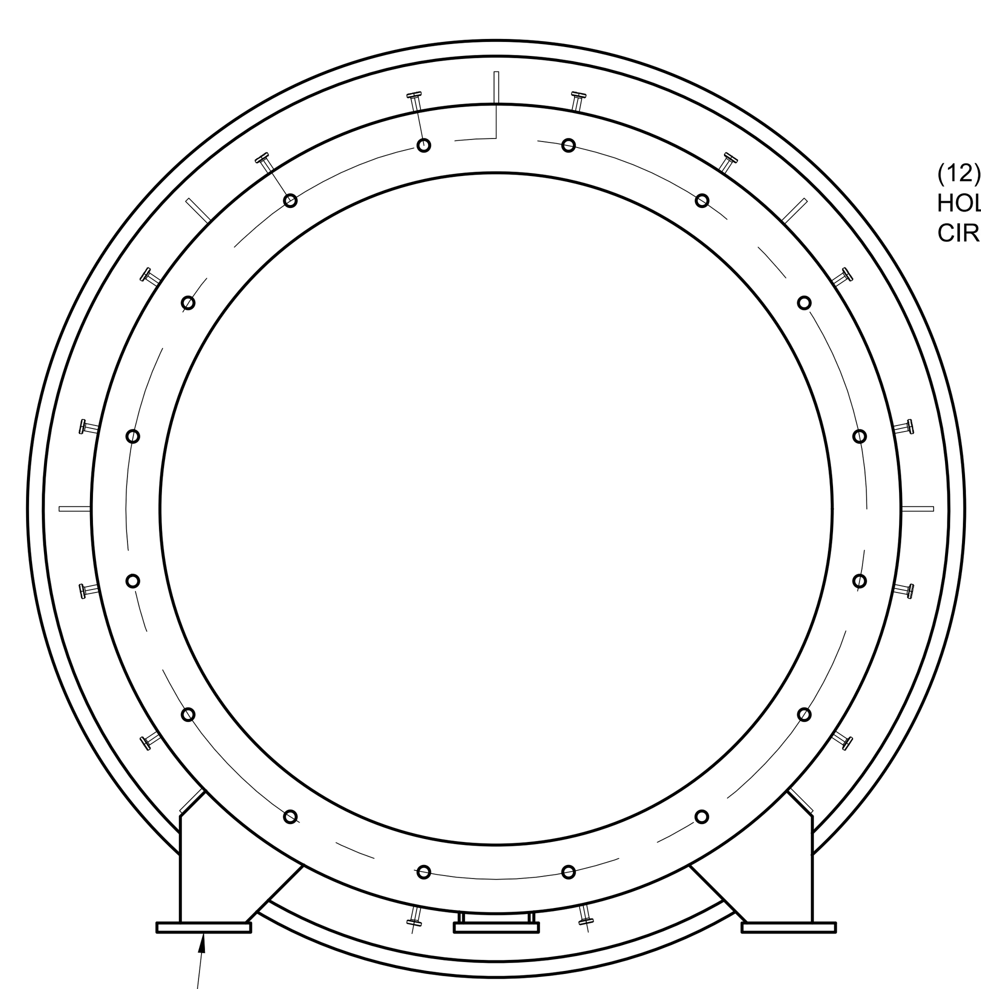
NOTES:

1. ALL DIAMETERS SHOWN ARE HYDRAULIC GOVERNED INTERIOR DIMENSIONS PROVIDED BY VOITH.
2. SECTION ONE DETAILS PROVIDED BY VOITH.
   A. FOR 1490 UNITS REFERENCE DRAWINGS 2K3899-9 SHEETS 1 THROUGH 3.
   B. FOR 895 UNITS REFERENCE DRAWINGS 2K3899-8 SHEETS 1 THROUGH 3.

   SHEET NUMBERS ARE FROM LOCK 14, SAME DETAILS WILL GOVERN FOR LOCK 11 & SHEETS WILL BE UPDATED WHEN RFC'd.
3. ALL SECTIONS AND STOPLOG SLOTS TO BE SHOP FABRICATED.
4. PROVIDE (6) 4" DIAMETER GROUT HOLES, (3) AT UPSTREAM END AND (3) AT DOWNSTREAM END, FOR EACH SHOP FABRICATED SECTION. HOLES TO BE EQUALLY SPACED (APPROX. 4' EA) WITHIN 12" OF EACH END.
5. FABRICATOR TO CONFIRM THAT MAX. SECTION WEIGHT IS LESS THAN 7,500 LBS. PROVIDE WEIGHTS OF ALL SECTIONS IN SHOP DRAWINGS.
6. STRUCTURAL STEEL MATERIAL: S355 = A572 GR 50
7. ALL PLATE CONSTRUCTION:
   A. 3/8" THICK (UNLESS OTHERWISE NOTED)
   B. ALL INTERIOR PLATE WELDS TO BE GROUND SMOOTH.
   C. TOLERANCE IS +/- 1/16" FOR THE INTERIOR DIAMETER.
8. STIFFENER ANGLES: L6x6x3/8"
9. SHOP WELD ALL ANGLE TO PLATE CONNECTIONS W/ 3/16" FILLET, TYP. USE STAGGERED SKIP WELD WITH A MINIMUM LENGTH OF 2" AND A MAXIMUM SPACING BETWEEN WELD ENDS OF 3".
   A. MAXIMUM WELD TOLERANCE FOR ALL SEAMS IN THE WATERERED AREA (INTERIOR SURFACE) FROM THE FINISH PLATE SURFACE IS 5/64"
10. FABRICATOR TO PROVIDE 1" ASTM 325 BOLTS TO CONNECT ALL DRAFT TUBE SECTIONS. FABRICATOR TO CONFIRM NUMBER OF BOLTS REQUIRED AND ALIGNMENT OF BOLT HOLES DURING SHOP DRAWING DEVELOPMENT.
11. FABRICATOR TO PROVIDE 1" F1554 GR. 55 THREADED ROD LEVELING ANCHORS 3 FEET LONG. FABRICATOR TO CONFIRM NUMBER OF LEVELING ANCHORS REQUIRED DURING SHOP DRAWING DEVELOPMENT.
12. FABRICATOR TO PROVIDE BOLTS AND NUTS FOR BOLTED CONNECTION BETWEEN DRAFT TUBE FLANGE AND SHUT-OFF VALVE AS SPECIFIED BELOW.
   A. FOR EACH 1490 UNIT (4 UNITS TOTAL) PROVIDE (20) 1 1/4" DIA. x 4 17/32" A304L BOLTS OR APPROVED EQUIVALENT.
   B. FOR EACH 895 UNIT (2 UNITS TOTAL) PROVIDE (16) 1" DIA. x 3 35/64" A304L BOLTS OR APPROVED EQUIVALENT.
   C. BOLT LAYOUT TOLERANCE SHALL BE +/- 0.5 DEGREES.
   D. BOLT LENGTH MAY BE LONGER AS REQUESTED BY OWNER OR DETERMINED BY FABRICATOR. FLANGE THICKNESS OF SHUT OFF VALVE IS 28mm (1 7/64") FOR BOTH 1490 AND 895 UNITS. SELF-LOCKING WASHERS OR DOUBLE NUTS ARE NOT REQUIRED.
13. COATINGS:
   A. ALL STRUCTURAL STEEL AND MISCELLANEOUS METAL ASSOCIATED WITH THE DRAFT TUBES AND STOPLOG SLOTS SHALL USE THE FOLLOWING COATING SYSTEM UNLESS NOTES OTHERWISE:
   I. SURFACE PERPARATION: SSPC-SP 10 NEAR WHITE BLAST CLEANING 1.0 MIL PROFILE.
   II. STOPLOG SLOTS: POLYSET WB HRZS SINGLE COAT SYSTEM BY POLYSET, 6-8 MILS DFT.
   III. DRAFT TUBES: POLYSET WB HRZS SINGLE COAT SYSTEM, 3-4MILS DFT.
      a. FOR STEEL AND MISCELLANEOUS METAL EMBEDDED IN CONCRETE: TO ACCELERATE THE FORMATION OF THE PAINT'S CERAMIC TYPE BARRIER ON THE STEEL, SPRAY PAINTED STEEL SURFACE IN CONTACT WITH CONCRETE WITH VINEGAR TO A WET SURFACE AND ALLOW TO DRY.
   IV. COATING SHALL BE APPLIED PER MANUFACTURERS INSTRUCTIONS.
14. INSTALLATION:
   A. CONTRACTOR TO USE SPIDERS AS REQUIRED TO PREVENT BUCKLING OF DRAFT TUBE PLATE DURING CONCRETE PLACEMENT. SPIDERS SHALL BE CUT 1" SHORTER THAN INTERIOR DIMENSION MINUS SELECTED FOOT WIDTH. WEDGES CAN BE USED TO HOLD SPIDER FIRM. WEDGES CAN BE NAILED, STAPLED OR GLUED IN PLACE. SPIDER FEET SHALL BE COMPLETELY COVERED WITH PADDING.
   B. IF SPIDERS ARE NOT IN PLACE TO INTERNALLY REINFORCE THE DRAFT TUBES THE MAXIMUM ALLOWABLE CONCRETE LIFT SHALL BE LIMITED TO 12".
   C. INSTALLATION TOLERANCE IS +/- 1/16" FOR THE INTERIOR DIAMETER.
   D. UPSTREAM VERTICAL FACE OF SECTION 1 SHALL BE INSTALLED +/- 0.5 DEGREES FROM VERTICAL.
   E. SHUT-OFF VALVE TO DRAFT TUBE CONNECTION:
      I. LUBRICATE THREADED RODS WITH MOLYKOTE BR2 PLUS OR EQUIVALENT LUBRICANT.
      II. FASTEN WITH CORRECT TORQUE:
         TBD AFTER RECEIVING CONFIRMATION FROM VOITH
         1" DIA. A304L = 3440 FT*LBS (DEPENDS ON THREADS PER INCH, 8 OR 14...3440 OR 3110 FT*LBS)
         1 1/4" DIA. A304L = 523 FT*LBS (DEPENDS ON THREADS PER INCH, 7 OR 12...523 OR 480 FT*LBS)



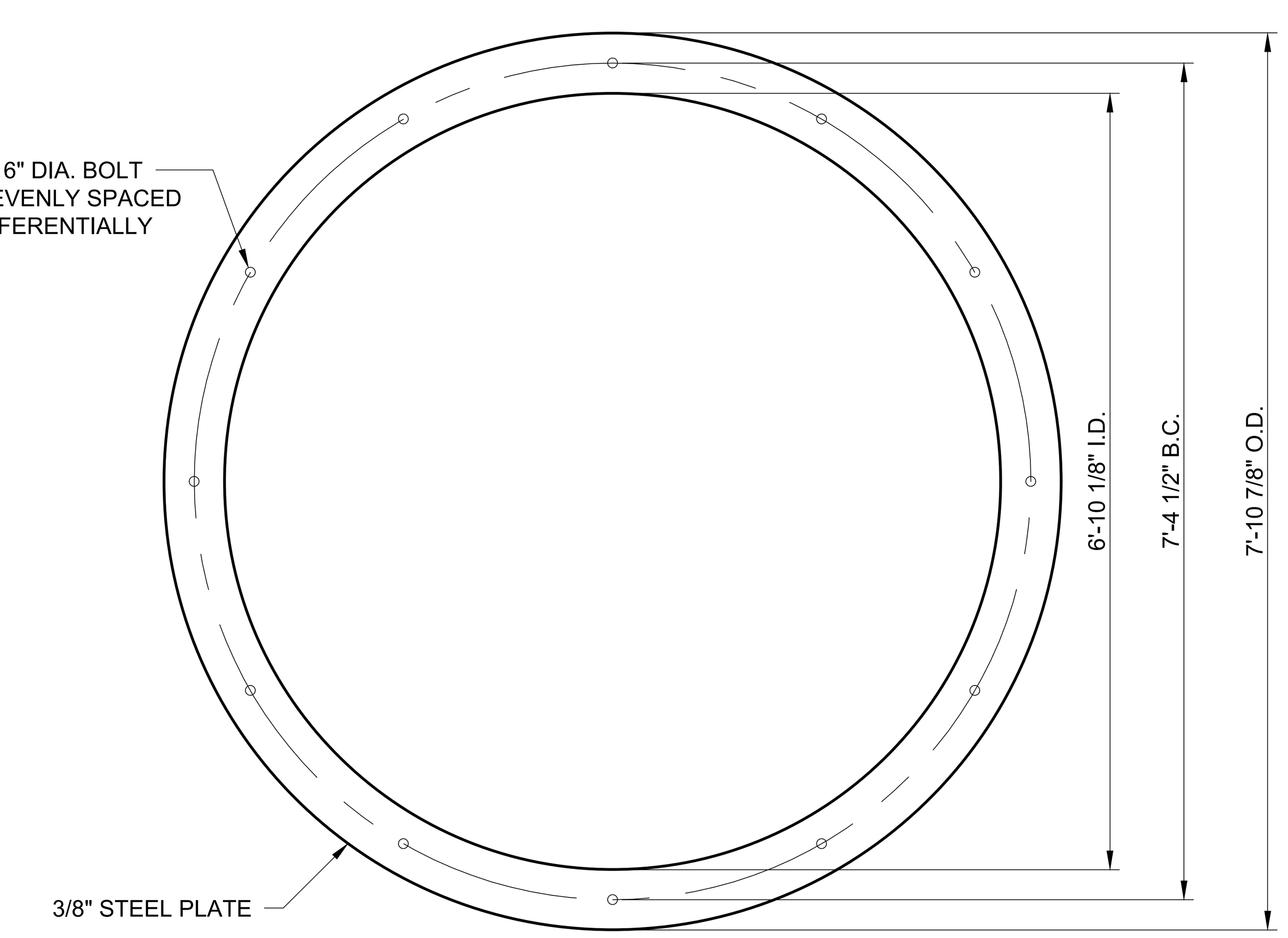
ELEVATION



ELEVATION LOOKING U/S

DRAFT TUBE (SECTION 1) DETAIL
3/4"= 1'-0"

NOTE: ADDITIONAL SECTION 1 FABRICATION DETAILS PROVIDED BY VOITH. SEE REFERENCE DRAWINGS 2K3899-9 SHEETS 1 THROUGH 3.



DRAFT TUBE (SECTION 1) FLANGE DETAIL
3/4"= 1'-0"

1 0 1 2 3
SCALE IN FEET

22x34 = FULL SCALE

PHASE 2A - NOT FOR CONSTRUCTION

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

STEAM DRIVER 1490
DRAFT TUBE SECTION AND DETAILS

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	320-01

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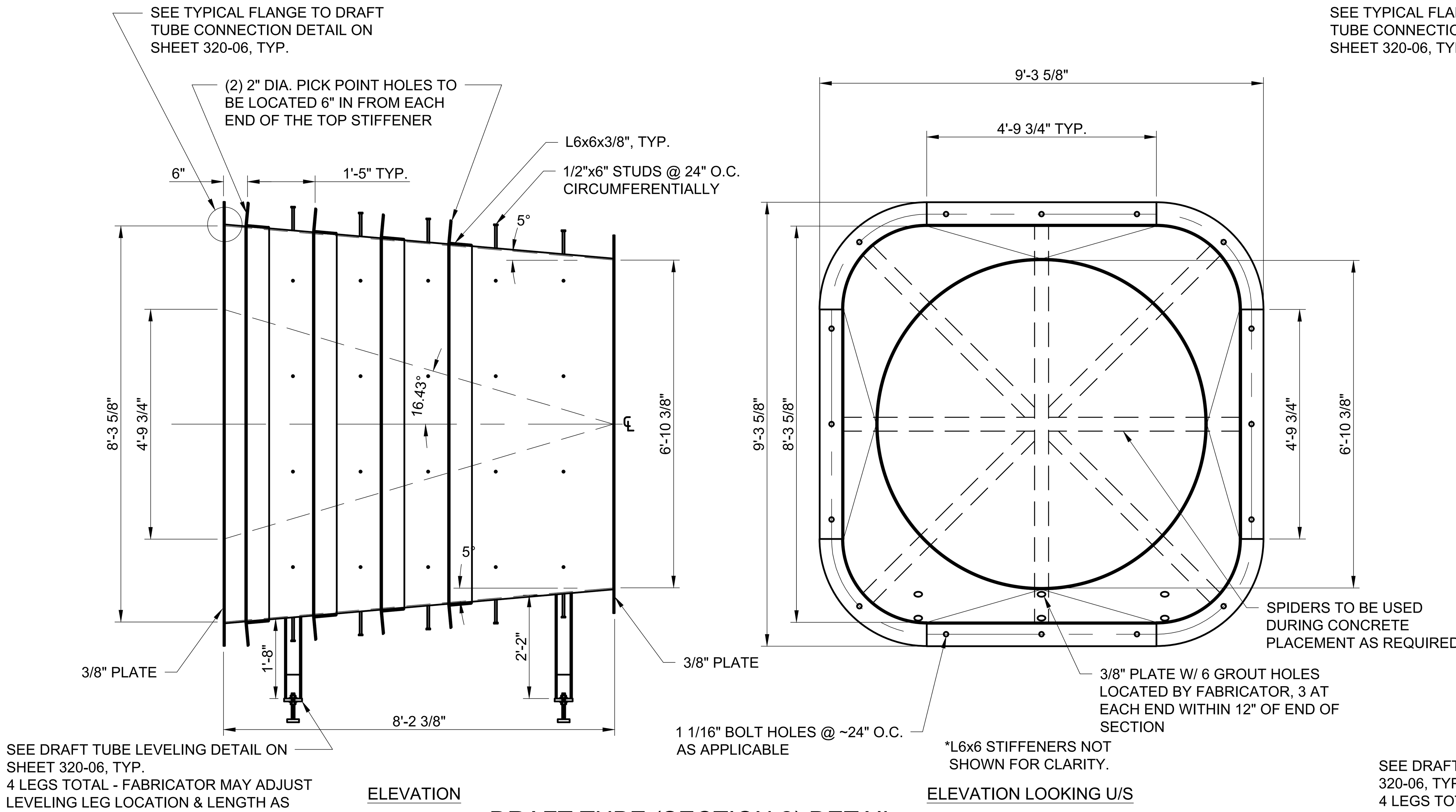
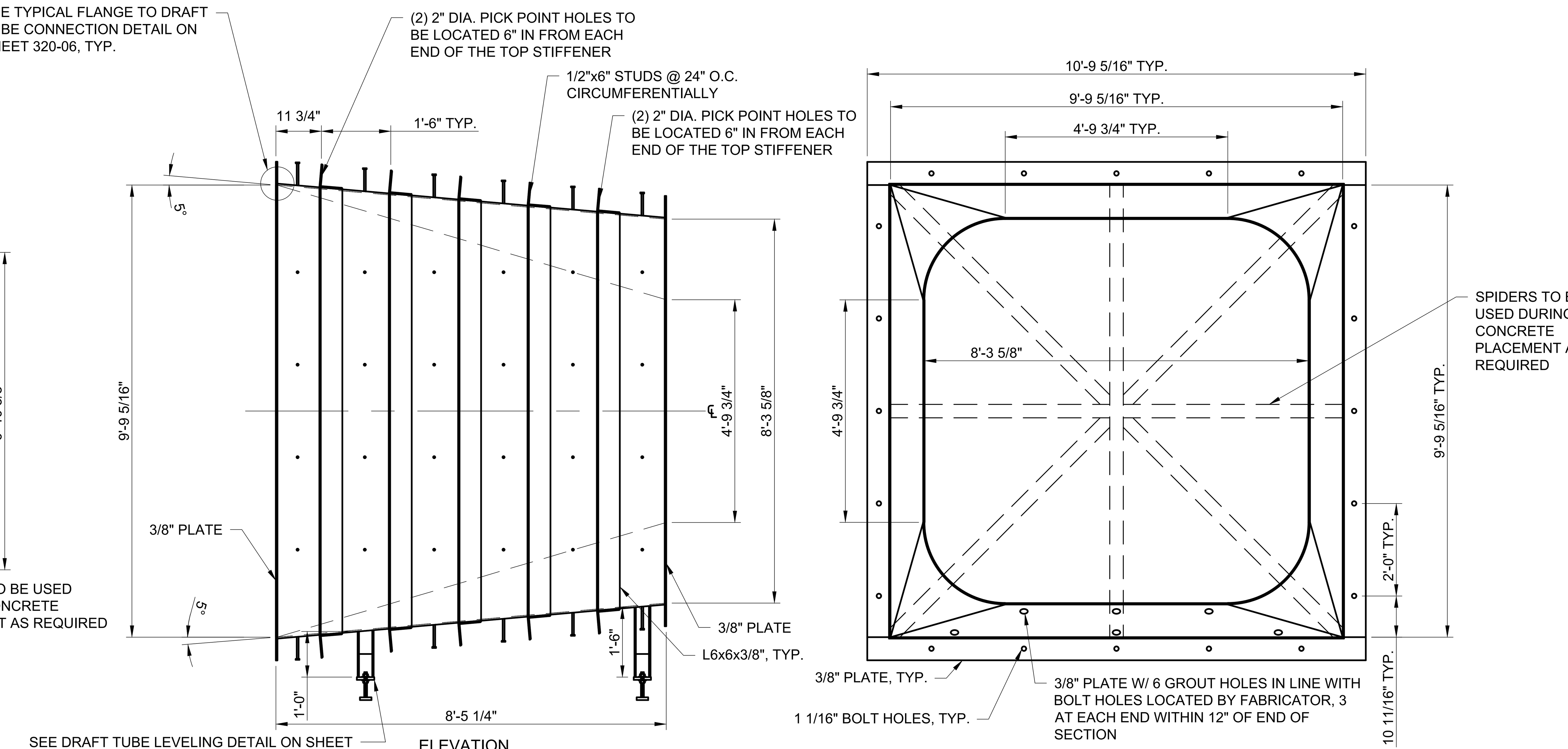
Jul. 31, 2024 - 11:58 AM

22x34 = FULL SCALE



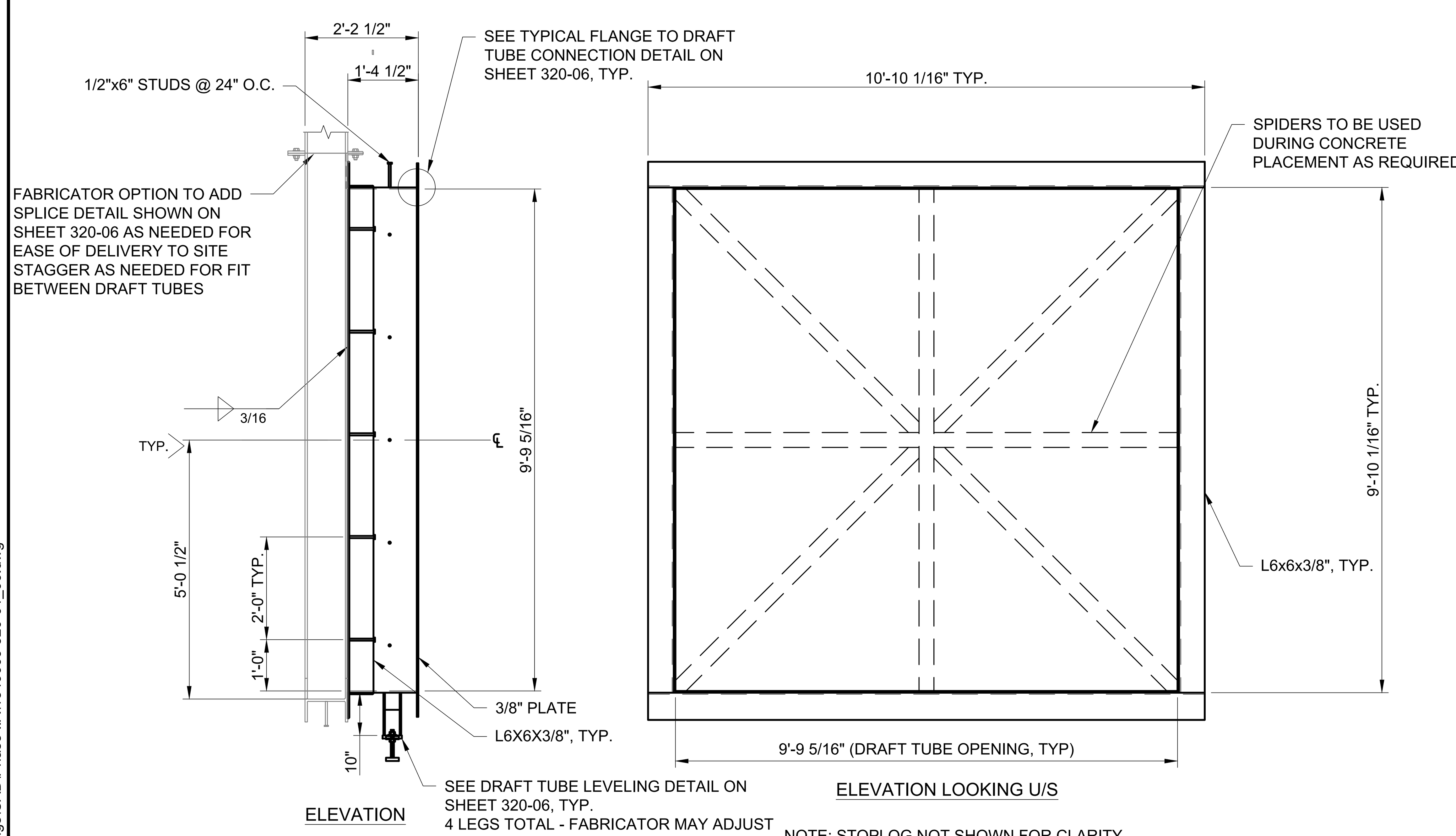
DRAFT TUBE (SECTION 2) DETAIL

1/2"= 1'-0"



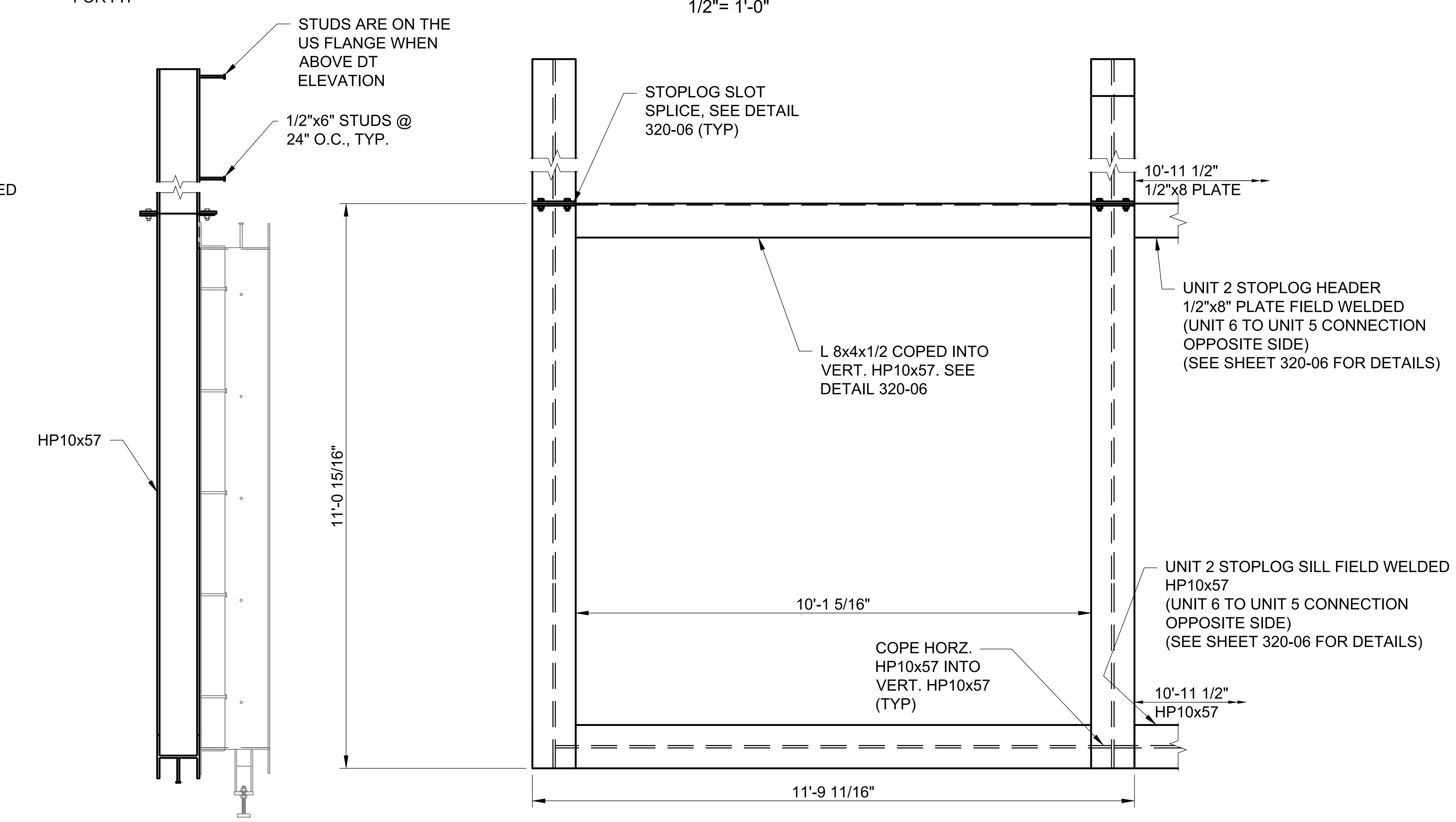
DRAFT TUBE (SECTION 3) DETAIL

1/2"= 1'-0"



DRAFT TUBE (SECTION 4) DETAIL

1/2"= 1'-0"



NOTE: DRAFT TUBES NOT SHOWN IN FOR CLARITY
FRAME FOR UNIT 1 SHOWN, UNIT 6 OPPOSITE
SEE SHEET 310-06 FOR FULL FRAME ASSEMBLY LAYOUT

DRAFT TUBE STOPLOG SLOT DETAIL

1/2"= 1'-0"

2 0 2 4
SCALE IN FEET

PHASE 2A - NOT FOR CONSTRUCTION

FOR CLIENT REVIEW

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

Designed	Drawn	Checked
PDC	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

STEAM DRIVER 1490
DRAFT TUBE DETAILS

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Project No.	Date Revised	Drawing No.
1349-009	08-01-24	320-02

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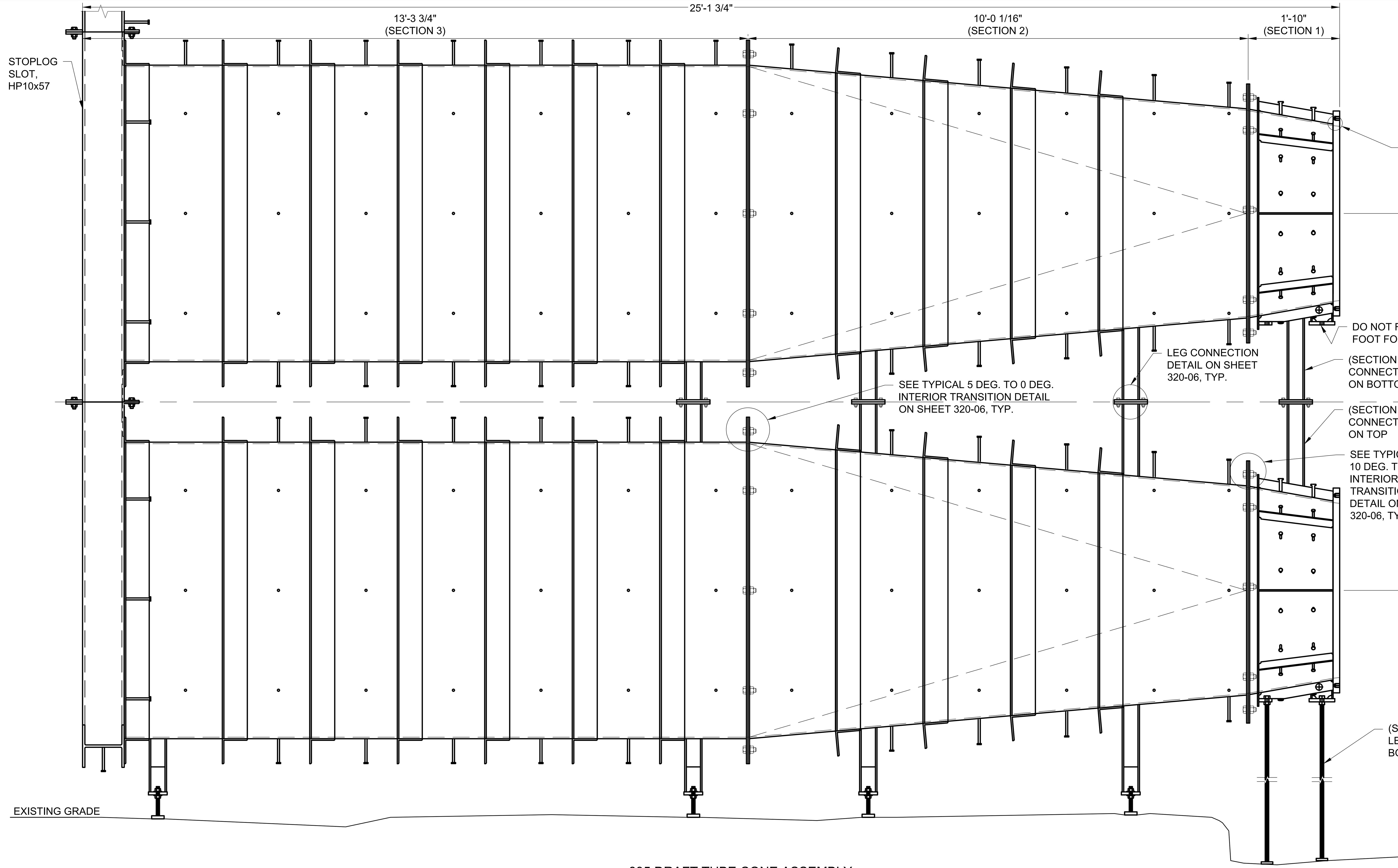
Jul. 31, 2024 - 11:58 AM

22x34 = FULL SCALE

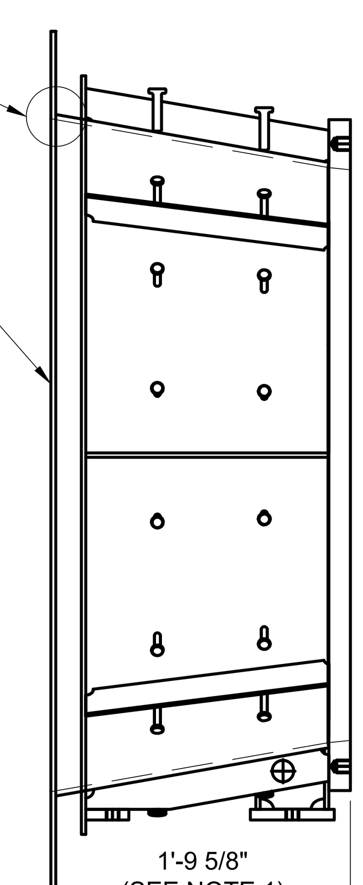
NOTE:
FABRICATOR TO SHOP ASSEMBLE TO CONFIRM ALIGNMENT



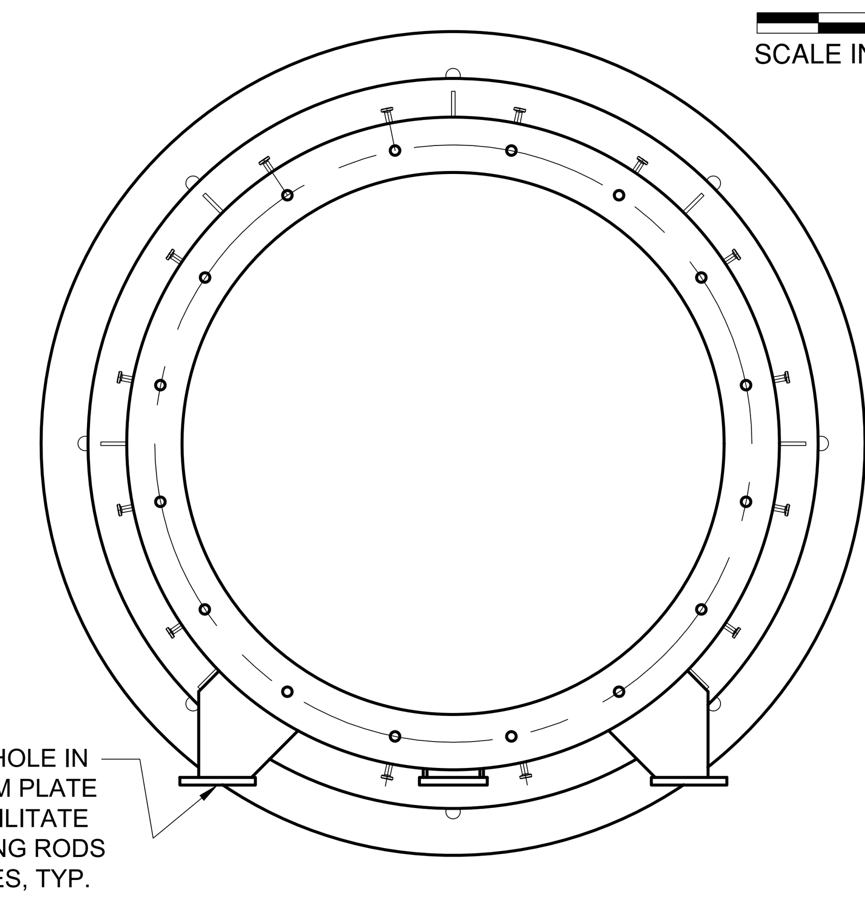
895 DRAFT TUBE CONE ASSEMBLY

3/4"= 1'-0"

SCALE IN FEET



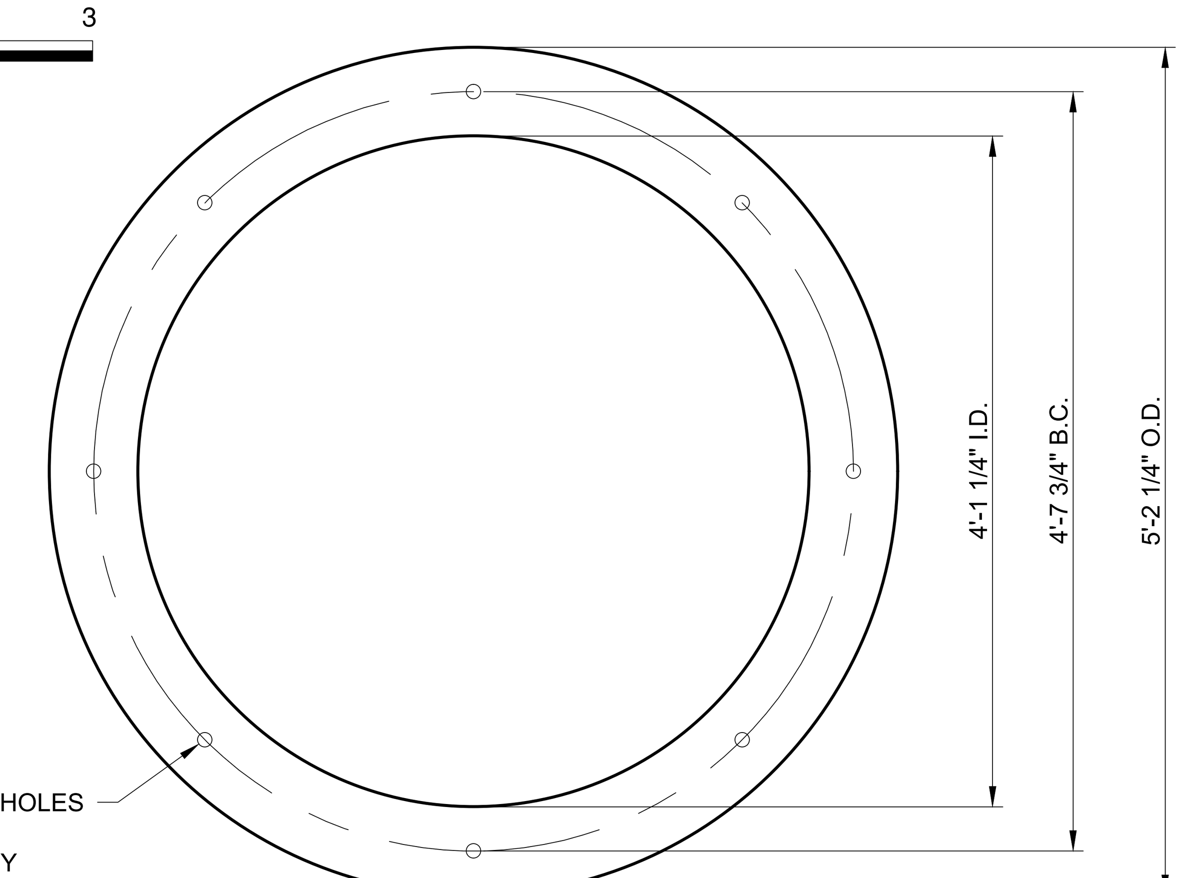
ELEVATION



ELEVATION LOOKING U/S

DRAFT TUBE (SECTION 1) DETAIL

1"= 1'-0"
(2 REQUIRED)



DRAFT TUBE (SECTION 1) FLANGE DETAIL

1"= 1'-0"
(2 REQUIRED)

SCALE IN FEET

NOTES:
1. ADDITIONAL SECTION 1 FABRICATION DETAILS PROVIDED BY VOITH. SEE REFERENCE DRAWINGS 2K3899-8 SHEETS 1 THROUGH 3.
2. SEE ASSEMBLY VIEW ABOVE FOR LEVELING AND CONNECTION LEG ORIENTATION.

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

Designed	Drawn	Checked
PDC	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

STEAM DRIVER 895
DRAFT TUBE SECTION AND DETAILS

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Project No.	Date Revised	Drawing No.
1349-009	08-01-24	320-03

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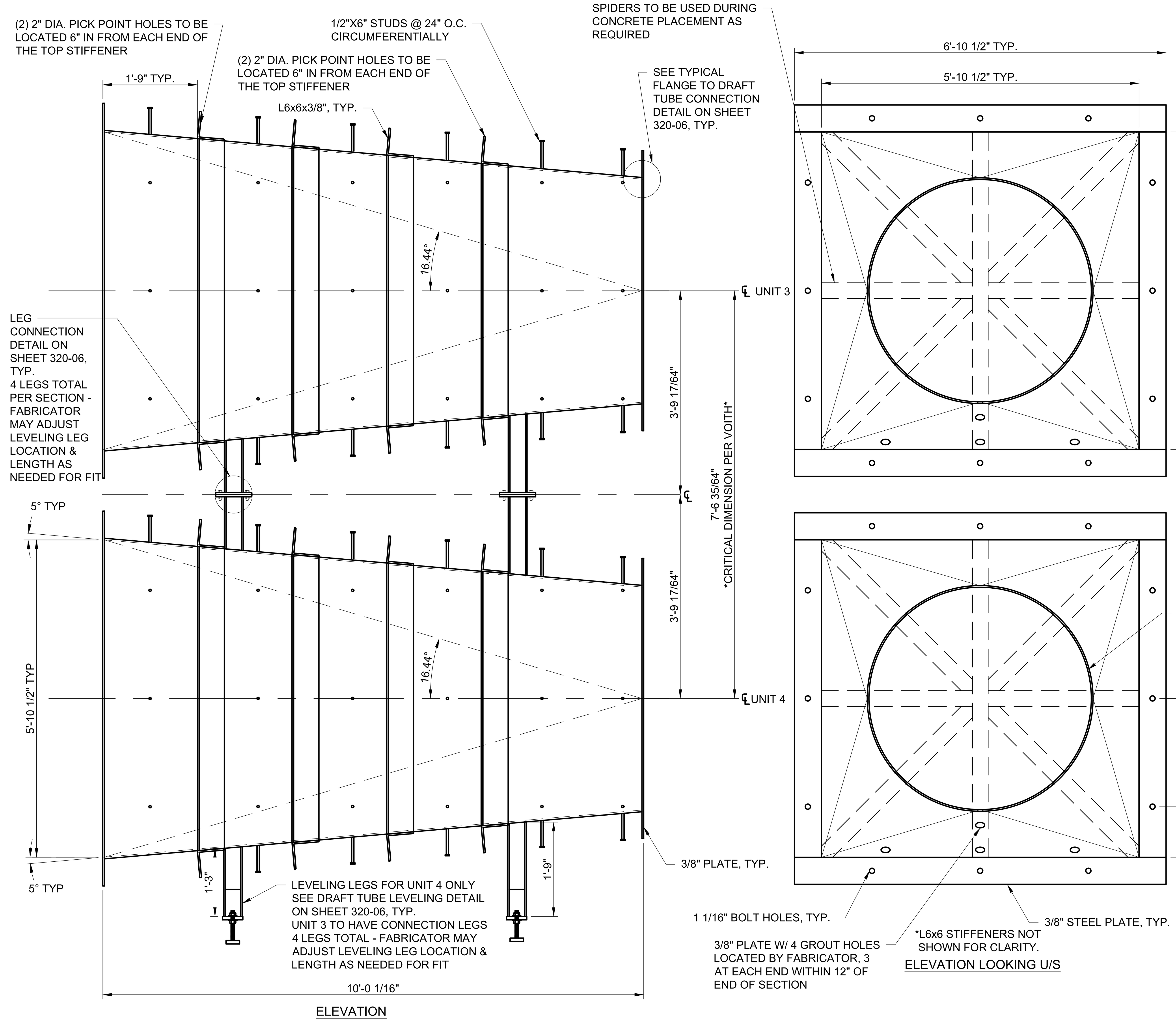
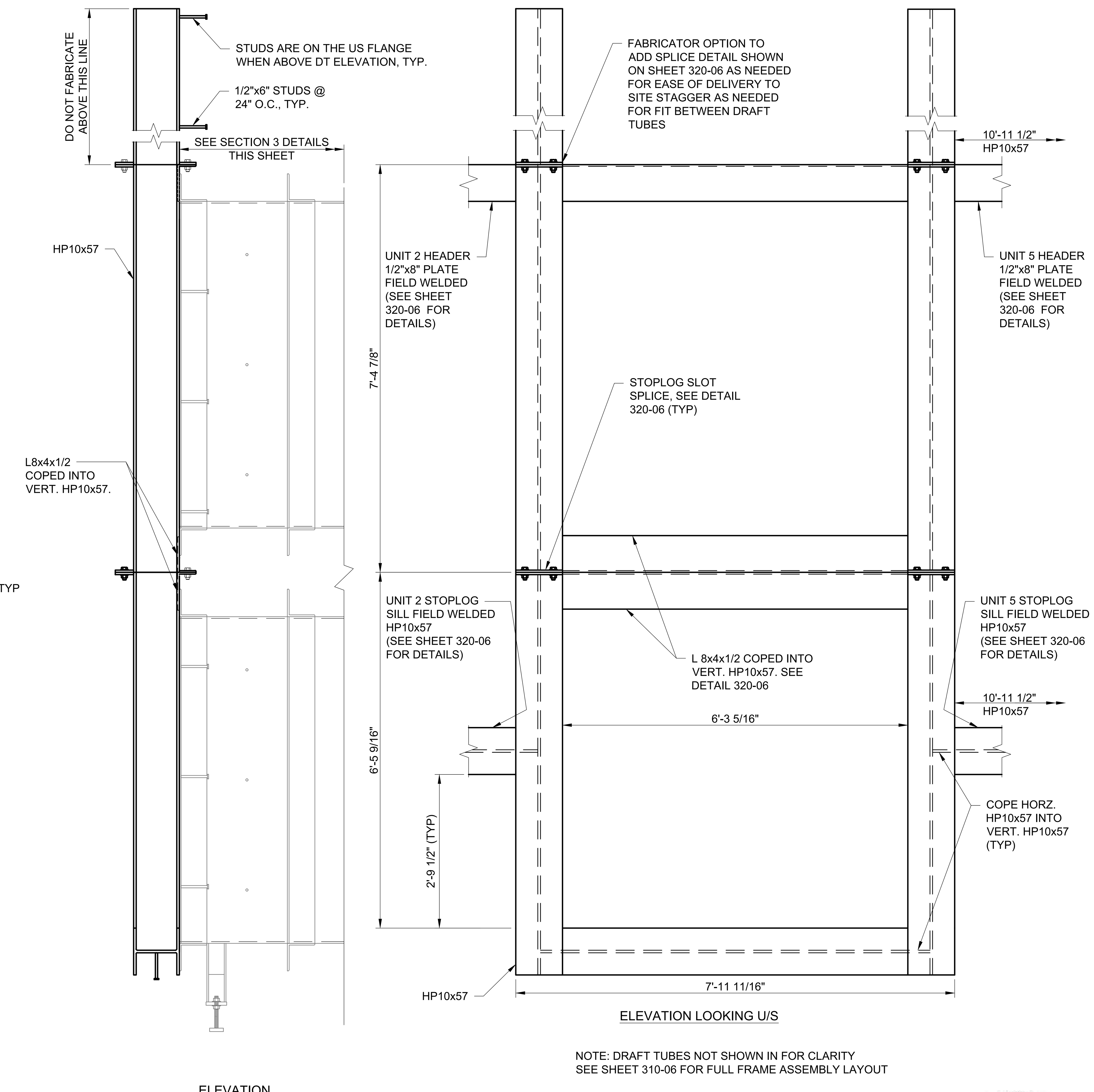


DRAFT TUBE (SECTION 2) DETAIL

3/4"= 1'-0"
(2 REQUIRED)

1 0 1 2 3
SCALE IN FEET



NOTE: DRAFT TUBES NOT SHOWN IN FOR CLARITY
SEE SHEET 310-06 FOR FULL FRAME ASSEMBLY LAYOUT

DRAFT TUBE STOPLOG SLOT DETAIL

3/4"= 1'-0"

3" 2" 1" 0
22x34 = FULL SCALE

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8/1/24

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	320-04

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LOCK No. 11

STEAM DRIVER 895
DRAFT TUBE DETAILS

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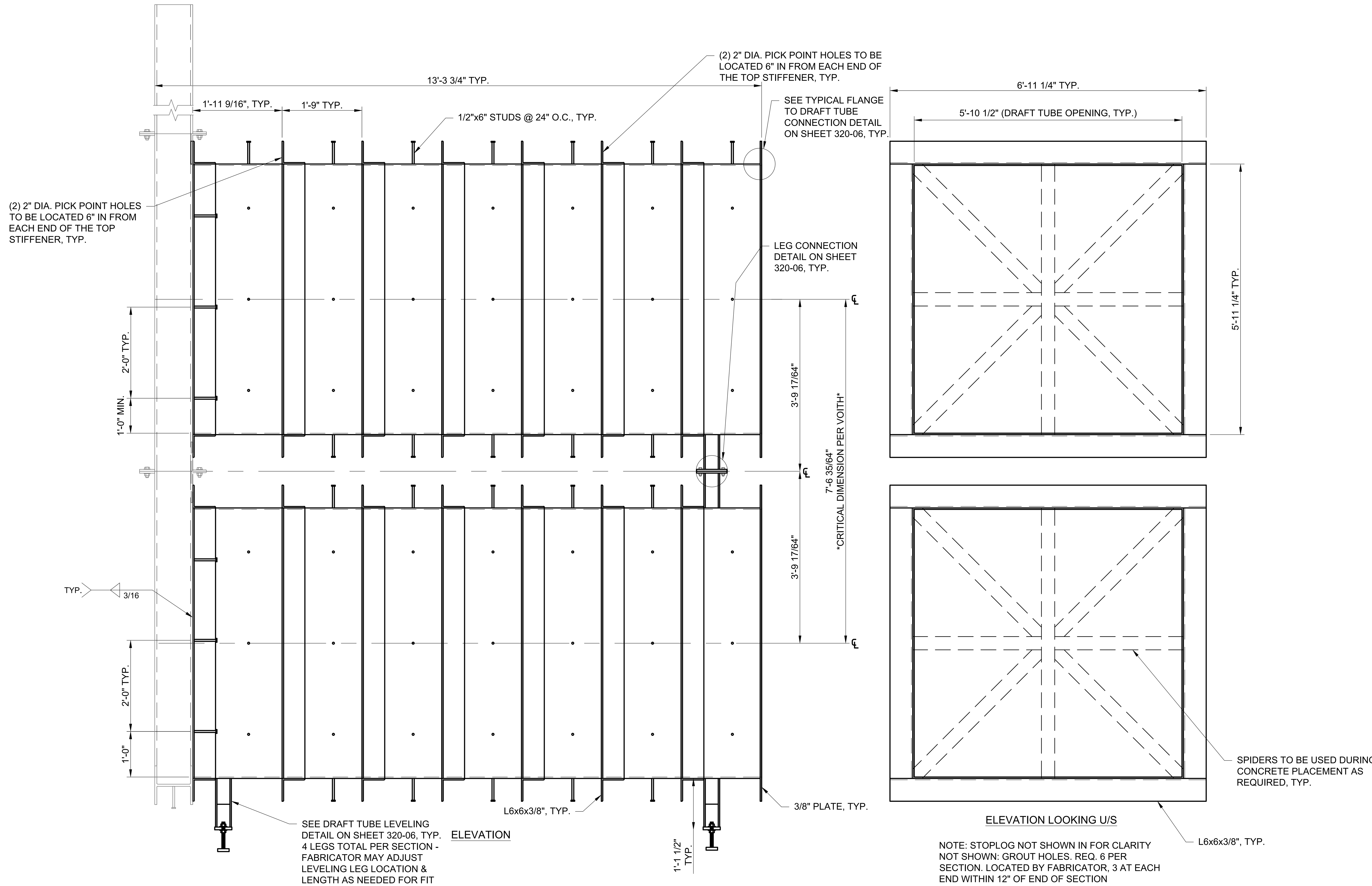

DRAFT TUBE (SECTION 3) DETAIL

3/4"= 1'-0" 1 0 1 2 3

SCALE IN FEET

22x34 = FULL SCALE

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	320-05

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LOCK No. 11

STEAM DRIVER 895
DRAFT TUBE DETAILS

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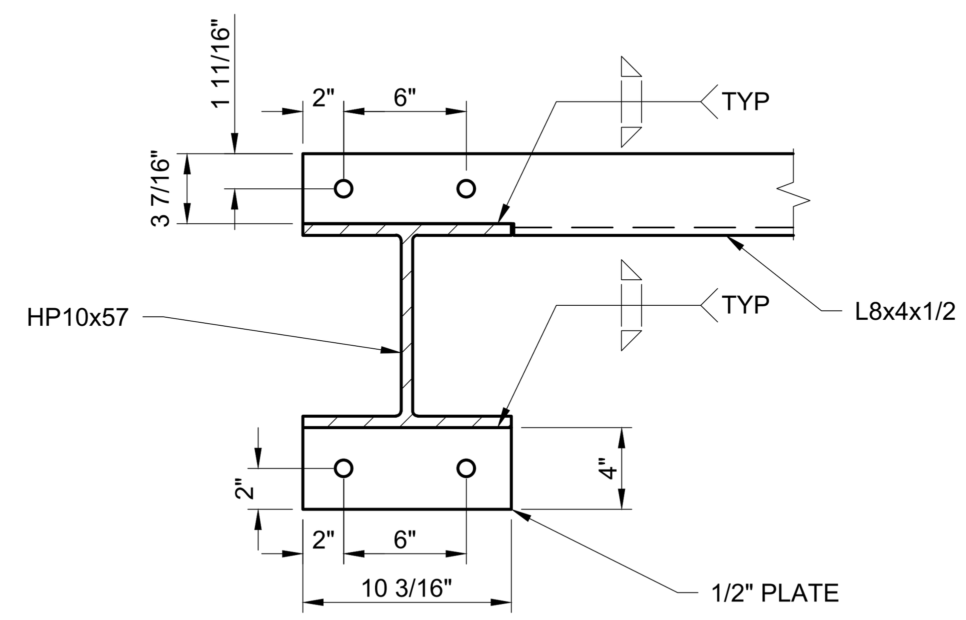
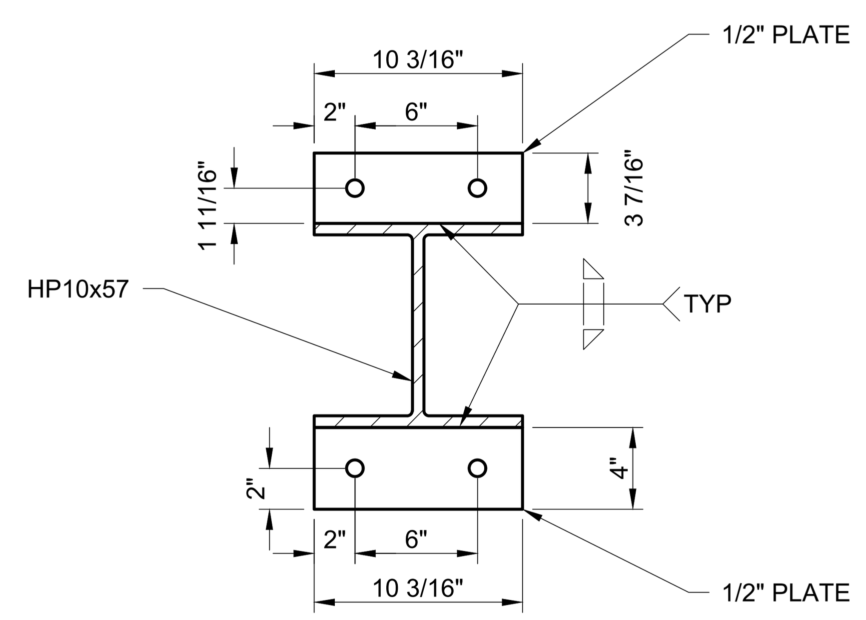
22x34 = FULL SCALE



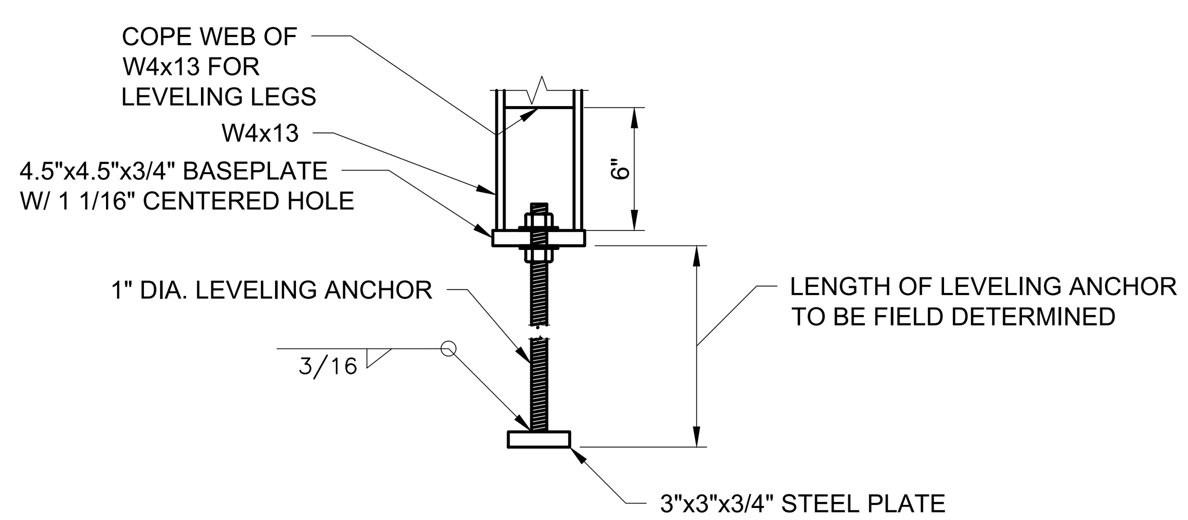
SPLICE DETAIL 1 DETAIL

1 1/2"= 1'-0"



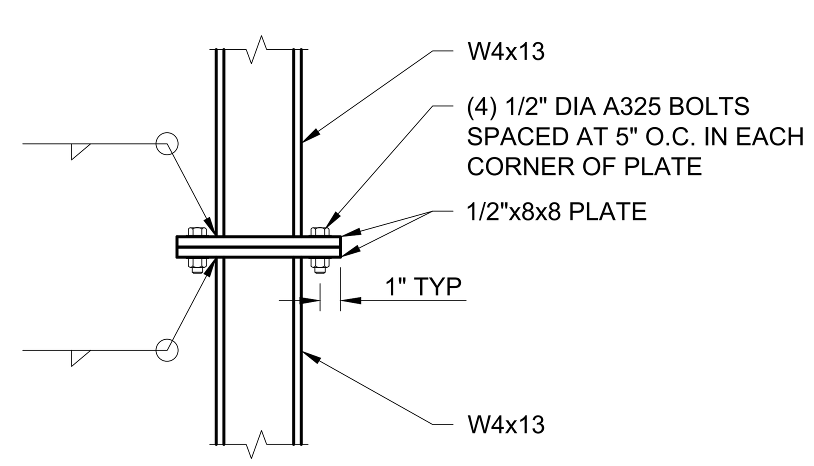
SPLICE DETAIL 2 DETAIL

1 1/2"= 1'-0"



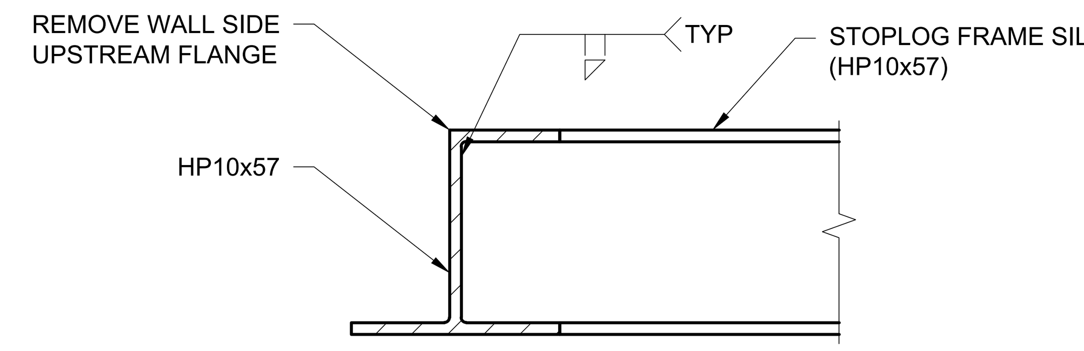
DRAFT TUBE LEVELING DETAIL

1 1/2"= 1'-0"



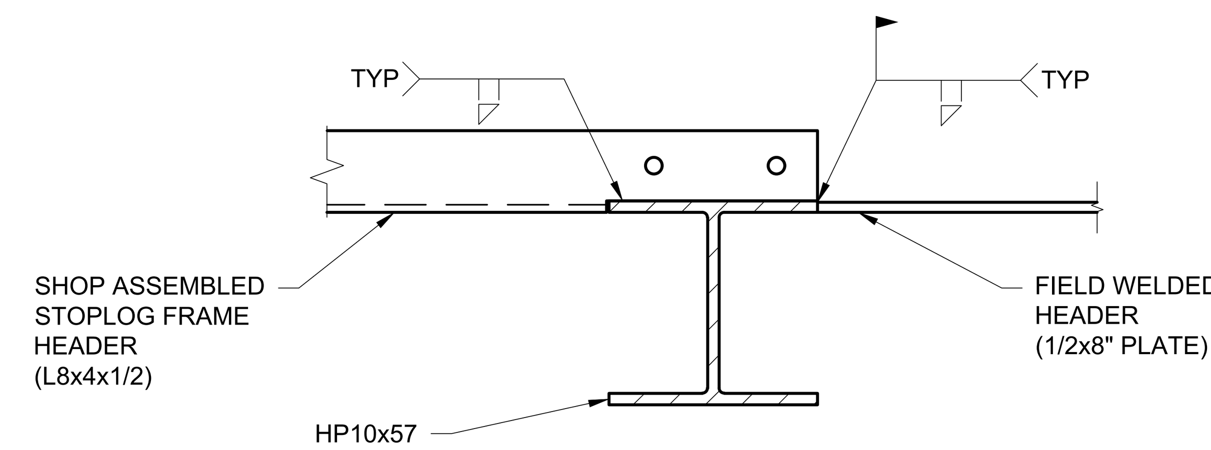
LEG CONNECTION DETAIL

1 1/2"= 1'-0"



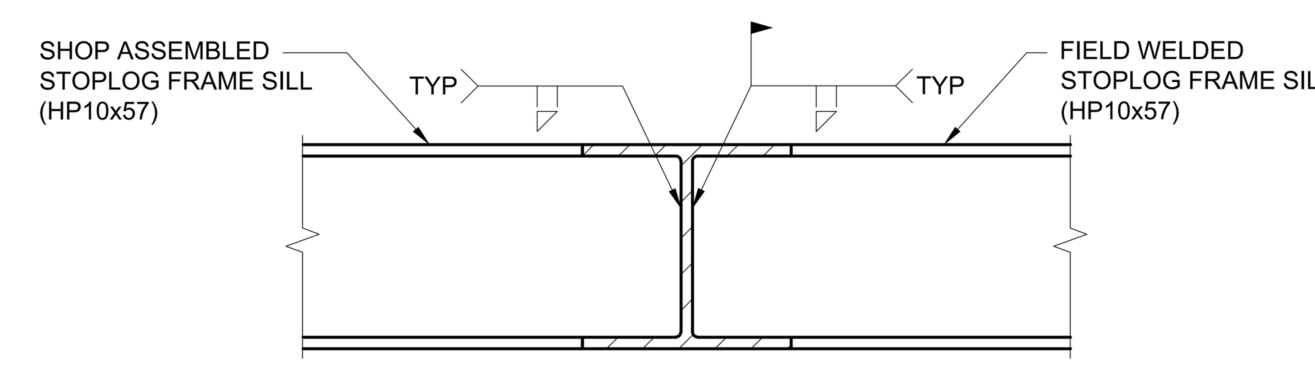
UNIT 1 AND 6 SIDE STOPLOG FRAME

1 1/2"= 1'-0" (UNIT 1 SHOWN, UNIT 6 OPPOSITE)



STOP LOG FRAME STD. HEADER CONNECTION

1 1/2"= 1'-0" (SEE SHEET 310-06 FOR ASSEMBLY LAYOUT)

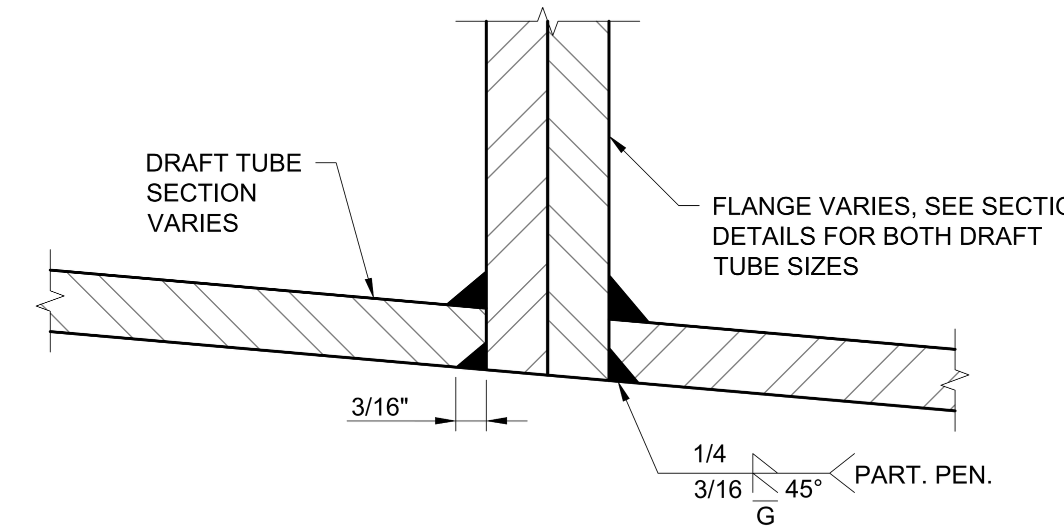


STOP LOG FRAME STD. SILL CONNECTION

1 1/2"= 1'-0" (SEE SHEET 310-06 FOR ASSEMBLY LAYOUT)

8 0 8 16

SCALE IN INCHES

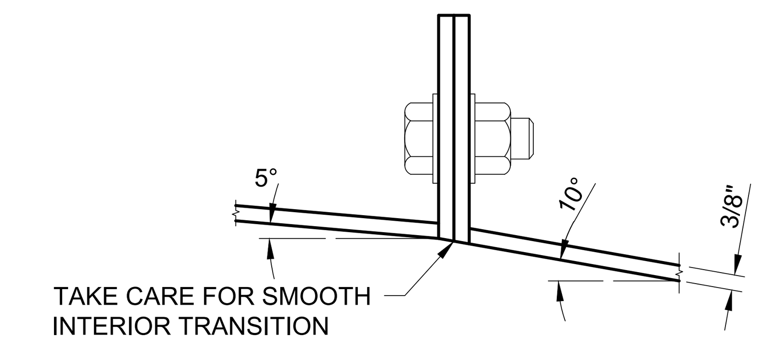


TYPICAL FLANGE TO DRAFT TUBE CONNECTION DETAIL

1'-0"= 1'-0"

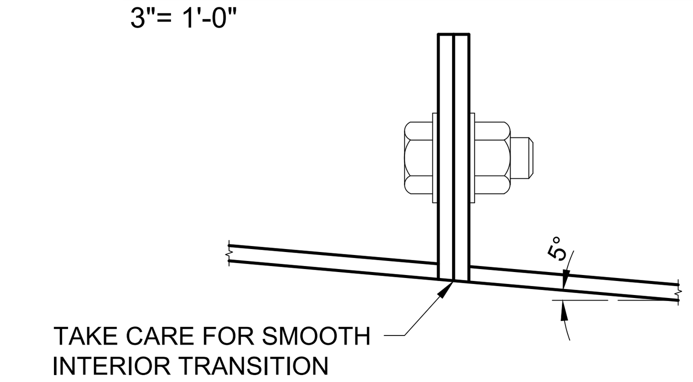
1 0 1 2

SCALE IN INCHES



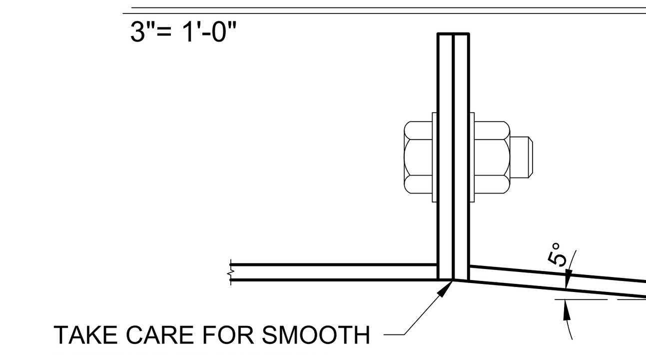
TYPICAL 10 DEG. TO 5 DEG.
INTERIOR TRANSITION DETAIL

3"= 1'-0"



TYPICAL 5 DEG. TO 5 DEG.
INTERIOR TRANSITION DETAIL

3"= 1'-0"



TYPICAL 5 DEG. TO 0 DEG.
INTERIOR TRANSITION DETAIL

3"= 1'-0"

3 0 3 6 9

SCALE IN INCHES

PHASE 2A - NOT FOR CONSTRUCTION

No.	Revision	Date	Drawn	Checked
0	FERC REVIEW (PHASE 2A)	08-01-24	BJL	JLD
B	ISSUE FOR FABRICATOR BID	06-12-24	BJL	JLD
A	FOR CLIENT REVIEW	06-07-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
PDC	BJL	JLD	1349-009	08-01-24	320-06

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LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

STEAM DRIVER
DRAFT TUBE DETAILS

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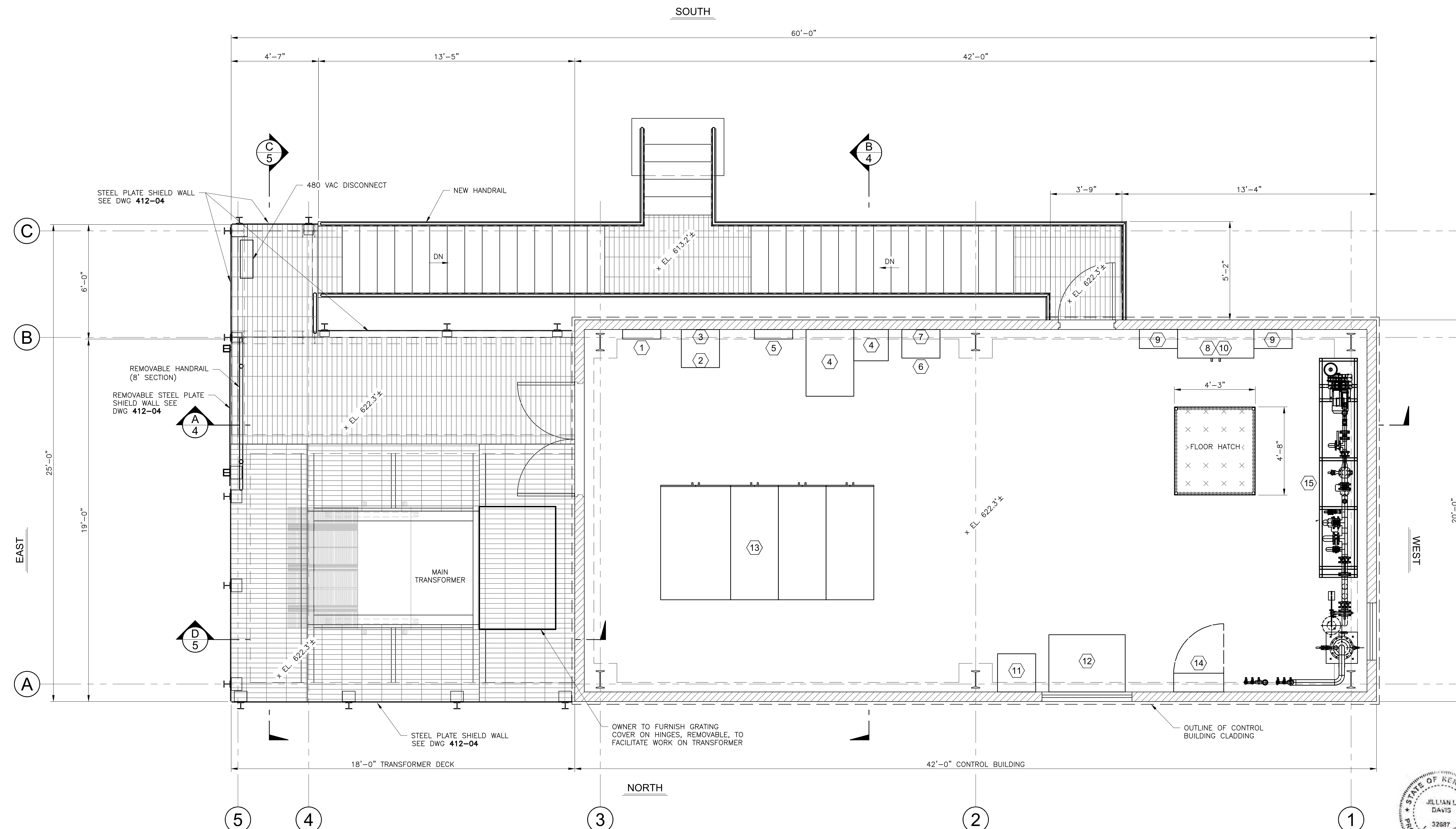

GENERAL ARRANGEMENT PLAN VIEW (EL. 622.3'±)

3/8"= 1'-0"

SCALE IN FEET 2 0 2 4 6

22x34 = FULL SCALE

NOTES:

1. SEE DRAWING SERIES 100 & 110 FOR GENERAL NOTES AND INFORMATION AS APPLICABLE.
2. SEE DWG 400-04 FOR ROUGH OPENING SCHEDULE AND CONTROLS EQUIPMENT SCHEDULE.
3. CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	400-01

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LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - GENERAL ARRANGEMENT
UPPER FLOOR PLAN

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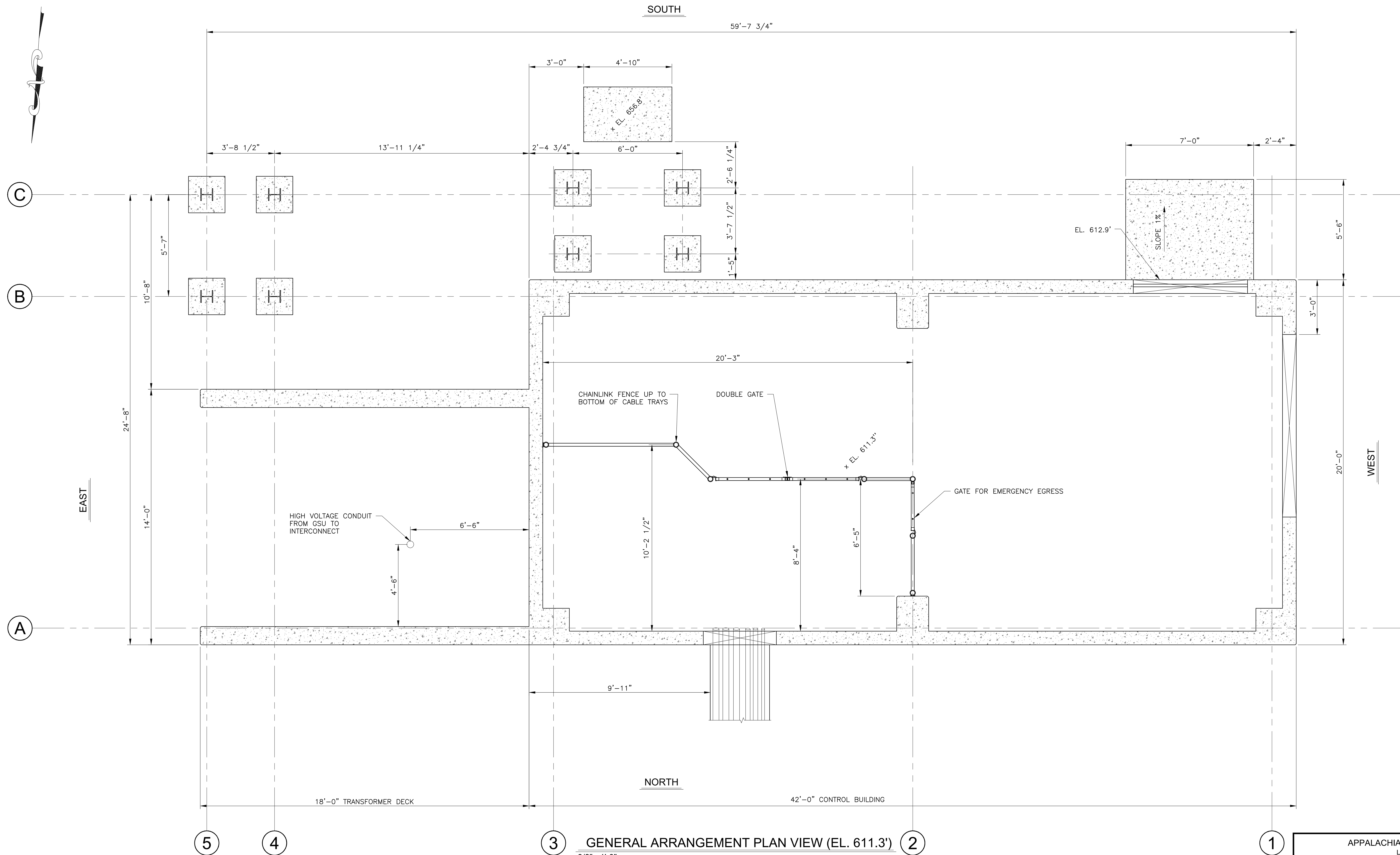

GENERAL ARRANGEMENT PLAN VIEW (EL. 611.3')

3/8"= 1'-0"

SCALE IN FEET

22x34 = FULL SCALE

NOTE:

SEE DWG 400-04 FOR ROUGH OPENING SCHEDULE AND CONTROLS EQUIPMENT SCHEDULE.

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STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - GENERAL ARRANGEMENT
LOWER FLOOR PLAN

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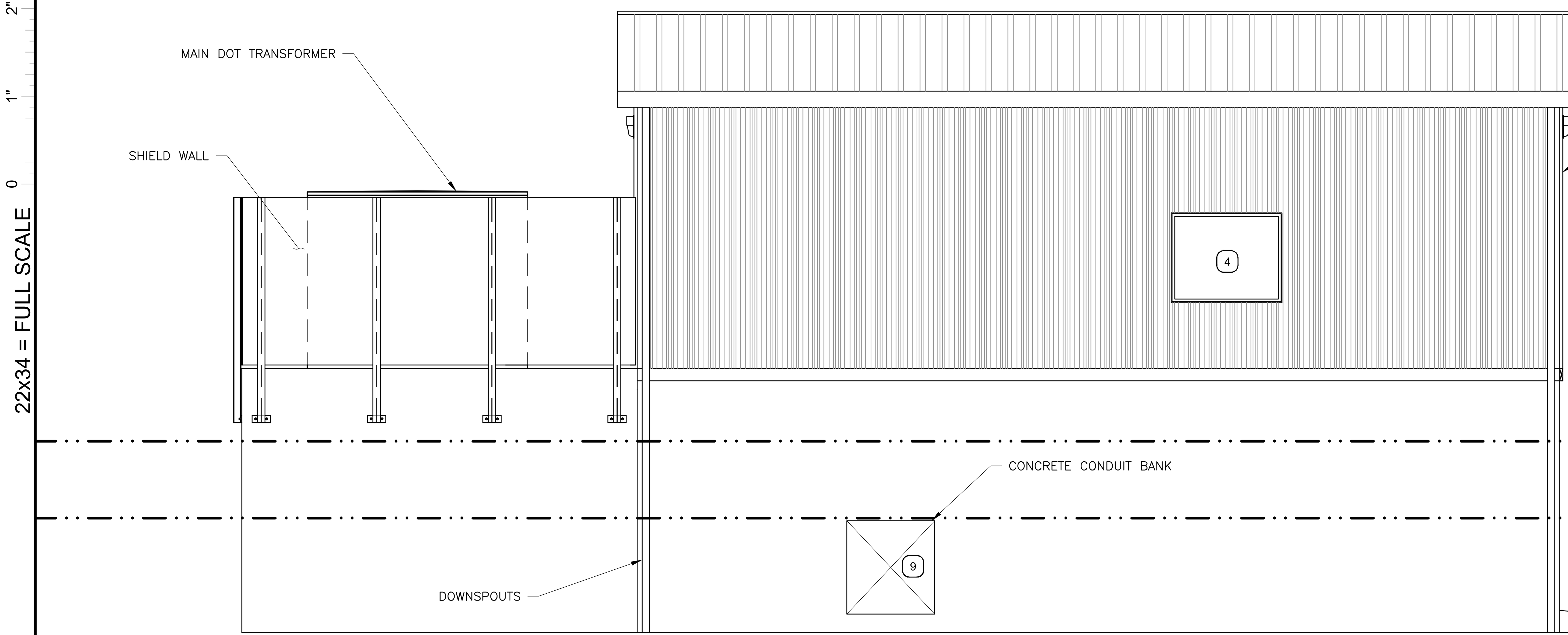
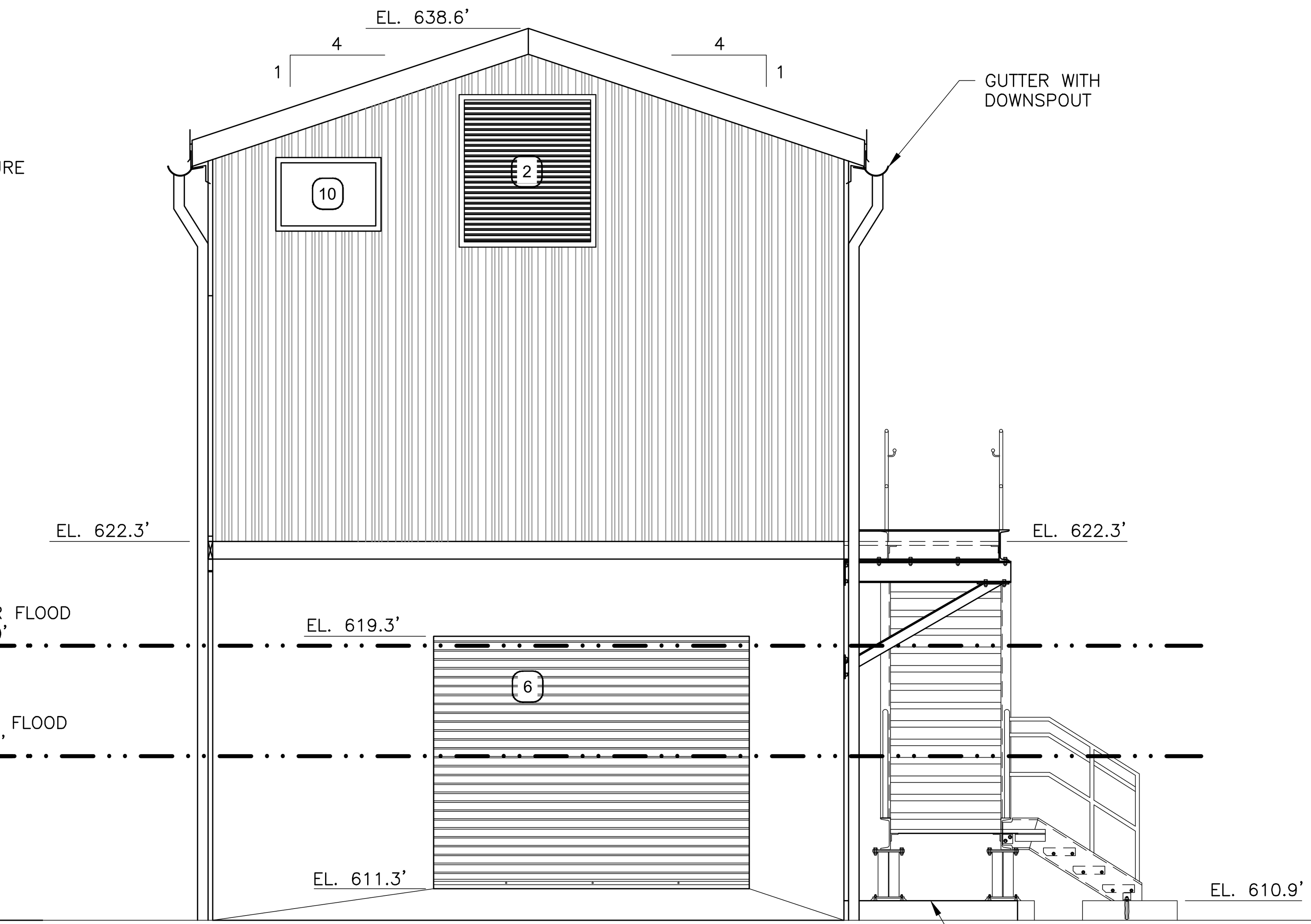
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	400-02

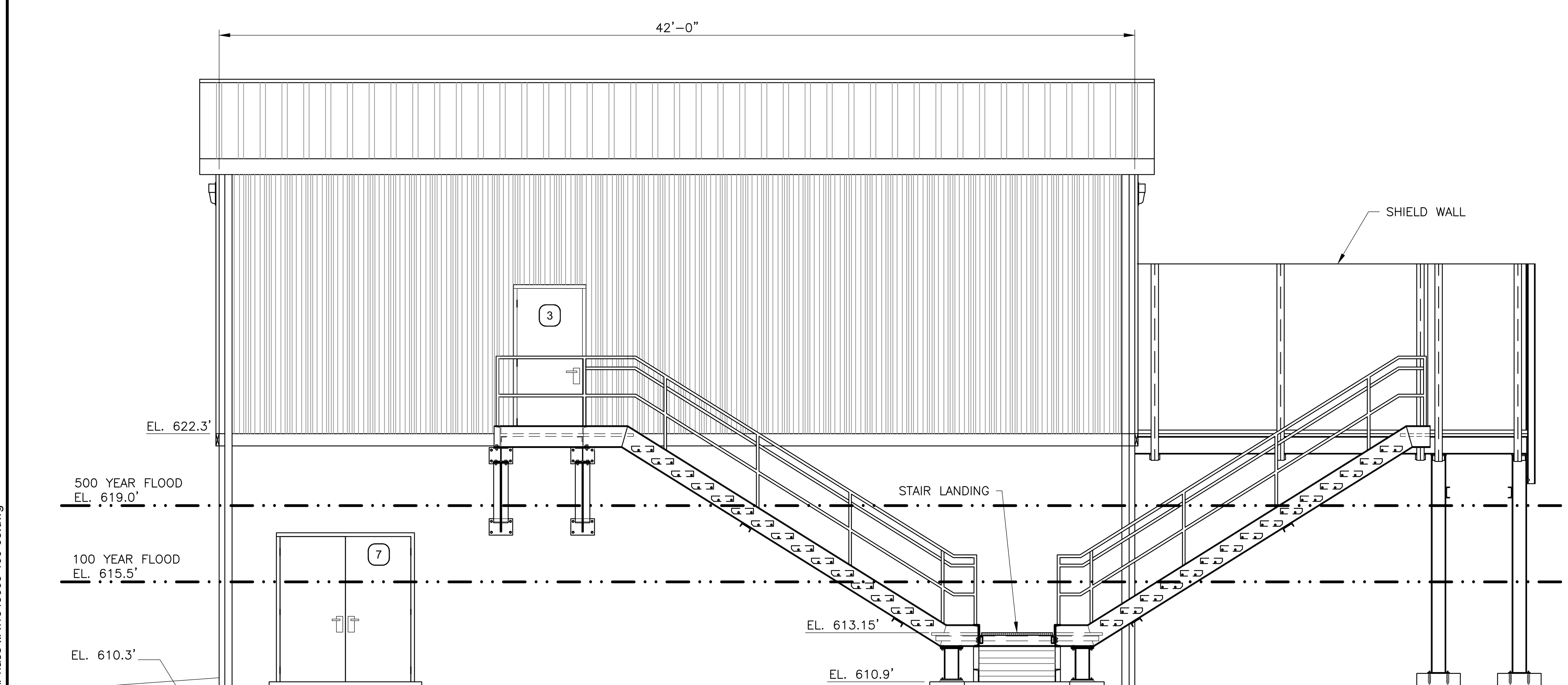
22x34 = FULL SCALE



NORTH ELEVATION
1/4"= 1'-0"

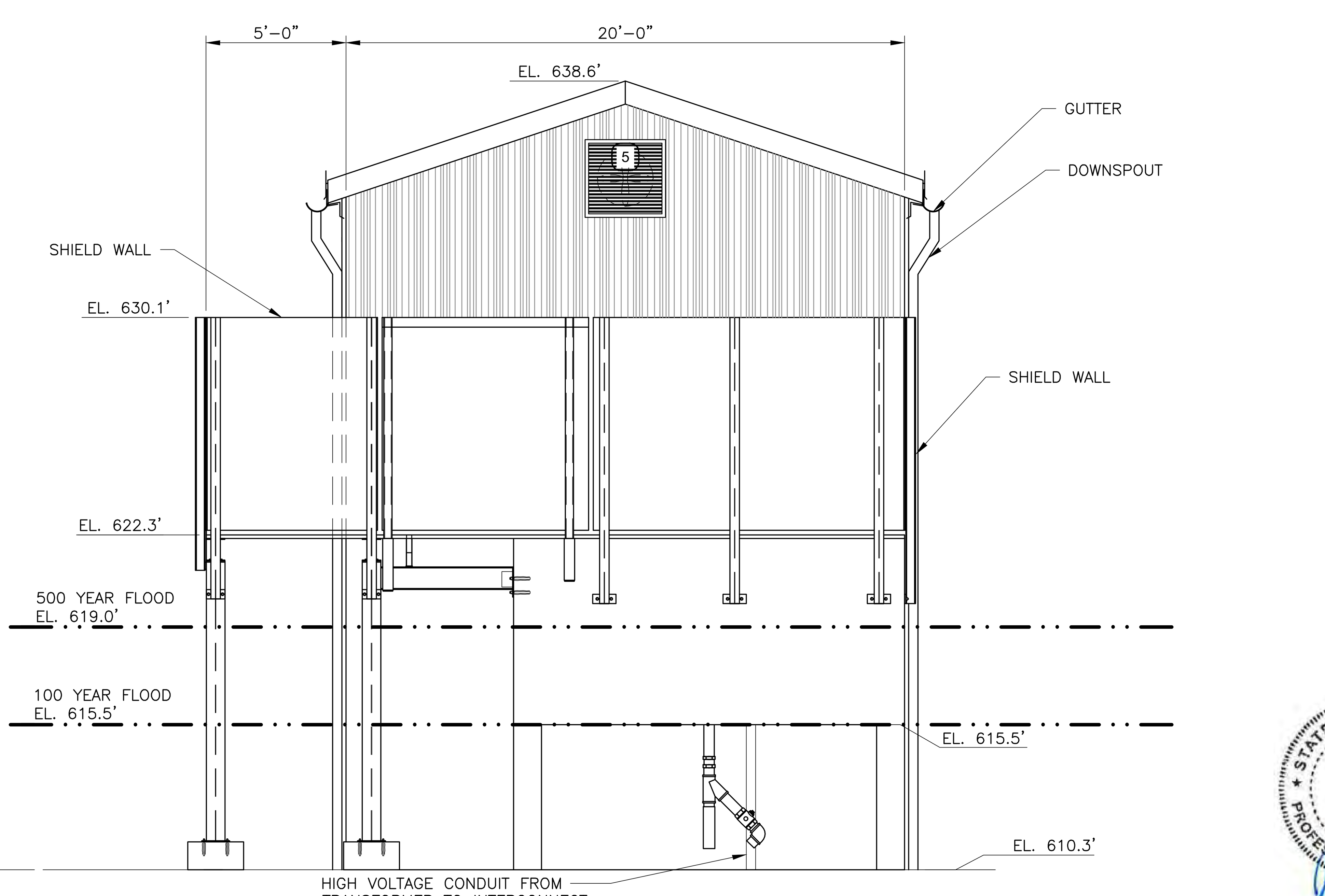


WEST ELEVATION
1/4"= 1'-0"



SOUTH ELEVATION
1/4"= 1'-0"

4 0 4 8
SCALE IN FEET



EAST ELEVATION
1/4"= 1'-0"

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

NOTE:
1. DRAWING ELEVATIONS ARE IN NAVD88 DATUM.
   USACE DATUM = PLANT DATUM
   NAVD88 = USACE − 3.1'
2. SEE DWG. 400-04 FOR ROUGH OPENING SCHEDULE AND CONTROLS EQUIPMENT SCHEDULE.

APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - GENERAL ARRANGEMENT
ELEVATIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	400-03

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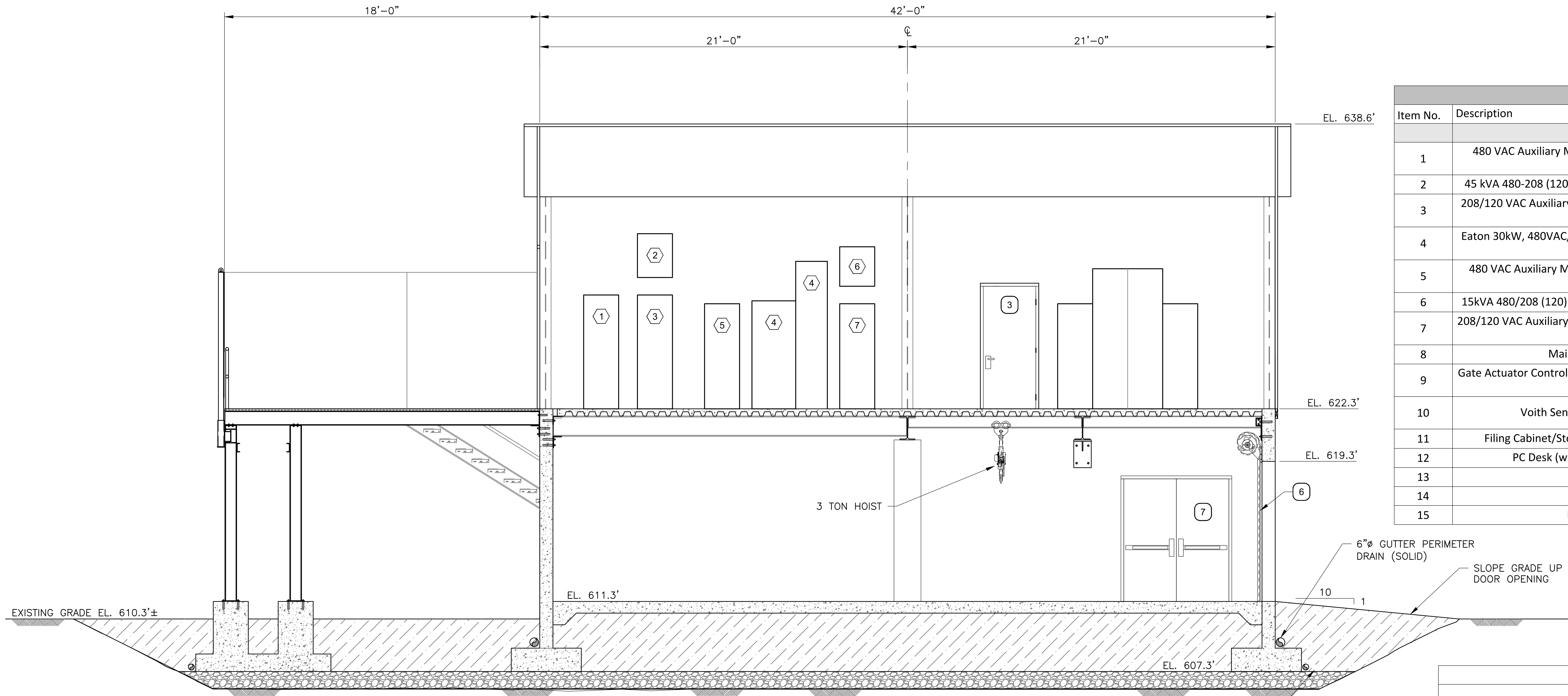


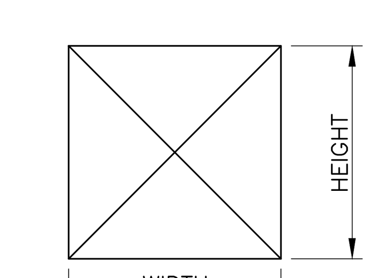
SECTION A/1
1/4"= 1'-0"

CONTROL BUILDING EQUIPMENT						
Item No.	Description	Manufacturer	Length	Width	Height	Weight
			FT	FT	FT	LB
1	480 VAC Auxiliary Main Breaker Service Panel (Non-Battery Backup) (Floor Mount)	Square D	2	0.5	0.5	<100
2	45 kVA 480-208 (120) Volt Transformer (Non-Battery Backup) (Ceiling Mount)	Square D	2	2	2.5	320
3	208/120 VAC Auxiliary Main Breaker Service Panel (Non-Battery Backup) (Floor Mount)	Square D	2	0.5	6.5	<100
4	Eaton 30kW, 480VAC/480VAC Li-Ion Battery Backup Cabinets (See Note 1 from Ross)	Eaton	4.5	5.25	14.75	1676
5	480 VAC Auxiliary Main Breaker Service Panel (Battery Backup Feeds) (Floor Mount)	Square D	2	0.5	6	<100
6	15kVA 480/208 (120) Volt Transformer (Battery Backup Feeds) (Ceiling Mount)	Square D	2	1.5	2.25	220
7	208/120 VAC Auxiliary Main Breaker Service Panel (Battery Backup Feeds) (Floor Mount)	Square D	2	0.5	6	<100
8	Main Control Cabinet (Set Directly on Floor)	AHA	4	1.5	8	1000
9	Gate Actuator Control Cabinet (Actuator Controllers Mounted to Cabinet) (Floor Mount)	Voith Loose Parts/AHA	2	1	6	500
10	Voith Sensor Suite & DO Control Cabinet (Floor Mount)	Voith Loose Parts/AHA	3	1	6	250
11	Filing Cabinet/Storage & Security Cameras NVR (Set Directly on Floor)		2	2	3	-
12	PC Desk (with Modem, Router, Etc.) (Set Directly on Floor)		4	3	4.5	-
13	Switchgear (Set Directly on Floor)	Eaton	11.17	6	8	10018
14	Rubber Dam Control Cabinet	DryHoff	2	1	-	-
15	Rubber Dam Piping and Compressor	DryHoff	15	5	5.25	-

(#) EQUIPMENT NO.

ROUGH OPENING SCHEDULE				
STEEL BUILDING WALL PENETRATION TABLE				
OPENING NO.	PURPOSE	ROUGH OPENING (INCHES)		DESCRIPTION
		HEIGHT	WIDTH	
1	DOOR	110.25	88.25	7'Wx9'H STEEL DOUBLE DOOR
2	MOTORIZED DAMPER	55	55	48" MOTORIZED DAMPER WITH WEATHERHOOD
3	DOOR	86.25	40.25	3'Wx7'H STEEL DOOR
4	WINDOW	48.5	60.5	48"Hx60"W FIXED PANE, STEEL FRAME WITH LEXAN
5	SUPPLY FAN	35.25	35.25	28" FAN WITH EXHAUST DAMPER
10	AIR CONDITIONING UNIT	24	36	AIR CONDITIONING UNIT PROVIDED BY OWNER
CONCRETE STRUCTURE WALL PENETRATION TABLE				
OPENING NO.	PURPOSE	ROUGH OPENING (INCHES)		DESCRIPTION
		HEIGHT	WIDTH	
6	ROLL UP DOOR	96	120	96"Hx120"W ROLL UP DOOR *
7	DOOR	86.25	76.25	6'Wx7'H STEEL DOUBLE DOOR
8	TRANSFORMER CONDUITS	31	60	
9	CONDUITS TO POWERHOUSE	51	48	

NOTE:
- DO NOT EXTEND SIDING INTO ROUGH OPENINGS
- PROVIDE FLASHING FOR EACH OPENING AS NEEDED



* LOCKSET BY OWNER

(#) OPENING NO.

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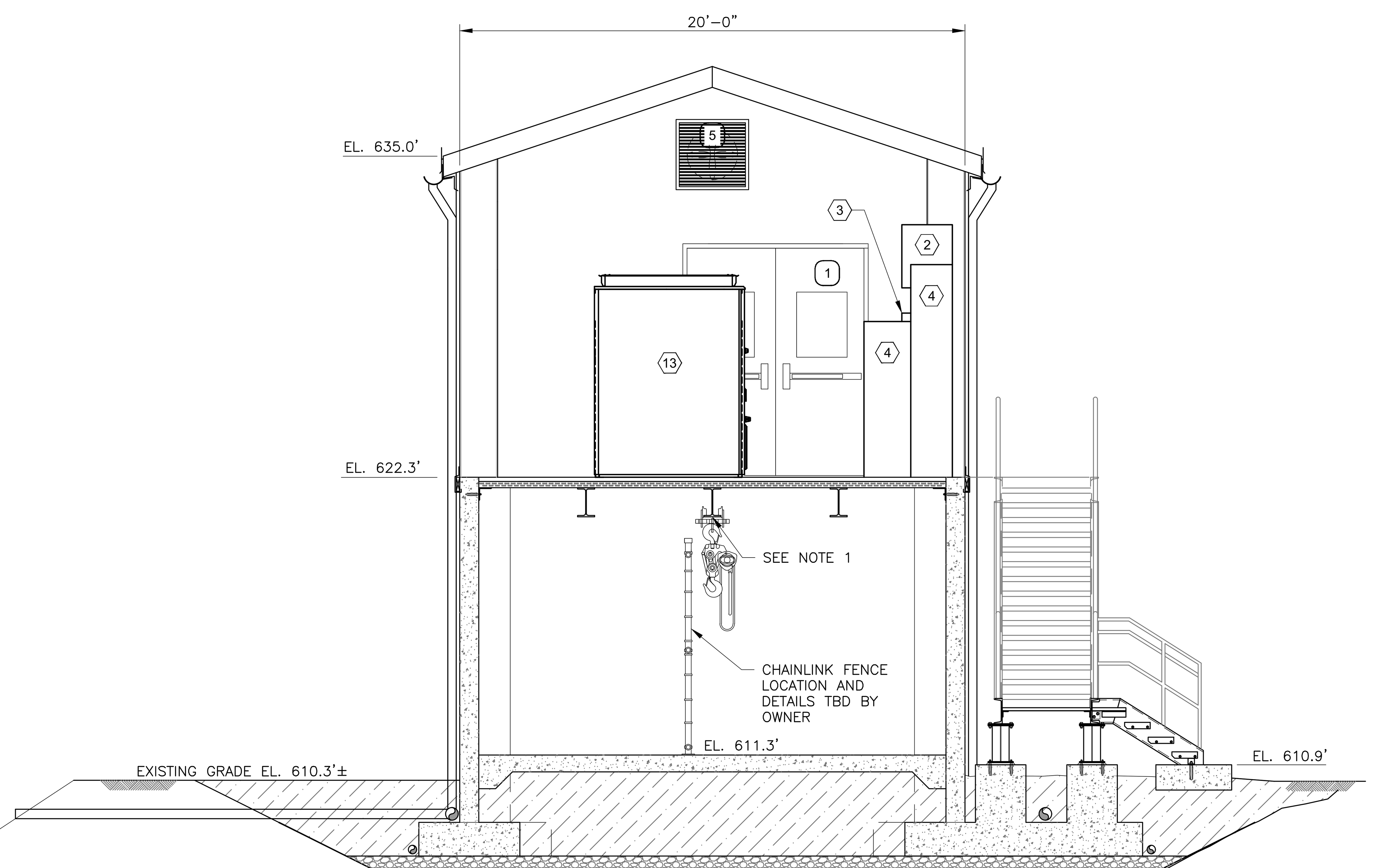

SECTION B/1
1/4"= 1'-0"

NOTES:
1. ALL FLOOR BEAMS DESIGNED FOR MAX. ALLOWABLE LOAD = 3 TON.

4 0 4 8
SCALE IN FEET

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - GENERAL ARRANGEMENT SECTIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	400-04

22x34 = FULL SCALE

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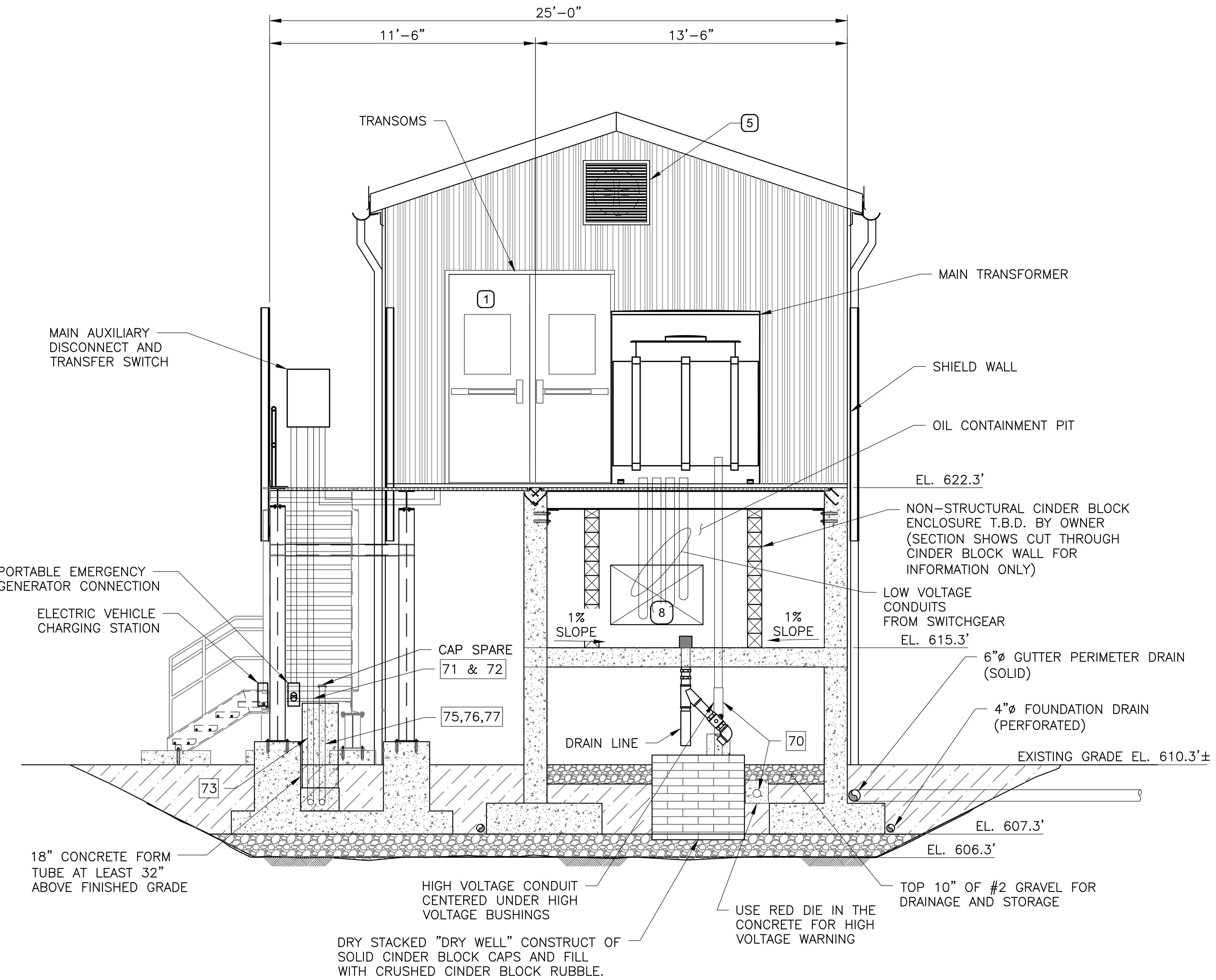
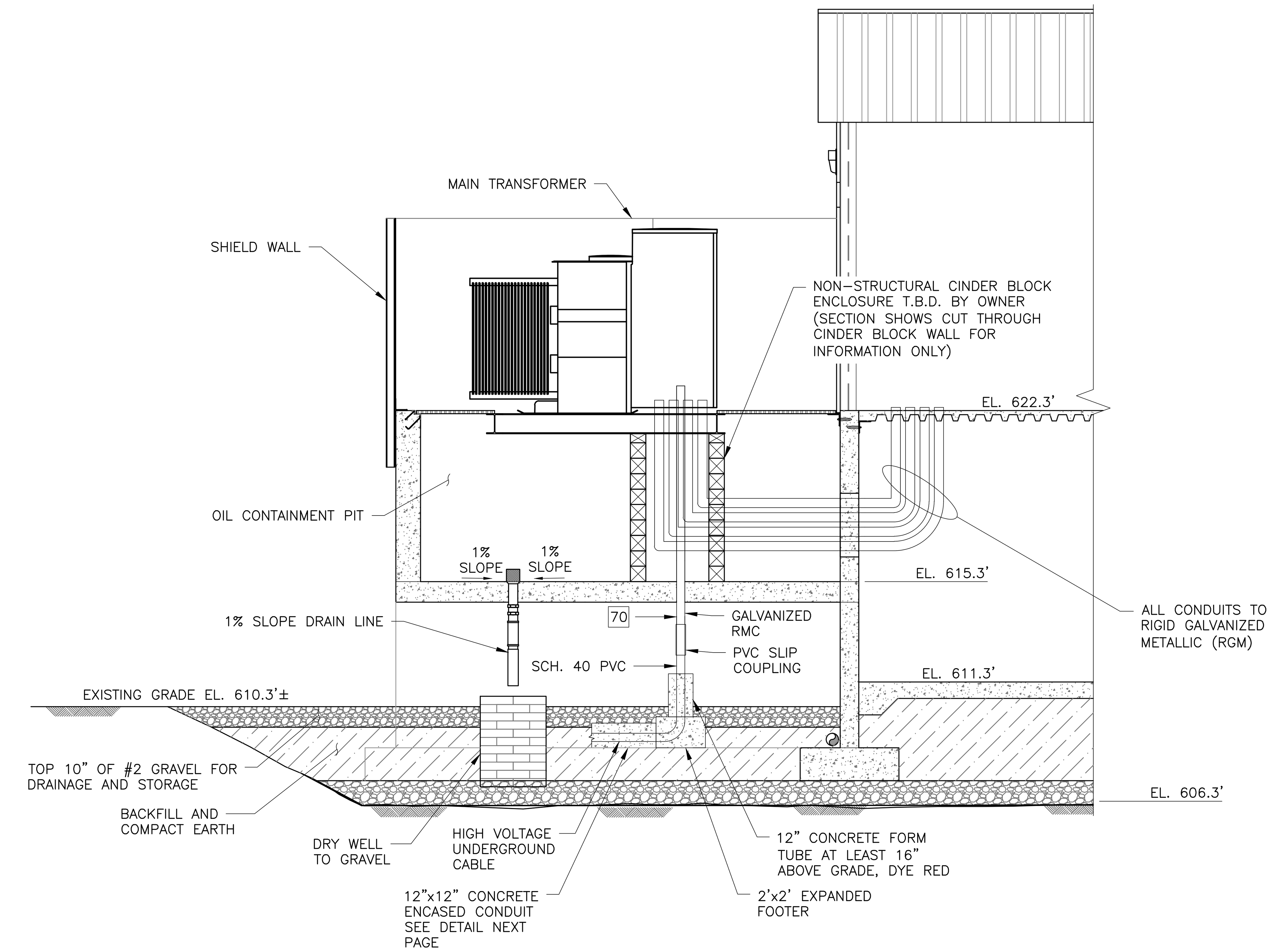
22x34 = FULL SCALE



SECTION C/1
1/4"= 1'-0"



SECTION D/1
1/4"= 1'-0"

NOTES:

1. THE SECONDARY OIL CONTAINMENT SYSTEM SHALL BE DESIGNED AS A PASSIVE SYSTEM NOT REQUIRING ANY INSTRUMENTATION OR CONTROL SYSTEMS. THE SYSTEM SHALL ALLOW WATER TO PASS THOUGH BUT SHALL SEAL AND BLOCK THE FLOW OF ANY LIQUID OR OIL IN THE EVENT OF AN OIL LEAK.
2. CONTAINMENT SYSTEM SHALL BE APPROVED BY A PROFESSIONAL ENGINEER EXPERIENCED WITH CONSTRUCTION OF SECONDARY OIL CONTAINMENT SYSTEMS.
3. SECONDARY OIL CONTAINMENT SYSTEM SHALL MEET OR EXCEED THE REQUIREMENTS SET OUT BY THE SPCC, 40 CFR 112.(7)(C) SECONDARY CONTAINMENT FOR ELECTRICAL EQUIPMENT. THE SYSTEM SHALL COMPLY WITH THE GUIDELINES SET OUT BY IEEE. P980 GUIDE FOR CONTAINMENT AND CONTROL OF OIL SPILLS IN ELECTRICAL SUBSTATIONS.
4. CONTAINMENT SYSTEM DRAIN SHALL BE PETRO-PIPE OIL FILTER WITH 4" PUSH ON CONNECTOR BY SPI OR APPROVED EQUIVALENT.
5. THE INSTALLATION OF THE SECONDARY OIL CONTAINMENT SYSTEM SHALL BE SUPERVISED BY A QUALIFIED TECHNICIAN PROVIDED BY THE MANUFACTURER OF THE SYSTEM. THE INSTALLATION SHALL BE MONITORED TO ENSURE THE DESIGN GUIDELINES ARE MET AND THE MATERIALS ARE INSTALLED CORRECTLY.
6. CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.
7. SCHEDULE FOR ELECTRICAL COMPONENTS NOT SHOWN, TO BE PROVIDED IN RFC PACKAGE.

4 0 4 8
SCALE IN FEET

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - GENERAL ARRANGEMENT SECTIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	400-05

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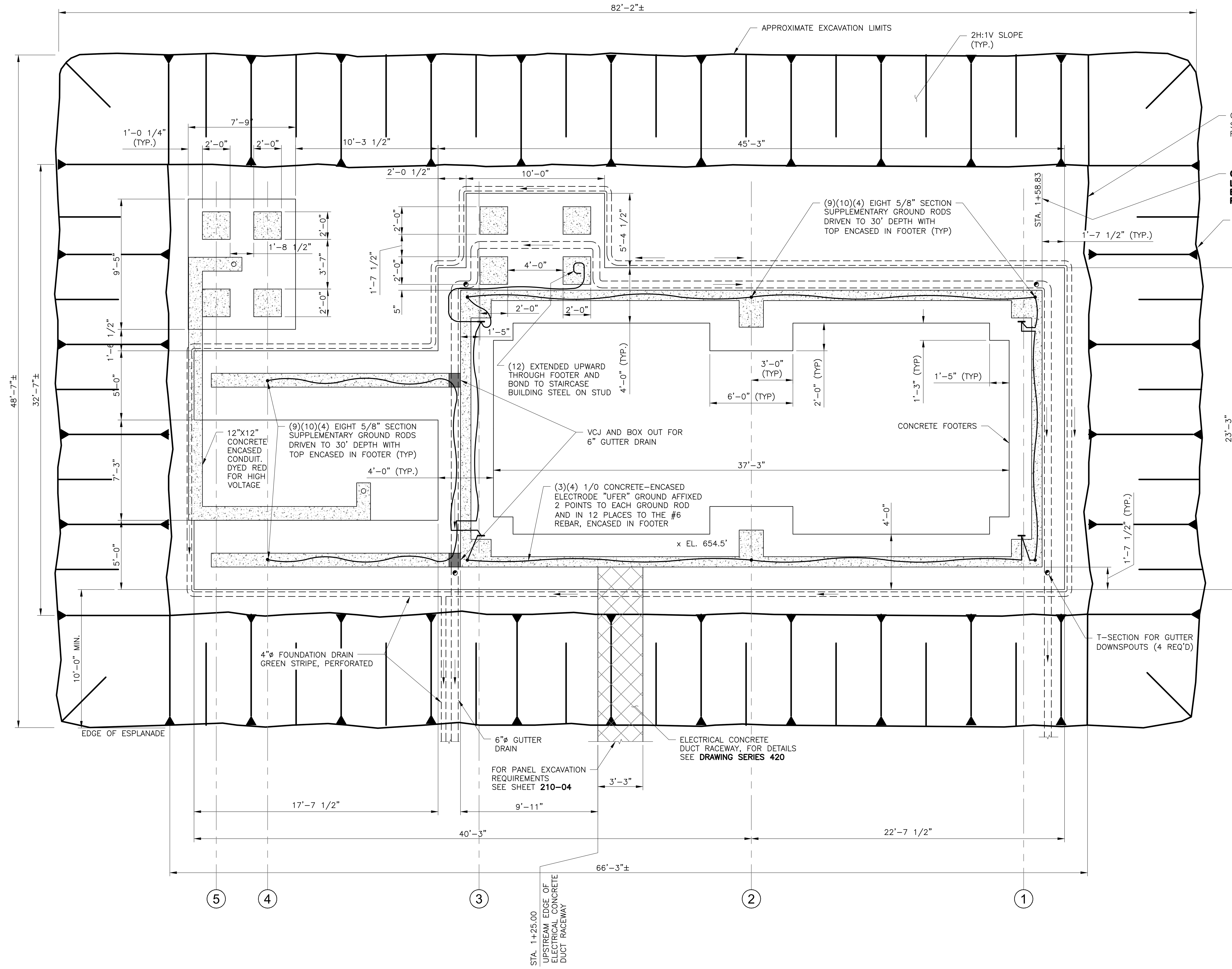

FOOTING PLAN @ EL. 609.3'

1/4" = 1'-0"

SCALE IN FEET

22x34 = FULL SCALE

NOTES:
1. SEE DWG SERIES 110 FOR GENERAL NOTES AND STANDARD DETAILS.
2. SEE DWG 400-04 FOR ROUGH OPENING SCHEDULE.
3. SEE EARTHWORK, DWG 110-02 FOR FOUNDATION PREP.
4. DO NOT CONNECT GUTTER & FOUNDATION DRAIN PIPES TOGETHER.
5. GUTTER AND FOUNDATION DRAINS TO OUTLET ONTO ESPLANADE AS DETERMINED BY OWNER DOWNSTREAM OF CONDUIT RACEWAY.
6. CONCRETE ENCASED ELECTRODE DETAILS ARE SHOWN. INSTALL 8 TOTAL 5/8" SECTIONAL GROUND RODS WITH 1/0 BARE GROUND IN THE FOOTER AS SHOWN.
7. CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

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APPALACHIAN HYDRO ASSOCIATES
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE FOOTING PLAN

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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RJC	BJL	JLD	1349-009	08-01-24	410-01

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

REINFORCED CONCRETE WALL PLAN @ EL. 614'

3/8"= 1'-0"

SCALE IN FEET: 2 0 2 4 6

NOTE:
OWNER TO PROVIDE EMBEDDED GROUNDING DETAILS. DO NOT PLACE CONCRETE UNTIL DETAILS ARE PROVIDED AND APPROVED BY OWNER.

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No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE WALL REINFORCEMENT PLAN @ EL. 614'

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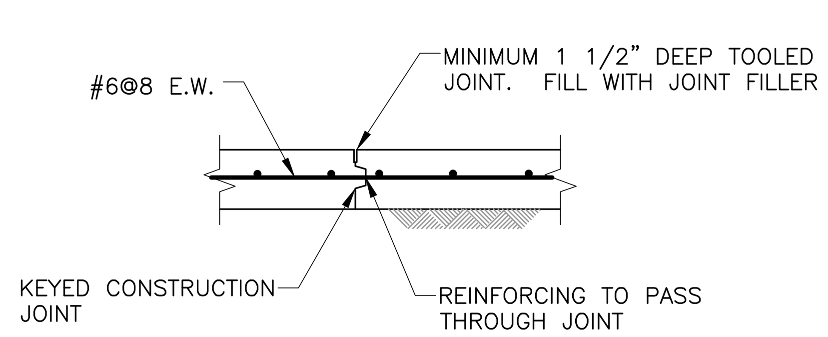
RJC	BJL	JLD	1349-009	08-01-24	410-02

22x34 = FULL SCALE

CONCRETE FLOOR PLAN @ EL. 611.3'

3/8"= 1'-0"

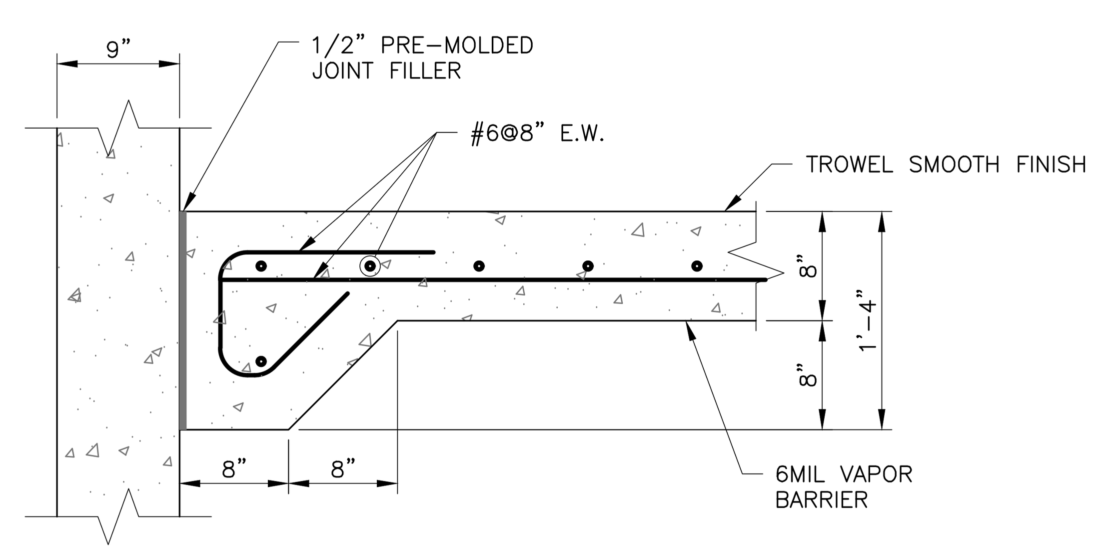
SCALE IN FEET



SLAB ON GRADE CONSTRUCTION JOINT

N.T.S.

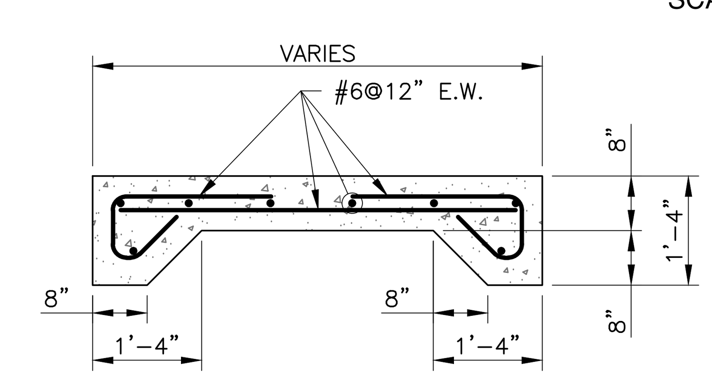
NOTE: LOCATE CONSTRUCTION JOINTS AND CONTROL JOINTS AS SHOWN ON PLAN



SLAB ON GRADE TYPICAL DETAIL

1"= 1'-0"

SCALE IN FEET



STAIR & DOOR LANDING PADS

1/2"= 1'-0"

SCALE IN FEET

NOTE:
CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

STATE OF KENTUCKY
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No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
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LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE
CONCRETE FLOOR PLAN @ EL. 611.3'

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RJC	BJL	JLD	1349-009	08-01-24	410-03

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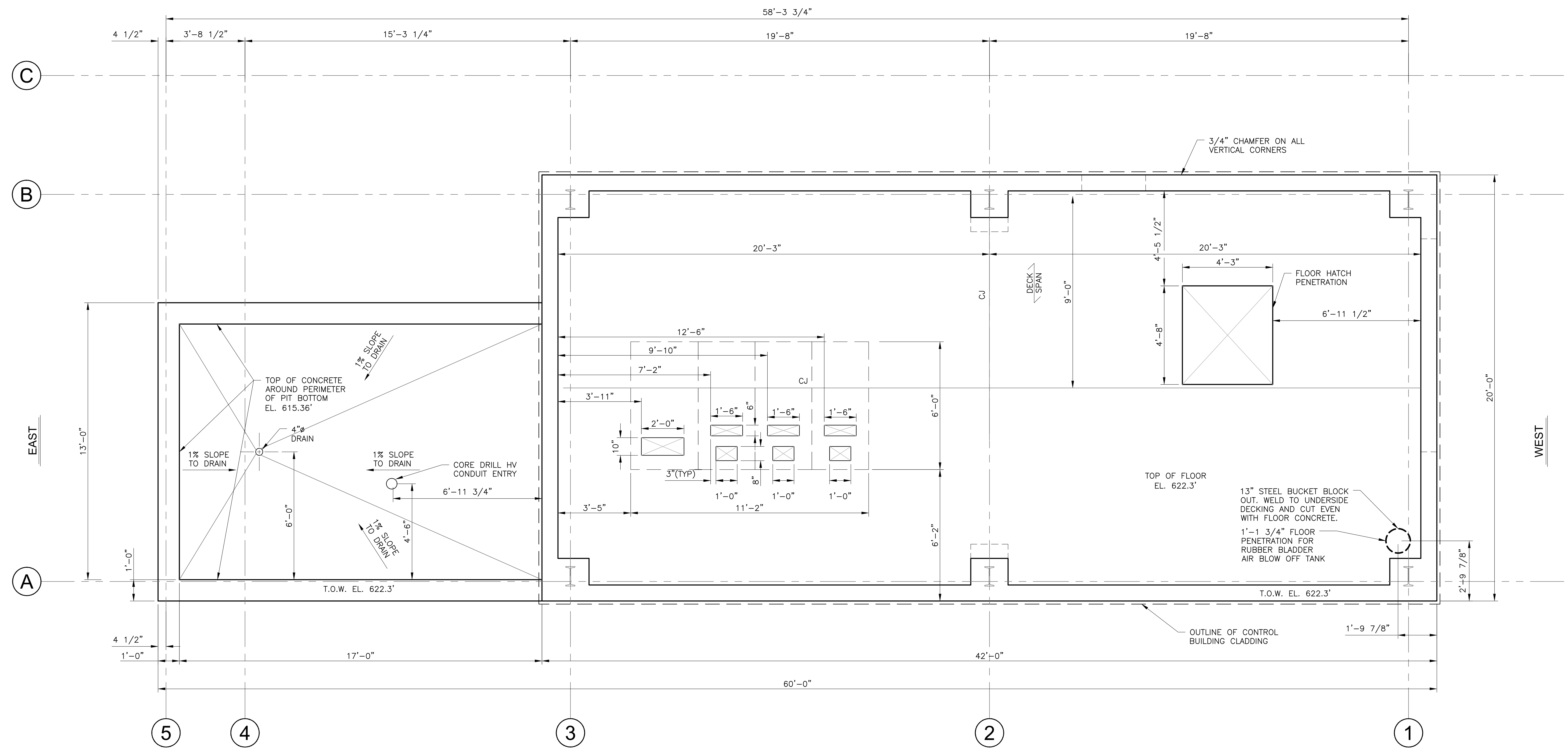
22x34 = FULL SCALE



CONCRETE FLOOR PLAN @ EL. 622.3'

3/8"= 1'-0"

NOTES:

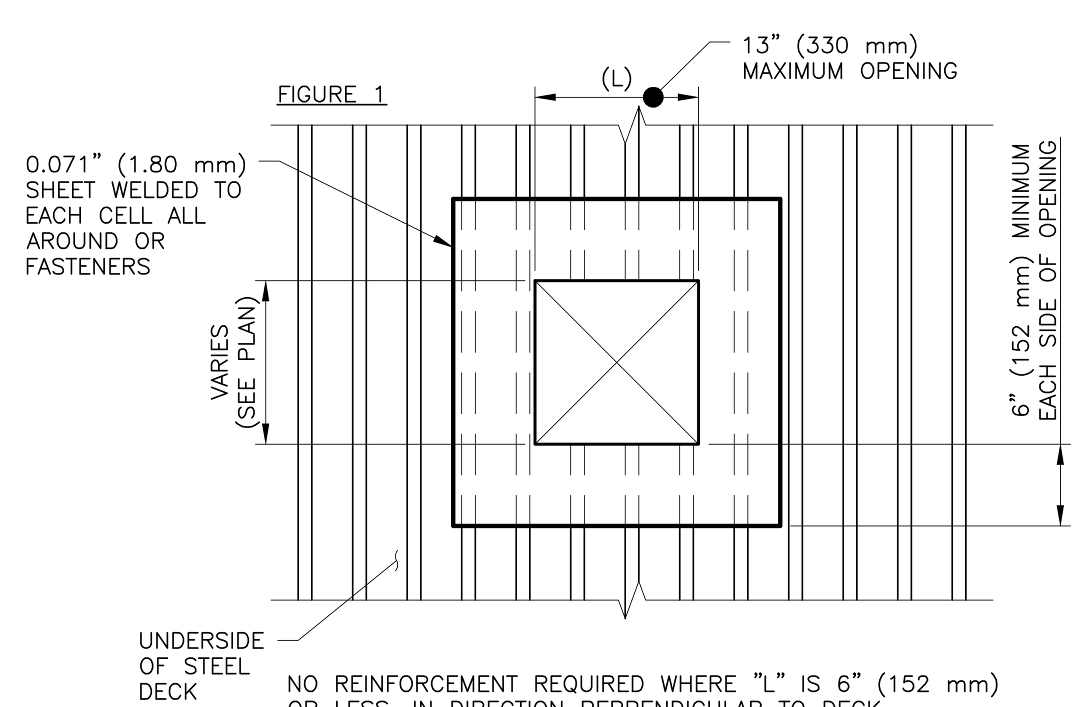
1. THE SECONDARY OIL CONTAINMENT SYSTEM SHALL BE DESIGNED AS A PASSIVE SYSTEM NOT REQUIRING ANY INSTRUMENTATION OR CONTROL SYSTEMS. THE SYSTEM SHALL ALLOW WATER TO PASS THOUGH BUT SHALL SEAL AND BLOCK THE FLOW OF ANY LIQUID OR OIL IN THE EVENT OF AN OIL LEAK.
2. SECONDARY OIL CONTAINMENT SYSTEM SHALL MEET OR EXCEED THE REQUIREMENTS SET OUT BY THE SPCC, 40 CFR 112.(7)(C) SECONDARY CONTAINMENT FOR ELECTRICAL EQUIPMENT. THE SYSTEM SHALL COMPLY WITH THE GUIDELINES SET OUT BY IEEE. P980 GUIDE FOR CONTAINMENT AND CONTROL OF OIL SPILLS IN ELECTRICAL SUBSTATIONS.
3. CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

COMPOSITE DECK FLOOR PENETRATION DETAILS

A) NO REINFORCEMENT IS REQUIRED OF A SINGLE OPENING, SMALLER THAN 6".

B) PLATES CAN BE WELDED AROUND THE OPENING IF THE OPENINGS ARE LARGER THAN 8", BUT SMALLER THAN 13", SPACED MORE THAN 4" APART (FIGURE 1).

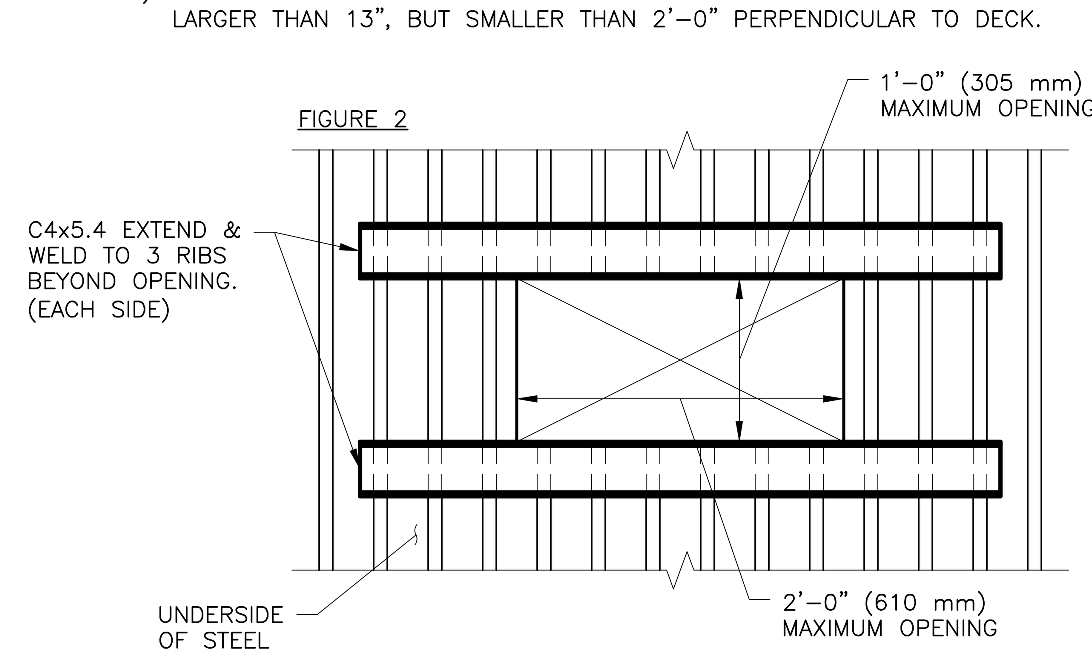
FIGURE 1



NO REINFORCEMENT REQUIRED WHERE "L" IS 6" (152 mm) OR LESS, IN DIRECTION PERPENDICULAR TO DECK.

C) STEEL FRAMING PER FIGURE 2 CAN BE USED IF THE OPENINGS ARE LARGER THAN 13", BUT SMALLER THAN 2'-0" PERPENDICULAR TO DECK.

FIGURE 2



CONCRETE STOP REQUIRED AT ALL OPENINGS

D) OPENINGS GREATER THAN SHOWN REQUIRE STRUCTURAL FRAMING TO SUPPORT. IF REQUIRED, CONTACT OWNER'S ENGINEER FOR DIRECTION AND STRUCTURAL DESIGN CHANGES.

2 0 2 4 6

SCALE IN FEET

STATE OF KENTUCKY
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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE
CONCRETE FLOOR PLAN @ EL. 622.3'

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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RJC	BJL	JLD	1349-009	08-01-24	410-04

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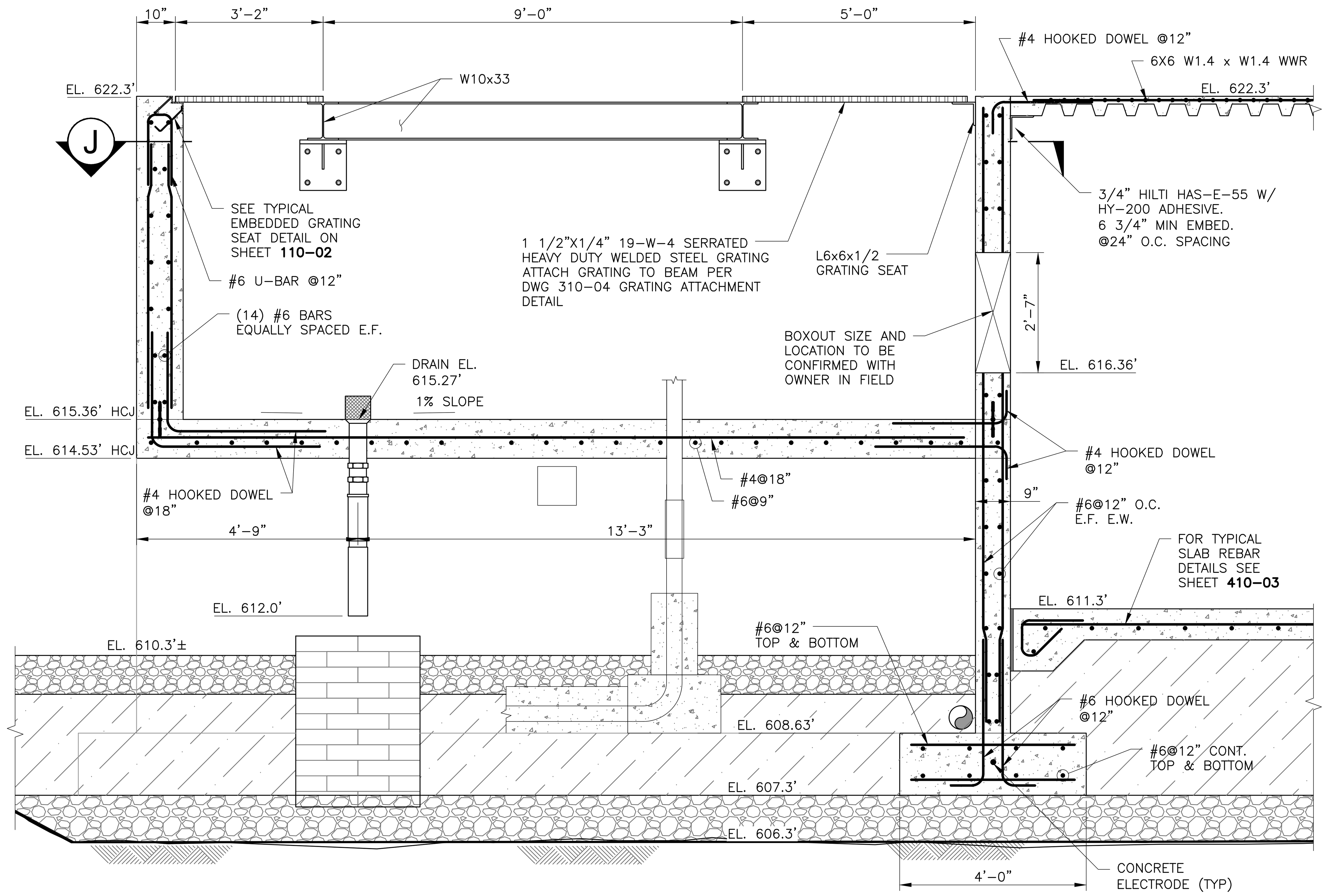
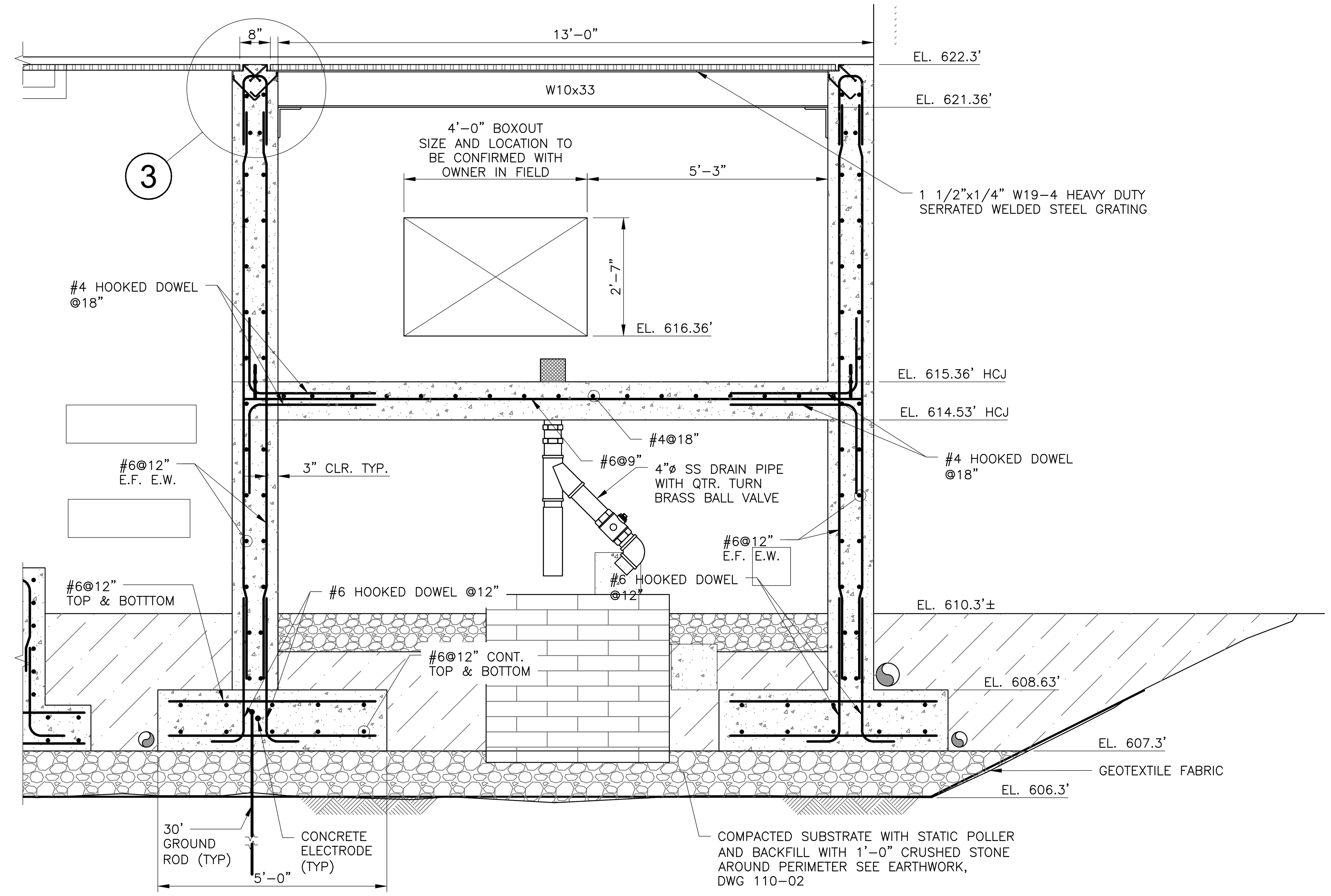
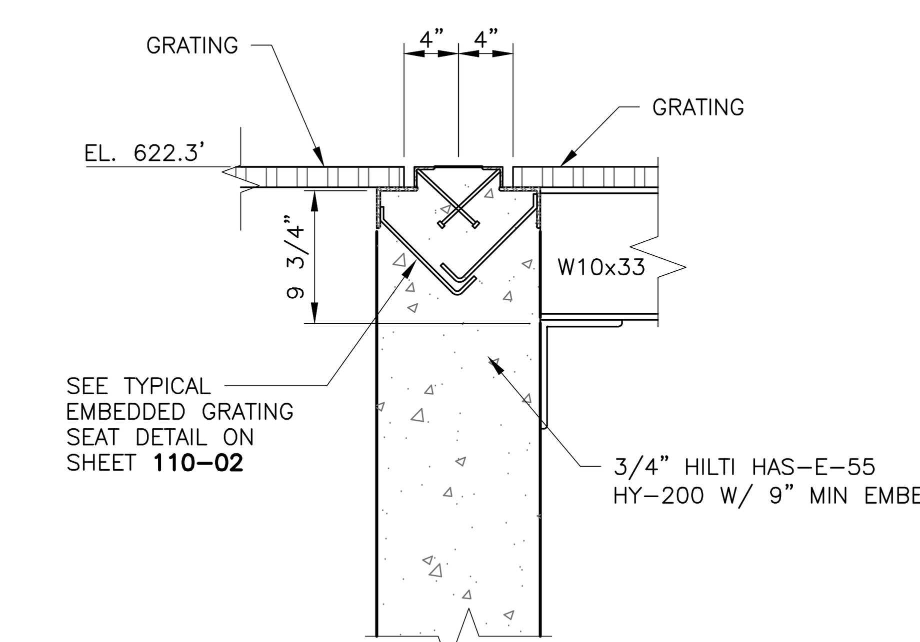


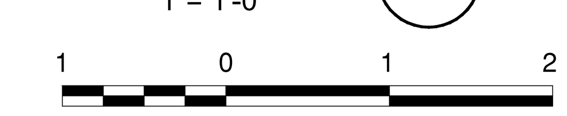
SECTION B/2
1/2"= 1'-0"

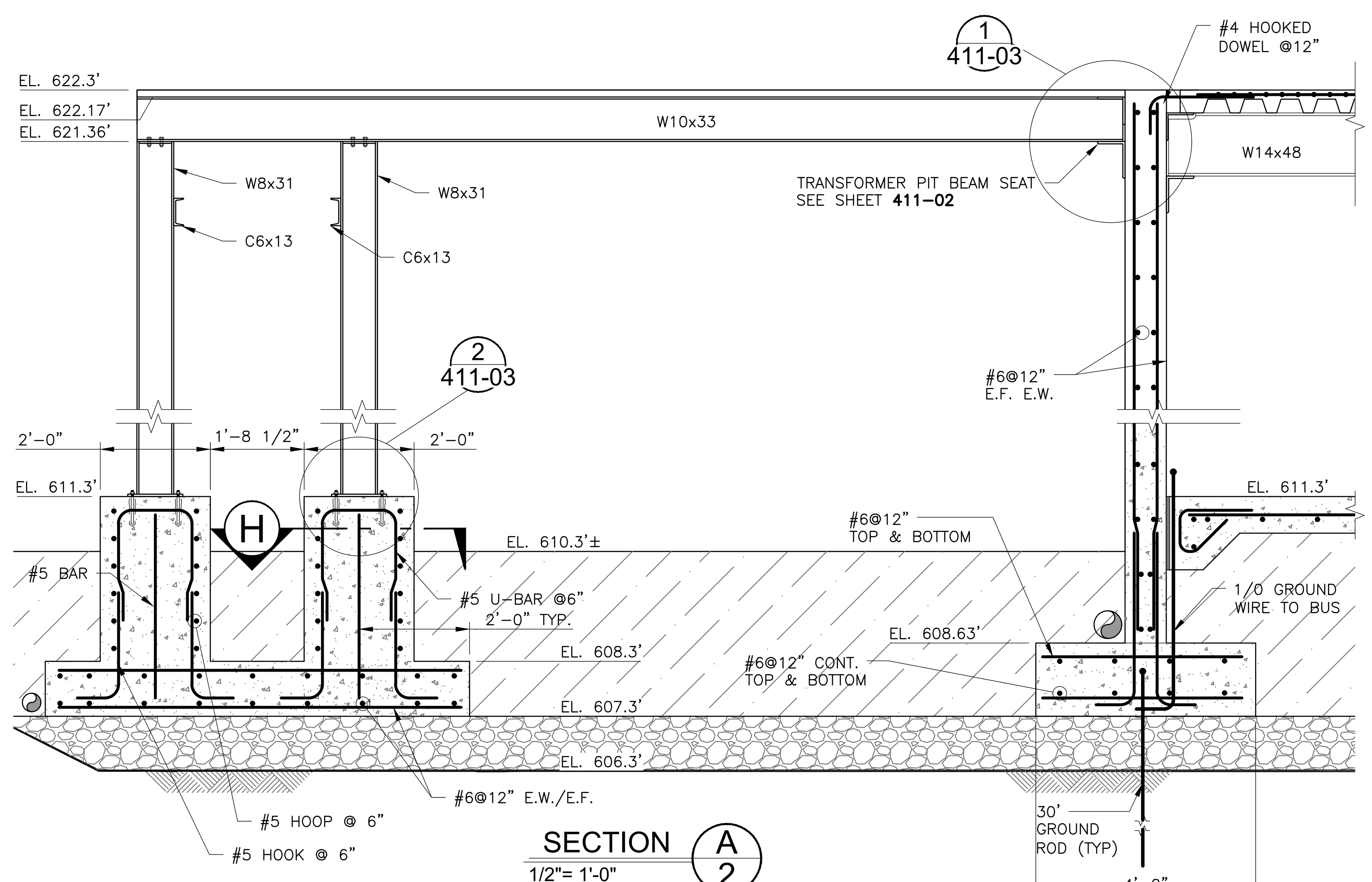


SECTION C/2
1/2"= 1'-0"

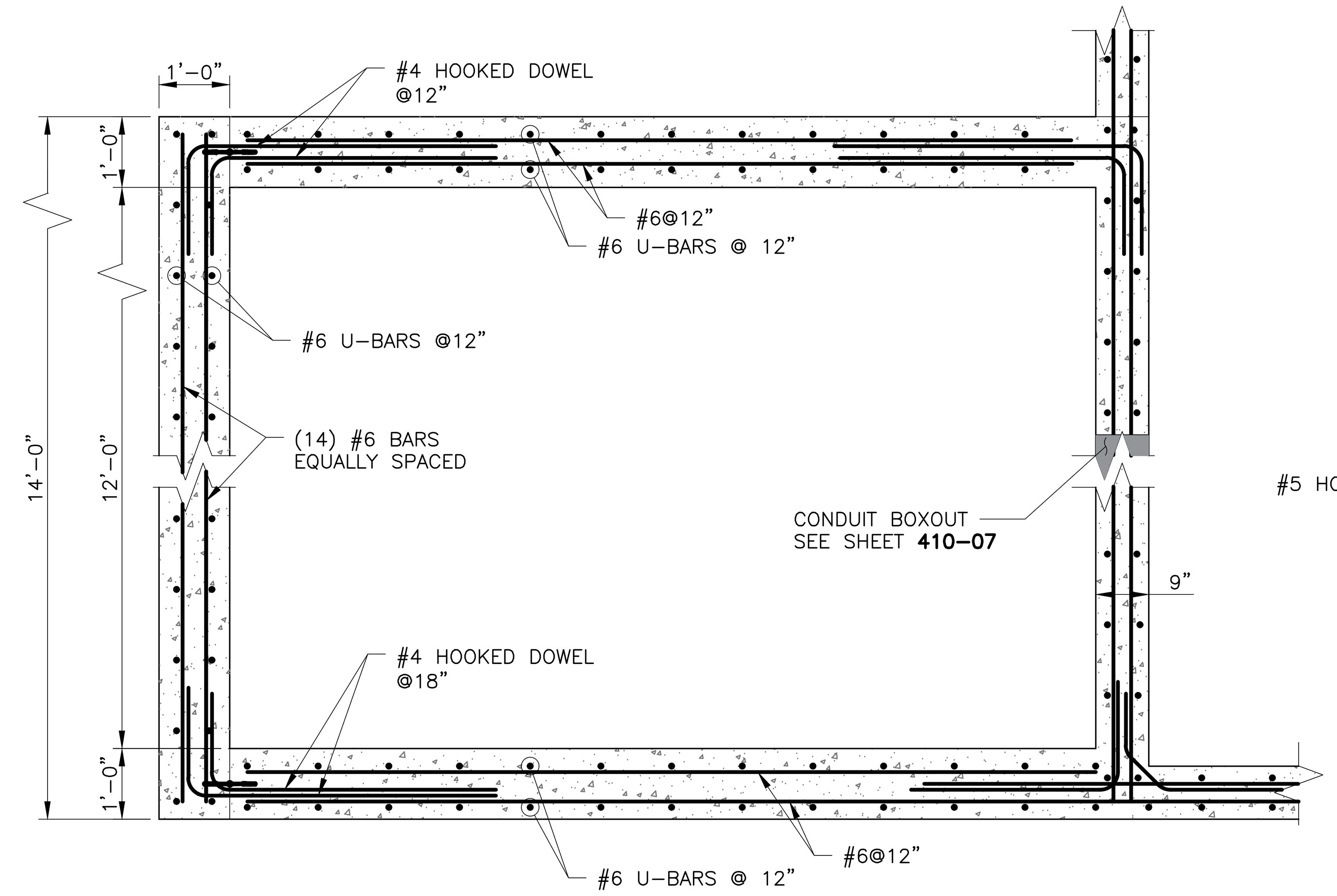


DETAIL 3
1"= 1'-0"

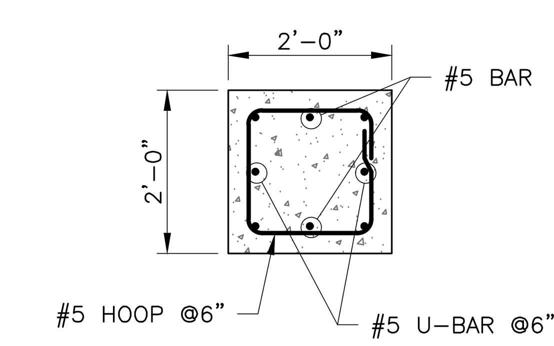




SECTION A/2
1/2"= 1'-0"



SECTION J
1/2"= 1'-0"



SECTION H
1/2"= 1'-0"

NOTE:
CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE STRUCTURAL SECTIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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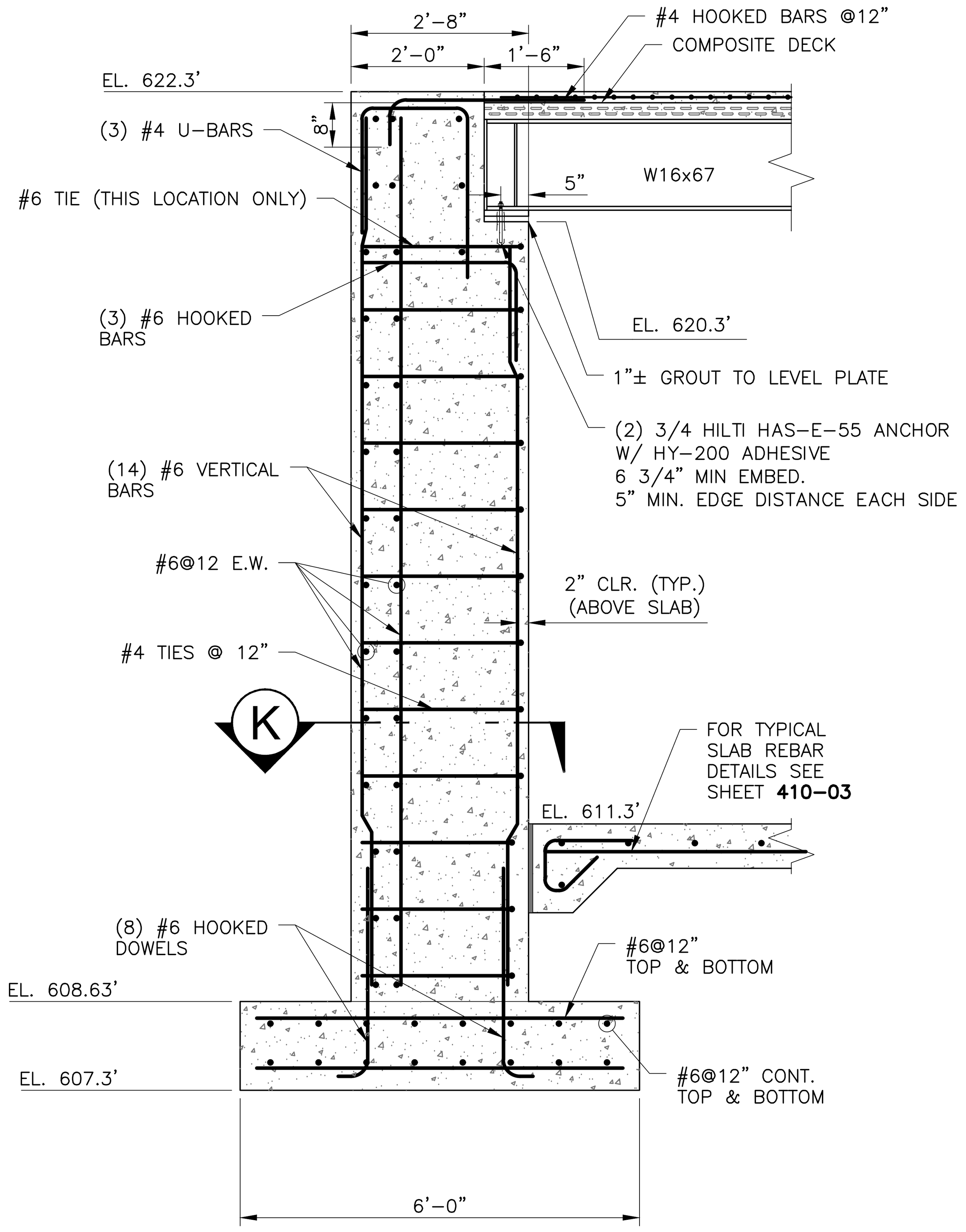
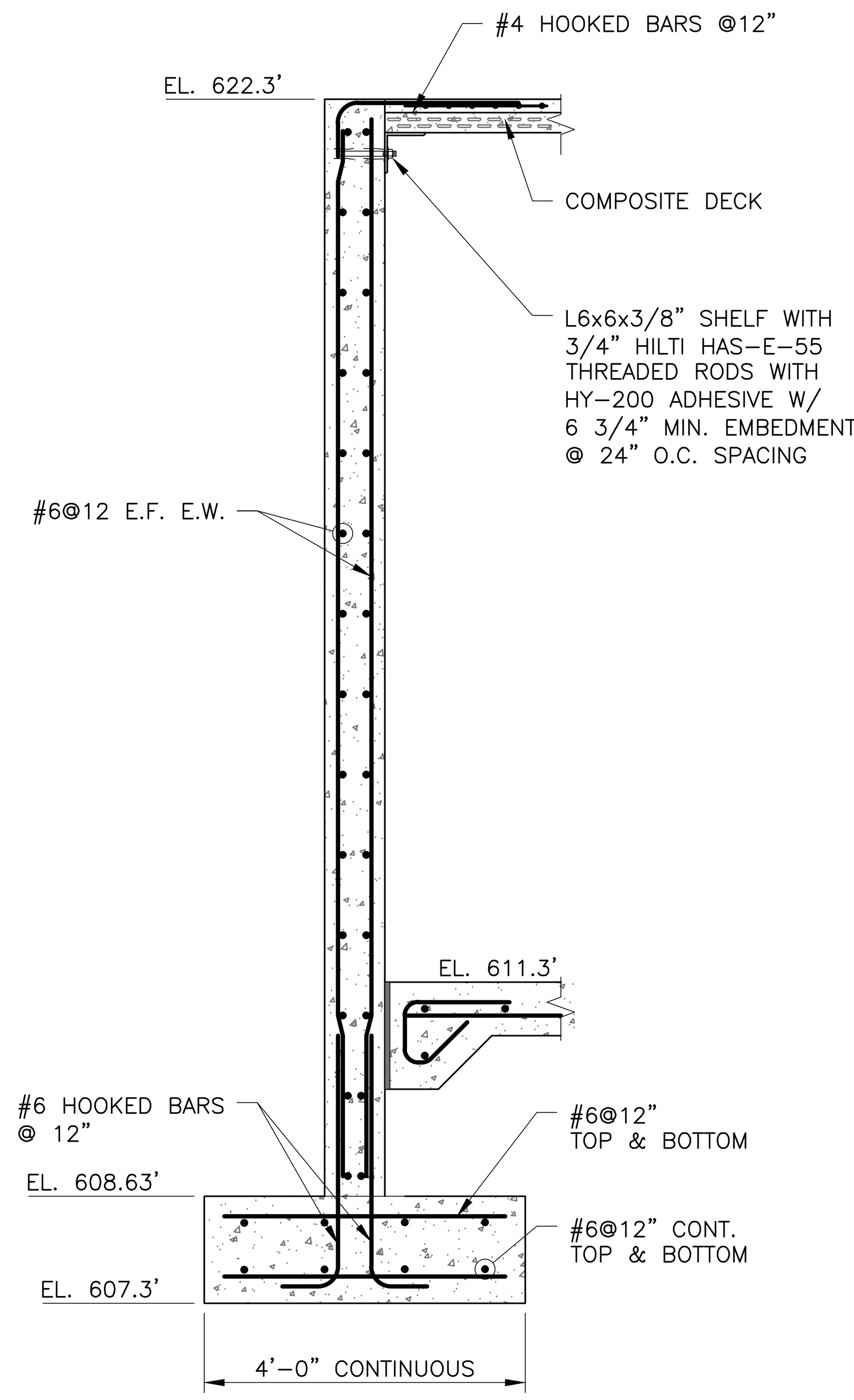
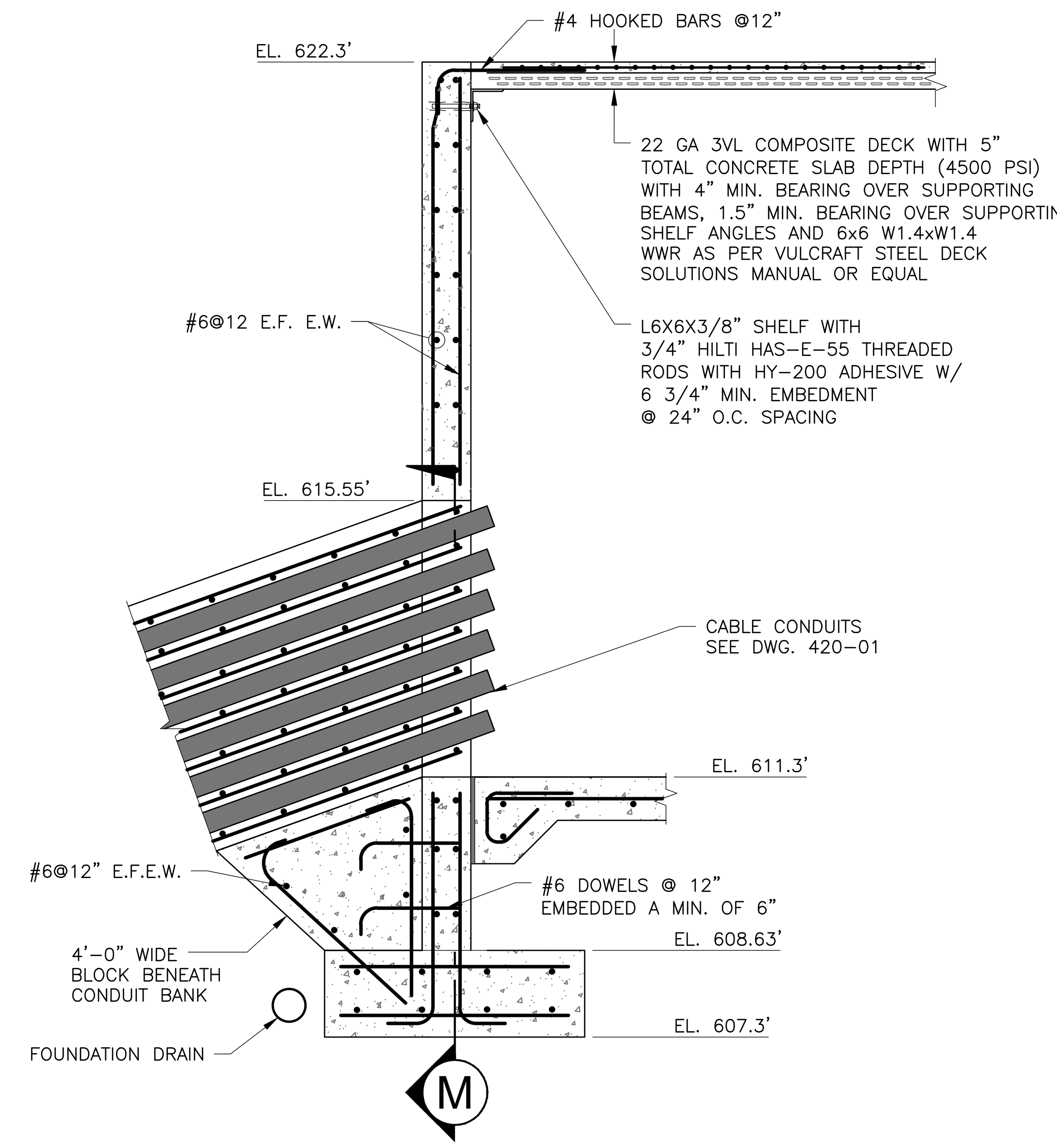
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BTL	JLD	1349-009	08-01-24	410-05



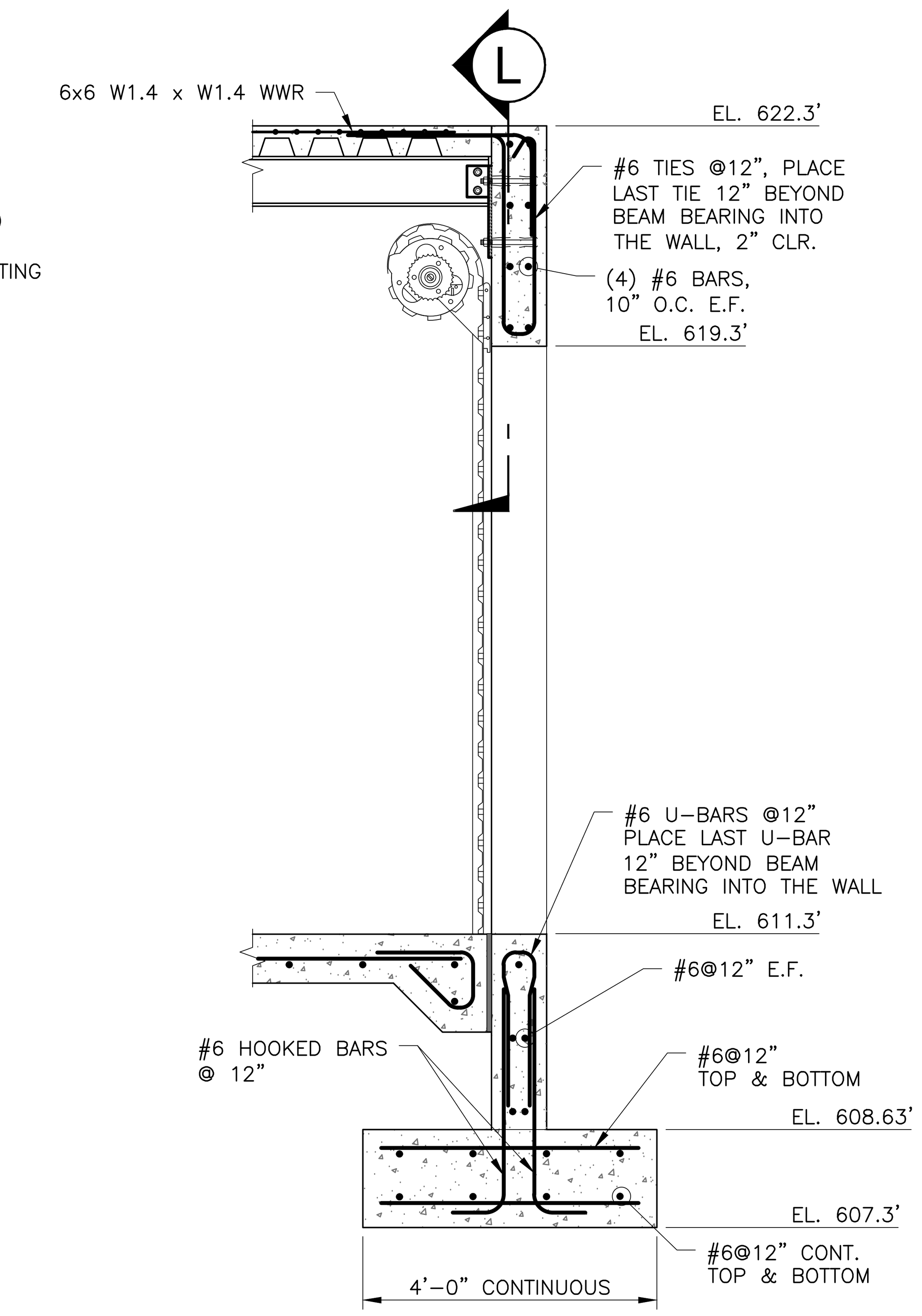
SECTION D/2
1/2"= 1'-0"



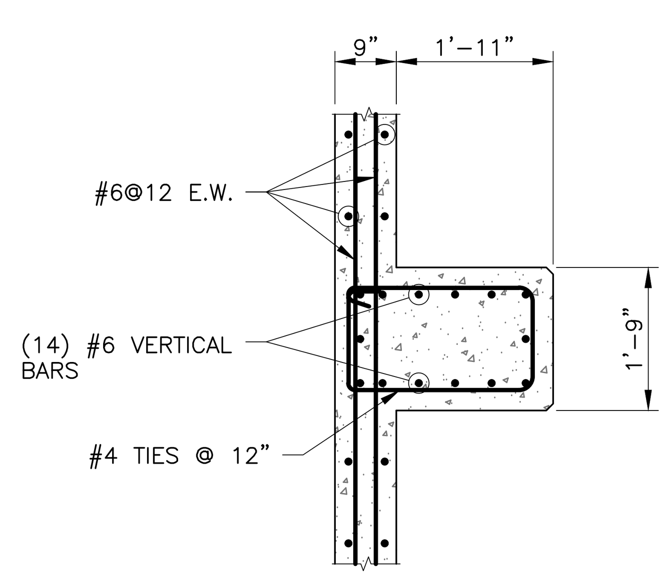
SECTION E/2
1/2"= 1'-0"



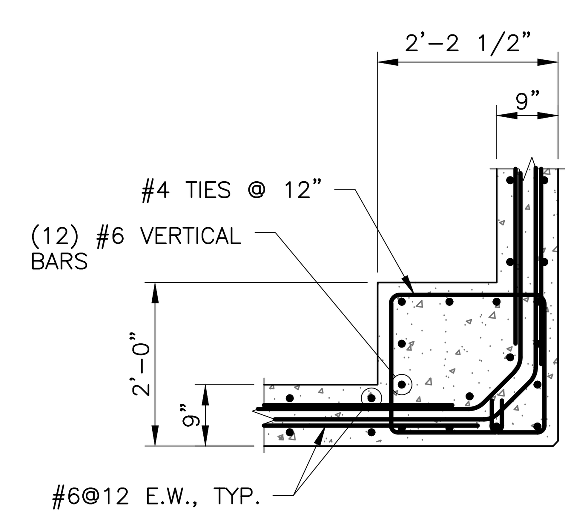
SECTION F/2
1/2"= 1'-0"



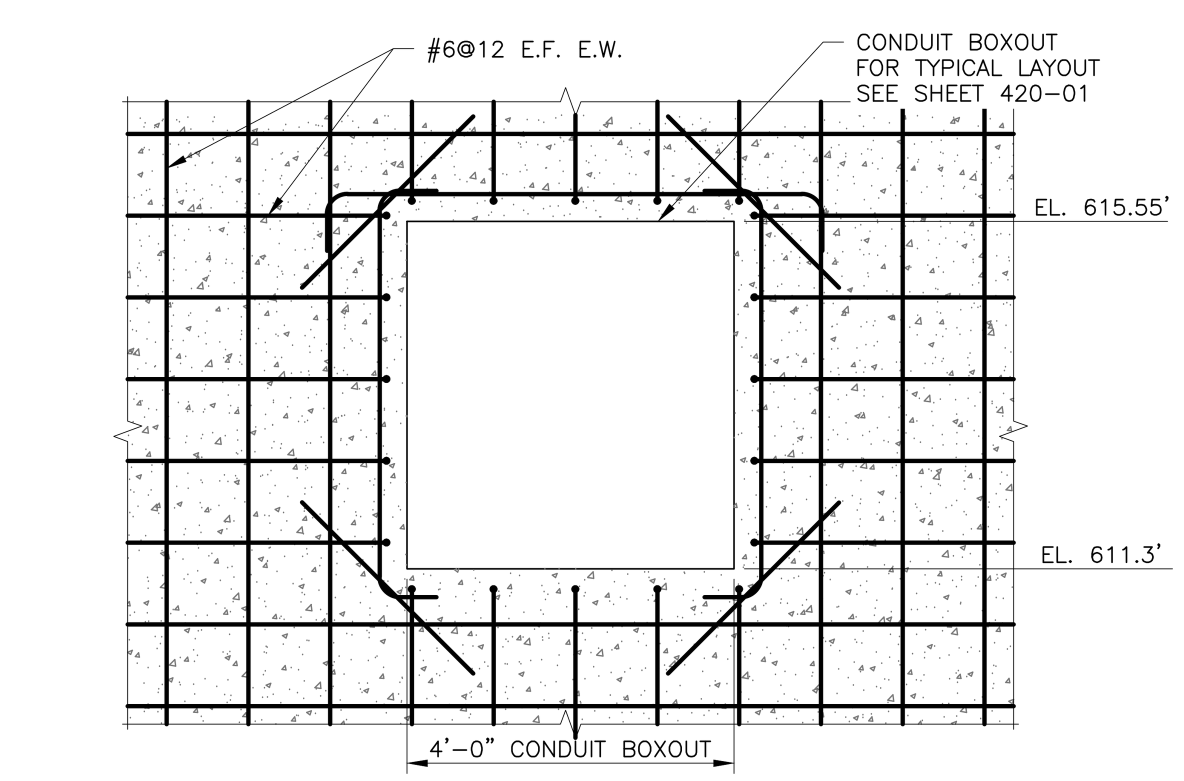
SECTION G/2
1/2"= 1'-0"



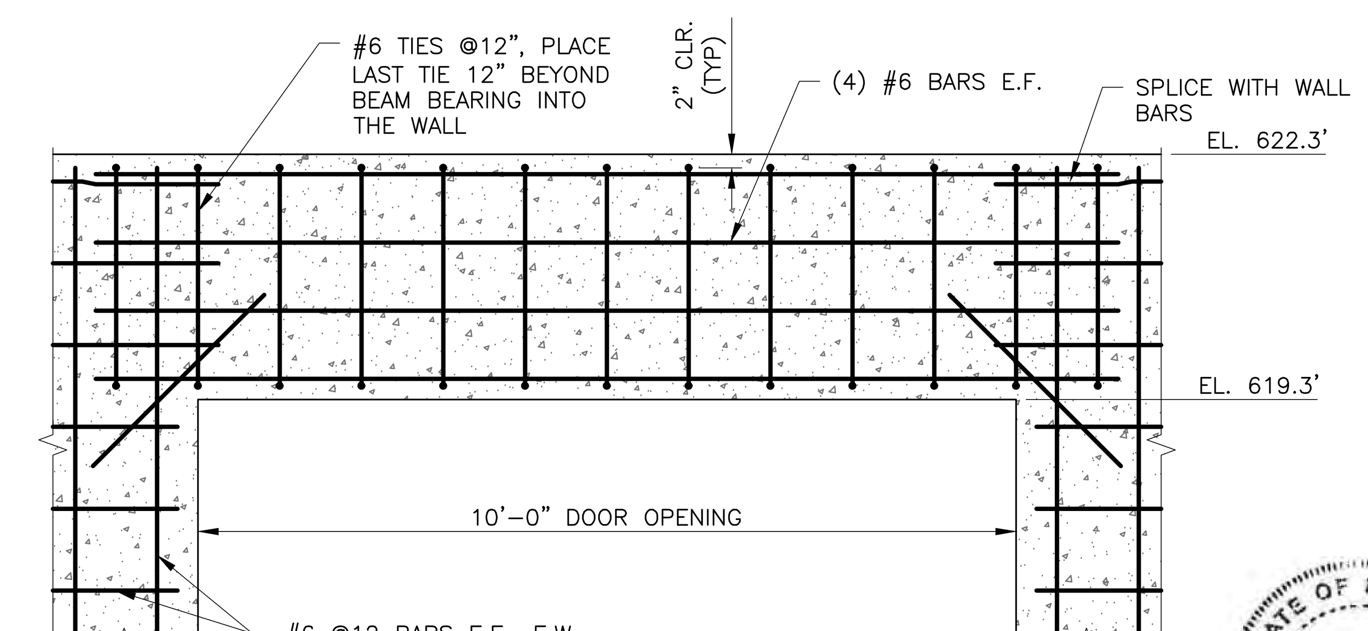
SECTION K
1/2"= 1'-0"



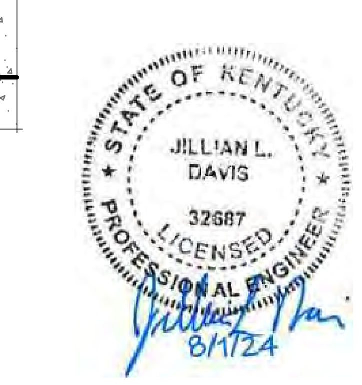
DETAIL 4/02
1/2"= 1'-0"



SECTION M
1/2"= 1'-0"



SECTION L
1/2"= 1'-0"



NOTE:
OWNER TO PROVIDE EMBEDDED GROUNDING DETAILS. DO NOT PLACE CONCRETE UNTIL DETAILS ARE PROVIDED AND APPROVED BY OWNER.

2 0 2 4
SCALE IN FEET

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE STRUCTURAL SECTIONS

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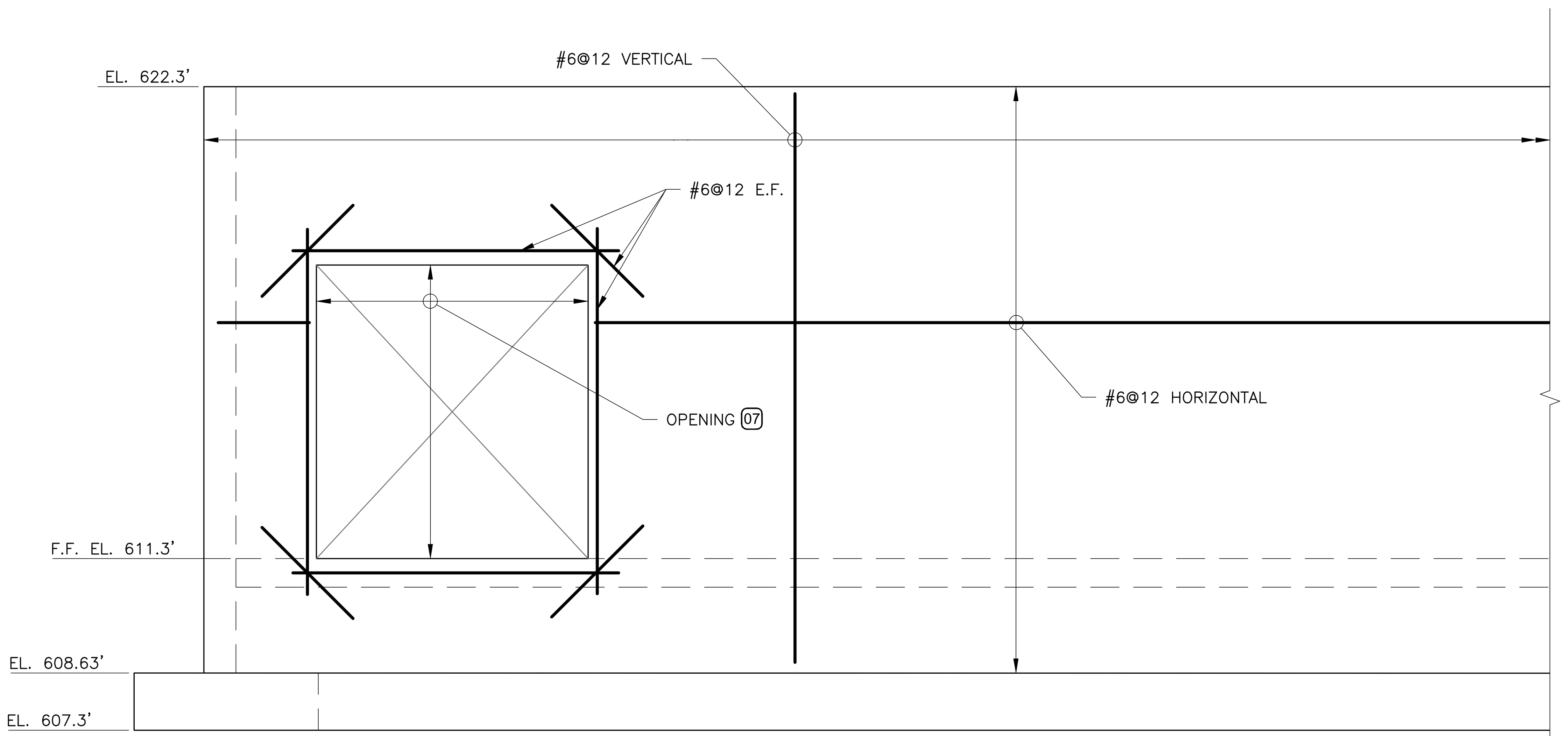
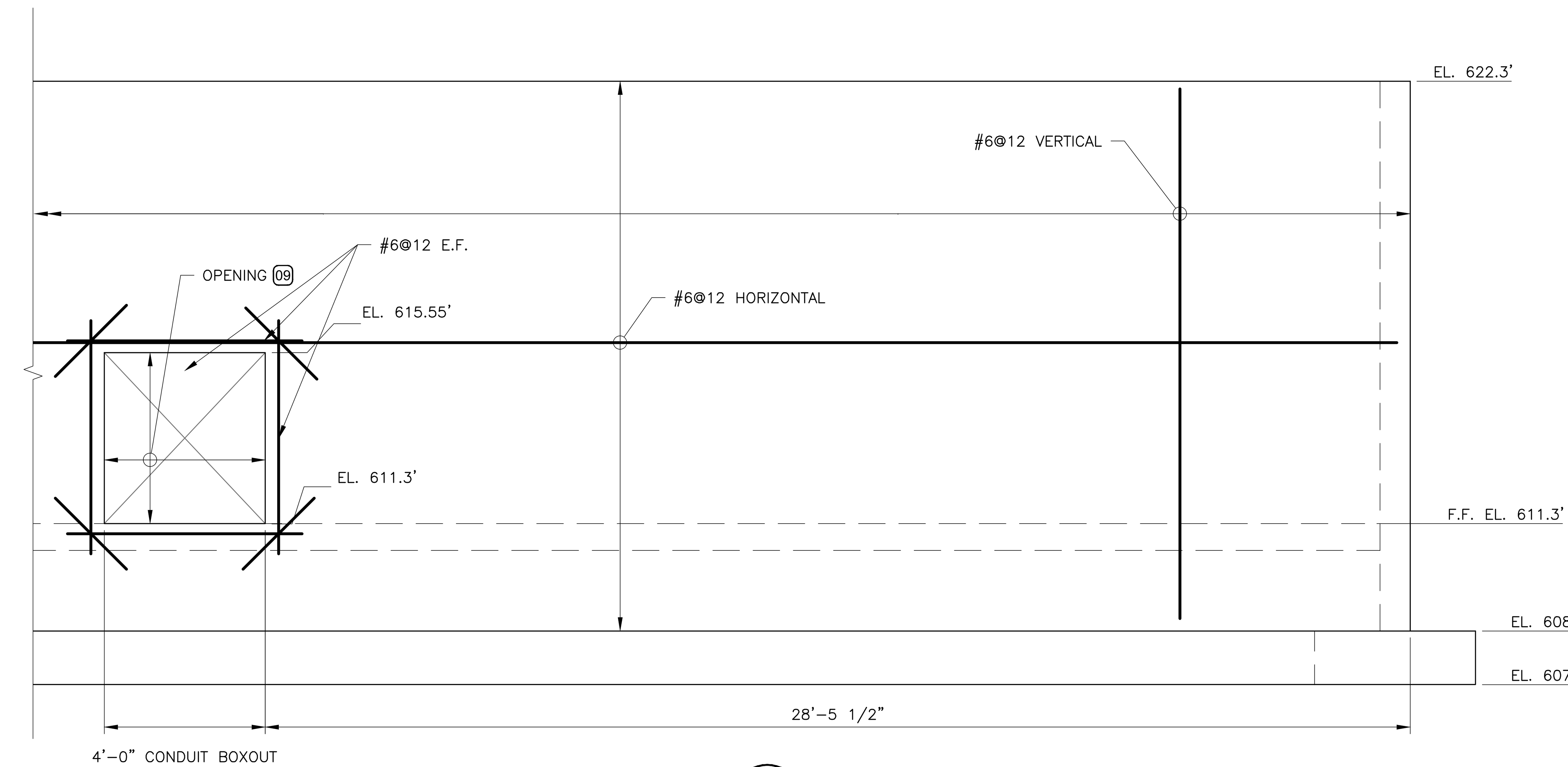
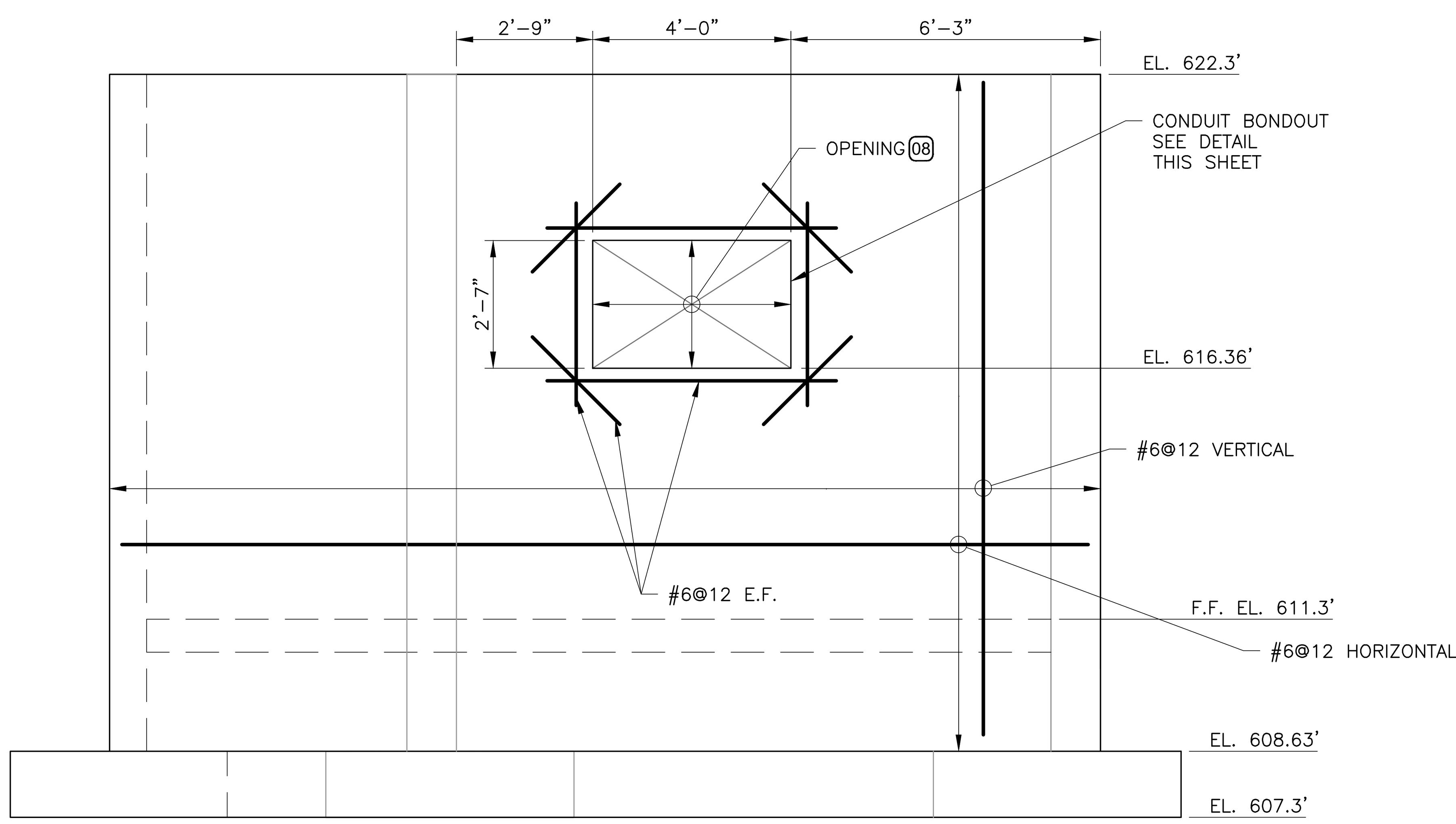
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	410-06



VIEW A-A
3/8"= 1'-0" 2

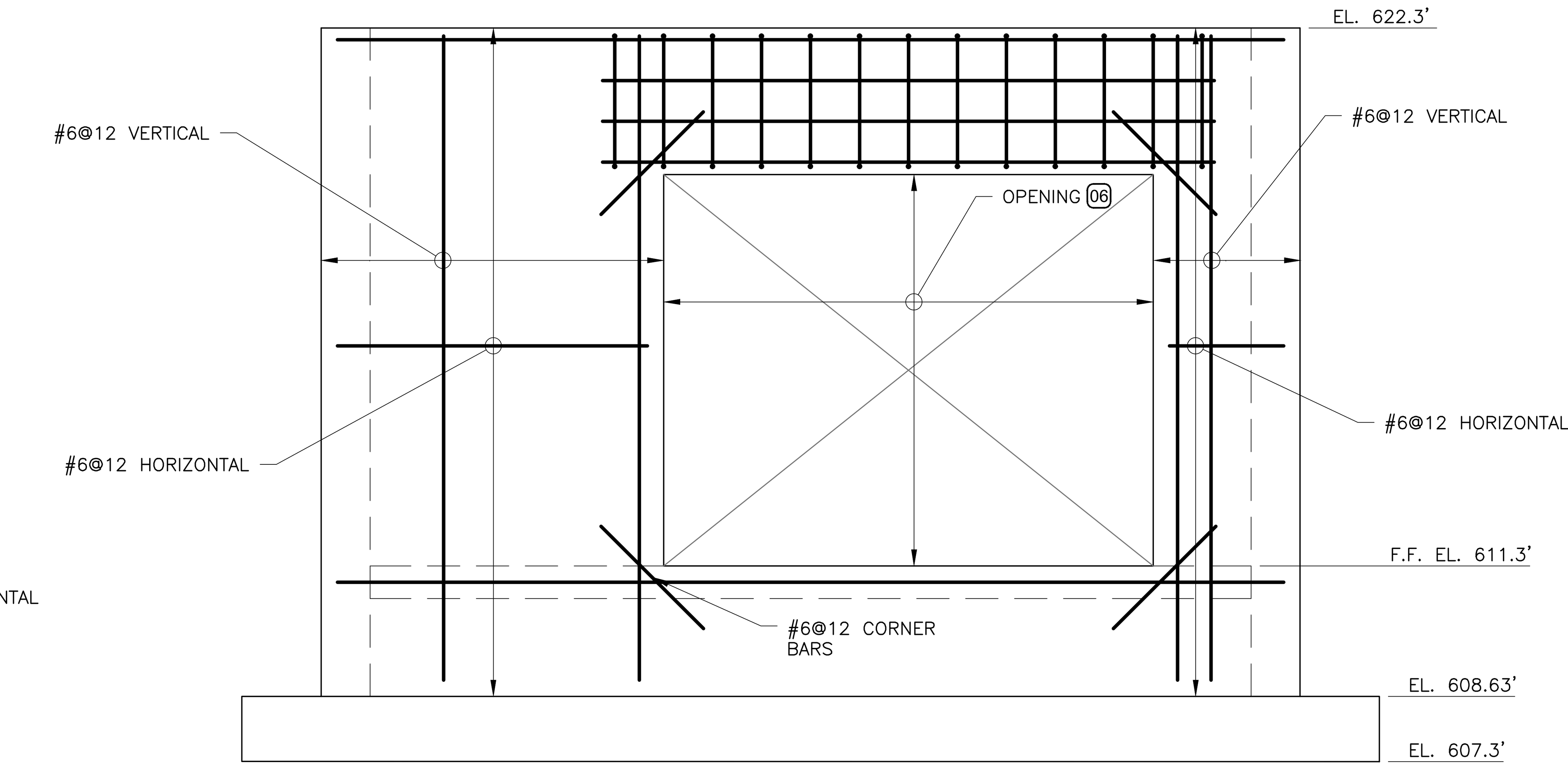


VIEW D-D
3/8"= 1'-0" 2

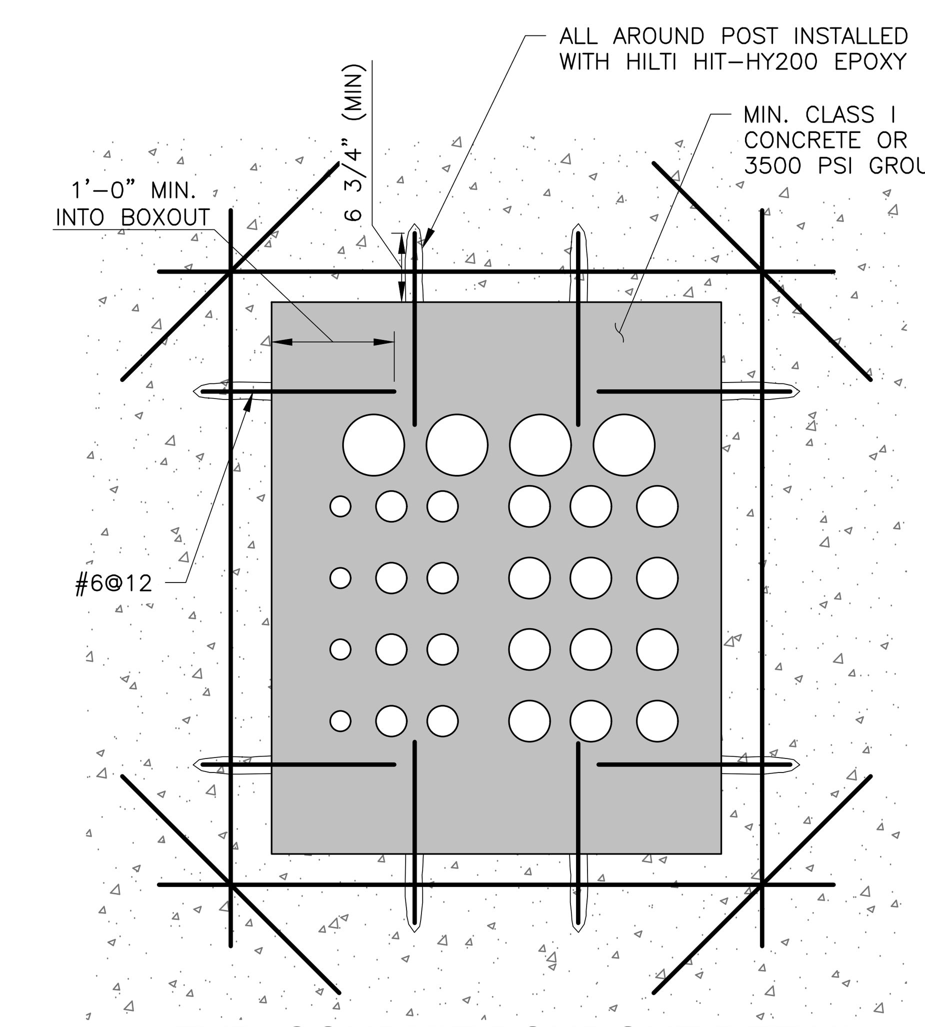


VIEW B-B
3/8"= 1'-0" 2

2 0 2 4 6
SCALE IN FEET



VIEW C-C
3/8"= 1'-0" 2



TYP. CONDUIT BONDOUT DETAIL
3/4"= 1'-0"

NOTE: ACTUAL CONDUIT NOT SHOWN; DETAIL FOR INFORMATION ONLY

1 0 1 2 3
SCALE IN FEET

NOTE:
CONDUITS, GROUNDING, FLOOR PENETRATIONS AND OTHER ELECTRICAL RELATED ELEMENTS SHOWN ON DRAWINGS PROVIDED BY OWNER.

22x34 = FULL SCALE

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APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - REINFORCED CONCRETE
STRUCTURAL ELEVATIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	410-07

22x34 = FULL SCALE

STEEL FRAMING PLAN T.O.S. @ EL. 621.68'

3/8"= 1'-0"

NOTES:

1. SEE DRAWING SERIES 100 & 110 FOR GENERAL NOTES AND INFORMATION AS APPLICABLE.
2. BEAM LAYOUT CONTROLLED BY FLOOR PENETRATION FOR SWITCHGEAR. OPENING SIZE AND LOCATION TO BE CONFIRMED BY ENGINEER PRIOR TO APPROVAL OF STRUCTURAL STEEL SHOP DRAWINGS.

2 0 2 4 6
SCALE IN FEET

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - STRUCTURAL STEEL
STEEL FRAMING PLAN @ EL. 621.68'

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	411-01

J:\1349\009\Drawings\CAD\Phase II\A\1349009 411-01.dwg

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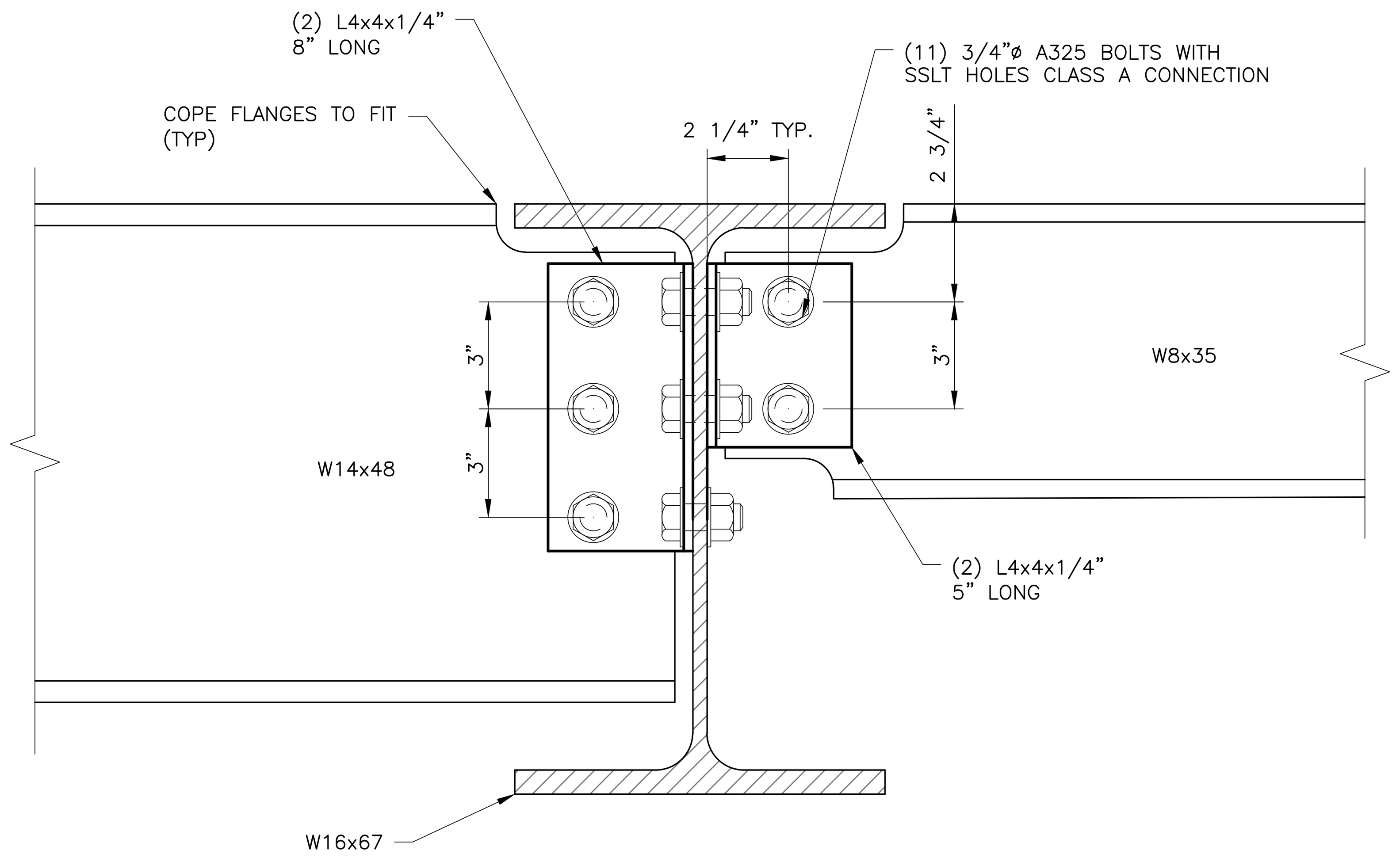
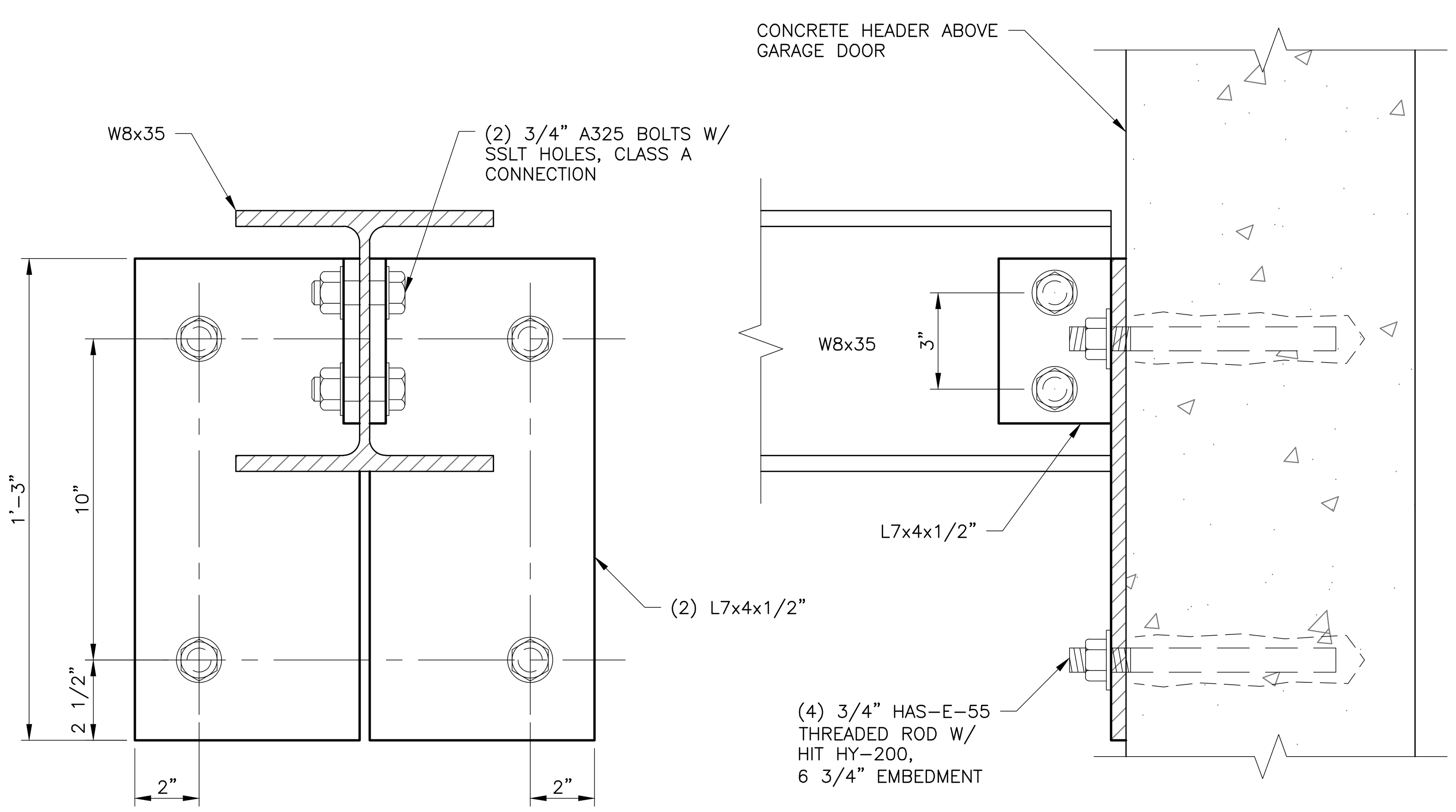


FLOOR BEAM CONNECTION TO W16
3"= 1'-0"

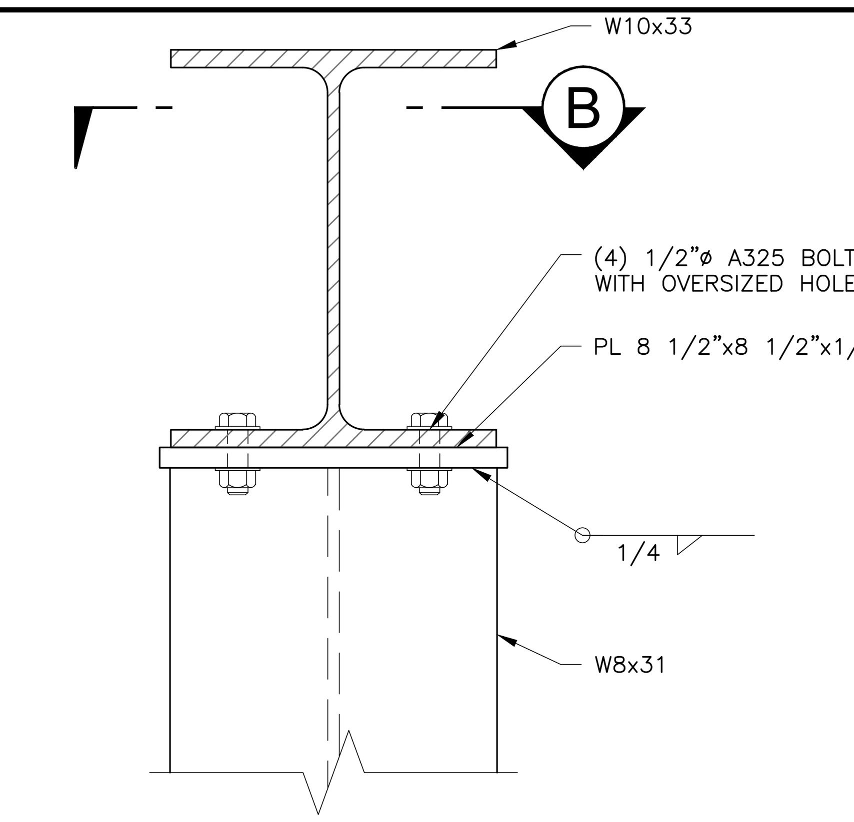
1 0 1 2
SCALE IN FEET



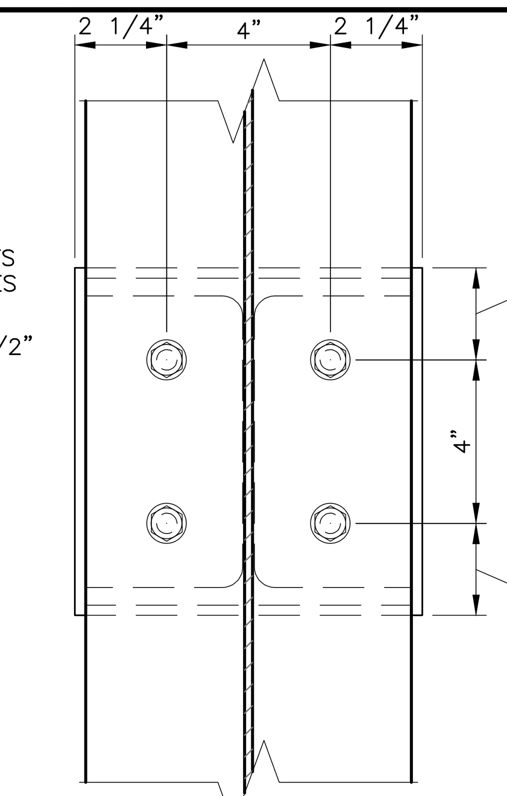
SECTION

ELEVATION

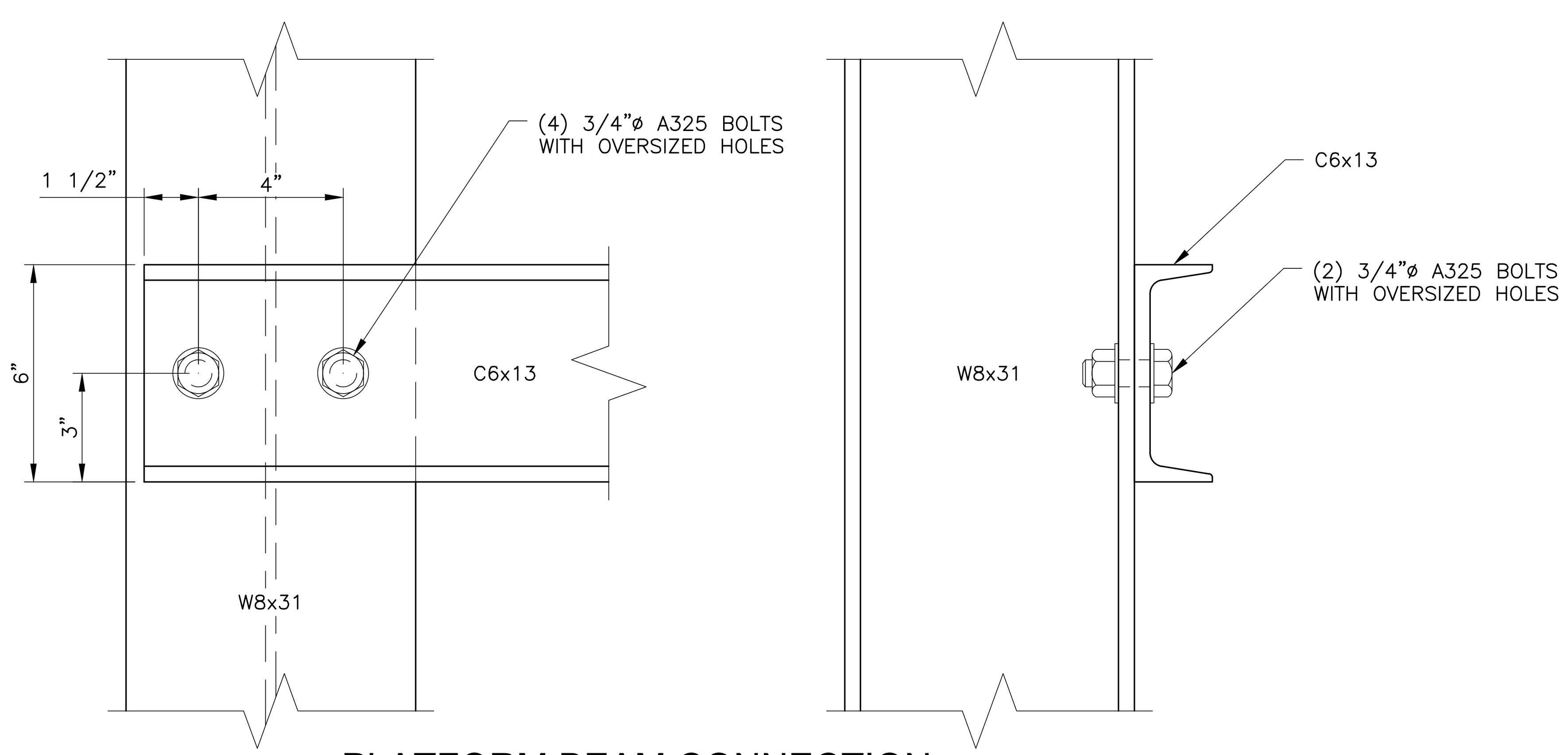
GARAGE DOOR FLOOR BEAM CONNECTION DETAIL
3"= 1'-0"



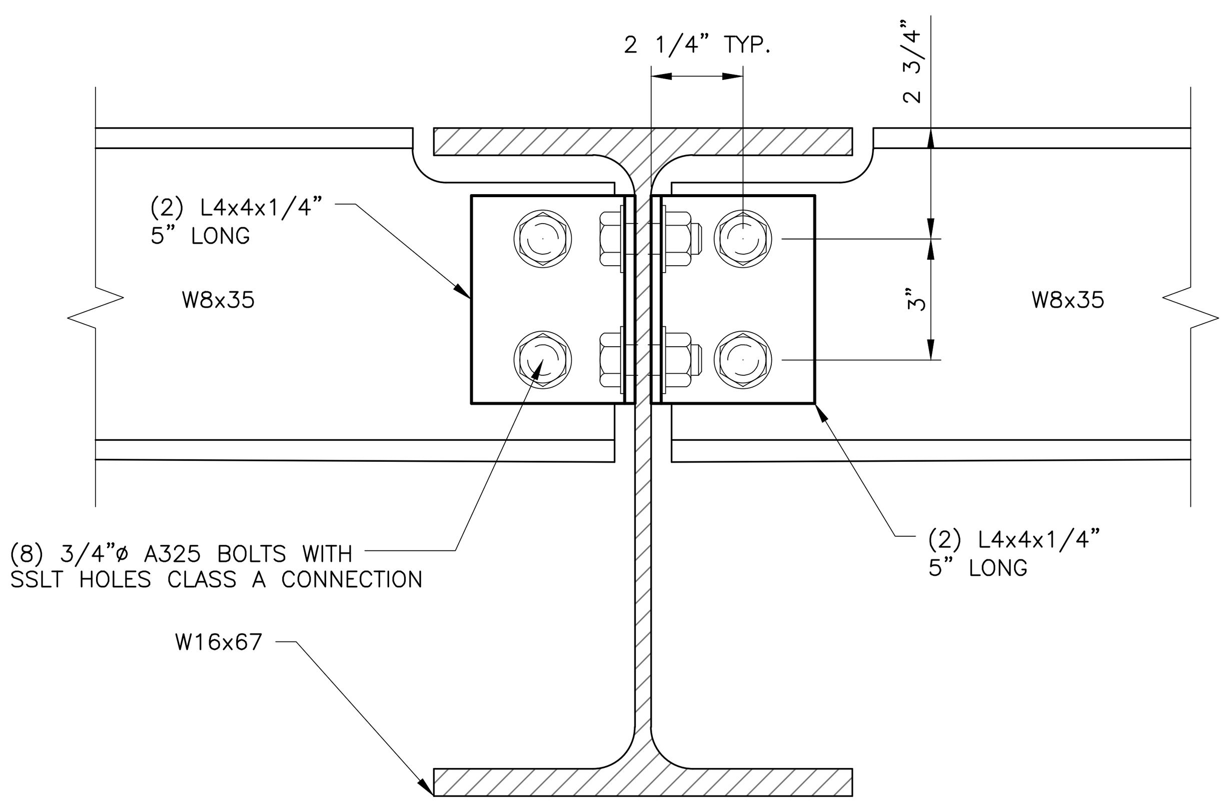
PLATFORM BEAM CONNECTION
W10 BEARING ON W8 COLUMN
3"= 1'-0"



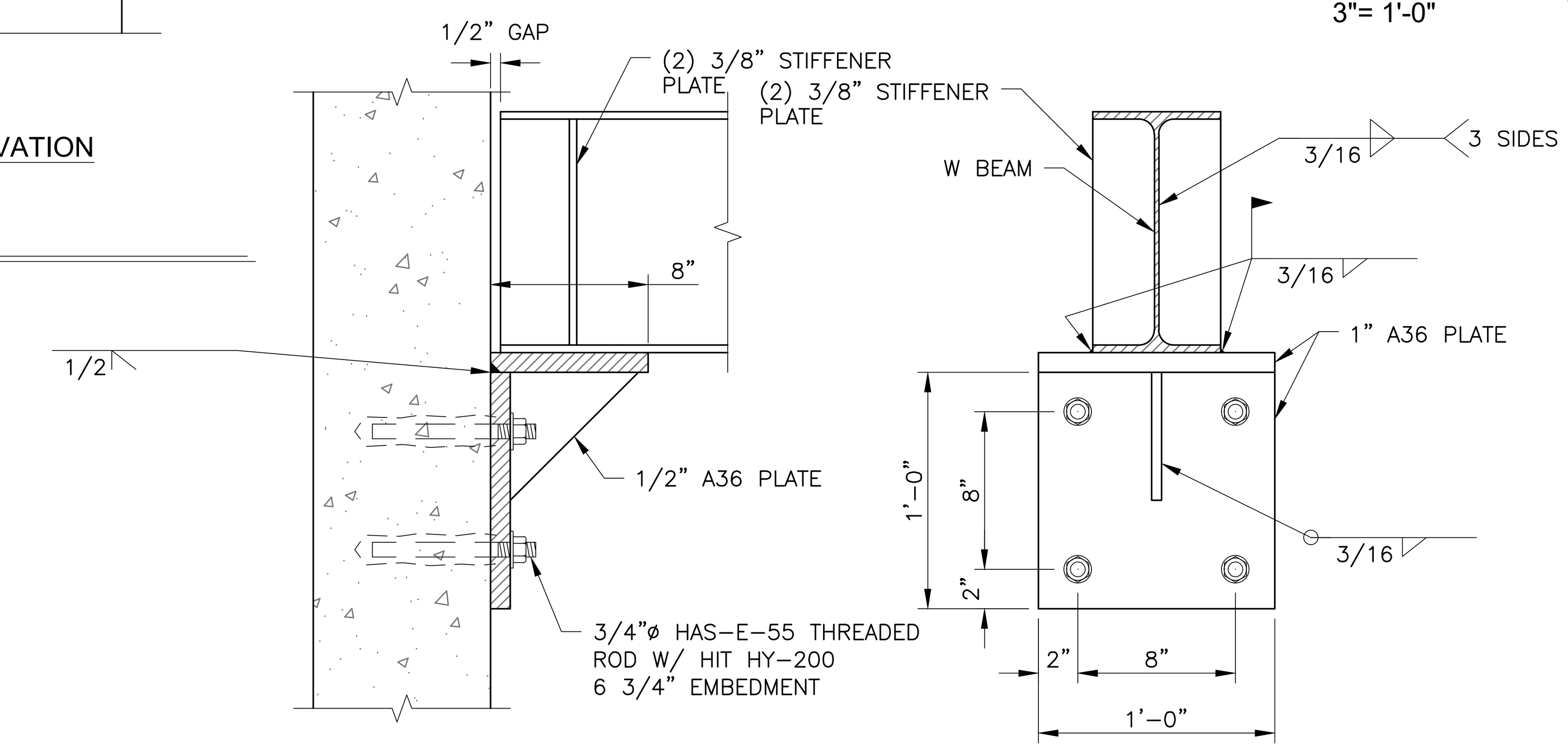
SECTION B
3"= 1'-0"



PLATFORM BEAM CONNECTION
C6 TO W8 COLUMN
3"= 1'-0"



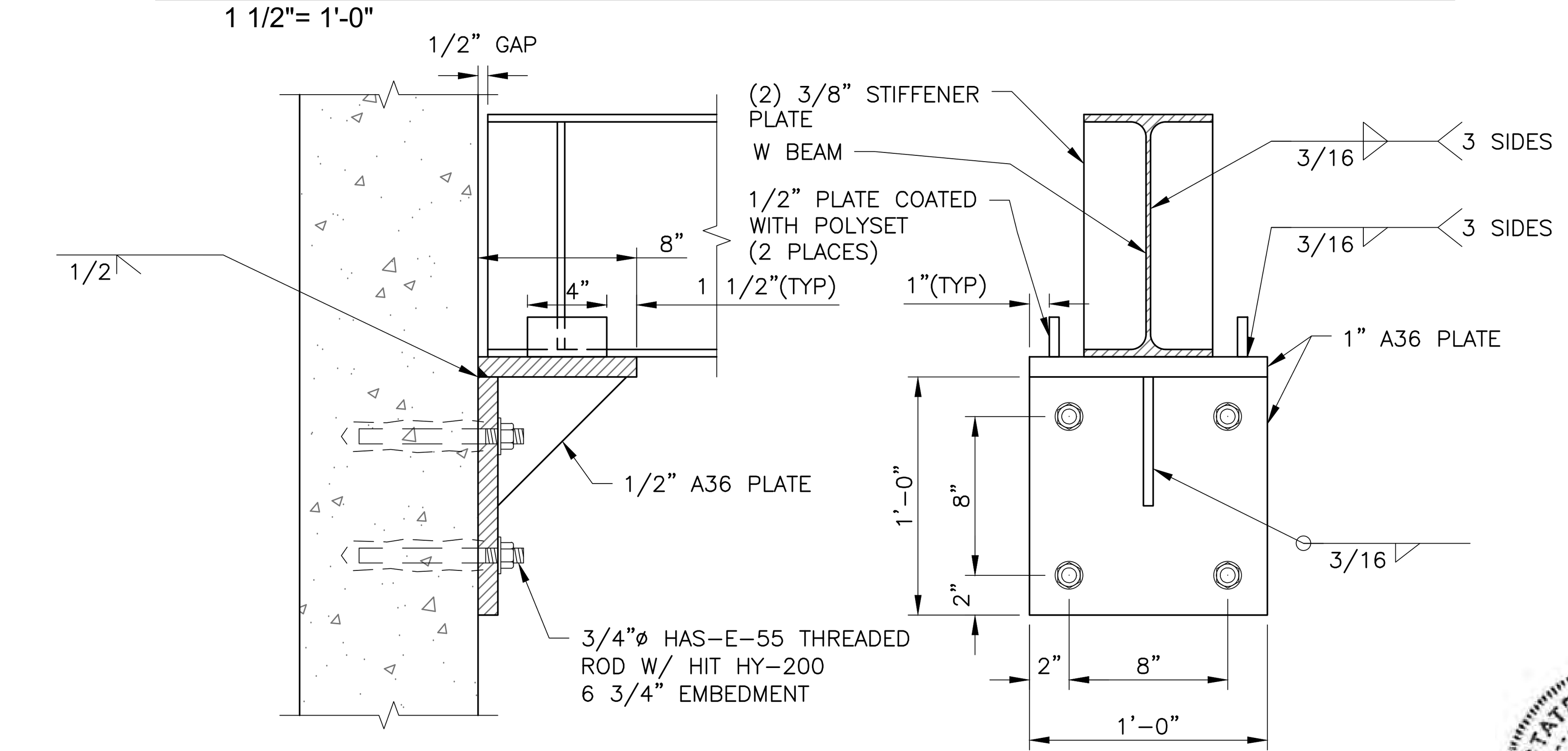
FLOOR BEAM CONNECTION W8 TO W16
3"= 1'-0"



ELEVATION

SECTION

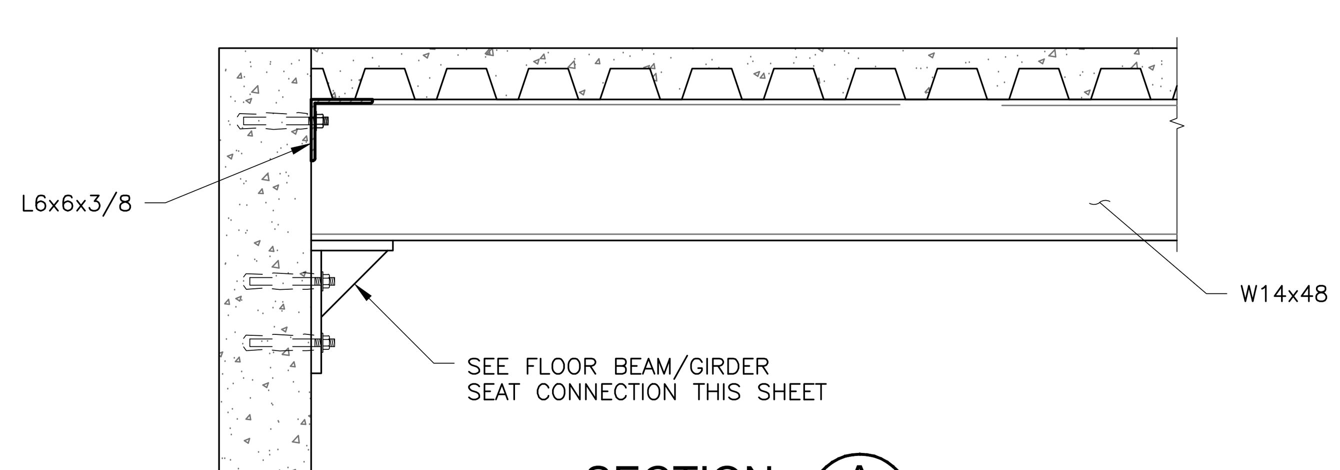
LANDSIDE TRANSFORMER PIT BEAM SEAT CONNECTION
1 1/2"= 1'-0"



ELEVATION

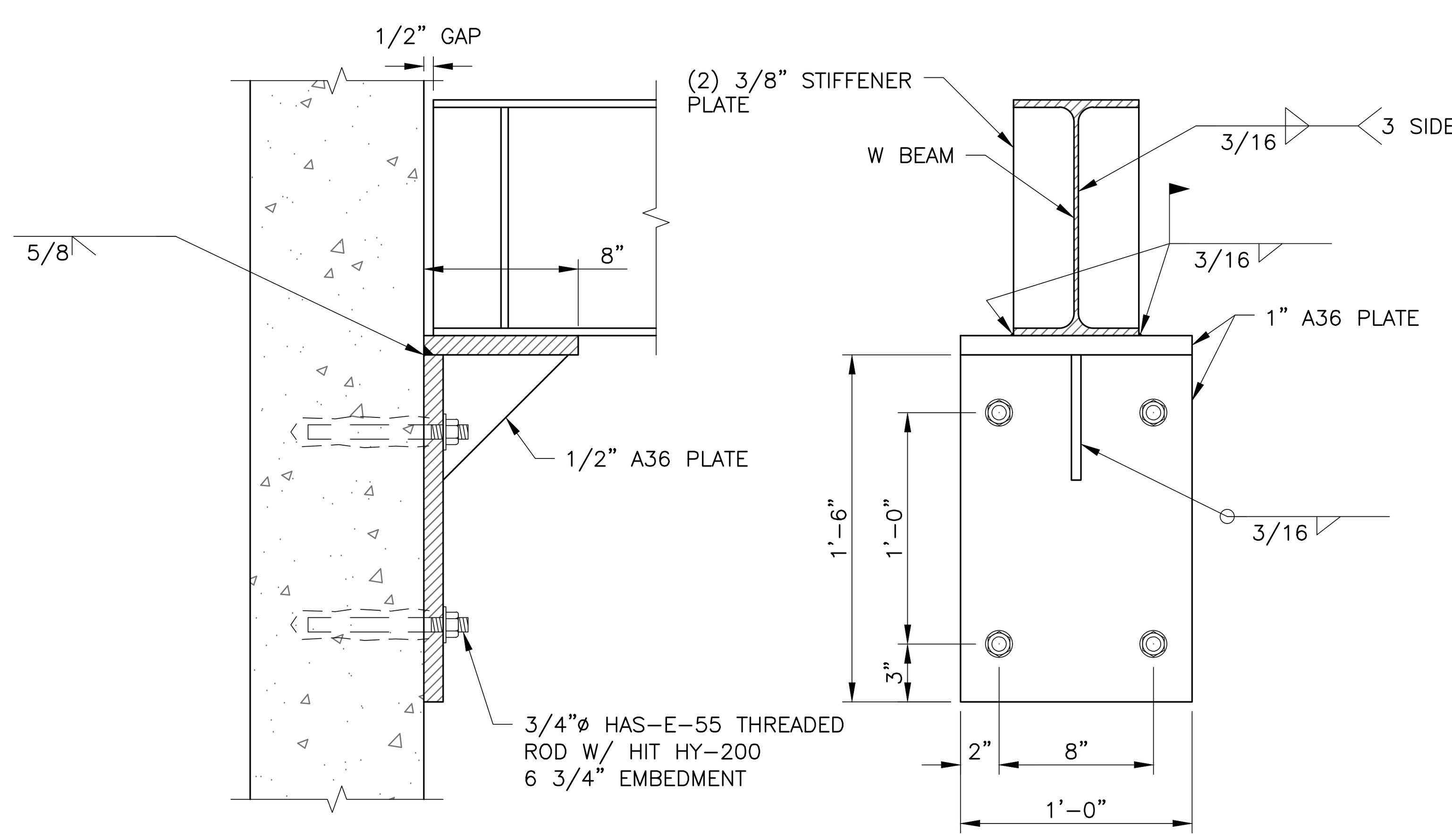
SECTION

RIVERSIDE TRANSFORMER PIT BEAM SEAT CONNECTION
1 1/2"= 1'-0"



SECTION A 01
3/4"= 1'-0"

1 0 1 2 3
SCALE IN FEET



ELEVATION

SECTION

FLOOR BEAM/GIRDER SEAT CONNECTION
1 1/2"= 1'-0"

STATE OF KENTUCKY
JILLIAN L. DAVIS
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8/1/24

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - STRUCTURAL STEEL DETAILS

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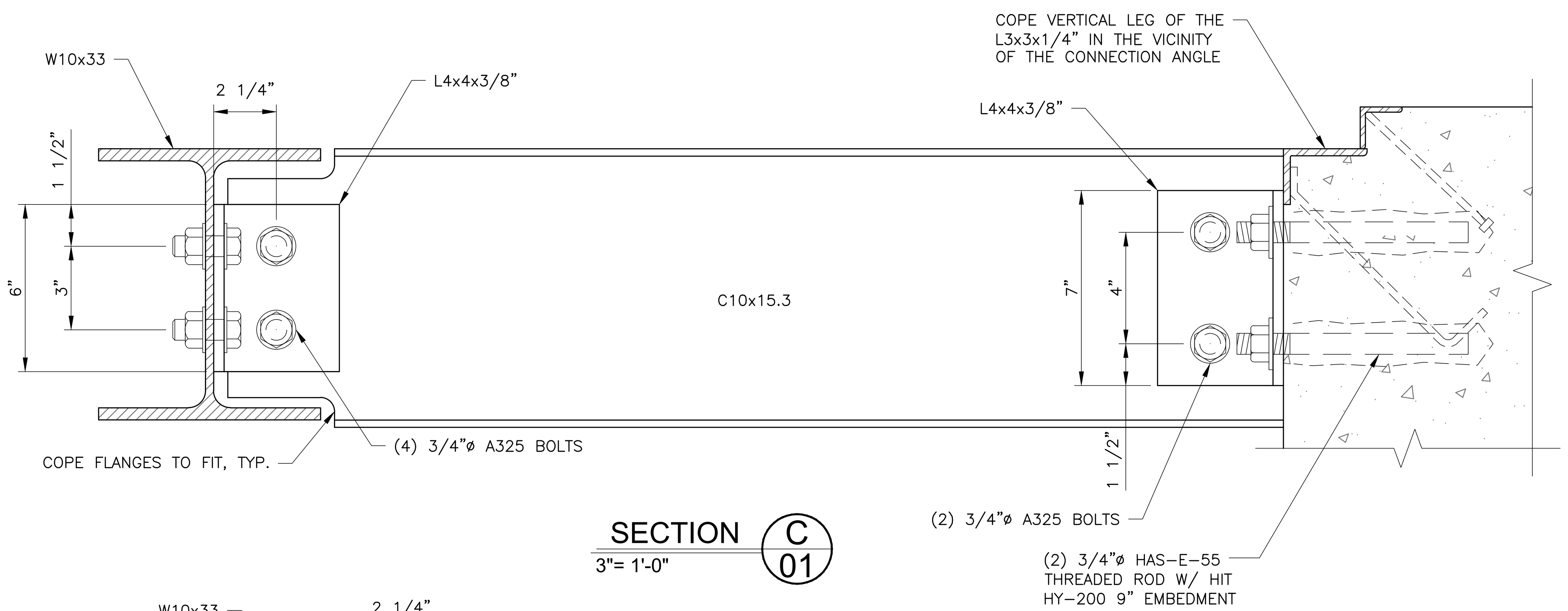
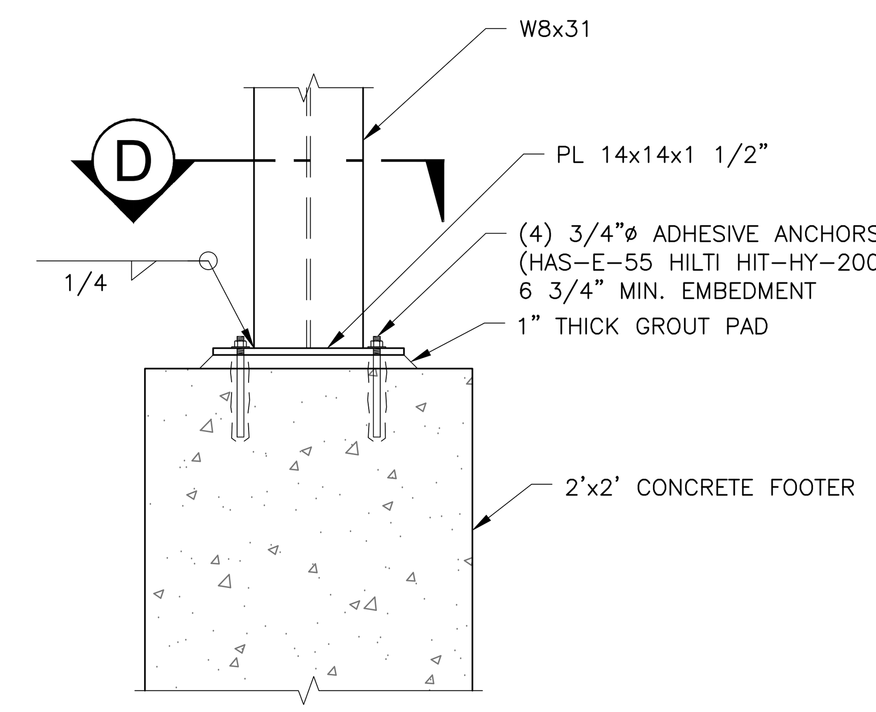
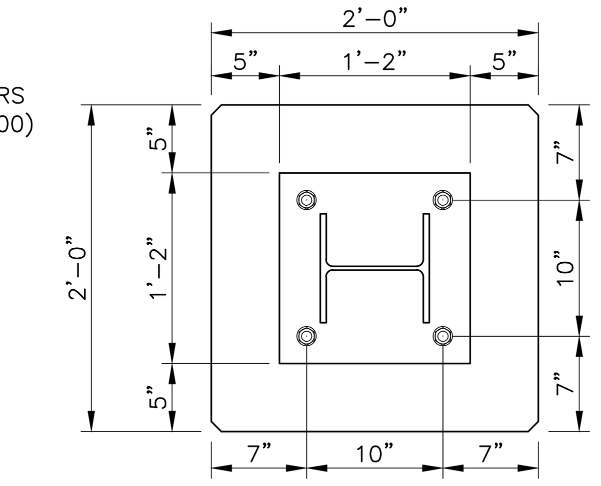
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	411-02



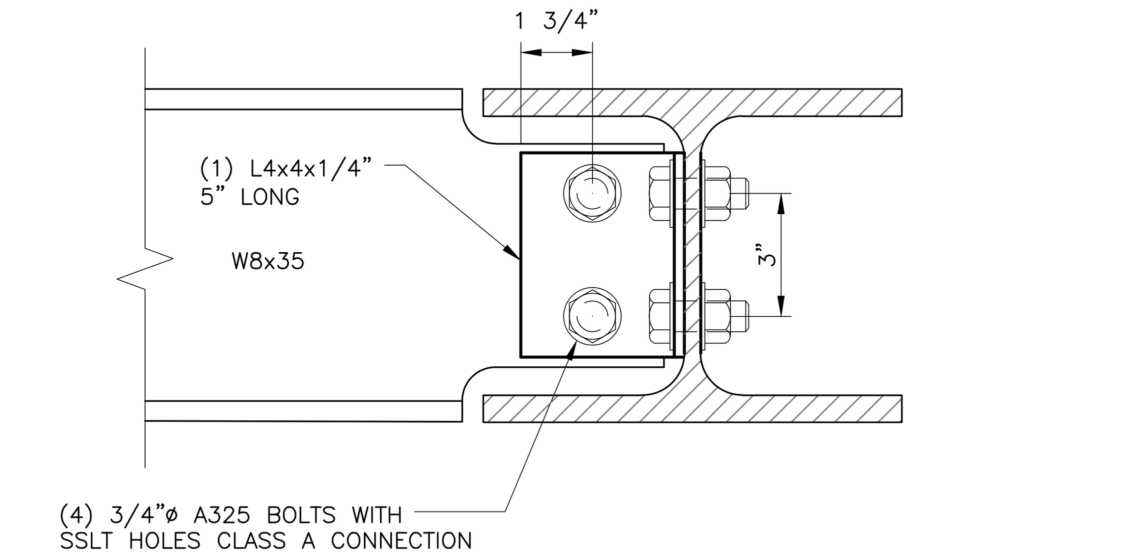
SECTION C 01
3"= 1'-0"



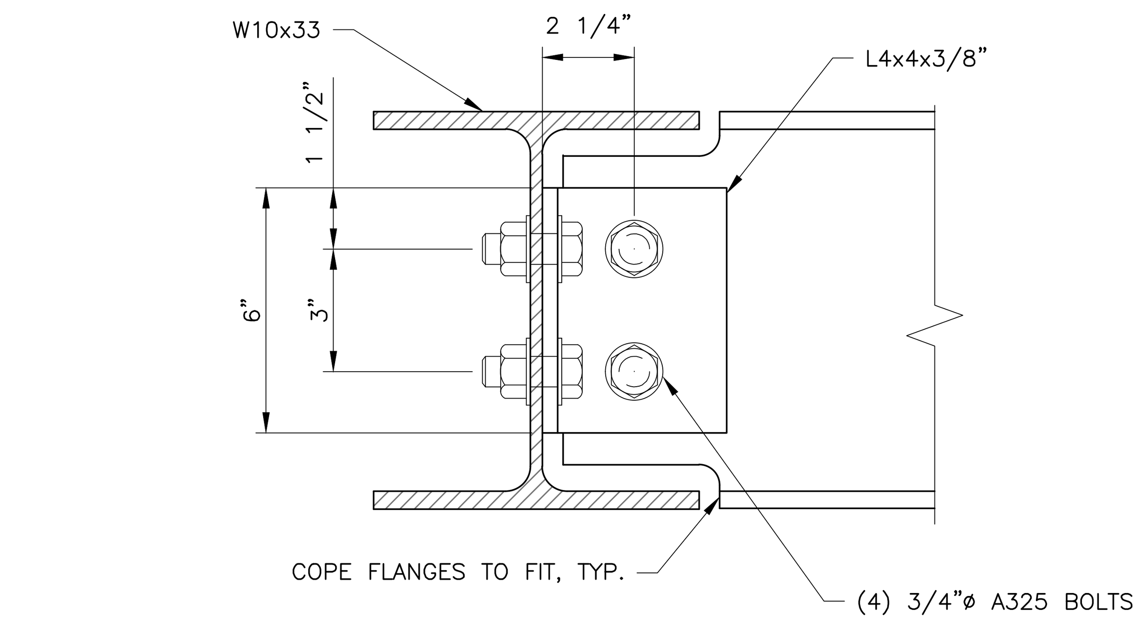
DETAIL 2 410-05
1"= 1'-0"



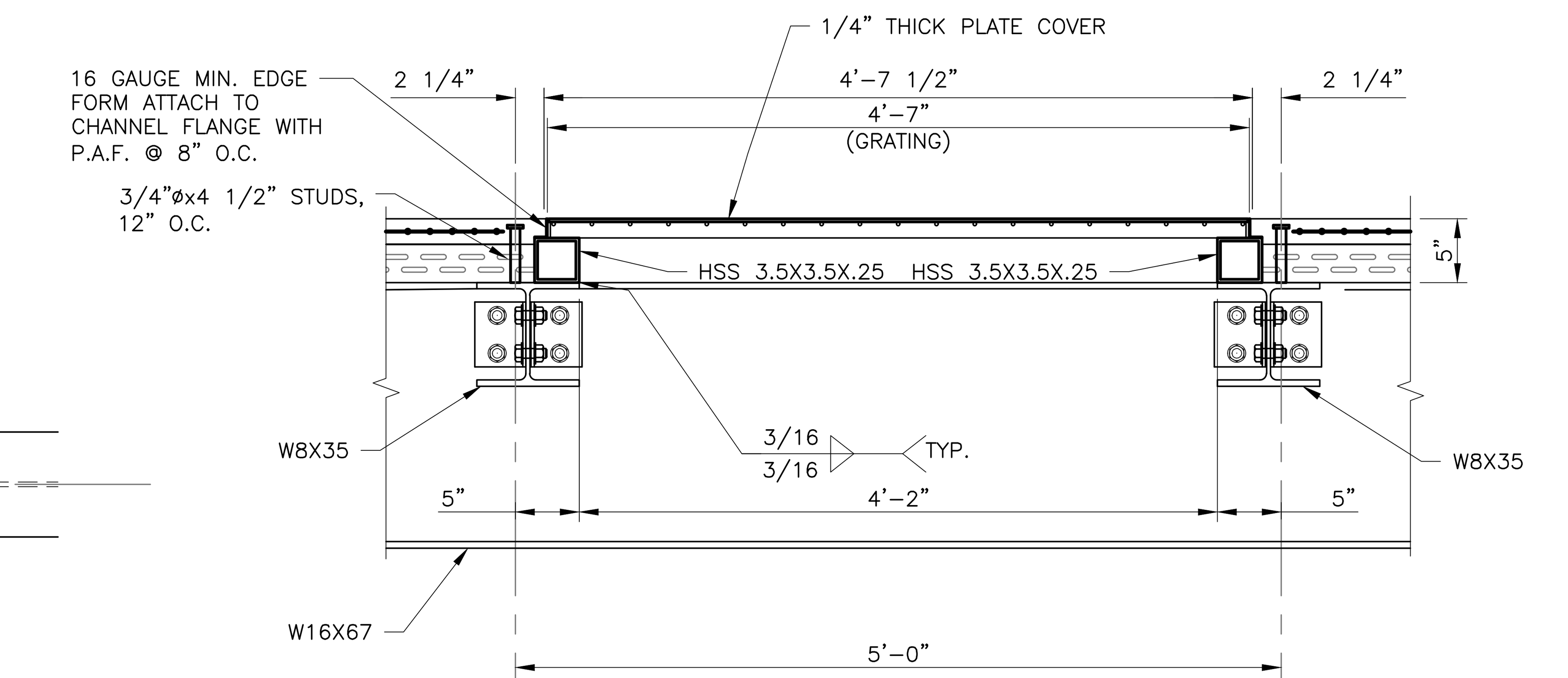
SECTION D
1"= 1'-0"



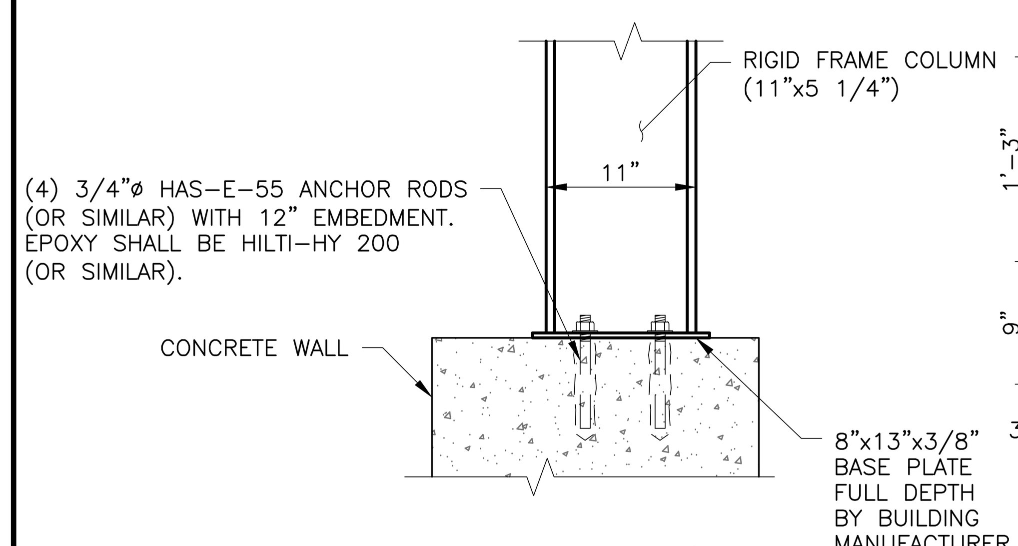
FLOOR BEAM CONNECTION W8 TO W8
3"= 1'-0"



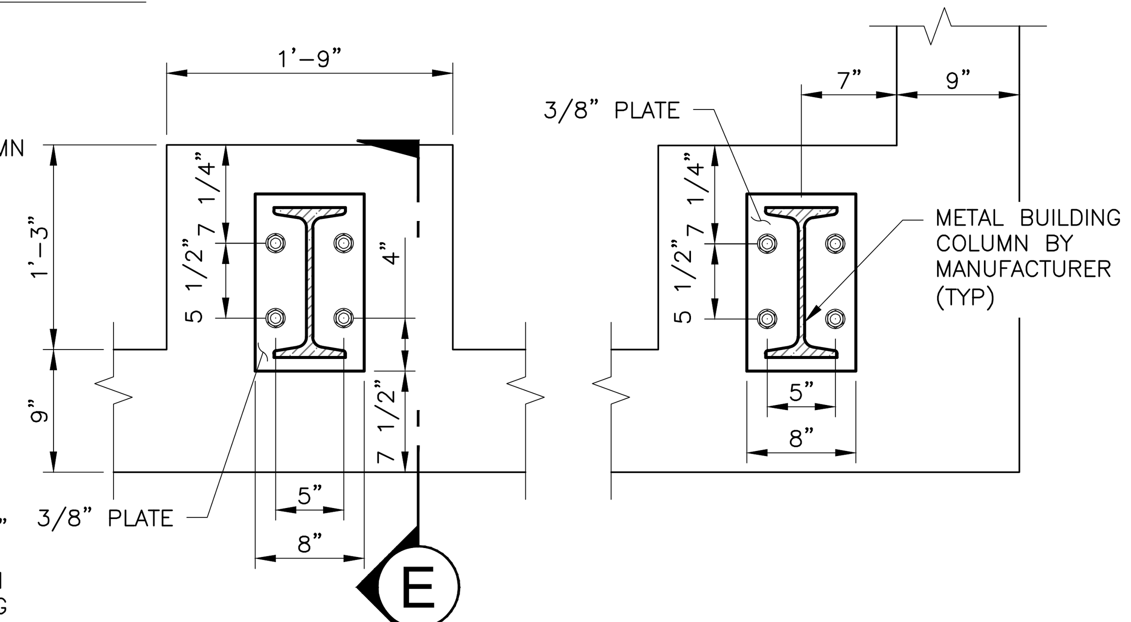
FLOOR BEAM CONNECTION W10 TO W10
3"= 1'-0"



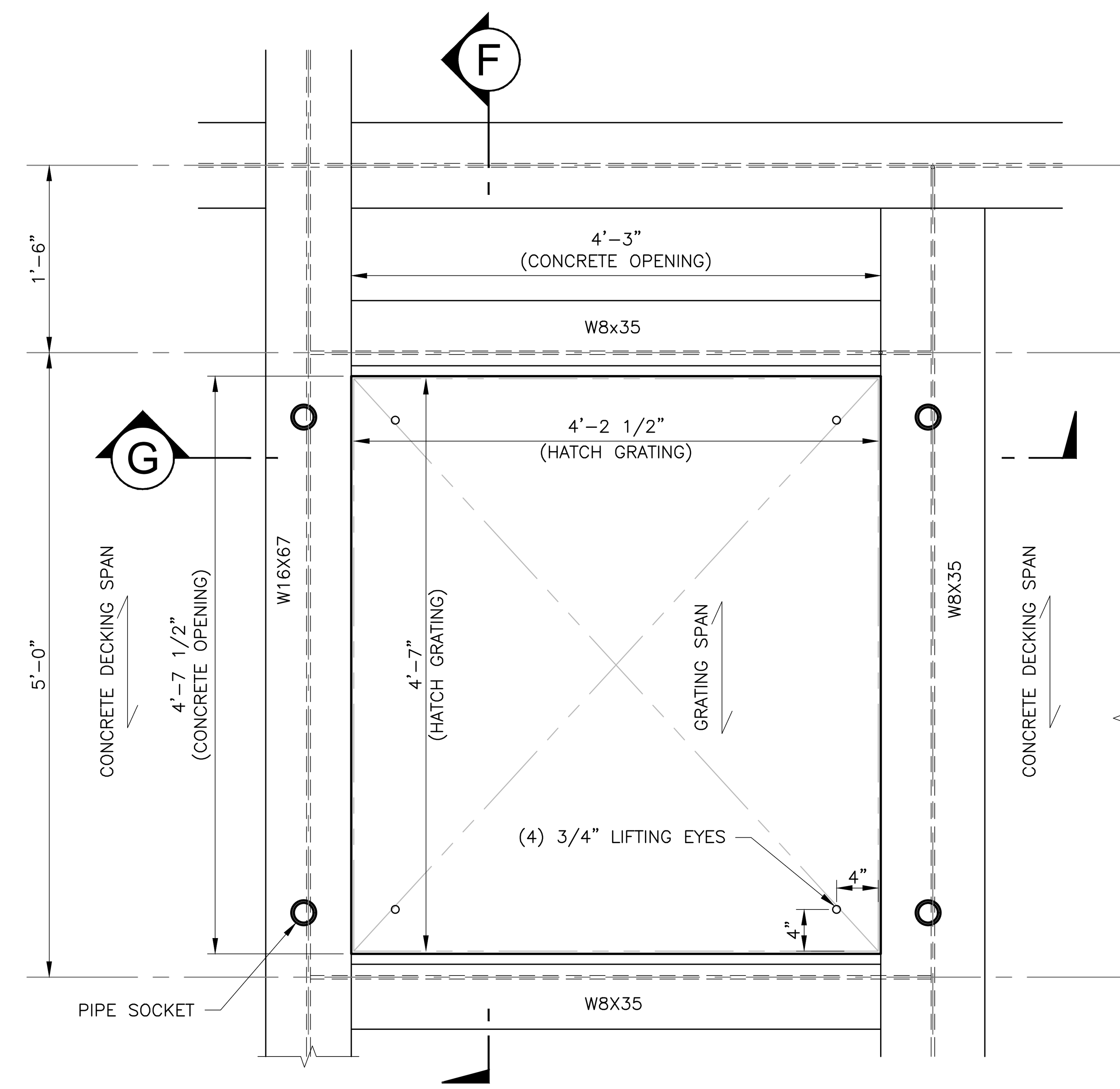
SECTION F
1"= 1'-0"



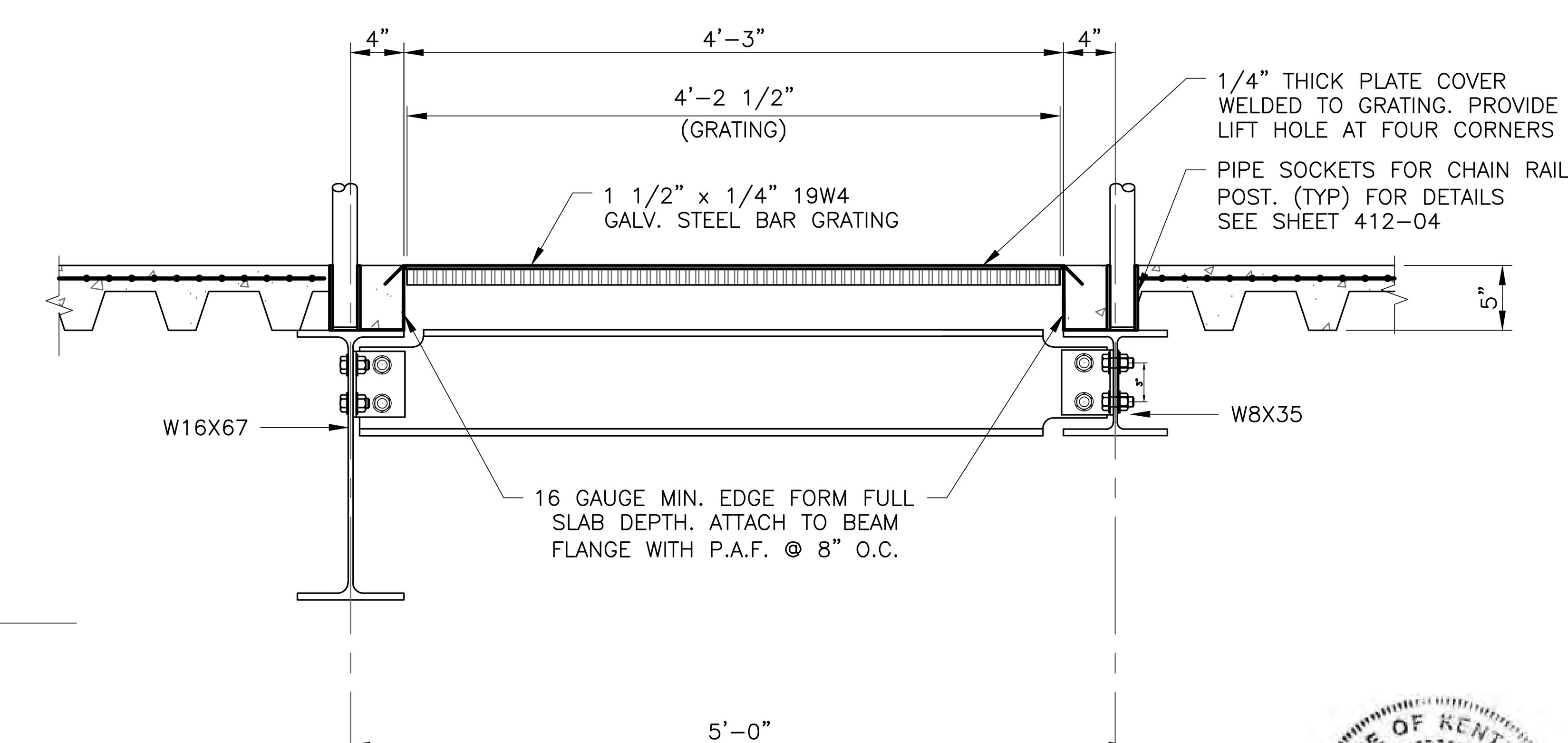
SECTION E
1"= 1'-0"



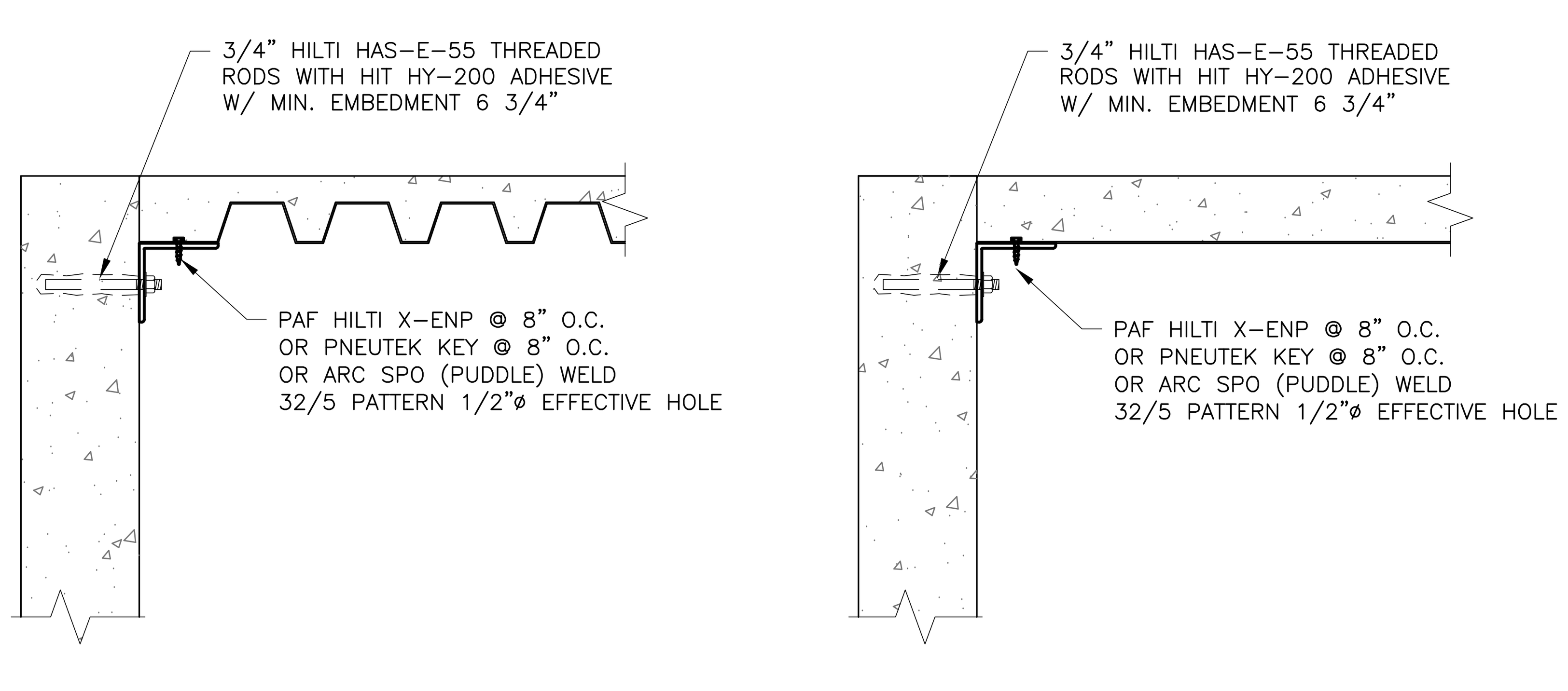
DETAIL 3 01
1"= 1'-0"



COMPOSITE SLAB OPENING PLAN
1"= 1'-0"



SECTION G
1"= 1'-0"



CORRUGATED DECK ATTACHMENT DETAILS
1"= 1'-0"

1 0 1 2
SCALE IN FEET

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - STRUCTURAL STEEL DETAILS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	411-03

22x34 = FULL SCALE

J:\1349\009\Drawings\CAD\Phase II\A\1349009 411-03.dwg

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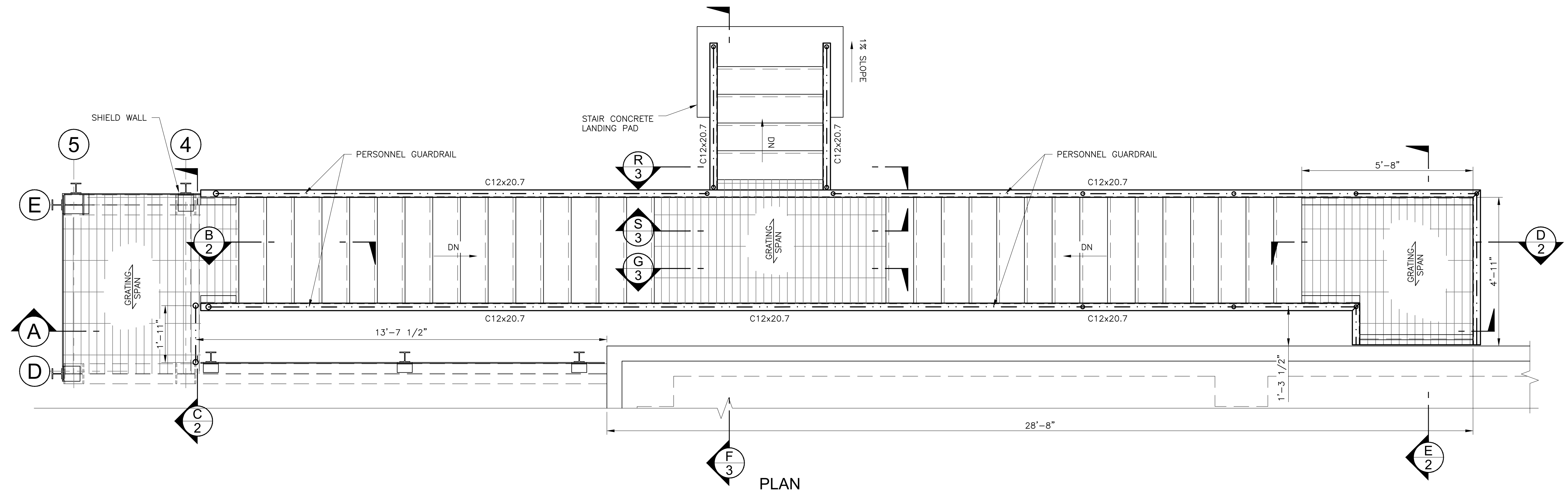
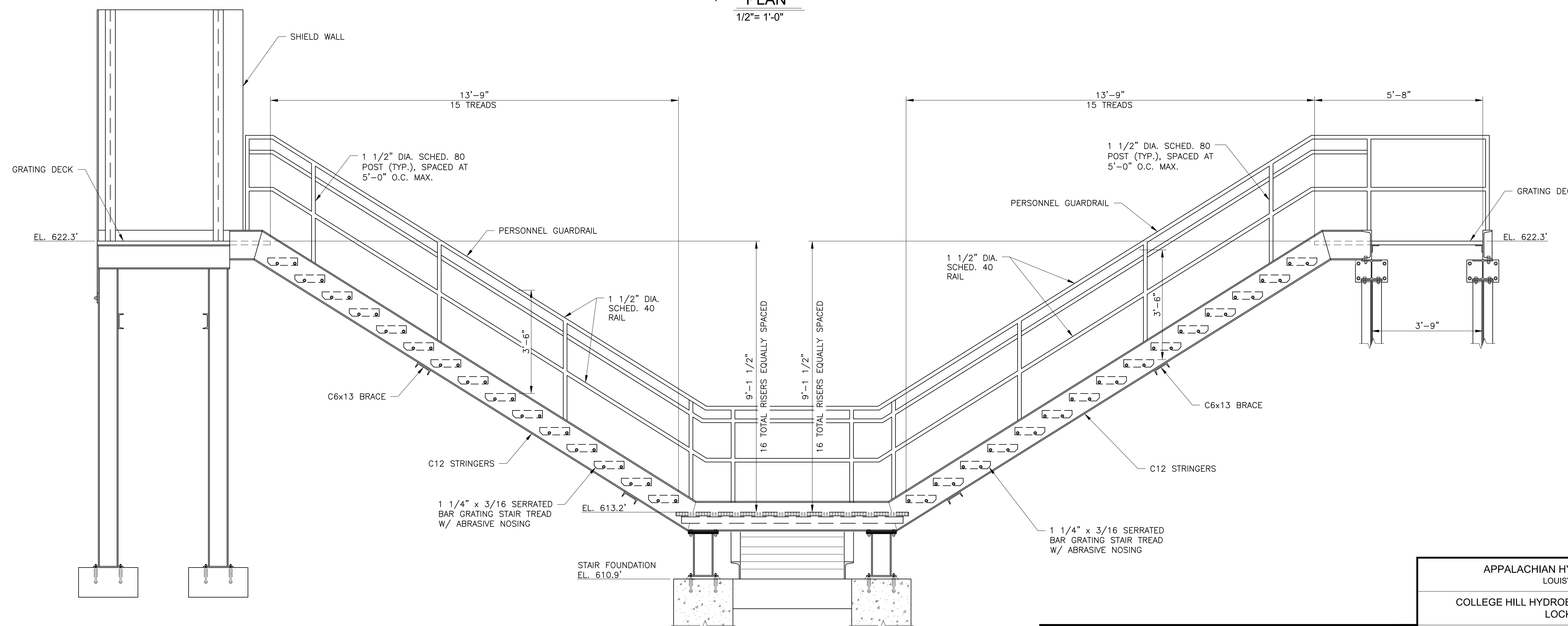
22x34 = FULL SCALE



PLAN
1/2"= 1'-0"



SECTION A
1/2"= 1'-0"

NOTES:

1. SEE DRAWING SERIES 100 & 110 FOR GENERAL NOTES AND INFORMATION AS APPLICABLE.

SCALE IN FEET

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - MISCELLANEOUS
STAIR PLAN AND SECTION

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Kleinschmidt
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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	412-01

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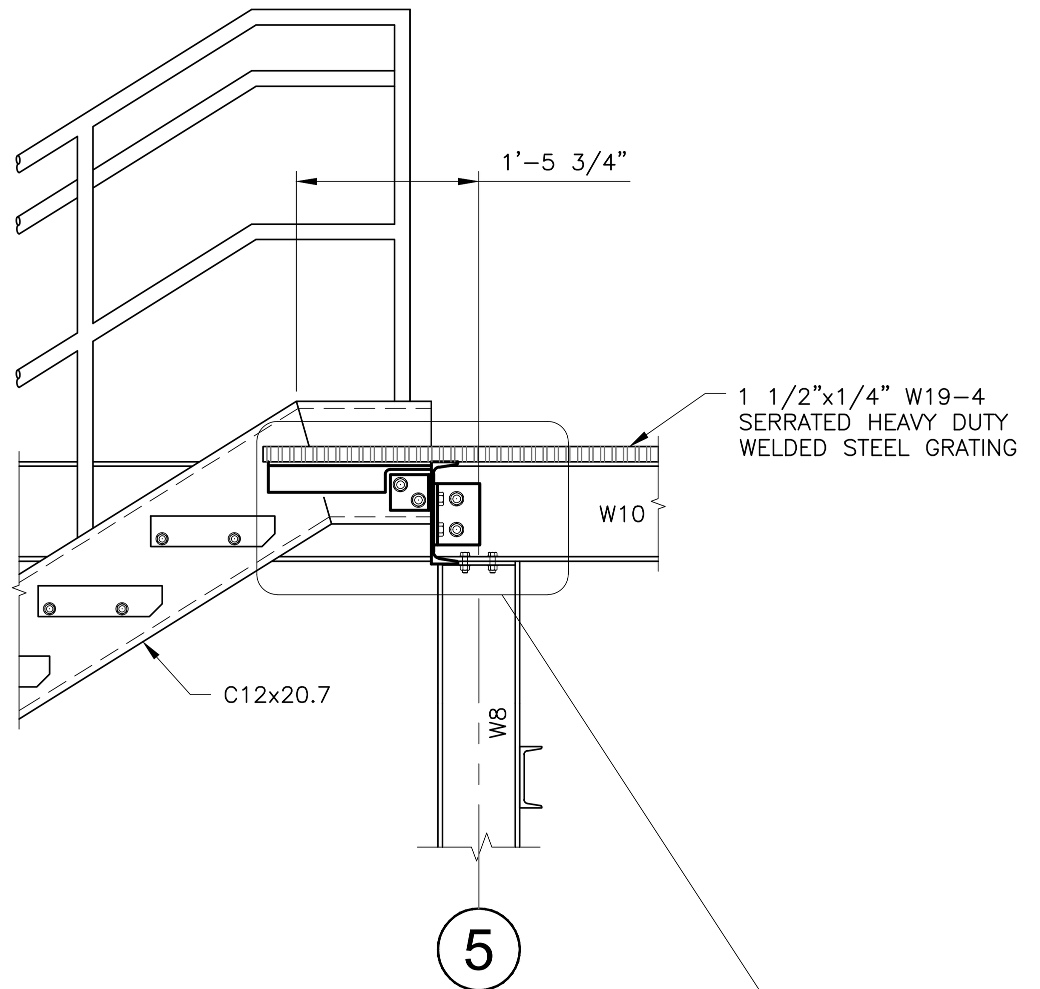
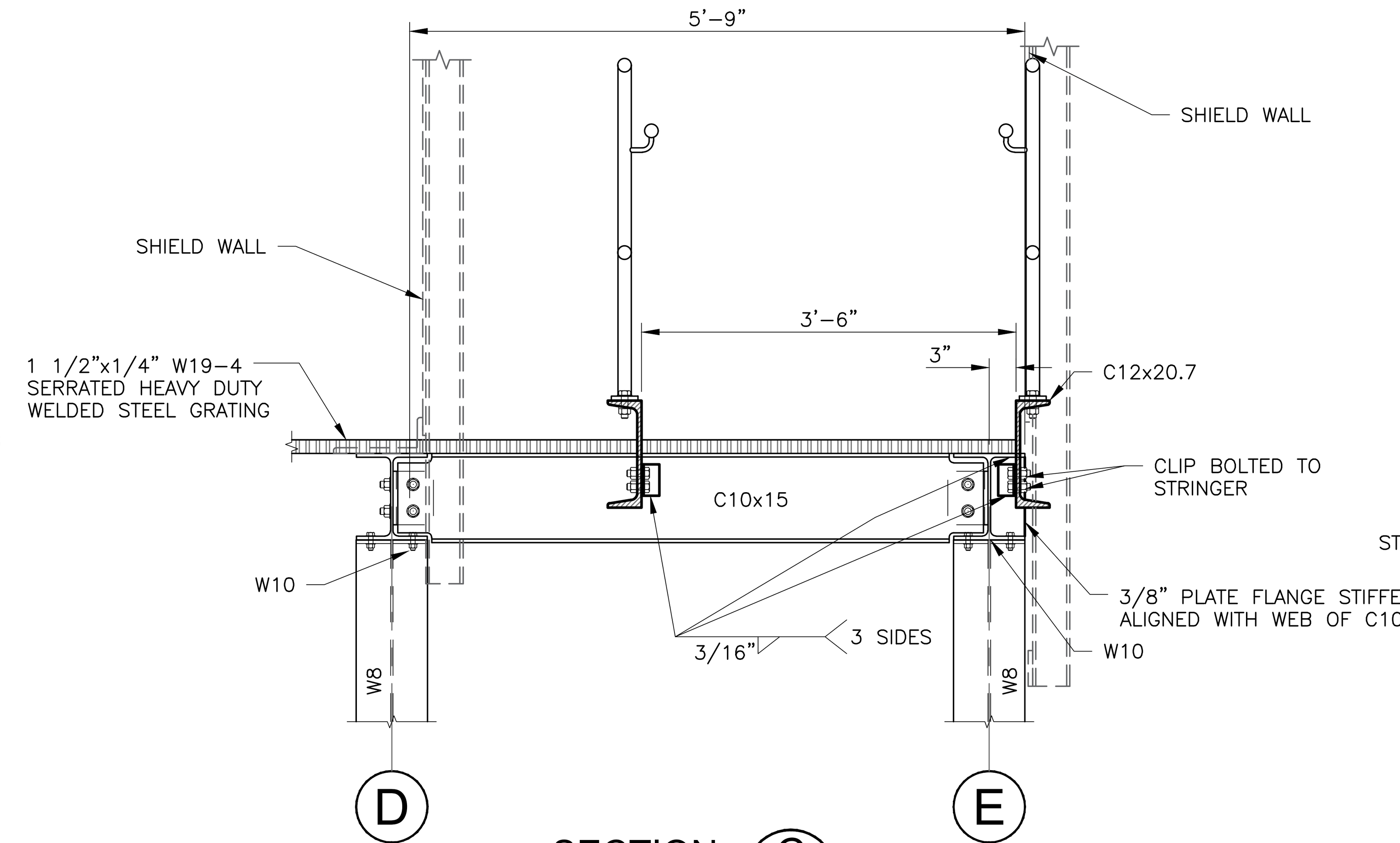
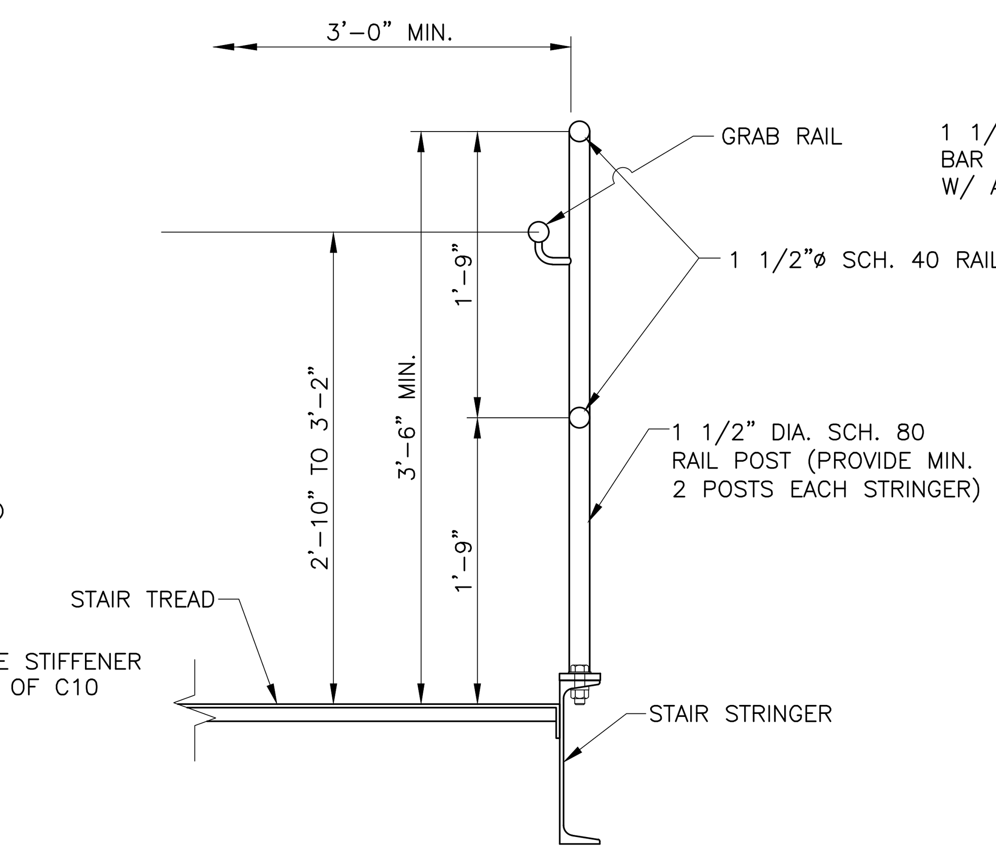


SECTION B/1
3/4"= 1'-0"

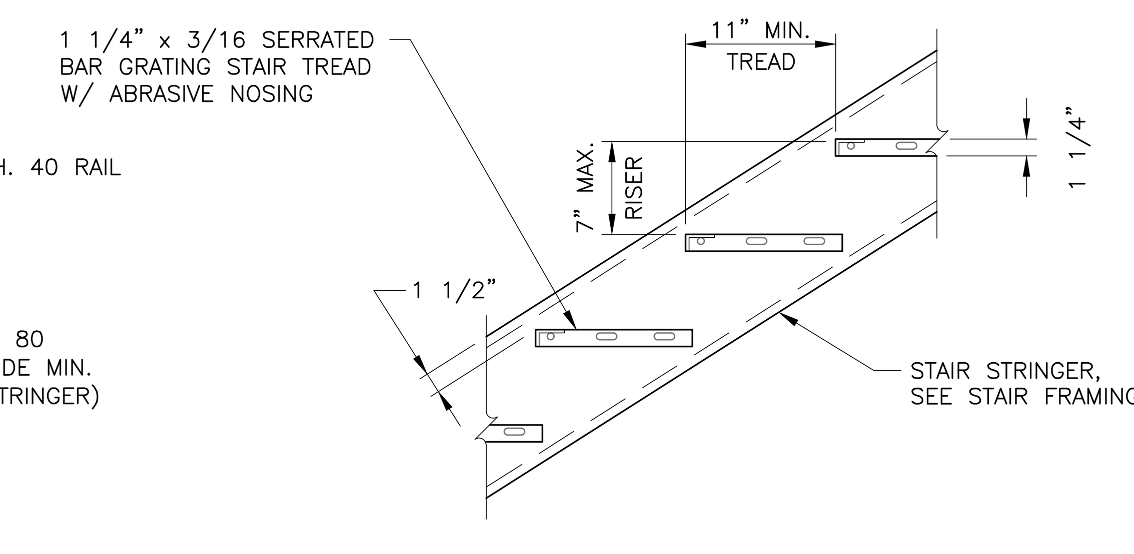


SECTION C/1
3/4"= 1'-0"

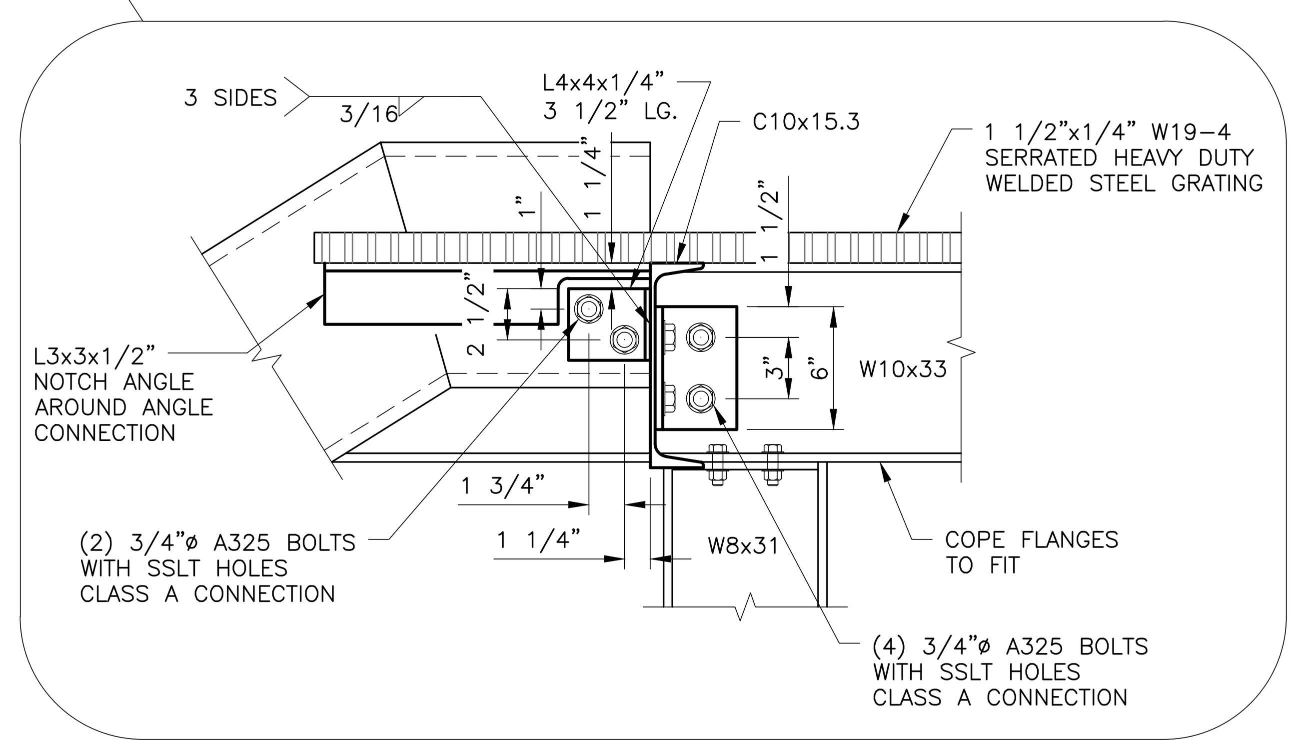


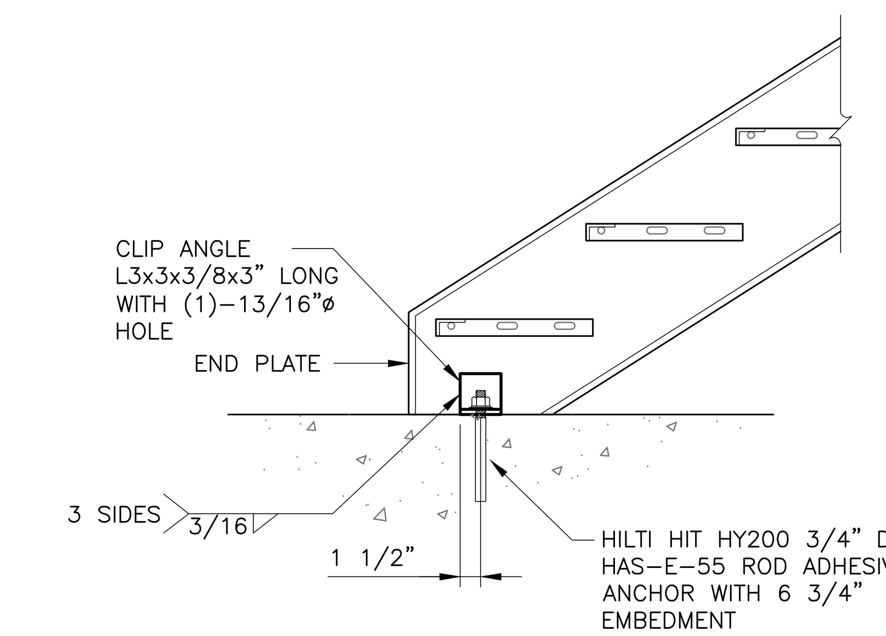
STAIR HANDRAIL DETAIL
1" = 1'-0"

1 0 1 2
SCALE IN FEET

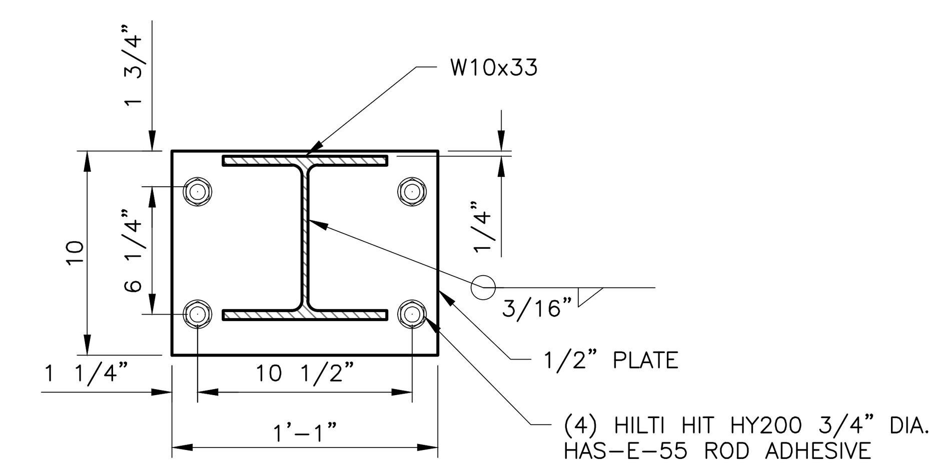


TYPICAL GRATING STAIR DETAIL
1"= 1'-0"

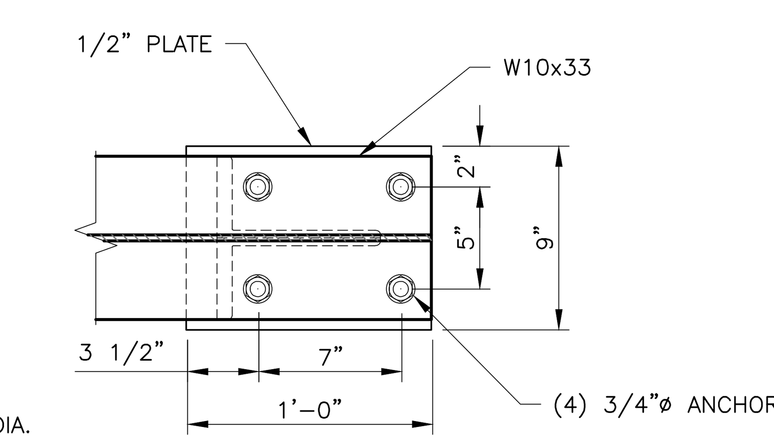




TYPICAL STAIR TO CONCRETE
CONNECTION DETAIL
1"= 1'-0"

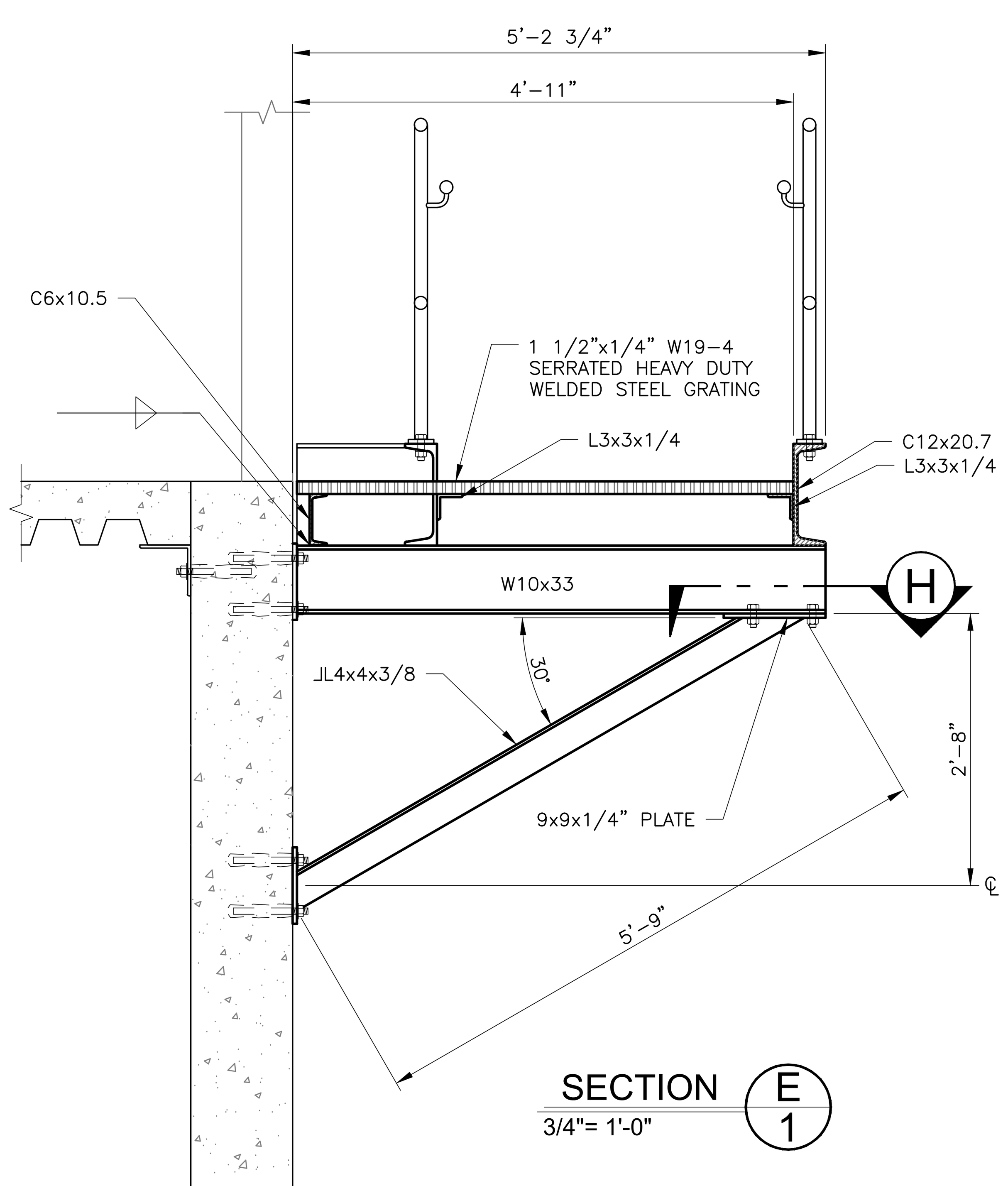


DETAIL 1
1 1/2"= 1'-0"

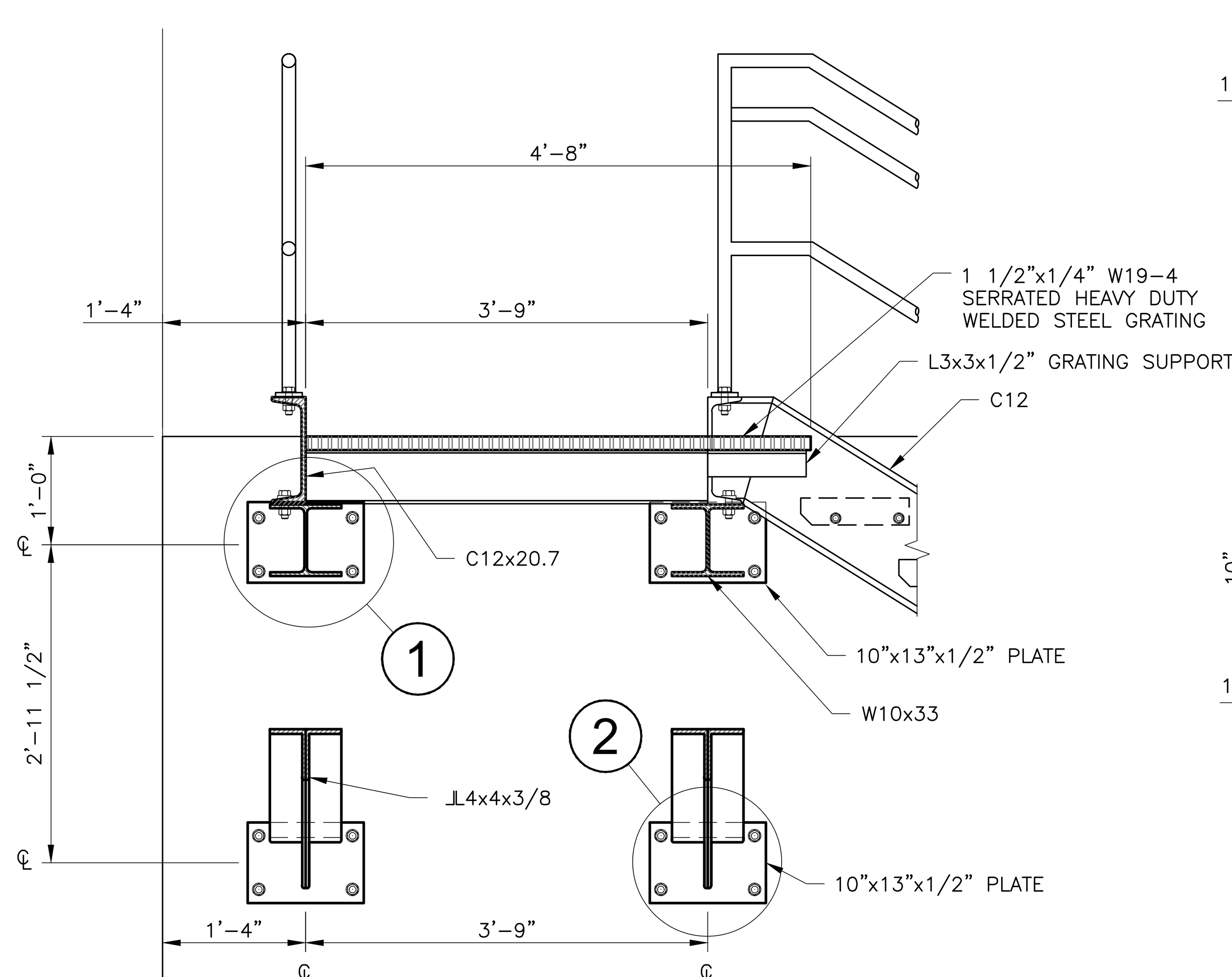


SECTION H
1 1/2"= 1'-0"

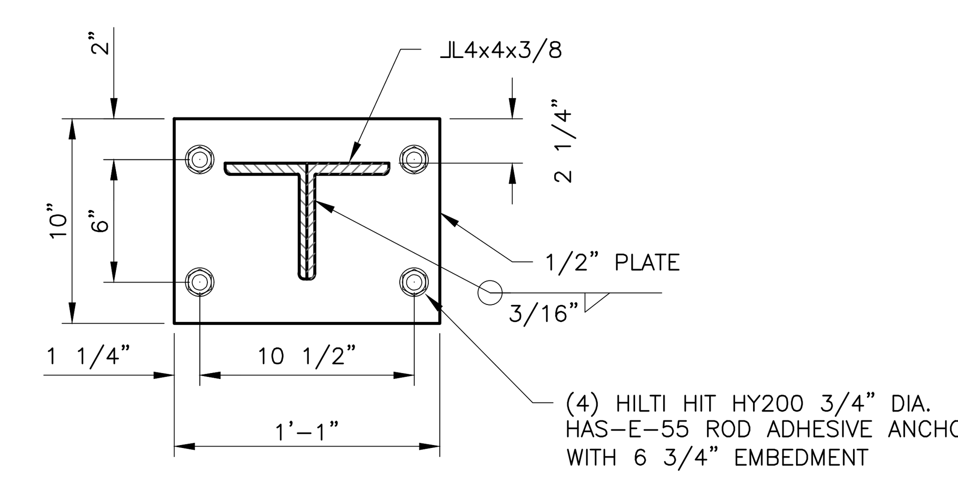
8 0 8 16
SCALE IN INCHES



SECTION E/1
3/4"= 1'-0"



SECTION D/1
3/4"= 1'-0"



DETAIL 2
1 1/2"= 1'-0"

1 0 1 2 3
SCALE IN FEET

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - MISCELLANEOUS
STAIR SECTIONS AND DETAILS

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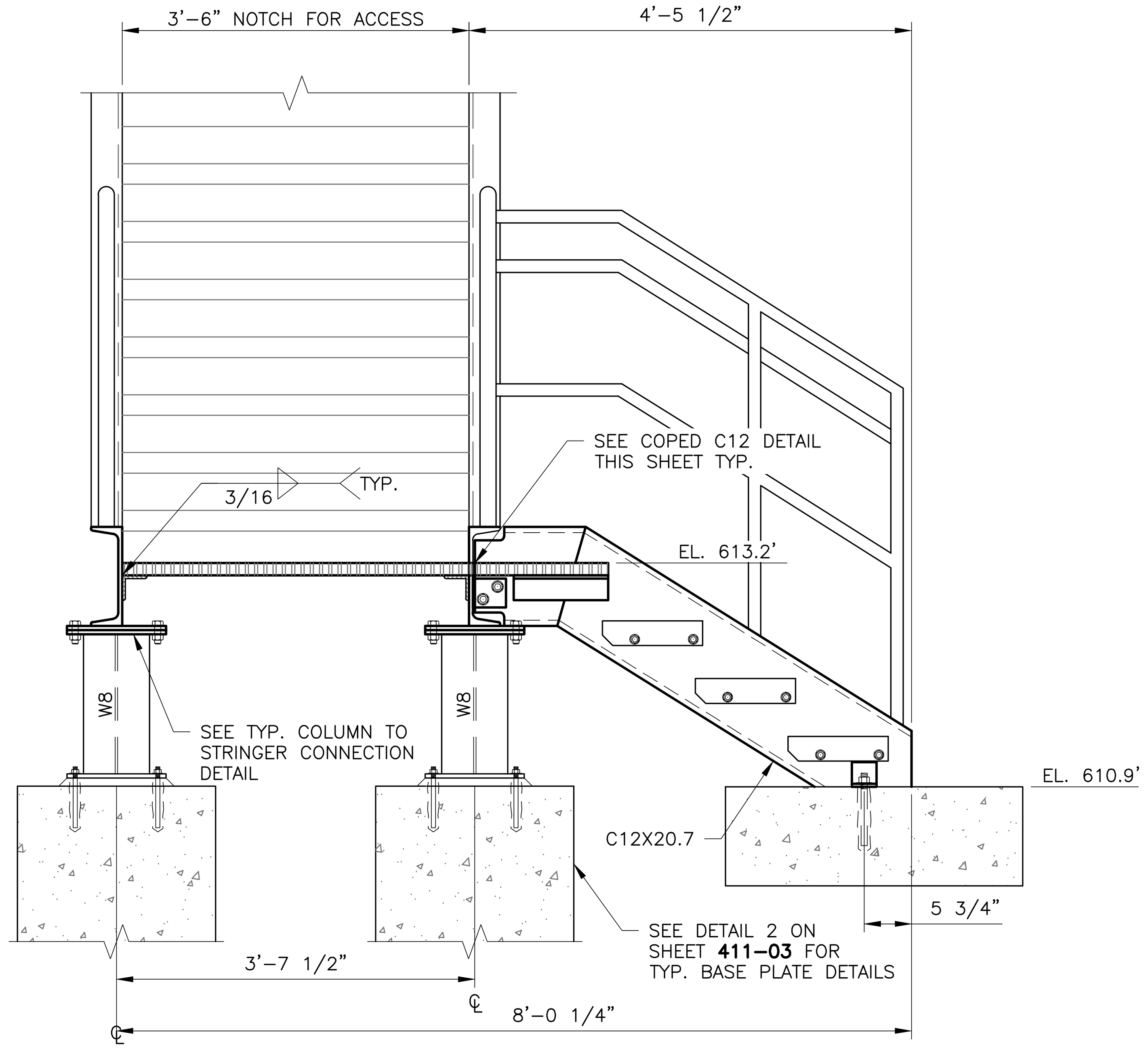
No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

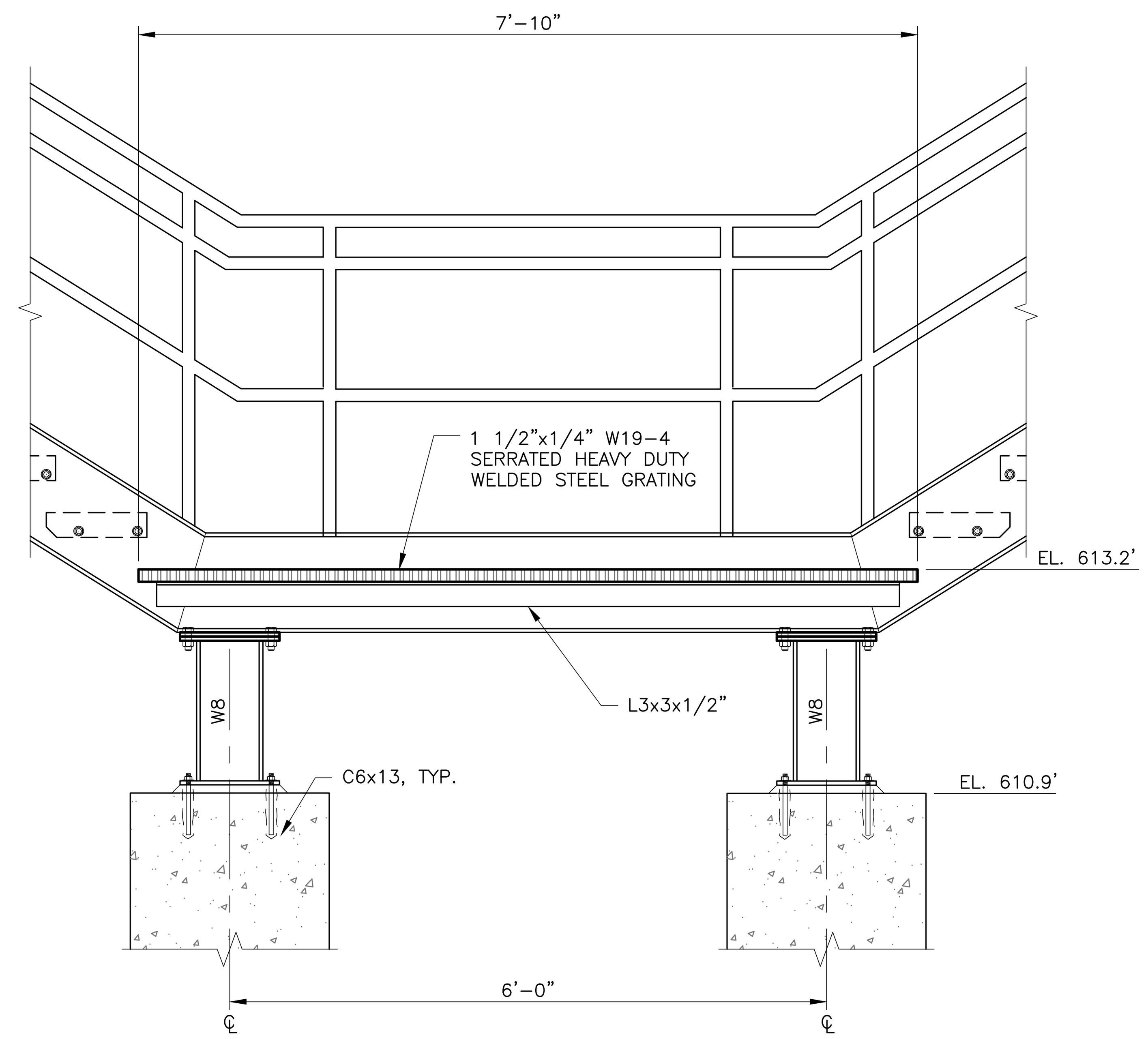
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	412-02

22x34 = FULL SCALE

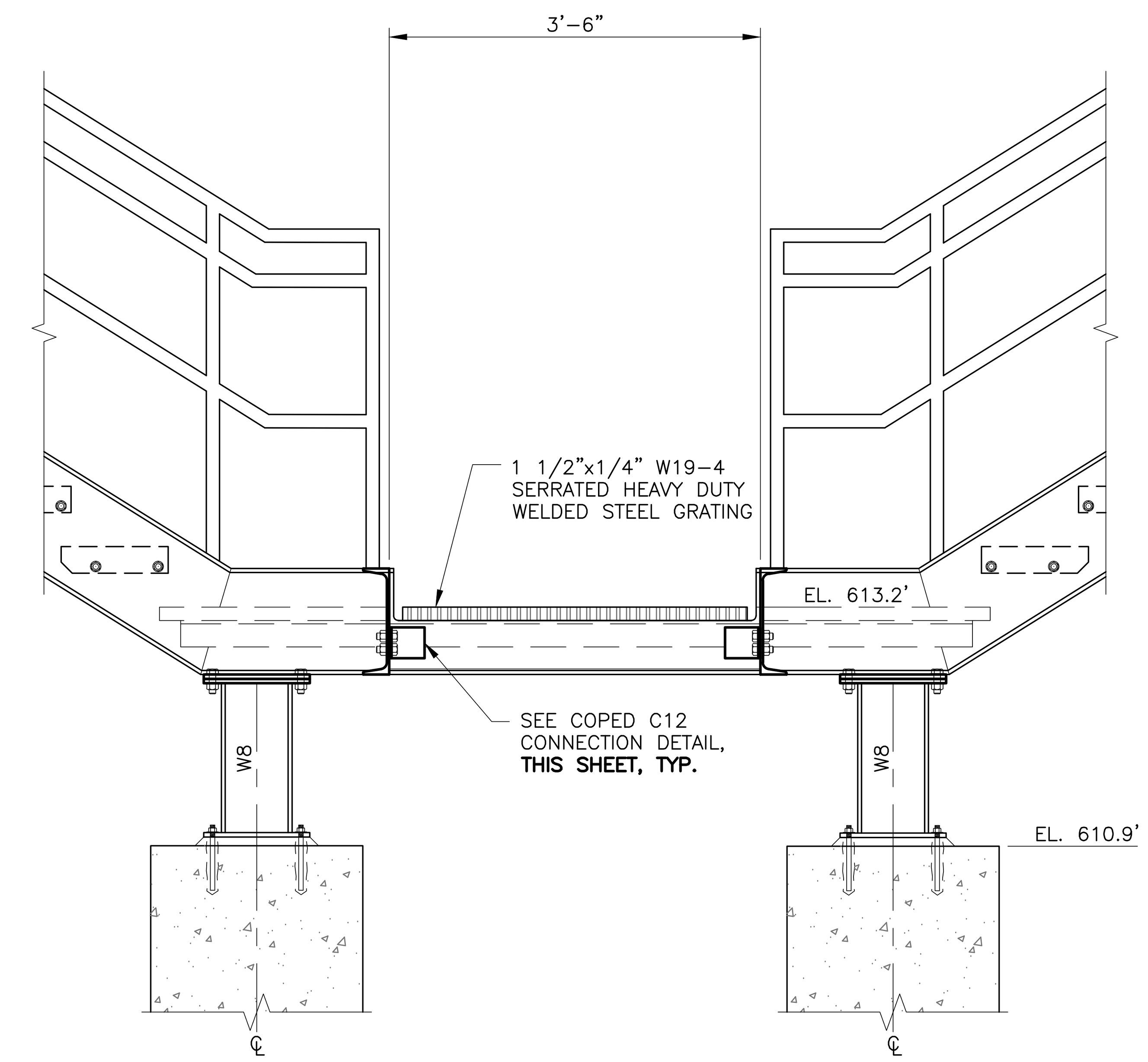


SECTION F/1
3/4"= 1'-0"

1 0 1 2 3
SCALE IN FEET

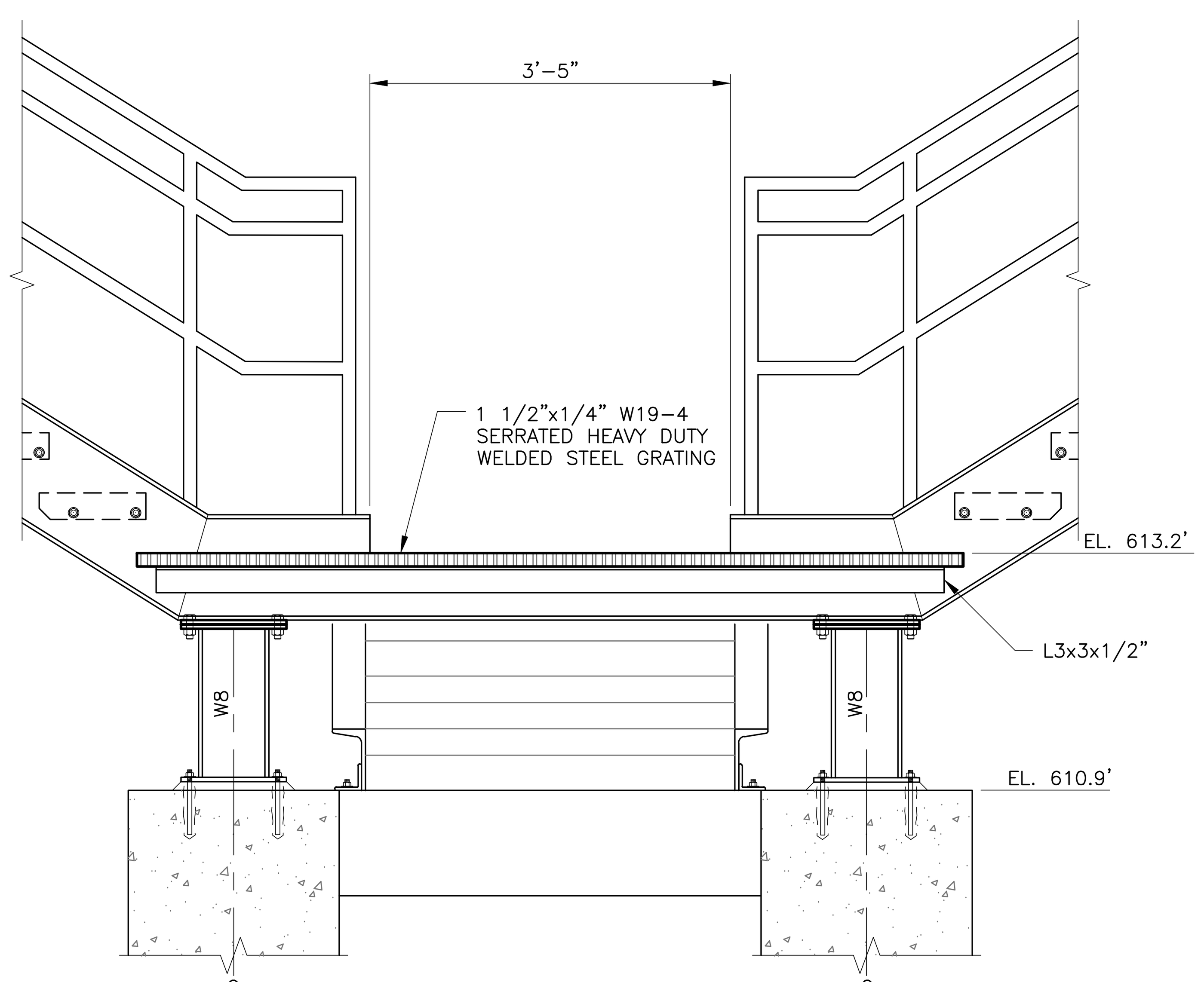


SECTION G/1
3/4"= 1'-0"

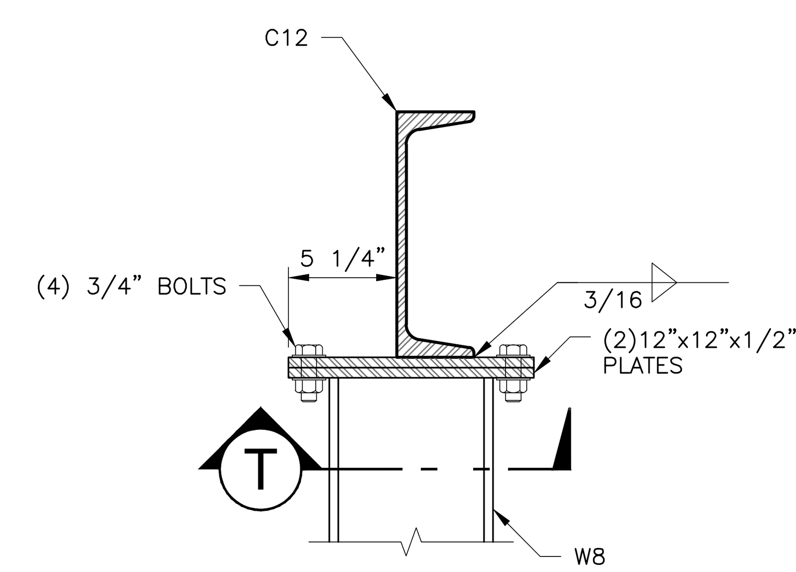


SECTION R/1
3/4"= 1'-0"

NOTE: BACK HANDRAIL AND STRINGER NOT SHOWN FOR CLARITY

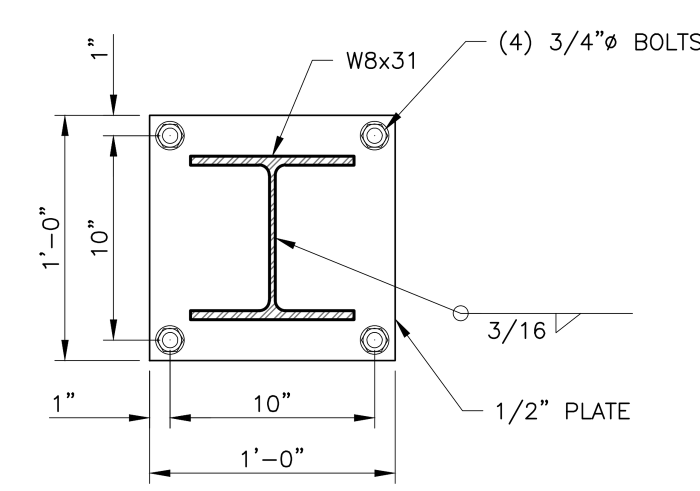


SECTION S/1
3/4"= 1'-0"

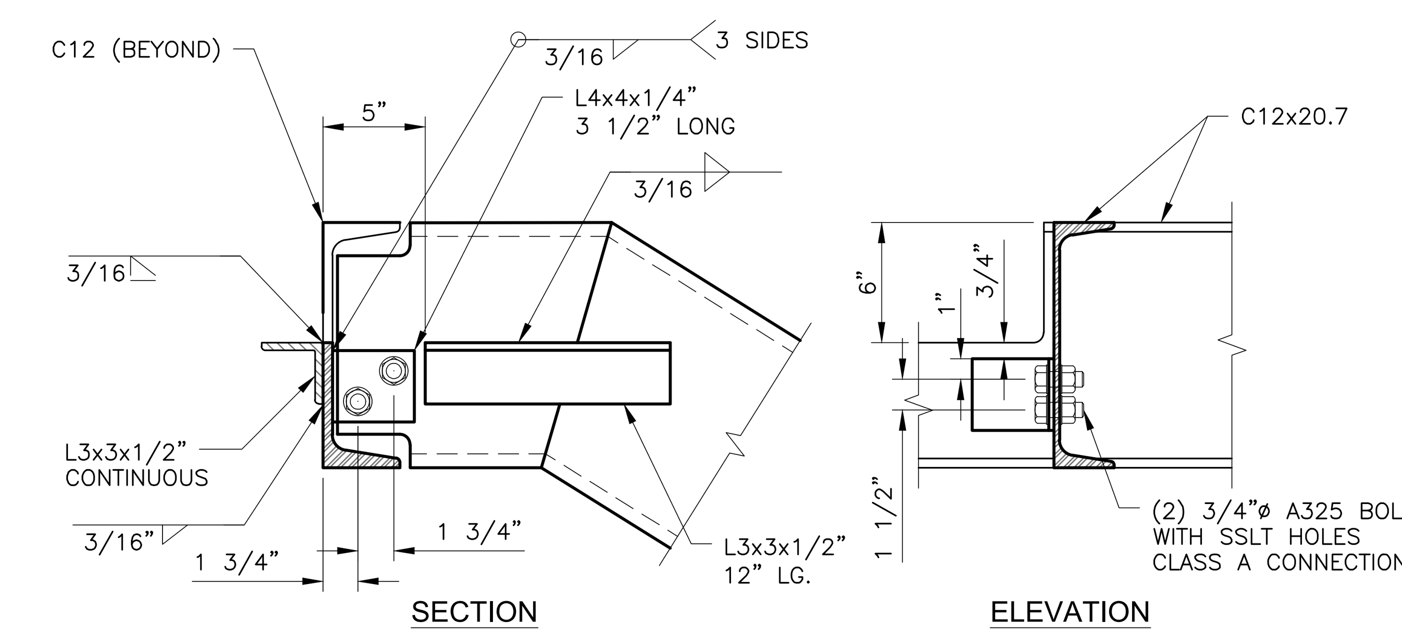


COLUMN TO STRINGER CONNECTION DETAIL
1 1/2"= 1'-0"

8 0 8 16
SCALE IN INCHES



SECTION T
1 1/2"= 1'-0"



COPED C12 CONNECTION DETAIL
1 1/2"= 1'-0"

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER
8/1/24

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - MISCELLANEOUS
STAIR SECTIONS AND DETAILS

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	412-03

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APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - MISCELLANEOUS
TRANSFORMER SHIELD WALL

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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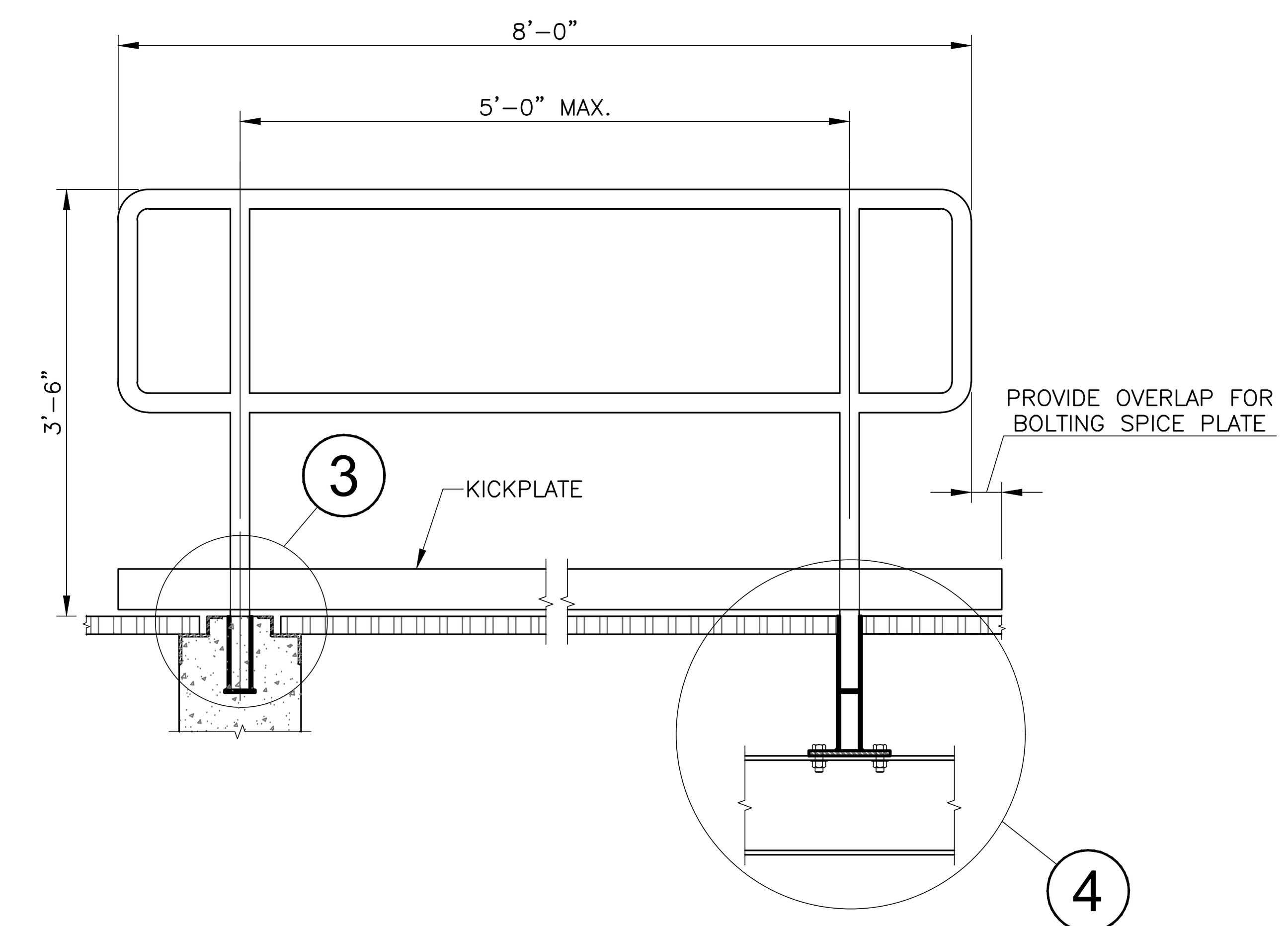
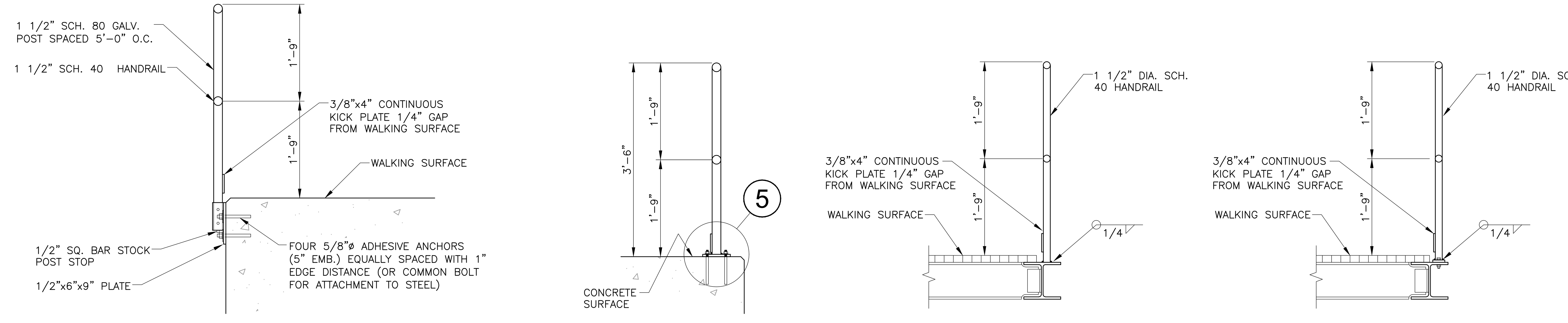
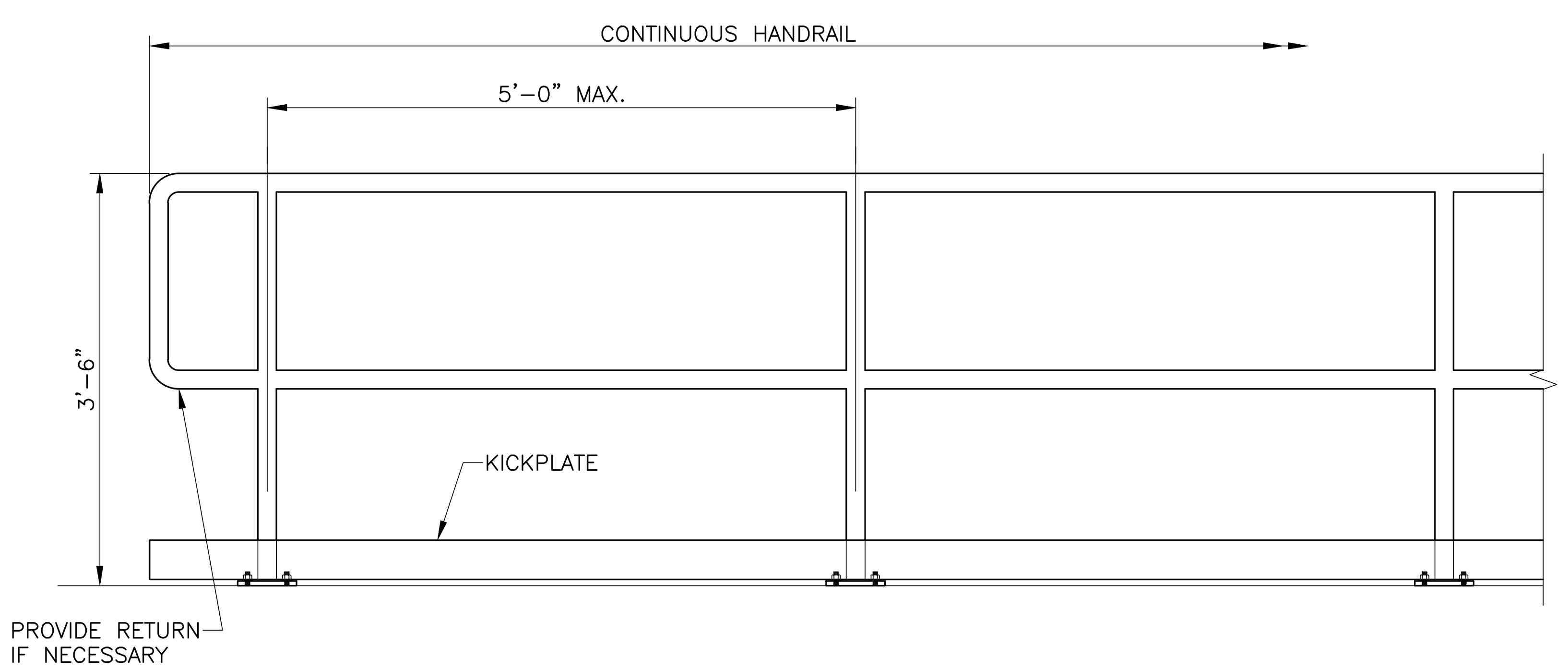
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	412-04



REMOVABLE HANDRAIL DETAIL
3/4"= 1'-0"

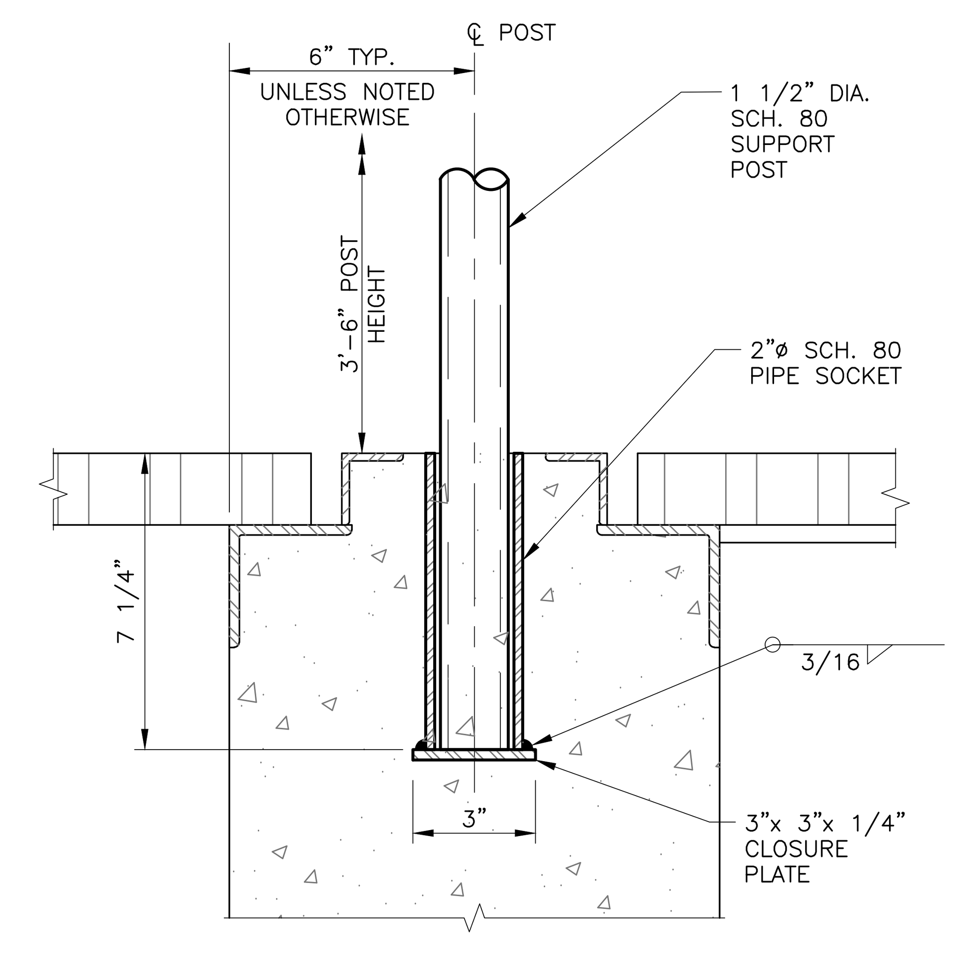


TYPICAL HANDRAIL DETAILS
3/4"= 1'-0"



TYPICAL FIXED HANDRAIL ELEVATION
3/4"= 1'-0"

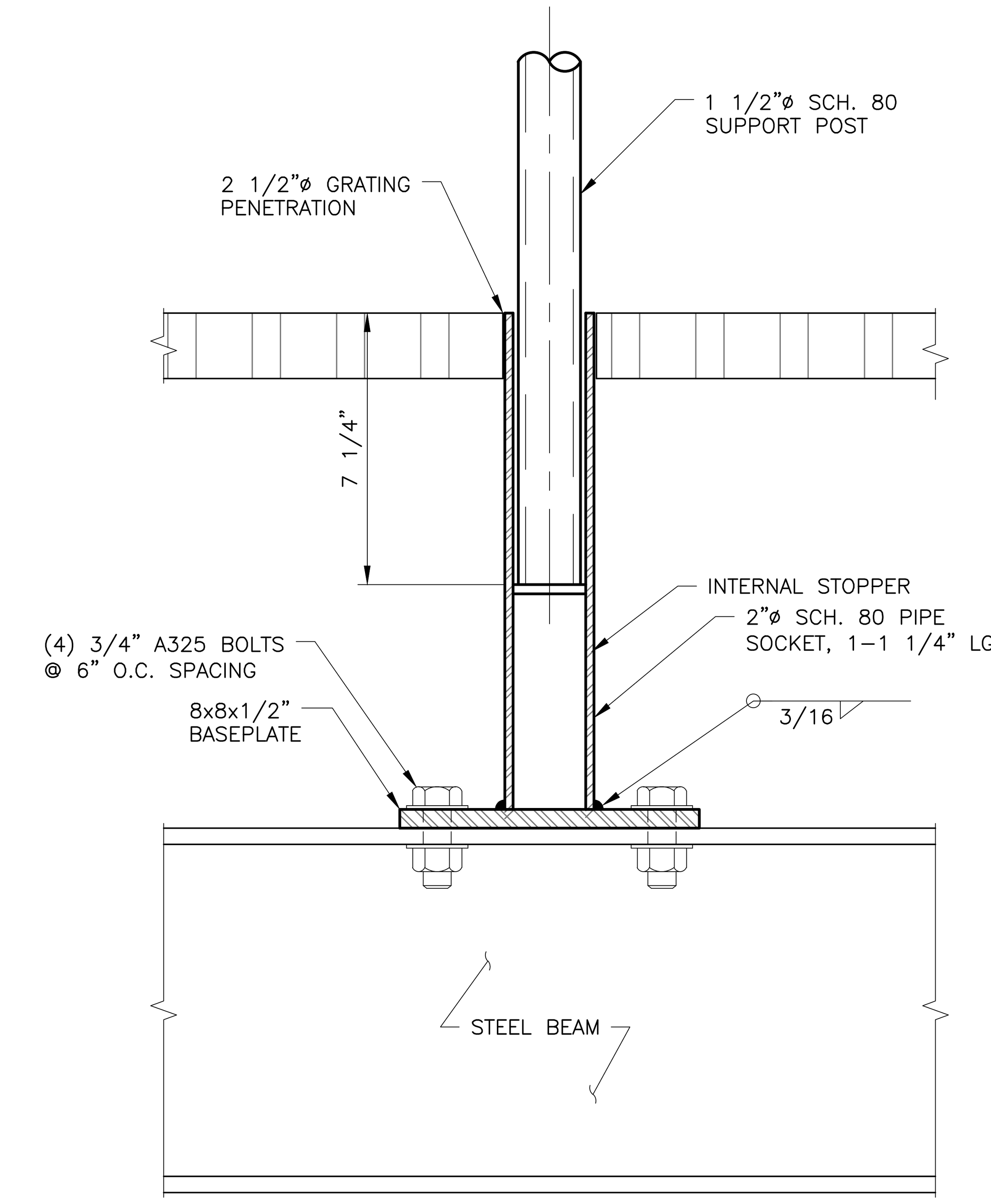
1 0 1 2 3
SCALE IN FEET



DETAIL 3
3"= 1'-0"

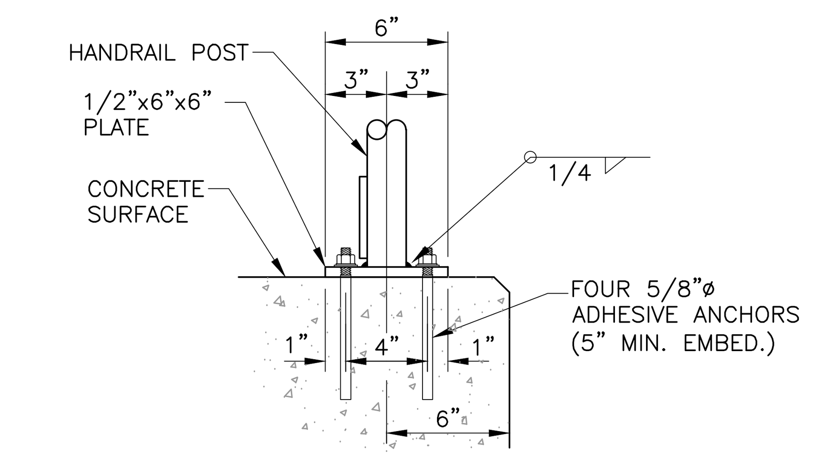
NOTE:
1. KICKPLATE NOT SHOWN FOR CLARITY.
2. EMBEDDED IN CONCRETE.

3 0 3 6 9
SCALE IN INCHES



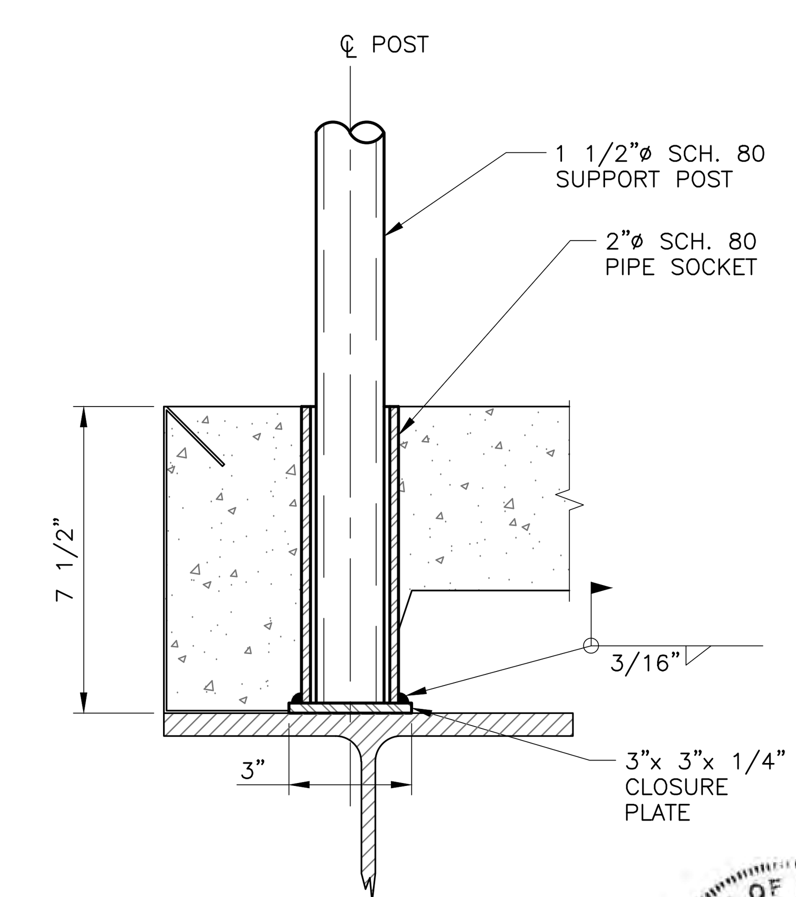
DETAIL 4
3"= 1'-0"

NOTE:
1. KICKPLATE NOT SHOWN FOR CLARITY.
2. PENETRATION THROUGH GRATING TO STRUCTURAL STEEL BELOW.

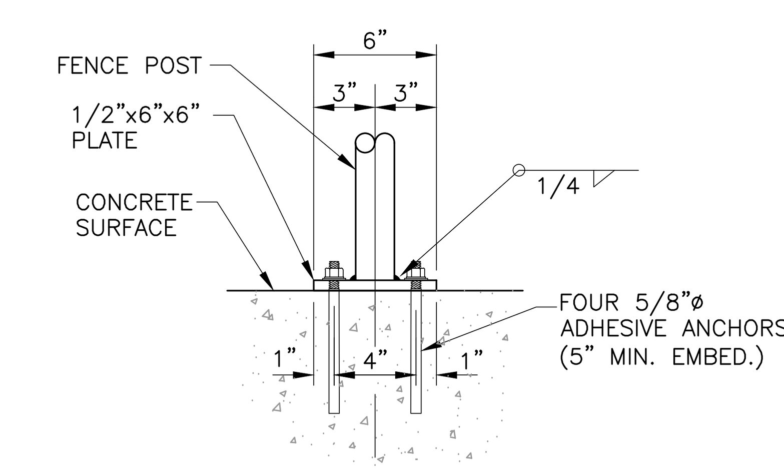


DETAIL 5
1 1/2"= 1'-0"

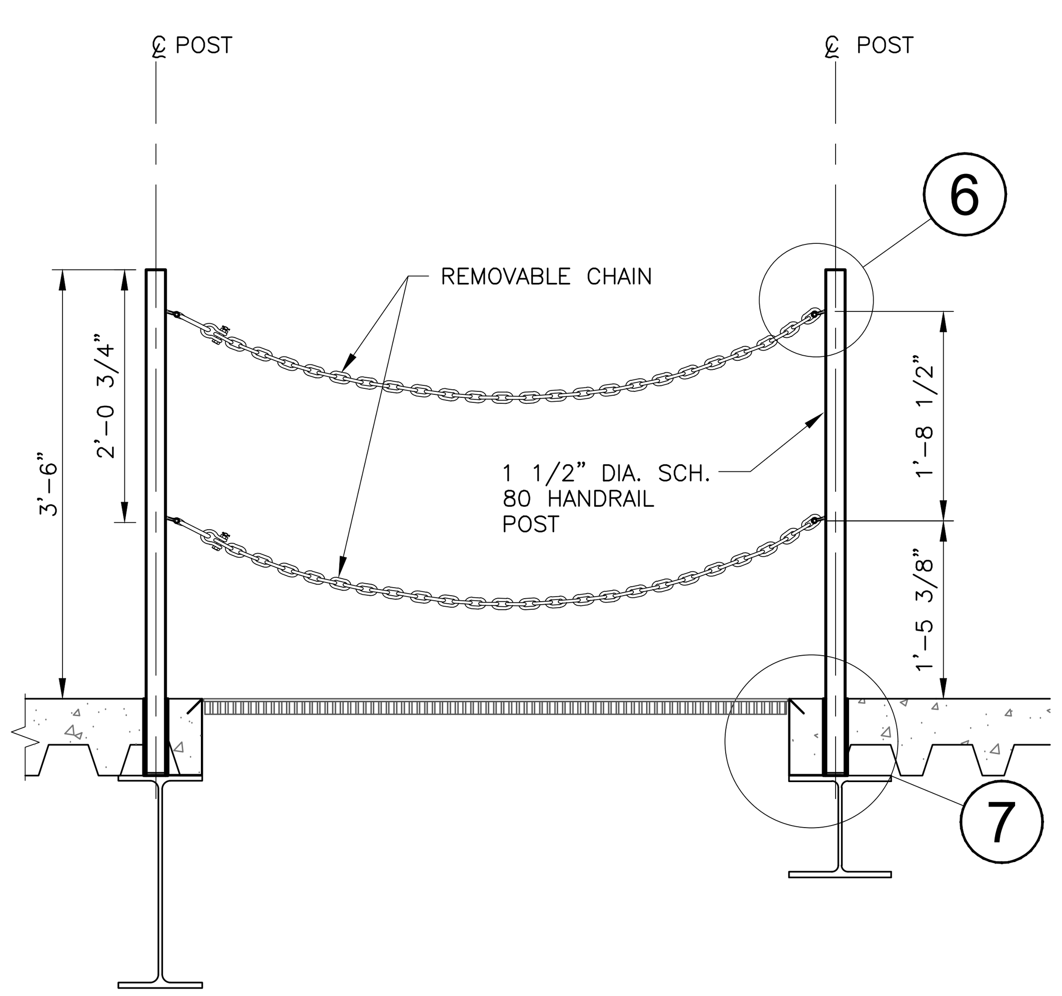
8 0 8 16
SCALE IN INCHES



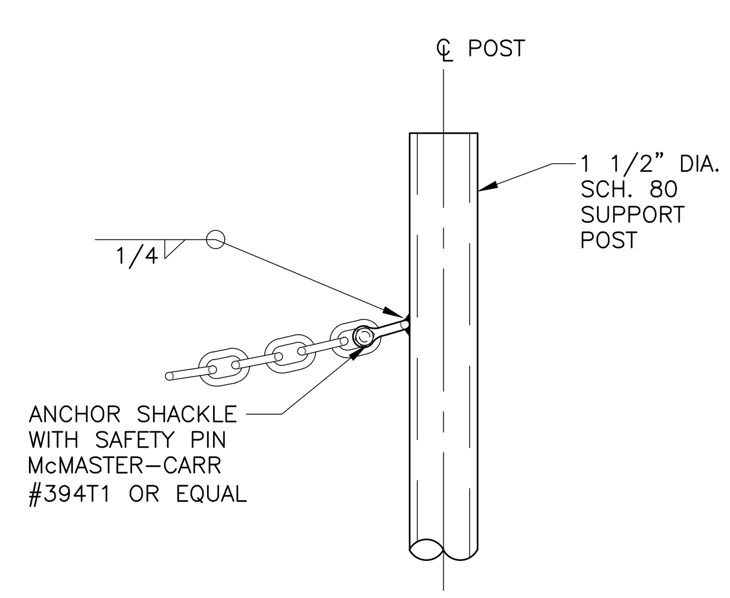
DETAIL 7
3" = 1'-0"



TYP. FENCE POST TO CONCRETE MOUNTING DETAIL
1 1/2"= 1'-0"

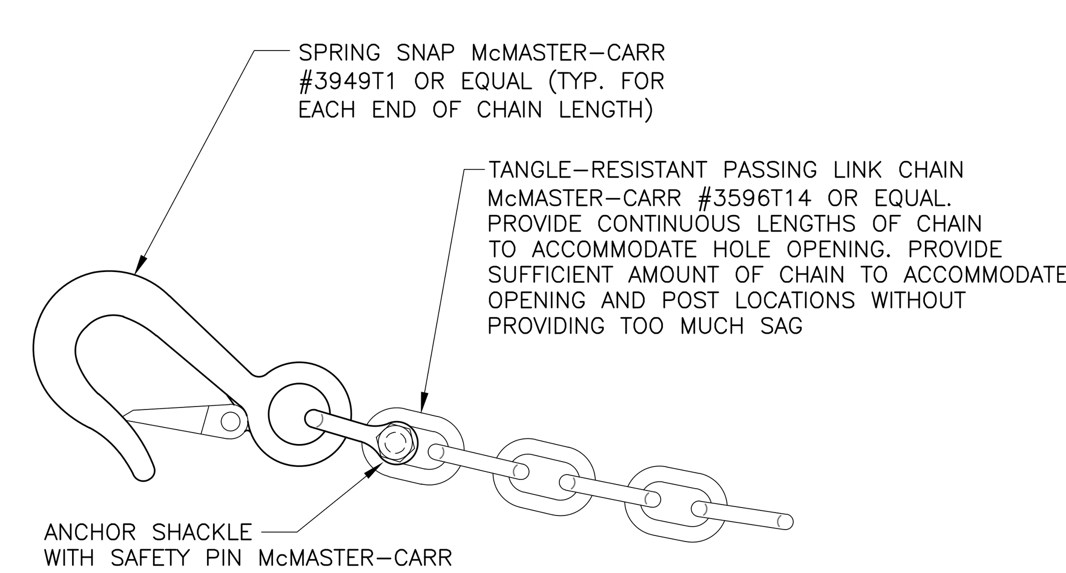


TYPICAL REMOVABLE CHAIN GUARDRAIL ELEVATION
3/4"= 1'-0"



DETAIL 6
3" = 1'-0"

3 0 3 6 9
SCALE IN INCHES



TEMPORARY REMOVABLE CHAIN DETAIL
N.T.S.

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

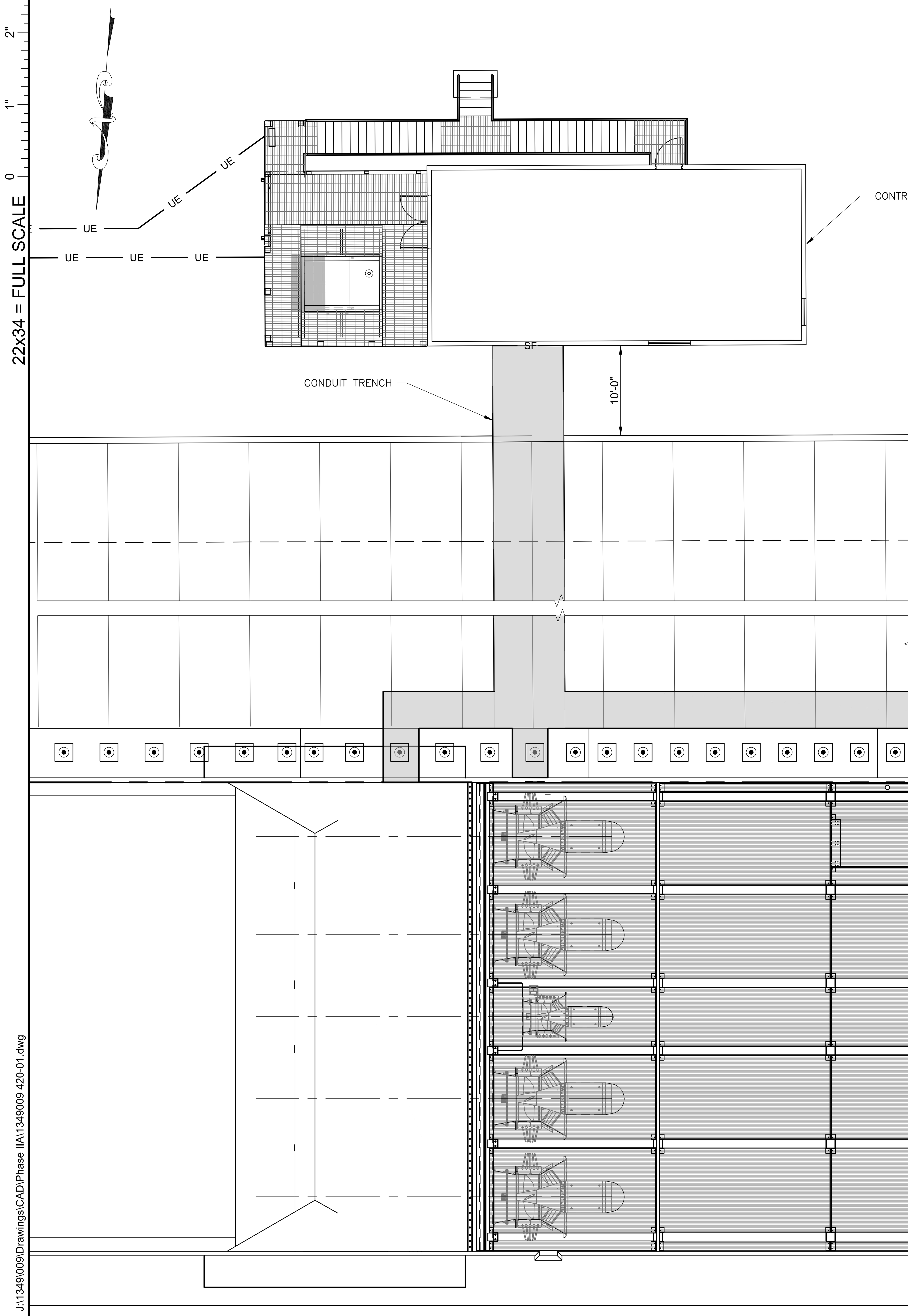
CONTROL BUILDING - MISCELLANEOUS STEEL DETAILS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	412-05

Kleinschmidt
888-224-5942
KleinschmidtGroup.com

22x34 = FULL SCALE

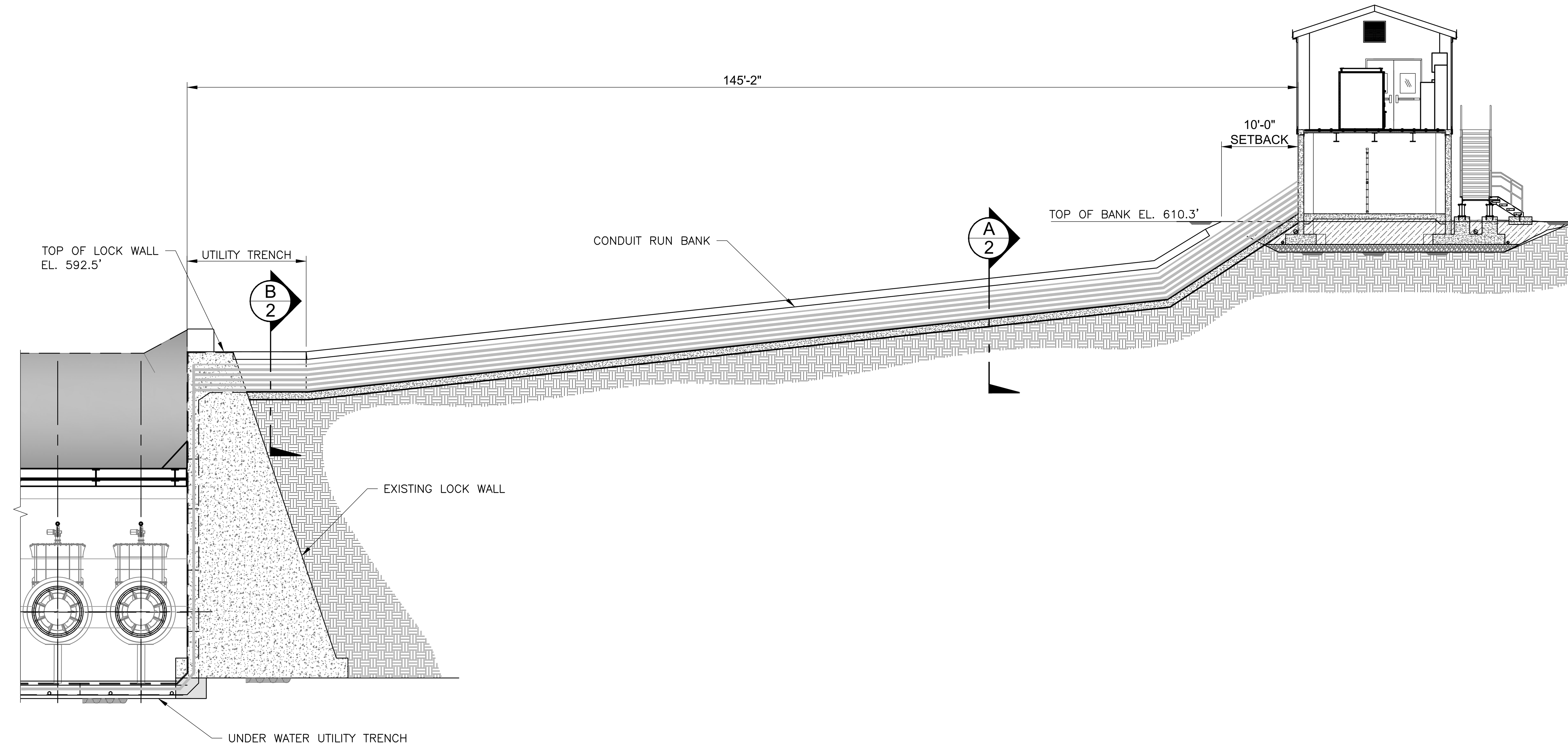


CONDUIT PLAN

1/8"= 1'-0"

8 0 8 16

SCALE IN FEET



CONDUIT PROFILE

3/32"= 1'-0"

12 0 12 24

SCALE IN FEET

STATE OF KENTUCKY
JILLIAN L. DAVIS
32687
LICENSED
PROFESSIONAL ENGINEER
8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING
CONDUIT PLAN AND PROFILE

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	420-01

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KleinschmidtGroup.com

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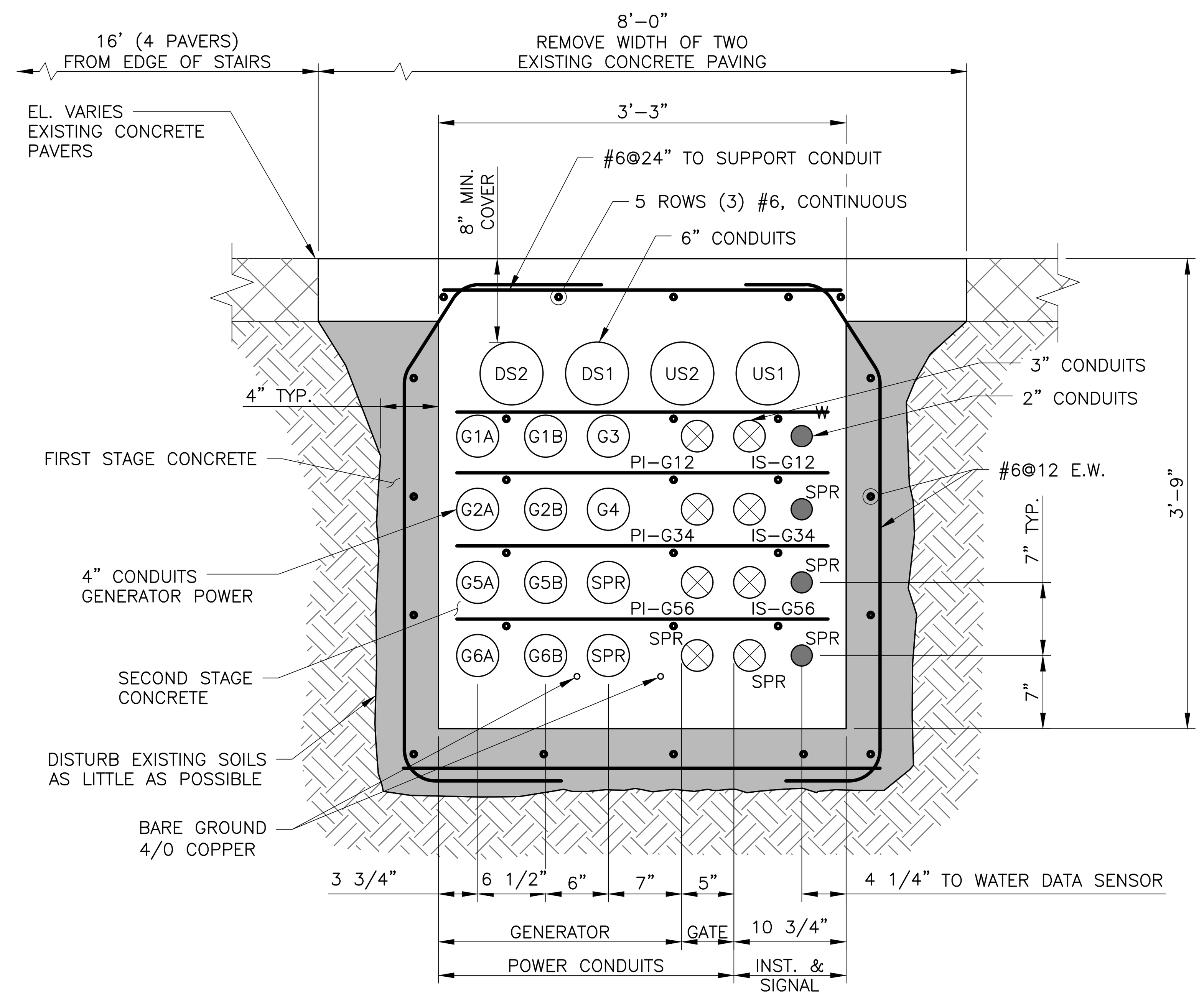
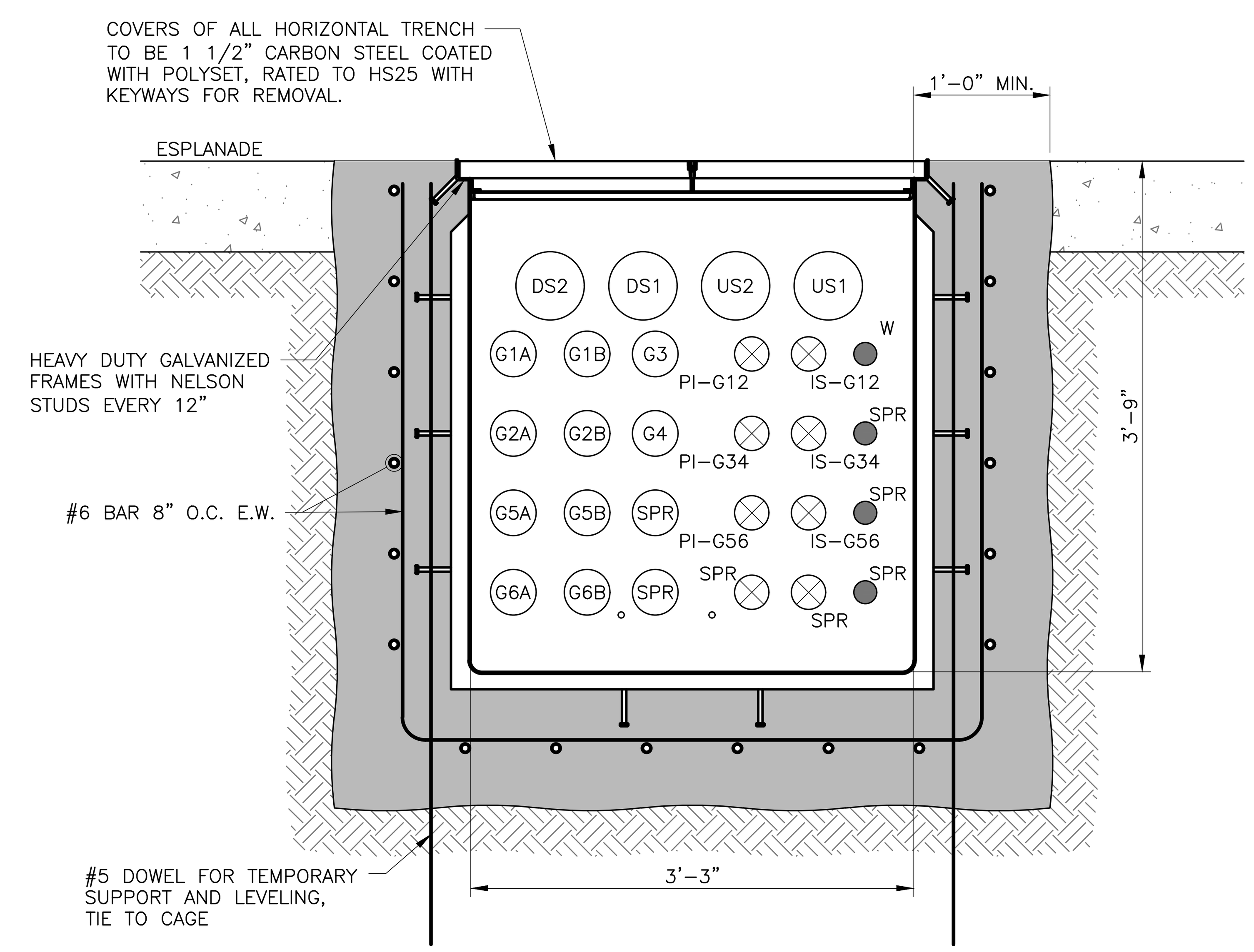


BANK TYP. SECTION A/1
1"= 1'-0"

1 0 1 2
SCALE IN FEET



TRENCH TYP. SECTION B/1
1"= 1'-0"

22x34 = FULL SCALE

NOTE: FINAL DIMENSIONS OF CONDUIT TRENCH TO BE DETERMINED.

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APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING
CONDUIT DETAILS AND SECTIONS

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

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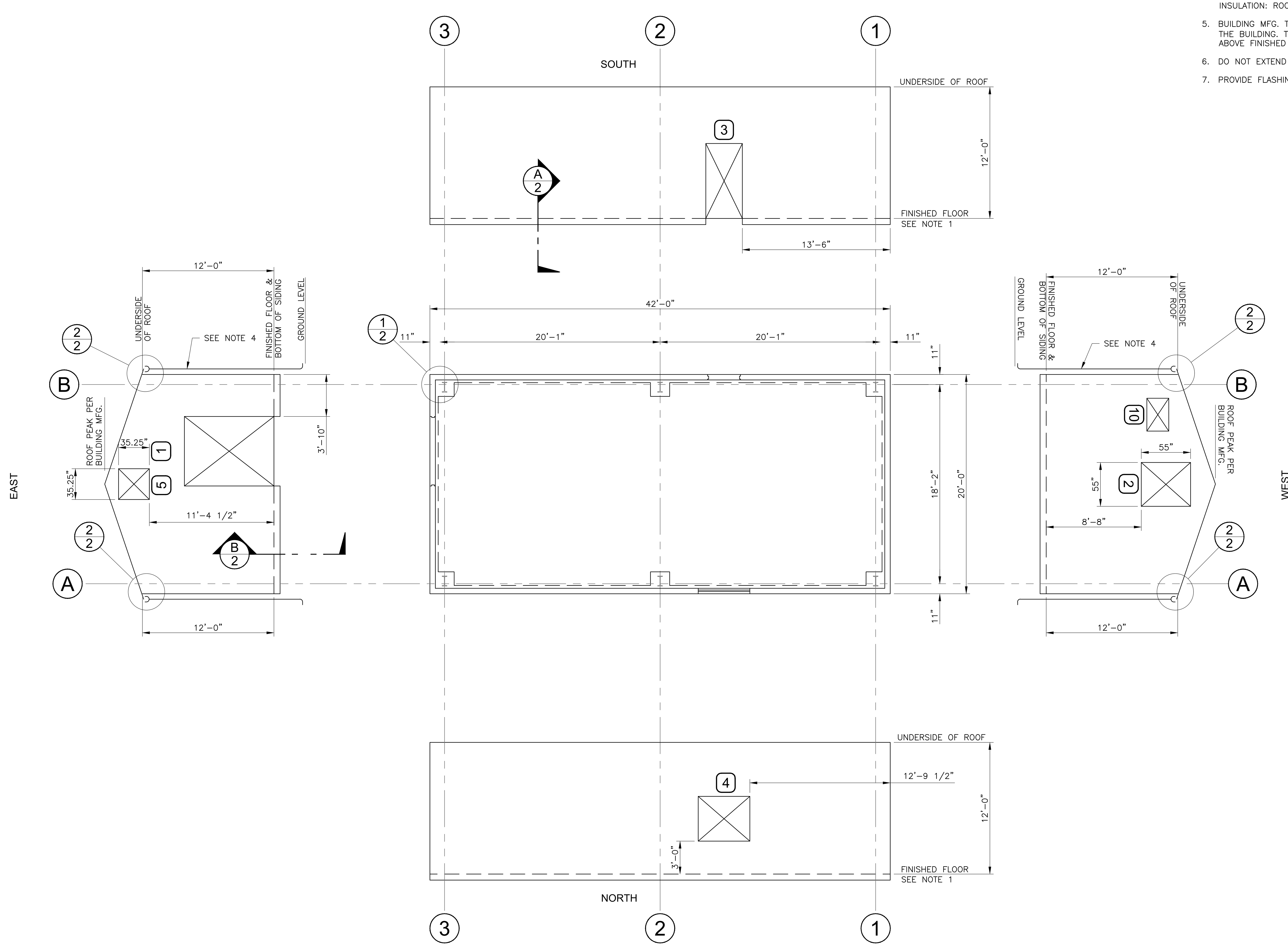
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	420-02

NOTES:

1. SEE DRAWING SERIES 100 & 110 FOR GENERAL NOTES AND INFORMATION AS APPLICABLE.
2. FINISHED FLOOR: EL.622.3'.
3. SEE DWG 400-04 FOR WALL OPENING SCHEDULE
4. WALLS & ROOF: DOUBLE SIDED STEEL SANDWICH PANELS; INSULATION: ROOF: R-19, WALLS: R-13
5. BUILDING MFG. TO PROVIDE MINIMUM OF 1 DOWNSPOUT ON EACH CORNER OF THE BUILDING. TERMINATING DOWNSPOUTS AT EL. 610.05', APPROXIMATELY 1.25' ABOVE FINISHED GRADE.
6. DO NOT EXTEND SIDING INTO ROUGH OPENING
7. PROVIDE FLASHING FOR EACH OPENING AS NEEDED.



CONTROL BUILDING

3/16"= 1'-0"

4 0 4 8 12

SCALE IN FEET

22x34 = FULL SCALE

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PRINTED: Jul. 31, 2024 - 12:27 PM

STATE OF KENTUCKY JILLIAN L. DAVIS 32687 LICENSED PROFESSIONAL ENGINEER 8/1/24

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

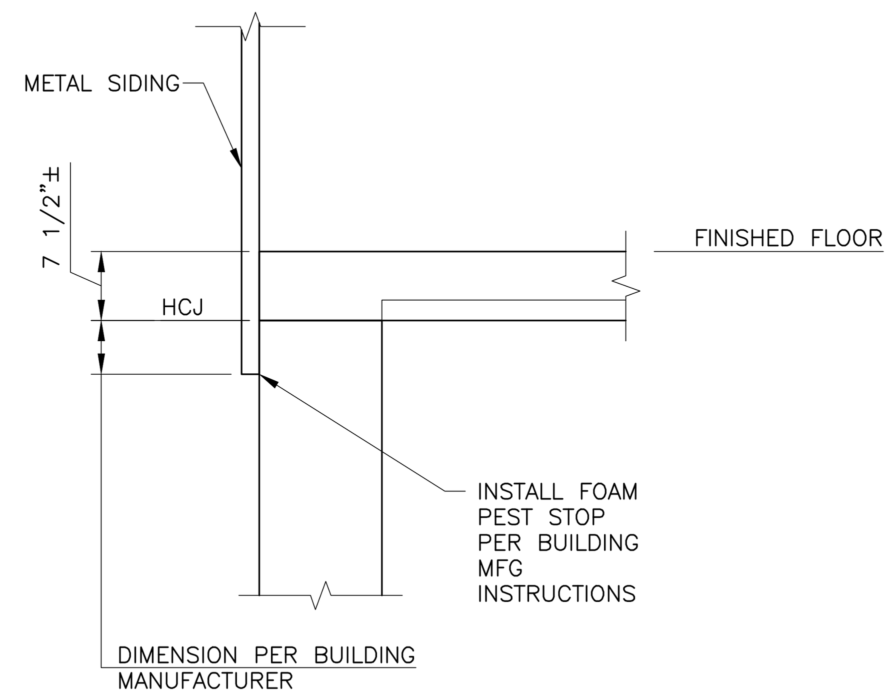
COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - SUPER STRUCTURE
PLAN & ELEVATION

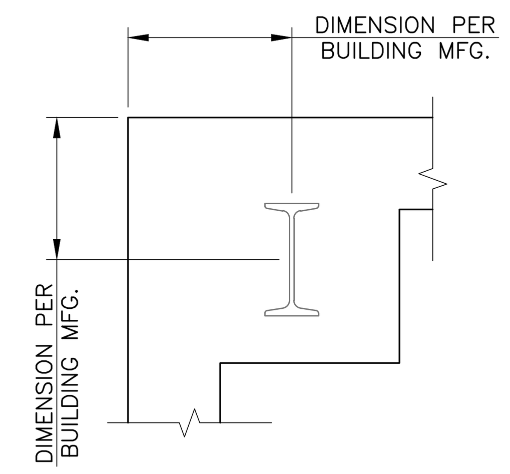
No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Kleinschmidt 888-224-5942 KleinschmidtGroup.com

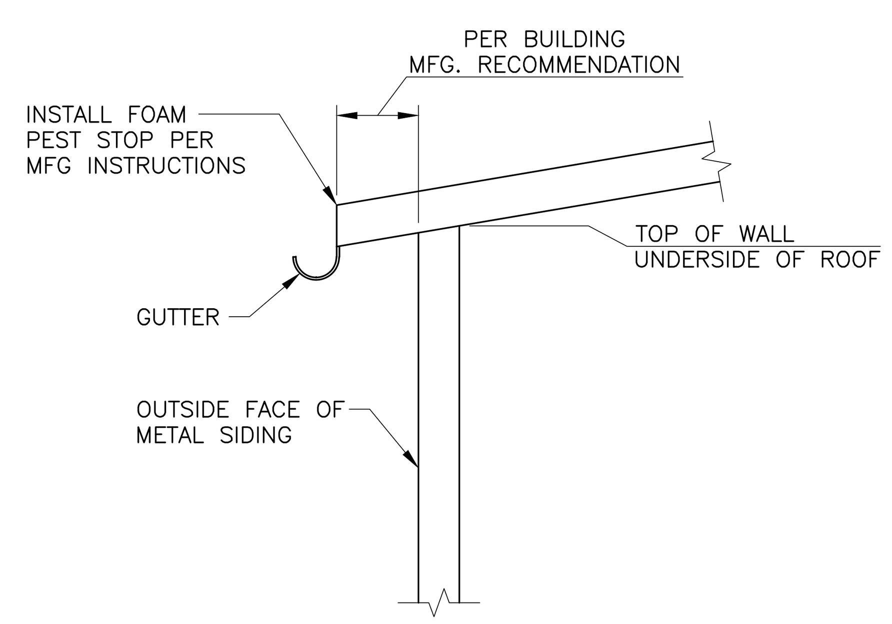
Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	430-01



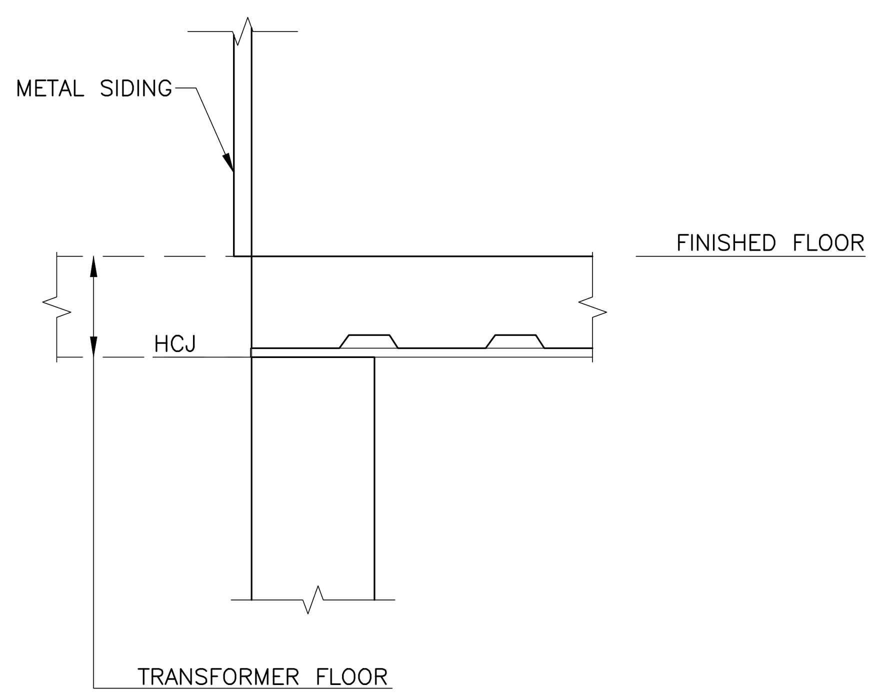
SECTION A/1
3/4"= 1'-0"
TYPICAL U.N.O.



DETAIL 1/1
3/4"= 1'-0"



DETAIL 2/1
1/2"= 1'-0"



SECTION B/1
3/4"= 1'-0"

NOTES:

1. SEE DWG. 400–04 FOR ROUGH OPENINGS
2. DO NOT EXTEND SIDING INTO ROUGH OPENINGS
3. PROVIDE FLASHING FOR EACH OPENING AS NEEDED

No.	Revision	Date	Drawn	Checked
1	RELEASED FOR CONSTRUCTION	08-01-24	BJL	JLD
0	FERC REVIEW (PHASE 1)	04-19-24	BJL	JLD

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
RJC	BJL	JLD	1349-009	08-01-24	430-02

APPALACHIAN HYDRO ASSOCIATES
LOUISVILLE, KY

COLLEGE HILL HYDROELECTRIC DEVELOPMENT
LOCK No. 11

CONTROL BUILDING - SUPER STRUCTURE DETAILS

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888-224-5942
KleinschmidtGroup.com

3" 2" 1" 0
22x34 = FULL SCALE

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APPENDIX B

USFWS IPaC Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
Phone: (502) 695-0467 Fax: (502) 695-1024
Email Address: kentuckyes@fws.gov

In Reply Refer To: 03/14/2025 13:30:00 UTC
Project Code: 2024-0023535
Project Name: Lock 11 Hydroelectric Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do..

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0467

PROJECT SUMMARY

Project Code: 2024-0023535
Project Name: Lock 11 Hydroelectric Project
Project Type: Power Gen - Hydropower - FERC
Project Description: Hydroelectric project on KY river.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.7841842,-84.10228236261587,14z

Counties: Estill and Madison counties, Kentucky

ENDANGERED SPECIES ACT SPECIES

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Gray Bat *Myotis grisescens* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ The project area includes potential gray bat habitat. Species profile: https://ecos.fws.gov/ecp/species/6329 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf	Endangered
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ The project area includes 'potential' habitat. All activities in this location should consider possible effects to this species. Species profile: https://ecos.fws.gov/ecp/species/5949 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf	Endangered
Virginia Big-eared Bat *Corynorhinus (=Plecotus) townsendii virginianus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8369 General project design guidelines: https://ipac.ecosphere.fws.gov/project/P27Y3U5J4NFYFHH4A4JX7EPPTQ/documents/generated/6422.pdf	Endangered

CLAMS

NAME	STATUS
Round Hickorynut *Obovaria subrotunda* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9879	Threatened
Salamander Mussel *Simpsonaias ambigua* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6208	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

FLOWERING PLANTS

NAME	STATUS
Short's Bladderpod *Physaria globosa* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7206	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency:	ICF
Name:	Scott Slankard
Address:	8055 Warwick Avenue
City:	Louisville
State:	KY
Zip:	40222
Email	scott.slankard@icf.com
Phone:	5025644890

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Department of Agriculture

APPENDIX C

Mussel Survey Report

COLLEGE HILL HYDRO PROJECT ON THE KENTUCKY RIVER - MUSSEL SURVEY REPORT

MADISON AND ESTILL COUNTIES, KY

PREPARED FOR

Appalachian Hydro Associates

DATE: 10.24.24

BIOSURVEY GROUP

PO Box 61
Oxfortd, OH 45056
(513) 839-0123

Table of Contents

Tables

Figures

Appendices

Introduction

BioSurvey Group was contracted to provide environmental consulting services to Appalachian Hydro Associates for a mussel survey on the Kentucky River in Madison and Estill Counties, Kentucky as part of a proposed hydroelectric project at Lock and Dam 11 (Figure 1). The Project facilities will consist of a submersible powerhouse constructed in the existing abandoned lock chamber and a control building on the shore containing switchgear, controls, transformers and a main circuit breaker for the plant. The powerhouse will contain six submersible turbine generators that are unaffected by flooding. An underground cable trench will connect the powerhouse to the control building.

Project Need

The proposed construction and operation of the hydroelectric facility may impact freshwater mussels occurring within construction areas as well as downstream of the lock and dam. Several federally listed mussel species, including Clubshell (*Pleurobema clava*; endangered), Fanshell (*Cyprogenia stegaria*; endangered), Round Hickorynut (*Obovaria subrotunda*; threatened), and Salamander Mussel (*Simpsonaias ambigua*; proposed endangered) are known or believed to occur in this reach of the Kentucky River. Therefore, the U.S. Fish and Wildlife Service (USFWS) and Kentucky Department of Fish and Wildlife Resources (KDFWR) required a mussel survey be completed to obtain the regulatory permits required for this project.

Methods

Mussel Survey

The mussel survey extent was determined based on guidance from USFWS. The survey area extended from approximately 160 m to 420 m downstream of the dam and 50 m riverward from each bank. Six 50-m transects, spaced at 50-m intervals, were established perpendicular to flow on each bank, for a total transect length of 600 m (Figure 2).

Divers searched a 1-m wide swath along each survey transect which was divided into 10-m segments. Search rates included a minimum effort of 1.0 min/m^2 in areas of heterogeneous substrate and 0.5 min/m^2 in areas of homogenous substrate (bedrock, mud, silt, and sand). The visual search included moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5 cm (2 in) of substrate to better view the mussels which may be there.

Data was compiled and recorded for each 10-m transect segment, including substrate (Wentworth Scale) and depth. In each segment, mussels observed (live and dead) were bagged and brought to the surface for further processing and positive identification. Live mussels were kept cool and moist on the surface and were not out of the water for more than five minutes. Dead mussel shells were scored as fresh dead, weathered dead, or subfossil. Mussel nomenclature followed that of the Freshwater Mollusk Conservation Society (2023). Photo vouchers of all representative species collected and any odd, questionably identified individuals were taken.

Timed Searches

Timed searches were completed for the development of a species richness curve to demonstrate that most species had been recorded from the survey area. Transect data was used to inform the best location to conduct the timed searches. The goal was to collect six consecutive samples in 10 min increments within the mussel concentration area until no new species were detected.

Results

The BioSurvey Group team performed the mussel survey on October 7 – 8, 2024, led by permitted malacologist Ms. Emily Grossman. Copies of Ms. Grossman's scientific collecting permits are presented in Appendix A. Weather conditions were favorable throughout the survey effort with sunny skies and an average air temperature of approximately 23ºC (73°F). Discharge on the Kentucky River at Lock and Dam 11 (USGS 03282290) ranged from 694 cubic feet per second (cfs) to 874 cfs and stage ranged from 11.27 ft to 11.45 ft. Water temperature was approximately 20ºC (68°F) at the surface. Site and mussel photos can be found in Appendix B.

Habitat

Variable habitat conditions were encountered throughout the survey area. Substrate on the right descending bank was primarily sand, though some coarse material (boulder / cobble / gravel) was present along the bank on Transects 1 – 3 and at the far riverward ends of some transects. In contrast, substrate along Transects 7 – 10 on the left descending bank was primarily coarse gravel, cobble, and boulder, and substrate along Transects 11 – 12 was almost exclusively bedrock (Figure 3). Depths ranged from approximately 1 ft (0.3 m) near the bank to a maximum of 15 ft (4.6 m) along Transect 1, with deeper depths generally occurring on the right descending half of the channel (Figure 3). Depth and substrate data by transect segment are presented in Table 1.

Transect Survey

A total of 109 mussels were detected during the transect survey, representing 11 species. Threeridge (*Amblema plicata*; 47.7%) was the most dominant species, followed by Pink Heelsplitter (*Potamilus alatus*; 26.6%) and the federally threatened Round Hickorynut (11.0%) (Table 2). Length and age estimates for all live federally listed mussels are presented in Table 3. Four additional species were represented by dead shell material only, including a weathered dead federally endangered Sheepnose (*Plethobasus cyphyus*) (Table 2). Catch per unit effort (CPUE) was 0.19 mussels per minute of search time.

Mussels were present on both the right and left descending banks, but abundance was highest along the right descending bank (Figure 3). Patches of relatively high density were present near the right descending bank at the downstream end of the survey area (Transects 5 – 6) and at the far riverward ends of Transects 3 – 4. Round Hickorynut individuals were found on most of the right descending bank transects and at the shoreward end of Transect 7 on the left descending bank (Figure 3).

Timed Searches

A total of eight timed searches, each 10 minutes in length, were completed to supplement the transect data for the development of a species richness curve. All timed searches were conducted

along the right descending bank, focusing on areas where mussels were abundant or federally listed species were present in transect samples. An additional 71 mussels were collected in timed searches, including one species not collected in transect samples (Pink Papershell; *Potamilus ohiensis*). Pink Heelsplitter (57.7%) and Threeridge (26.8%) were the dominant species. Five additional Round Hickorynut were collected during the timed search effort, and CPUE was 0.89 mussels / min (Table 2). The species richness curve, developed using both transect and timed search data, suggests that approximately 97 more individuals would need to be collected to find one additional species (Figure 5).

Discussion

Survey efforts yielded a total of 180 live mussels representing 12 species, including 17 federally threatened Round Hickorynut and a weathered dead federally endangered Sheepnose shell. Most mussels, including federally listed species, were collected on the right descending half of the channel in sandy substrate. Given the presence of federally listed species, additional consultation with USFWS may be needed prior to construction. Data collected in this survey can be used to develop population estimates for federally listed species in the project area if needed and can serve as a pre-construction baseline to assess whether the mussel community is being affected by operation of the hydropower facility.

Tables

Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
1											
RDB	0-10	10					10	30	60		
	10-20	12				40		60			
	20-30	13				100					
	30-40	14				75	25				
	40-50	15				50	20	30			
2											
RDB	0-10	6					30		70		
	10-20	10				80	20				
	20-30	12				90	10				
	30-40	13					20	40	40		
	40-50	14						30	70		
3											
RDB	0-10	6				10			90		
	10-20	10				50		50			
	20-30	12				40	30	30			
	30-40	12					40	40	20		
	40-50	13					40	40	20		
4											
RDB	0-10	7				100					
	10-20	8		10		90					
	20-30	10		20		80					
	30-40	12				50	20	30			
	40-50	13				10	40	50			
5											
RDB	0-10	5				100					
	10-20	7				90			5		5
	20-30	8				100					
	30-40	9				40		40			20
	40-50	9				40		40			20
6											
RDB	0-10	5				95					5
	10-20	7				90					10
	20-30	8				80			5		15
	30-40	9				100					
	40-50	9				75					25
7											
LDB	0-10	6	80					10			10
	10-20	7	70					5	5		20
	20-30	7		10		10		80			
	30-40	8		10		10		80			
	40-50	8		10		10		80			

BioSurvey Group

Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
8											
	0-10	6	30			30		30			10
	10-20	7	30			40					30
LDB	20-30	7	30			30					40
	30-40	8				30		30	20		20
	40-50	8				20		60	20		
9											
	0-10	3		10			40	50			
	10-20	6		10			40	50			
LDB	20-30	7					30	40	30		
	30-40	8		10			10	30	50		
	40-50	9				10	20		40		30
10											
	0-10	3					20	70	10		
	10-20	4		10				40	50		
LDB	20-30	4		10				30	60		
	30-40	5		10				60	30		
	40-50	7		10		10	20	60			
11											
	0-10	4					10	30	60		
	10-20	7					10		90		
LDB	20-30	8								100	
	30-40	8								100	
	40-50	8								100	
12											
	0-10	1								100	
	10-20	2								100	
LDB	20-30	4								100	
	30-40	4								100	
	40-50	4								100	

Table 2. Mussels Collected Downstream of Kentucky River Lock and Dam 11

		Transects		Timed Searches			
Tribe / Species	**Common Name**	**No. Live**	**%**	**No. Live**	**%**	**Total**	**%**
Amblemini							
Amblema plicata	Threeridge	52	47.7	19	26.8	71	39.4
Pleurobemini							
Fusconaia flava	Wabash Pigtoe	2	1.8	3	4.2	5	2.8
Plethobasus cyphyus	Sheepnose	WD	-	-	-	WD	-
Quadrulini							
Cyclonaias pustulosa	Pimpleback	1	0.9	-	-	1	0.6
Megalonaias nervosa	Washboard	WD	-	-	-	WD	-
Quadrula quadrula	Mapleleaf	1	0.9	-	-	1	0.6
Lampsilini							
Actinonaias ligamentina	Mucket	1	0.9	-	-	1	0.6
Ellipsaria lineolata	Butterfly	1	0.9	-	-	1	0.6
Lampsilis cardium	Plain Pocketbook	SF	-	-	-	SF	-
Lampsilis siliquoidea	Fatmucket	4	3.7	1	1.4	5	2.8
Lampsilis teres	Yellow Sandshell	1	0.9	-	-	1	0.6
Obliquaria reflexa	Threehorn Wartyback	5	4.6	-	-	5	2.8
Obovaria subrotunda	Round Hickorynut	12	11.0	5	7.0	17	9.4
Potamilus alatus	Pink Heelsplitter	29	26.6	41	57.7	70	38.9
Potamilus ohiensis	Pink Papershell	-	-	2	2.8	2	1.1
Truncilla donaciformis	Fawnsfoot	WD	-	-	-	WD	-
Total		**109**	**100.0**	**71**	**100.0**	**180**	**100.0**
Live Species		**11**		**6**		**12**	
Total Species		**15**		**6**		**16**	
CPUE (no. live / min)		**0.19**		**0.89**			

BioSurvey Group

Table 3. Length and Age Estimates for Federally Listed Species

Species	Common Name	Transect / Timed Search	Transect Segment	Est. Age (External Annuli)	Length (mm)
Obovaria subrotunda	Round Hickorynut	Transect 1	20 - 30	6	29
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	17	60
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	13	47
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	7	31
Obovaria subrotunda	Round Hickorynut	Transect 4	0 - 10	8	42
Obovaria subrotunda	Round Hickorynut	Transect 5	0 - 10	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Transect 5	30 - 40	5	33
Obovaria subrotunda	Round Hickorynut	Transect 6	0 - 10	14	44
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	23	67
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	13	41
Obovaria subrotunda	Round Hickorynut	Transect 6	20 - 30	8	41
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	24
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	23
Plethobasus cyphyus	Sheepnose	Transect 7	30 - 40	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	22	61
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	8	35
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	6	30
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	13	37
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	10	39
Total No. Live				**17**	

Figures

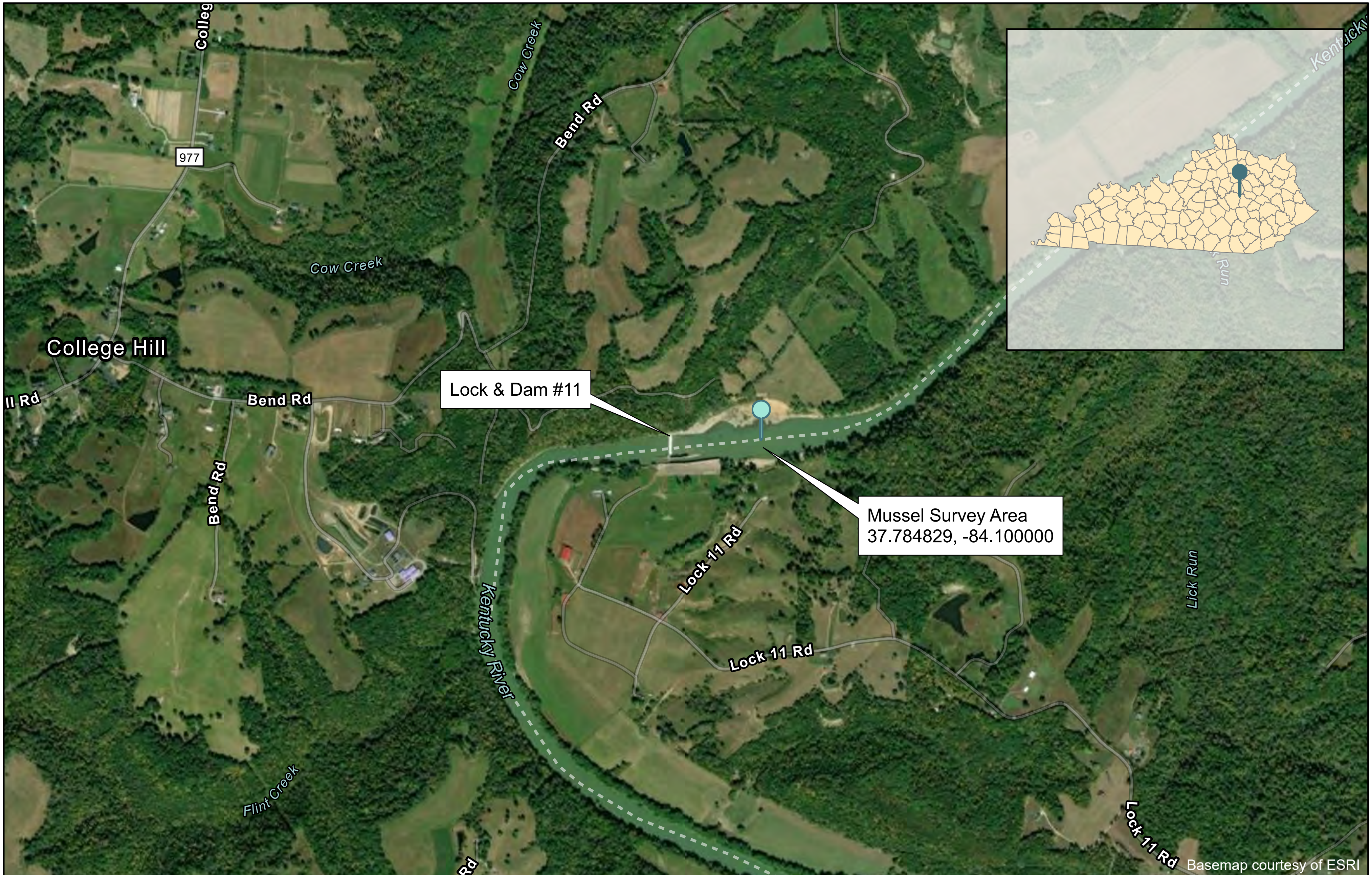


Figure 1. Project Location Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

Figure 2. Mussel Survey Design Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

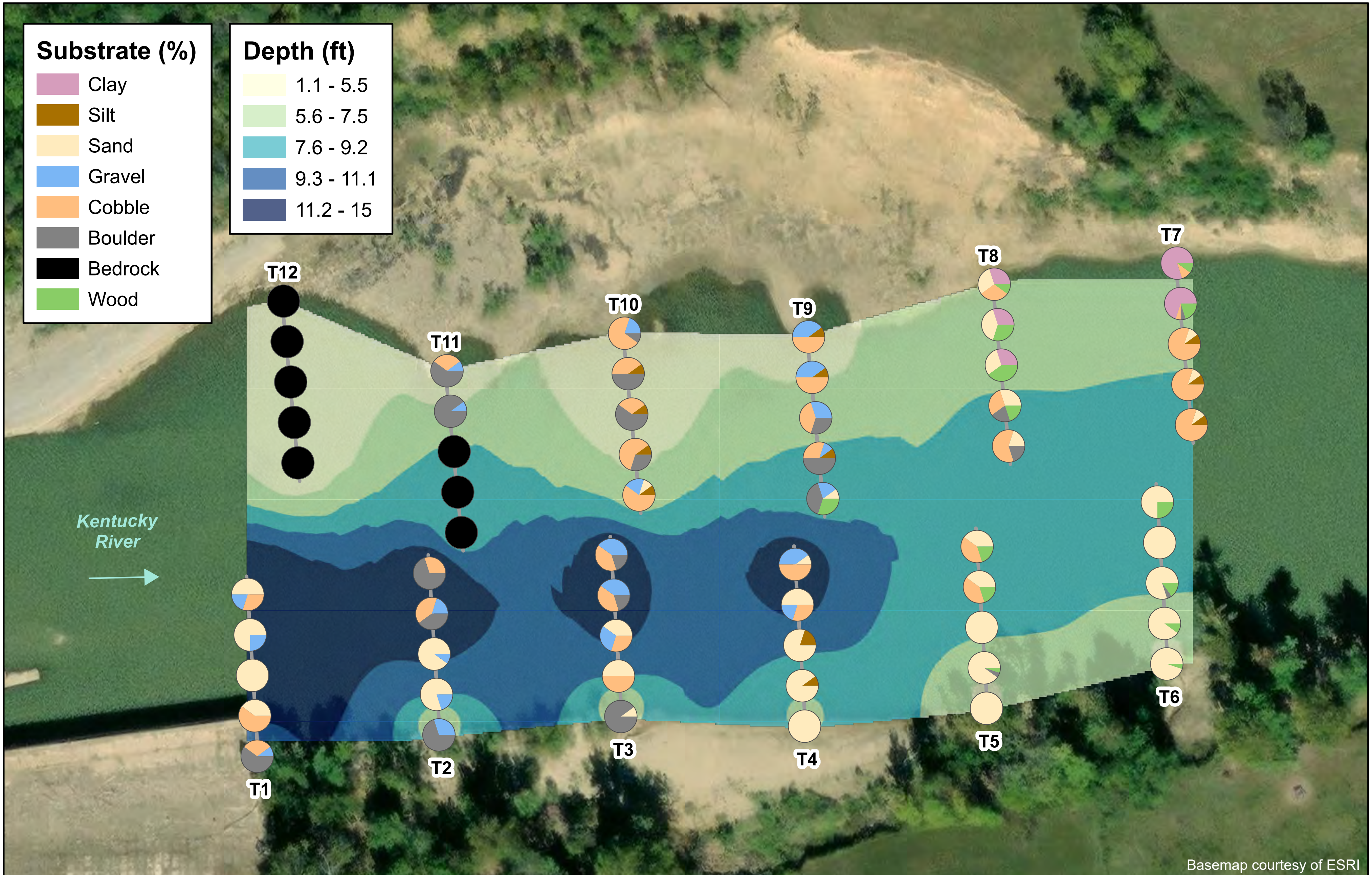


Figure 3. Substrate and Depth Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

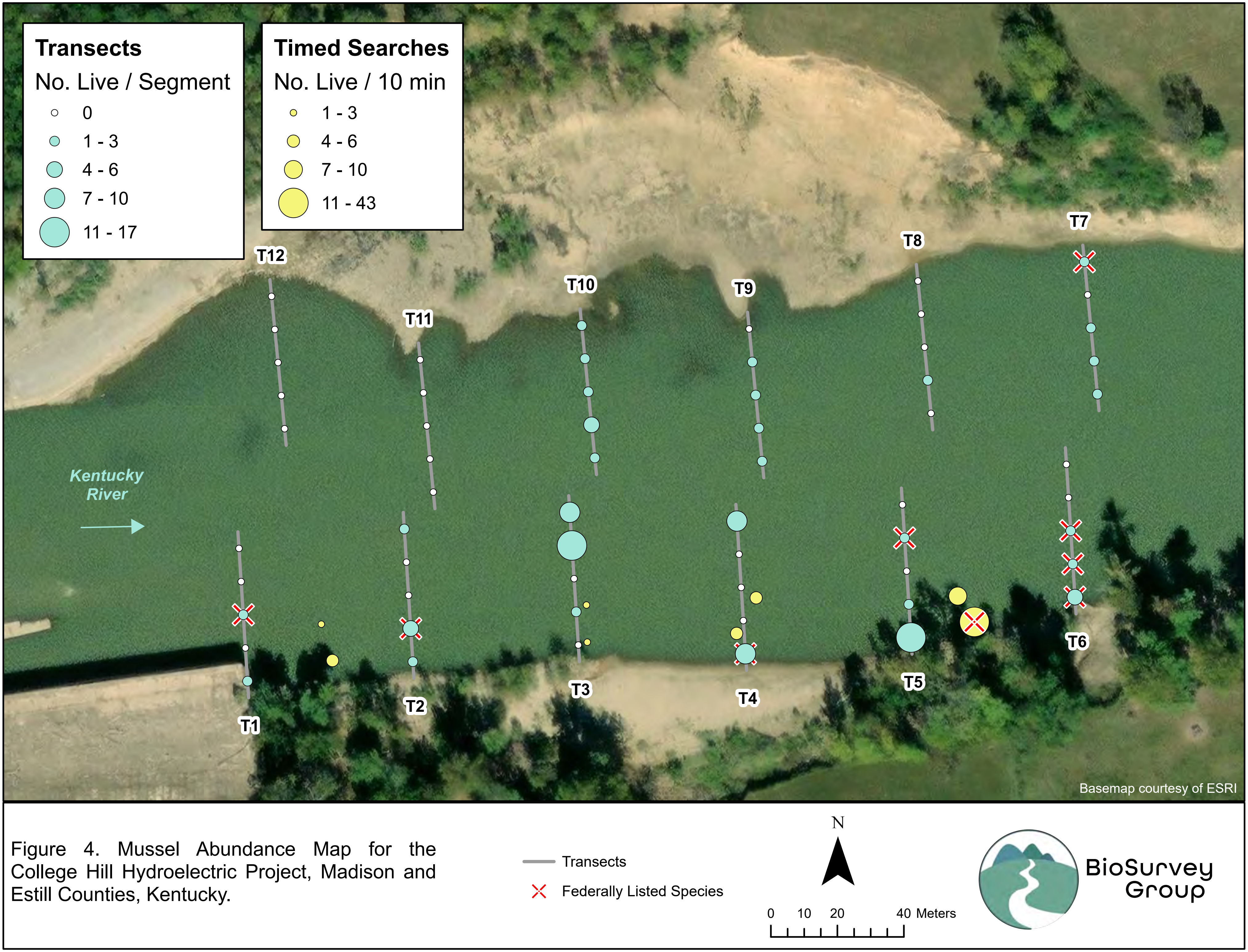
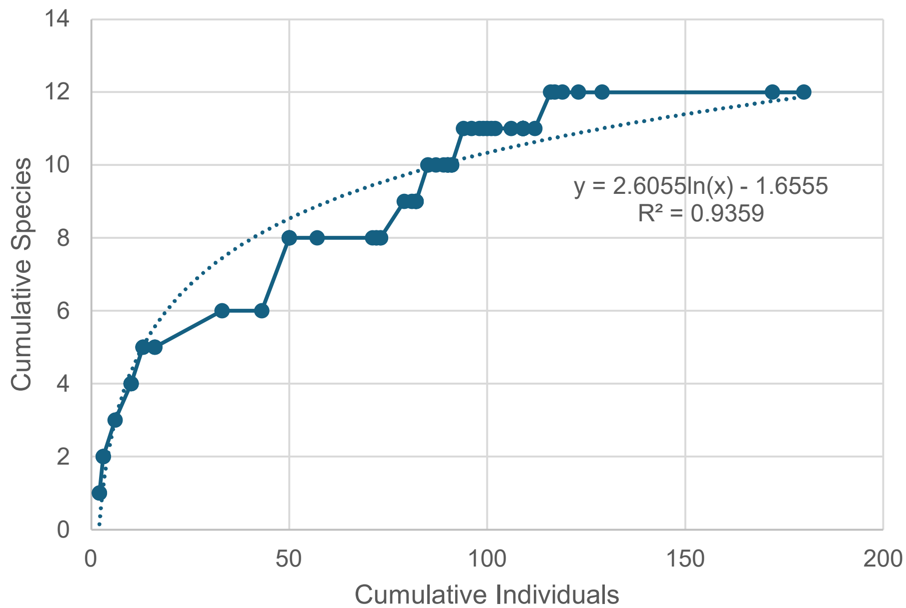


Figure 4. Mussel Abundance Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

Figure 7. Species Richness Curve for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky



Appendix A
Scientific Collection Permits

Scientific Wildlife Collecting - Fed Protected

SC2411259

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

Effective: **1/1/24**
Expires: **12/31/24**
Fed Permit # ESPER0009122

This permit allows the taking and subsequent possession or release of federally-protected wildlife for the purposes of conducting scientific investigations or evaluations for which remuneration is received.

Regulated by
301 KAR 4:070

Your Scientific Wildlife Collecting - Fed Protected is attached below. Keep top portion for your records

Authorization Number: 9460
Issued on date: 03-Oct-2024

Kentucky Dept. of Fish and Wildlife Resources

Scientific Wildlife Collecting - Fed Protected
SC2411259 **Valid:** 1/1/24 **to** 12/31/24

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

ESPER0009122 **Authorized by KDFWR**

The Kentucky Department of Fish and Wildlife Resources is funded through the sale of hunting and fishing licenses. KDFWR receives no general tax dollars.

REPORT-A-POACHER 1-800-25ALERT

Have a question? Call 1-800-858-1549

Visit us on the web at fw.ky.gov

Important Document

Enclosed

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

NATIVE ENDANGERED & THREATENED SP. RECOVERY

Permit Number: ESPER0009122

Version Number: 2

Effective: 2024-04-26 **Expires:** 2027-12-31

Issuing Office:

Department of the Interior

U.S. FISH AND WILDLIFE SERVICE

ES Bloomington Permit Office
5600 American Boulevard, West, Suite 990
Bloomington, Minnesota 55437-1458
permitsR3ES@fws.gov

Karen Herrington Midwest Region Ecological Services Program Leader	**Digitally signed by** Karen Herrington 2024-04-25 15:27:07

Permittee:

Emily Grossman

21 Fort Zumwalt Dr.

O Fallon, Missouri 63368

U.S.A.

Authority: Statutes and Regulations: 16 U.S.C. 1539 (a), 16 U.S.C. 1533 (d) 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13

Location where authorized activity may be conducted:

ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

Reporting requirements:

DUE ANNUALLY ON 1/31

See permit conditions for reporting requirements

Appendix B
Mussel Survey Photo Log

Digital Image 1. View looking upstream toward Lock and Dam 11 from the middle of the survey area.

Digital Image 2. View looking downstream from the right descending bank.

Digital Image 3. View looking toward the left descending bank from the shoreward end of Transect 1.

Digital Image 4. View looking upstream along the left descending bank.

Digital Image 5. View looking toward the right descending bank of survey efforts on the left descending bank.

Digital Image 6. Representative photo of Mucket (*Actinonaias ligamentina*) collected in the survey.

Digital Image 7. Representative photo of Threeridge (*Amblema plicata*) collected in the survey.

Digital Image 8. Representative photo of Pimpleback (*Cyclonaias pustulosa*) collected in the survey.

Digital Image 9. Representative photo of Butterfly (*Ellipsaria lineolata*) collected in the survey.

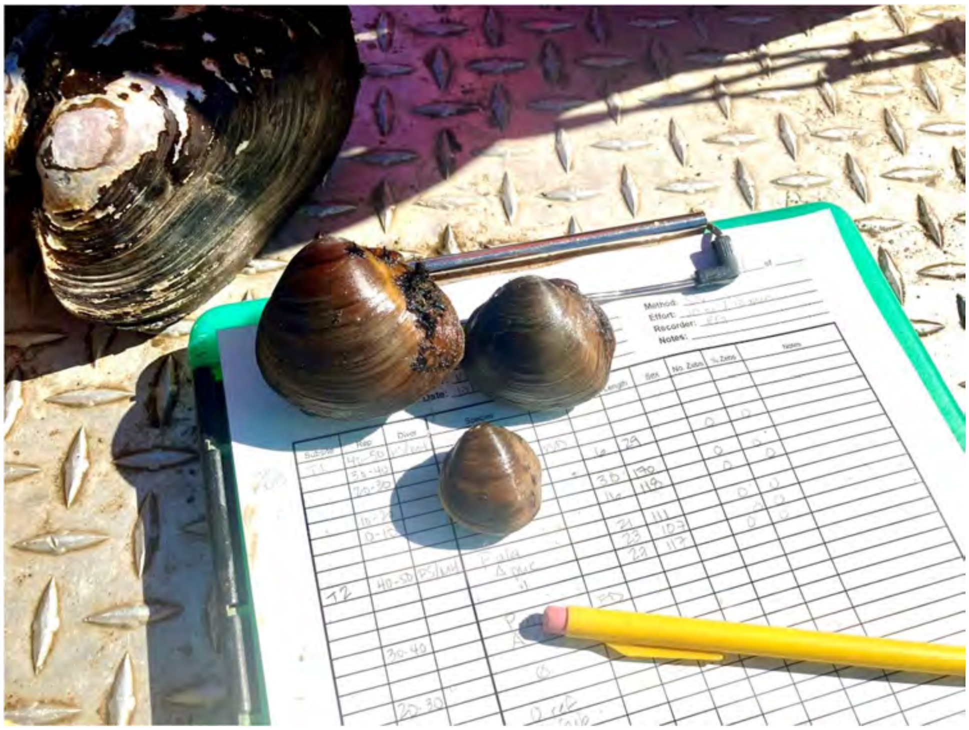
Digital Image 10. Representative photo of Wabash Pigtoe (*Fusconaia flava*) collected in the survey.

Digital Image 11. Representative photo of Fatmucket (*Lampsilis siliquoidea*) collected in the survey.

Digital Image 12. Representative photo of Yellow Sandshell (*Lampsilis teres*) collected in the survey.

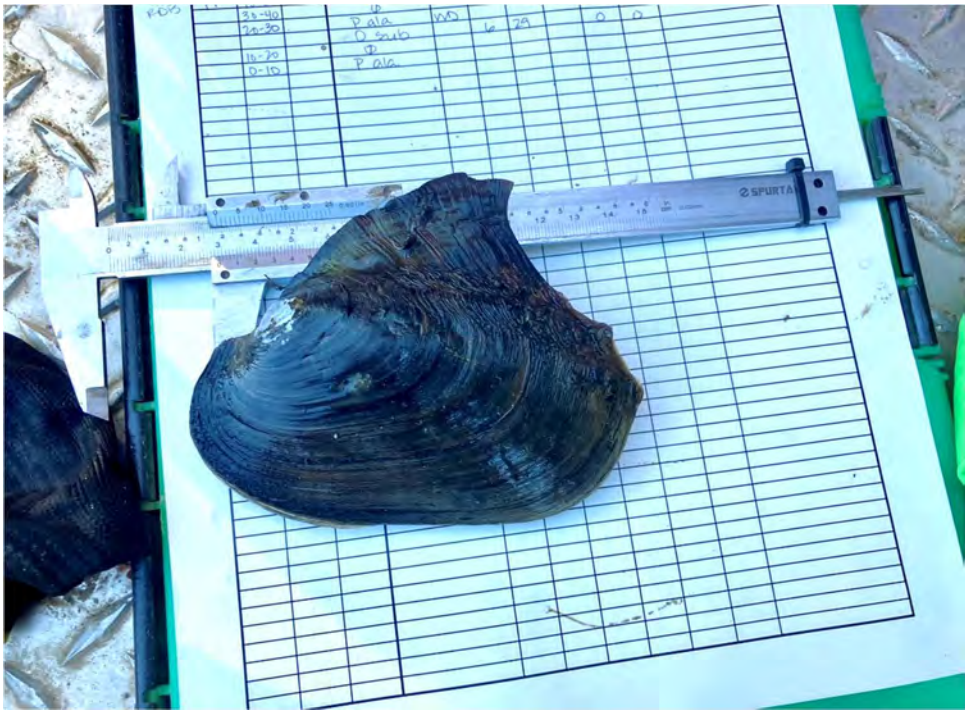
Digital Image 13. Representative photo of Threehorn Wartyback (*Obliquaria reflexa*) collected in the survey.

Digital Image 14. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 15. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.

Digital Image 16. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 17. Representative photo of Pink Heelsplitter (*Potamilus alatus*) collected in the survey.

Digital Image 18. Representative photo of Pink Papershell (*Potamilus ohiensis*) collected in the survey.

Digital Image 19. Representative photo of Mapleleaf (*Quadrula quadrula*) collected in the survey.

Digital Image 20. Representative photo of subfossil Plain Pocketbook (*Lampsilis cardium*) shell collected in the survey.

Digital Image 21. Representative photo of weathered dead Washboard (*Megalonaias nervosa*) shell collected in the survey.

Digital Image 22. Representative photo of weathered dead Sheepnose (*Plethobasus cyphyus*) shell collected in the survey.

Digital Image 23. Representative photo of weathered dead Fawnsfoot (*Truncilla donaciformis*) collected in the survey.

APPENDIX D

Hydraulic Study Memorandum

TECHNICAL MEMORANDUM

To: Mr. David Brown Kinloch (Appalachian Hydro Associates)

From: Jill L. Davis, P.E. (Kleinschmidt Associates)

Cc: Paul D. Drew, P.E., CFM, Will Pruitt, CE (Kleinschmidt Associates)

Date: January 28, 2025 **Project No.** 1349009.03

Re: Lock and Dam No. 11 – Mussel Hydraulic Review

INTRODUCTION

Appalachian Hydro Associates contracted Kleinschmidt Associates (Kleinschmidt) to perform a hydraulic analysis to evaluate and compare the existing and proposed (post-construction) flow conditions at Lock and Dam No. 11 (Lock No. 11). The U.S. Fish and Wildlife Service (USFWS), upon review of the recent Mussel Survey Report (BioSurvey Group 2024), has three primary concerns regarding the impact from planned operations for the College Hill Hydroelectric Project (Project; FERC Project No. 14276):

1. Changes in flow conditions that would cause dislodgement of existing mussel beds.
2. Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.
3. Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.

This Technical Memorandum documents the development of a hydraulic model and the evaluation of the potential impacts of flow condition changes on federally listed mussel species and their host fish of concern downstream of the proposed Project (see Table 1).

Table 1 Federally Listed Species of Concern Downstream of the Proposed Project

Mussel Species	Host Fish Species
Round Hickorynut (*Obovaria subrotunda*) (17 live found)	Eastern Sand Darter (*Ammocrypta pellucida*)
Sheepnose (*Plethobasus cyphyus*) (1 dead, weathered shell found)	Sauger (*Sander canadensis*)

Elevations listed in this report reference the North American Vertical Datum of 1988 (NAVD 88). The spatial project is in reference to North American Datum of 1983 State Plan Kentucky South FIPS 1602 (feet US).

PROJECT DESCRIPTION

The proposed Project is located at River Mile 201 on the Kentucky River in east-central Kentucky, Madison County, near the Town of College Hill (Latitude 37° 47' 03", Longitude -84° 6' 11"), approximately 28 miles southeast of Frankfort, at Lock No. 11. The Kentucky River flows in a north-northwest direction to discharge into the Ohio River. The existing lock and dam were completed in 1906 by the United States Army Corps of Engineers (USACE) for purposes of navigation. The dam is no longer used for navigation, and use of the lock has been discontinued. In 1996, the USACE placed a concrete bulkhead on the sill of the upstream lock gate to close off the lock, and the downstream miter gates were left in the open position. The dam is currently owned and operated by the Kentucky River Authority, which took ownership from the USACE in March 2006.

The existing water retaining structures at the site span 289 feet between the guide and training walls that form the dam's north and south abutments. The structures develop a gross head of 17 feet between the upper (Elevation [El.] 582.5 feet) and lower pools (low pool condition, El. 565.5 feet). Tailwater from the downstream Lock and Dam No. 10 backs up against the dam. The passive spillway is 208 feet long, with a crest at El. 582.5 feet and a maximum height of approximately 35 feet above the foundation rock. The spillway is a concrete gravity structure, with an apron constructed of derrick stone that extends nearly 42 feet downstream of the spillway.

HYDRAULIC MODEL DEVELOPMENT

MODEL COMPUTATIONAL SETTING AND FLOW SCENARIOS

Kleinschmidt developed a two-dimensional (2D) hydraulic model using the USACE Hydraulic Engineering Center's River Analysis Software (HEC-RAS) version 6.4.1 to evaluate existing and proposed flow conditions for the Project. The model domain extends approximately 1,000 feet upstream of the Lock No. 11 spillway and 1,500 feet downstream.

The 2D model uses an unstructured computational mesh that allows computation cells with up to eight sides and a mixture of cell shapes and sizes. Each computation cell and cell face are based on the details of the underlying terrain to develop the geometric and hydraulic property tables for the flow simulations. Using RAS Mapper, one computation mesh was generated that covered the domain of the study area. The model existing conditions domain was developed using a 15-foot by 15-foot initial mesh square. The mesh was refined with several break lines to define the centerline, channel banks, hydraulic structures, and other pertinent features within the model domain. The resulting domain consists of 7,709 cells with maximum, minimum, and average cell areas equal to 4,257, 63, and 337 square feet, respectively. The proposed conditions domain used a

duplicate of the existing conditions domain, with modifications as necessary. The 2D model geometry is illustrated in Attachment 1.

The upstream boundary condition for the model was defined as a constant flow hydrograph for six flow scenarios summarized in Table 2. The downstream boundary condition was set as a rating curve using tailwater elevations developed using the one-dimensional (1D) HEC-RAS model (Kleinschmidt 2024a). The 1D HEC-RAS model uses a rating curve at the downstream Lock No. 10 spillway calibrated to flow and gage heights at U.S. Geological Survey (USGS) Gage No. 03284000 located in the Lock No. 10 headpond. Model calibration results are provided in Attachment 2. The hydraulic model was performed using the Full Momentum Shallow Water Equations with a 0.5-second timestep.

Table 2 HEC-RAS Model Scenarios

Model Scenario	Description	Flow (cfs*)
Existing Conditions		
1	Normal Flow – proposed maximum turbine capacity	2,636
2	Maximum Spillway Capacity – 20,000 cfs over the spillway only	20,000
3	Mean Annual Peak Flow (~2.3 Annual Exceedance Probability)	45,233
Proposed Conditions		
4	Maximum Turbine Capacity – maximum Project capacity before water spills over spillway	2,636
5	Maximum Spillway Capacity – 2,636 through Project; 17,364 over spillway	20,000
6	Mean Annual Peak Flow – bladder for Project lowered	45,233

* cfs = cubic feet per second

MODEL TERRAIN

The model terrain was developed using GIS and RAS Mapper (within HEC-RAS) from a combination of digital elevation models, depth sounding, and other hydraulic models. All elevation data were referenced with respect to NAVD88. The following is a comprehensive summary of data sources:

- Kentucky Light Detection and Ranging: KYFromAbove, 5-foot resolution.
- The mussel survey conducted by BioSurvey Group on October 7, 2024, included depth measurements from 12 transects (BioSurvey Group 2024). Depths were converted to elevations based on water surface elevation recorded by USGS Gage

No. 03284000 near the Lock No. 10 headpond. *Note that at low flows, the Lock No. 11 tailwater is approximately equivalent to the normal headwater elevation at Lock No. 10.*

- Upstream of the mussel survey area, channel elevations were estimated using data from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) reports for Madison and Estill counties (FEMA 2011, 2017).
- Downstream of the mussel survey area, the bathymetric surface was created using cross-sections from the effective FEMA 1D HEC-RAS model.
- Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b).

MANNING'S ROUGHNESS COEFFICIENTS (N)

The Manning's roughness coefficients (*n*) used in the model were selected based on guidance from the USACE *HEC-RAS 2D User's Manual* (USACE 2024), values reported in the FEMA FIS, and engineering judgement. Land cover regions were determined through a review of aerial imagery and manually assigned (Google 2024). The selected Manning's roughness coefficients (*n*) are summarized in Table 3.

Table 3 Manning's Roughness Coefficients (*n*)

Land Cover Type	Manning's Roughness Coefficient (*n*)
Channel	0.045
Lock	0.045
Forest	0.120
Overbanks	0.070
Pasture	0.040
Barren	0.040
Concrete	0.016

STRUCTURES

The spillway dimensions for both scenarios referenced Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b). The spillway was represented in the model as a single storage-area/2D (SA/2D) connection with a weir coefficient of 3.0. The predicted model headwater elevations were compared to the USGS gage data for each flow scenario to calibrate the weir coefficient. In the existing conditions, the upstream lock gates were assumed to remain closed during all flow scenarios. A comparison between predicted model headwater elevation and USGS gage data are provided in Attachment 2.

Proposed conditions incorporate a maintenance rubber bladder at the upstream end of the lock and an operational bladder located above the turbines. For all scenarios, the emergency bladder was fully deflated (572.5 feet). The operational bladder elevation was varied for different flow scenarios.

- In the lowest flow proposed scenario, the operational bladder is fully inflated (592.5 feet) with the turbines operating at maximum capacity (2,636 cfs), with all inflows passing through the turbines.
- In higher flow scenarios, turbines are non-operational, passing no flow, and the operational bladder is fully deflated (577.5 feet).

HYDRAULIC MODEL RESULTS

Reporting locations were selected based on mussel sampling transects in the BioSurvey report (BioSurvey Group 2024), combining collinear transects. The flood routing results at select transects are summarized in Table 4.

The model results indicate varying changes in peak velocity across different flow conditions and transects:

- The largest increase in velocity occurs at Transect 1 (immediately downstream of the lock structure) in all flow conditions (2.0 during normal flow and 0.5 feet per second [fps] during mean annual peak flow).
- **Normal Flow:** Maximum velocity increases at all transects. Under these conditions, the flow, which was previously distributed across the spillway, is now constrained to pass through the lock with a smaller cross-sectional area, leading to a relatively small (0.1 to 2.0 fps) increase in peak velocity.
- **Maximum Spillway Capacity:** In this scenario, the greatest change is an increase of 0.1 cfs at Transect 1; however, at all other transects, velocity decreases. This is due to flow passing through both the spillway and lock in the proposed condition, which allows flow to be more evenly distributed across the channel instead of only across the spillway.
- **Mean Annual Peak Flow:** At Transect 1, velocity increases by 0.5 fps, but at the remaining transects, there is little to no change. This proposed condition is most like the existing condition, where flow is distributed across both the spillway and the lock, with water overtopping both structures.

In addition to changes in velocity at each transect, flow patterns change between the existing and proposed conditions. Figure 1 through Figure 6 present plan views of velocity results at the transect locations, incorporating particle tracing to illustrate flow direction.

Under normal flow conditions, distinct differences are observed between existing and proposed conditions. In the existing conditions, flow within the main channel moves directly downstream. However, under the proposed conditions, the concentration of flow from the powerhouse outlet, combined with the absence of flow from the spillway, results in a zone of relatively low velocities directly downstream of the spillway. Additionally, a large eddy forms on the left side of the river between Transects 1 and 4.

Under maximum spillway capacity and mean annual flow conditions, flow patterns exhibit minimal changes. In both existing and proposed conditions, flow within the main channel continues to move directly downstream, with no significant alterations to flow direction or velocity distribution.

Table 4 Flood Routing Results

Reporting Location	Flow (cfs)*	Maximum Existing (fps)	Maximum Proposed (fps)	Velocity Change (fps)
Location 1	2,636	0.9	2.9	2.0
	20,000	3.1	3.2	0.1
	45,233	4.2	4.7	0.5
Location 2	2,636	0.8	2.0	1.2
	20,000	2.9	2.8	-0.1
	45,233	3.9	3.9	0.1
Location 3	2,636	0.8	1.6	0.8
	20,000	2.7	2.4	-0.3
	45,233	3.7	3.6	-0.1
Location 4	2,636	0.7	1.2	0.5
	20,000	2.5	2.1	-0.4
	45,233	3.5	3.5	0.0
Location 5	2,636	0.8	1.1	0.3
	20,000	2.5	2.2	-0.3
	45,233	3.4	3.5	0.1
Location 6	2,636	0.9	1.0	0.1
	20,000	2.6	2.5	-0.1
	45,233	3.5	3.6	0.1

* Flows of 2,636, 20,000, and 45,233 cfs correspond to the “Normal Flow,” “Maximum Spillway Capacity,” and “Mean Annual Peak Flow” flow scenarios, respectively.

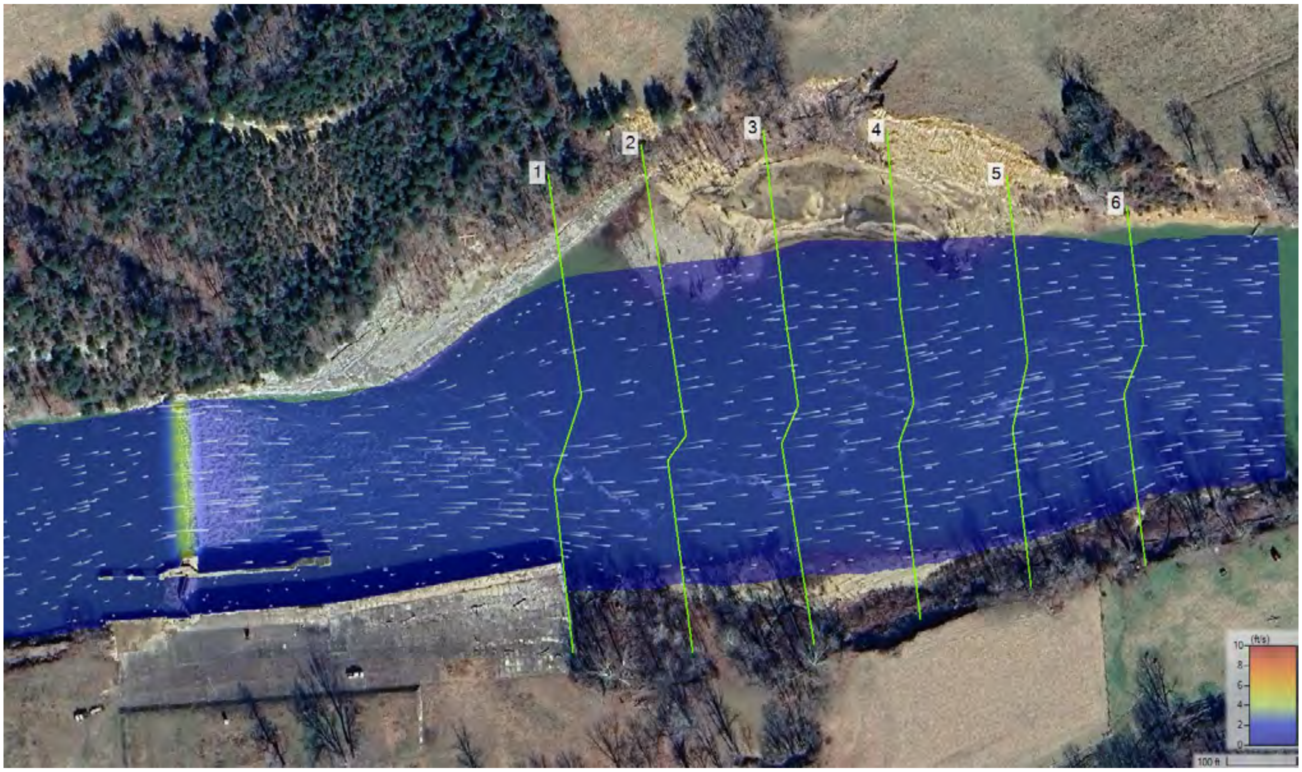


Figure 1 Existing Conditions Normal Flow

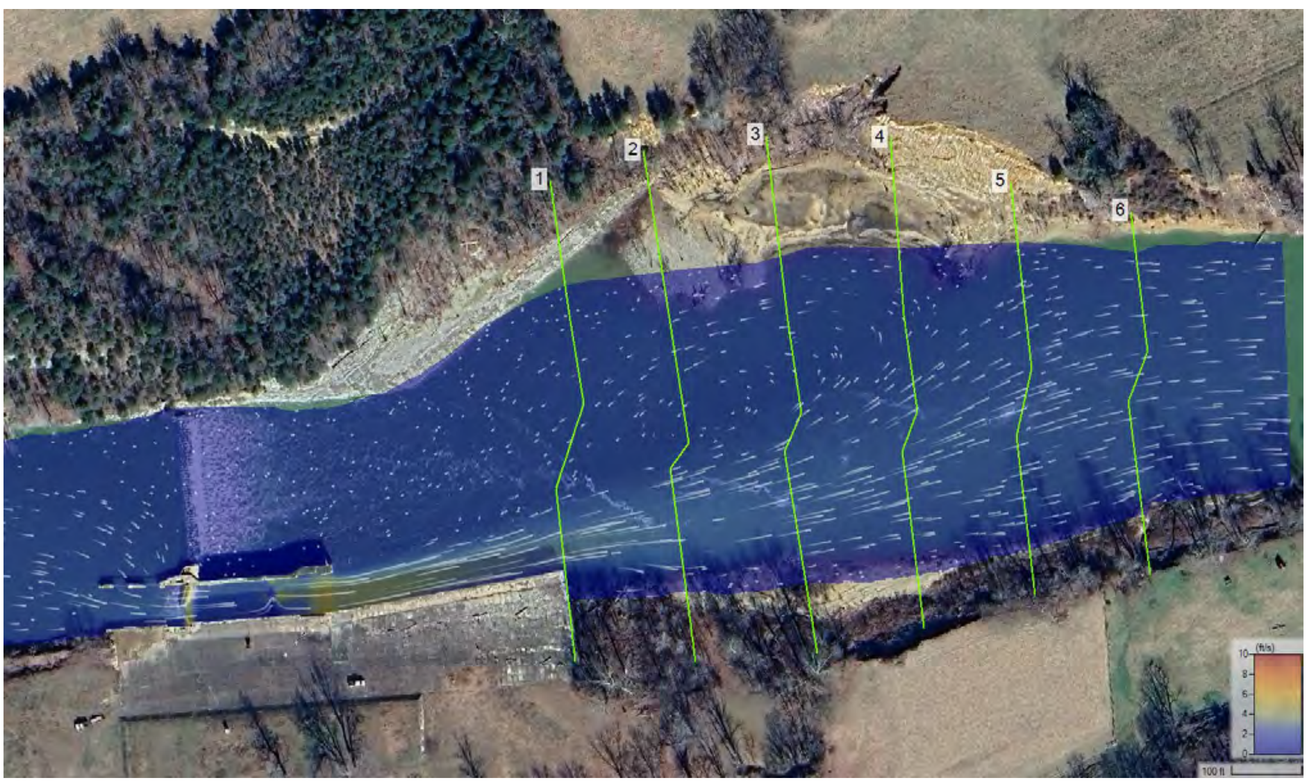


Figure 2 Proposed Conditions Normal Flow

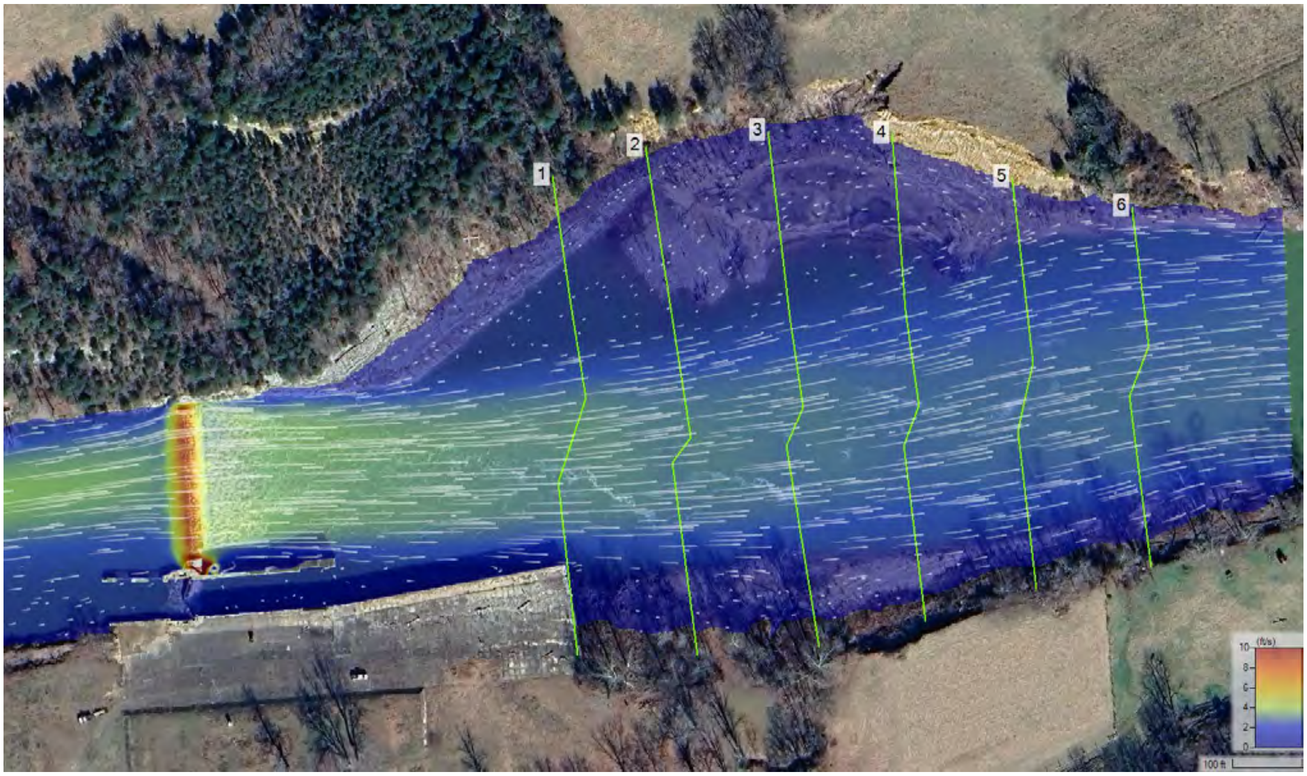


Figure 3 Existing Conditions Maximum Spillway Capacity Flow

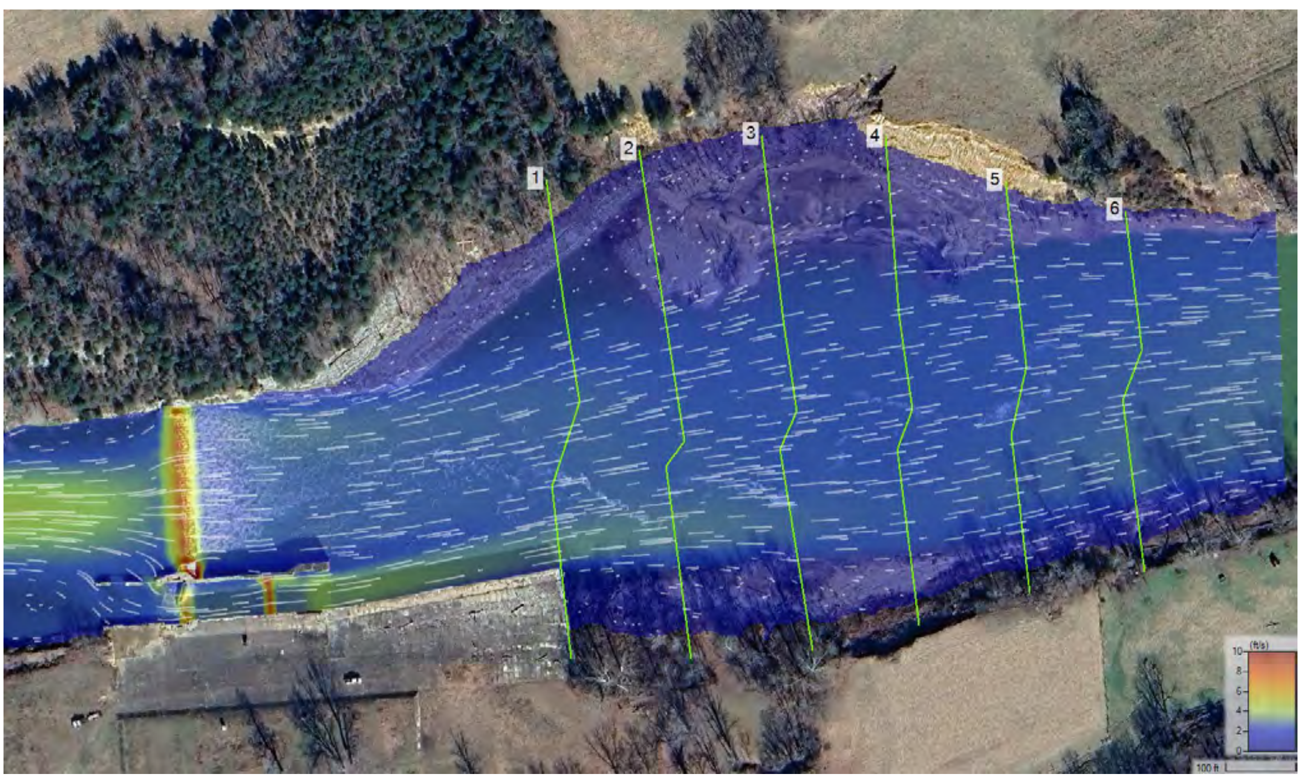


Figure 4 Proposed Conditions Maximum Spillway Capacity Flow

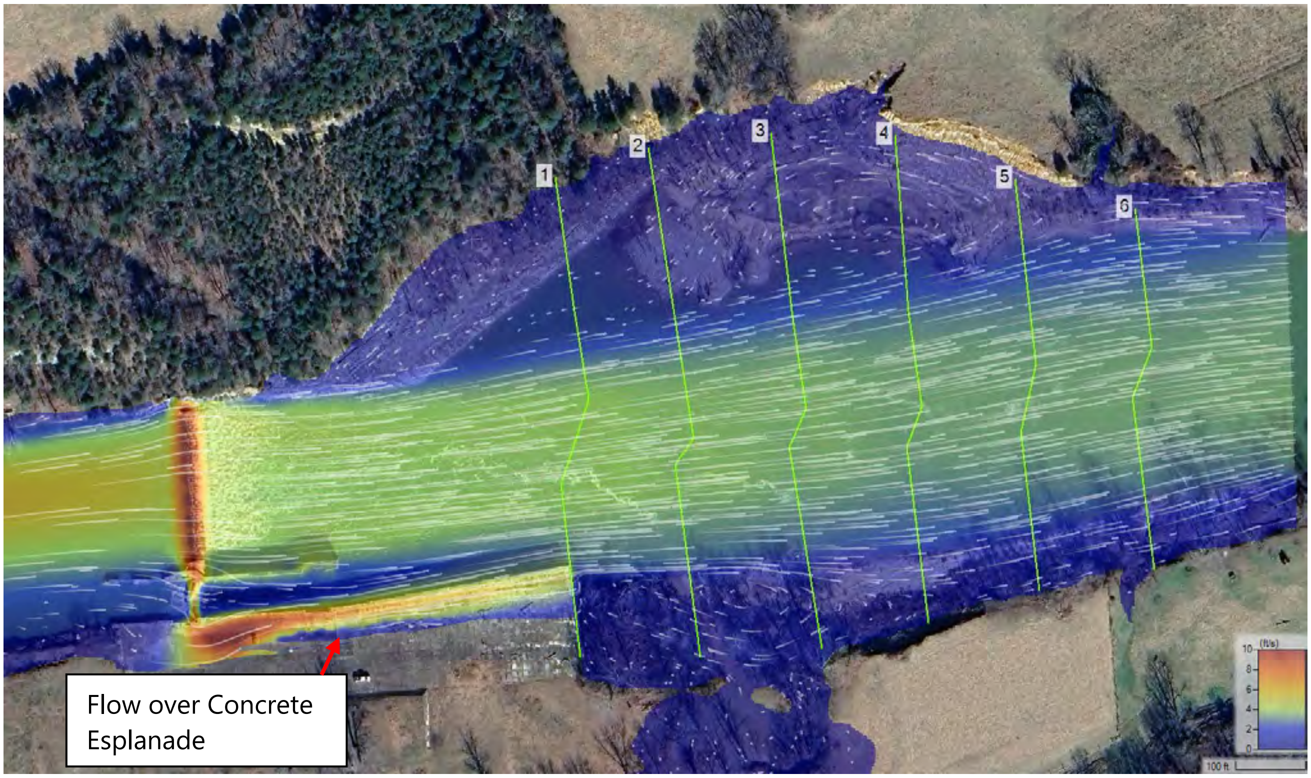


Figure 5 Existing Conditions Mean Annual Peak Flow

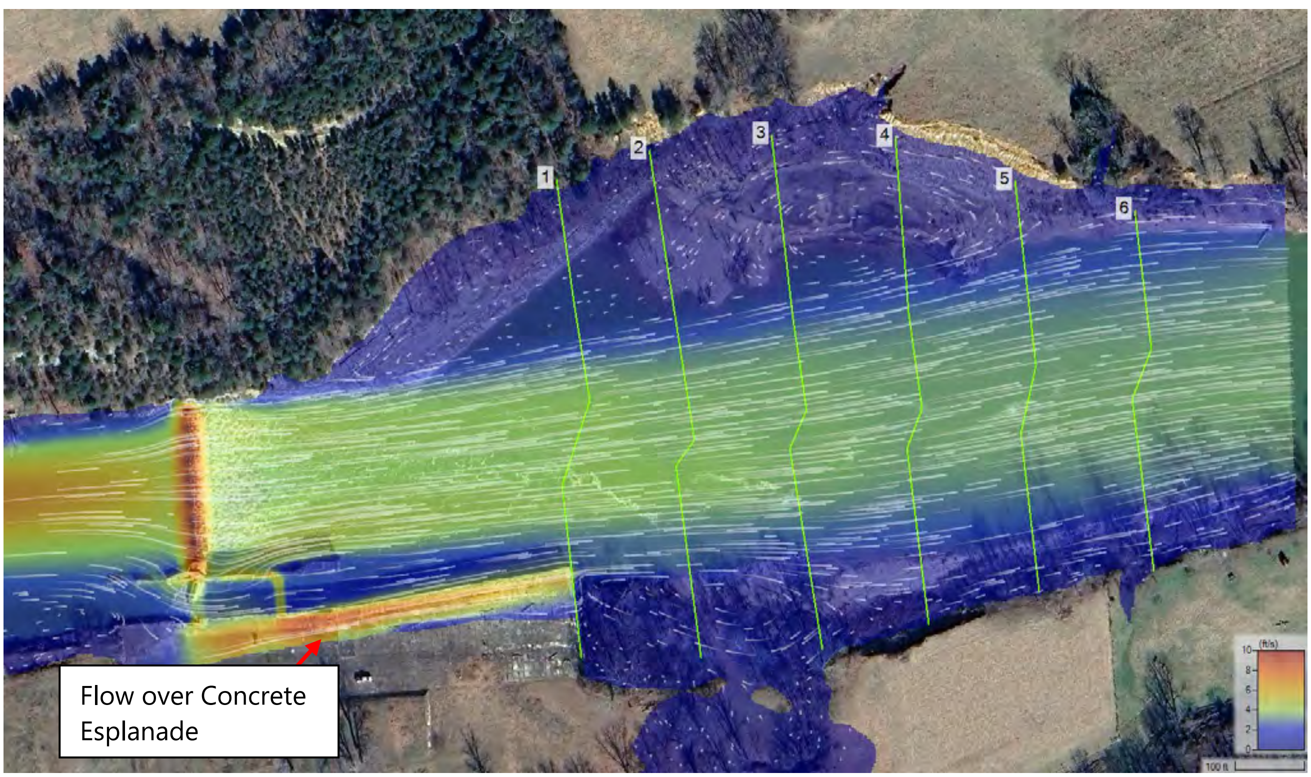


Figure 6 Proposed Conditions Mean Annual Peak Flow

MUSSEL IMPACT REVIEW

Freshwater mussel populations' susceptibility to environmental changes such as habitat fragmentation and alterations in flow regimes from dam construction and hydropower operations have been well-documented. Large-scale alteration in flow regimes, such as the series of locks and dams along the Kentucky River, had population-level effects on mussels, resulting in the listing of several species of concern. Although these past actions along the Kentucky River have altered the aquatic community throughout the basin over the last century, the focus of this discussion is at a much finer geographic scale (i.e., the potential change in hydraulic conditions at Lock No. 11 and potential effects on the mussel community). Specifically, the mussel species of concern include Round Hickorynut and Sheepnose.

As mentioned in the hydraulic model results above, the expected maximum change in peak depth-averaged velocity between existing and proposed conditions across each location/mussel transect is negligible in most flow scenarios. The most noticeable differences between existing and proposed conditions can be seen during the Normal Flow (2,636 cfs) scenario (Table 4, Figure 1, and Figure 2). In the Normal Flow scenario, most locations are not expected to have a noticeable change in peak depth-averaged velocity. However, Location 1 and Location 2 are expected to experience a 2.0 fps and a 1.2 fps change in water velocity under the proposed conditions, respectively (Table 4). In existing conditions, water is prevented from entering the lock structure, and all flow is routed over the existing spillway over a wide cross-sectional area. This allows more uniform dispersal of flows across the river channel. Conversely, under proposed conditions at normal flows, all water will be routed through the proposed powerhouse and discharged at the outlet of the existing lock structure. This creates an area of increased water velocities at the edge of the concrete esplanade at the right descending bank at Location 1 as water exits the existing lock structure (Figure 2). Continuing downstream, flow patterns begin to distribute across the river channel through Locations 3 and 4 and begin to resume "normal" flow patterns across Locations 5 and 6 and exiting the survey reach. Another potential change in flow pattern under the Normal Flow scenario includes the creation of an eddy along the left bank during base flow conditions. This eddy may allow fine sediments to settle when normal flows resume post-high event. The area is predominately bedrock substrates and generally unsuitable for mussels.

For proposed conditions, increased water velocity in Locations 1 and 2 (i.e., a maximum depth-averaged velocity of 2 fps) and change to flow patterns under Normal Flow scenario have the potential to affect the mussels in the immediate vicinity. The area at the outlet of the existing lock structure is expected to be most affected. Coincidentally, this is also the deepest part of the river that contains boulder, cobble, and gravel substrates. The water column depth and coarse substrate types are likely the result of this area continually

receiving the majority of discharge during high-water events. As such, these coarse substrates are not expected to scour under the proposed normal flow conditions. Some sand is present in Location 1, which may potentially be mobilized once the proposed project is in full operation, ultimately leaving more coarse substrates (i.e., boulder, cobble, and gravel) behind, as seen in Locations 2 and 3. However, this potential change is expected to be a one-time occurrence until a new equilibrium is reached.

In the Maximum Spillway Capacity (20,000 cfs) scenario (Figure 3 and Figure 4), there are some slight variations in flow patterns between existing and proposed conditions. This is the result of the modeled flows passing both through the powerhouse/lock structure and over the existing spillway. Although there may be a slight increase in water velocity exiting the lock in proposed conditions, the flow distribution across the river channel is relatively uniform and is not expected to affect substrates and in-river habitat conditions. Further, the flow of approximately 20,000 cfs occurs annually if not more frequently during the winter and springs months. As a result, there are no anticipated risks of mussel dislodgement or scouring of habitats, smothering of existing mussel beds, or alterations of habitats for fish hosts (i.e., Eastern Sand Darter and Sauger).

In the Mean Annual Peak Flow (45,233 cfs) scenario (Figure 5 and Figure 6), there is virtually no change in expected flow dynamics between existing and proposed conditions. The design and operation of the proposed gates would allow flows over the top of the turbine and through the lock structure during the Mean Annual Peak Flow. Because changes in flow pattern are essentially imperceivable, there are no anticipated impacts to mussels, their habitats, or host fishes in the Mean Annual Peak Flow proposed conditions.

It is important to understand the limitations of the modeling exercise and its 2D approach. As it stands, the existing model can produce a peak depth-averaged water velocity. Because this model is not three-dimensional, the expected velocities at various depths cannot be estimated. As such, the model cannot predict changes in velocities at the surface versus velocities at the substrate.

REVIEW SUMMARY

Based on the results of the hydraulic model and the evaluation of the potential impacts of these flow condition changes on the federally listed mussel species and their host fish of concern, the responses to the USFWS three primary concerns are as follows:

1. *Changes in flow conditions that would cause dislodgement of existing mussel beds.*

   During the Normal Flow scenario, flow conditions are expected to change at Locations 1 and 2. However, due to the existing depth and coarse substrate types, the expected increase in water velocity is unlikely to dislodge existing mussel beds

when compared to the yearly flow velocity changes that already exist. An important consideration when examining potential project effects are the flow conditions and river fluctuations that are currently experienced. This reach of the river frequently experiences flashy flows, particularly in the winter and spring months. As observed within the Mean Peak Flow scenario under existing conditions, water velocities increase 4.2 fps in Location 1 compared to the Normal Flow scenario. These flows pose a greater risk to mussel dislodgment than the expected increase of 2.0 fps at Normal Flow once the hydropower facility is in operation. In summary, the risk of mussel dislodgement and the movement of sediment occurs during high-flow events, which frequently happen under existing conditions. Under the proposed conditions, there is no observable difference in flow condition during the Mean Peak Annual Flow and is not likely to increase the risk of dislodgment that the existing mussel community currently faces. However, the substrates between Lock No. 11 and Location 1, presumed to be finer sediments, may potentially shift to coarser types after project implementation. This is due to the increased water velocity keeping the substrates in this deeper channel free of finer sediments, which is expected to stabilize post-project operation.

2. *Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.*

   The sandy areas between Lock No. 11 and Location 1 (approximately 200-foot-long reach along the right bank) will likely be mobilized once power generation is online. This movement of substrates is expected to be a one-time occurrence until a new equilibrium is reached post-project implementation. Any mobilized soft sediments are expected to settle within or immediately downstream of the assessment area. Therefore, while initial scour and sediment deposition may occur, the volume is not expected to smother the mussel beds. The volume of sediment is not expected to exceed what is naturally scoured, transported, and deposited annually as the river continually fluctuates between base flow and peak flow conditions. As stated in Item 1 above, the risk of sediment scour or deposition is greatest during high-flow conditions and is not tied to the hydropower operations.

3. *Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.*

   Although some flow patterns are expected at the Project location during normal flow conditions at Locations 1 and 2, the changes in water velocity and flow patterns are not expected to alter habitats in a way that would affect the presence of known or potential fish host species.

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ATTACHMENT 1

HEC-RAS MODEL GEOMETRY

ATTACHMENT 2

MODEL CALIBRATION RESULTS

RECORD OF REVIEWS

For internal purposes only. The following table is maintained within MS Word and removed prior to client submission via PDF.

Revision[1]	Document Team	Initials	Date	Notes
A	Author(s):	CAK & WAP	1/16/25	For AHA Review
	Reviewer(s):	PDD	1/16/25	
	TE:	LL	1/20/25	
	Approver(s):	JLD	1/17/25	
	PC:	SCB	1/17/25	
0	Author(s):	CAK & WAP	1/27/25	Finalized, AHA will share w/ USFWS
	Reviewer(s):	PDD	1/25/25	
	TE:	n/a	n/a	
	Approver(s):	JLD	1/28/25	
	PC:	SCB	1/28/25	
	Author(s):			
	Reviewer(s):			
	TE:			
	Approver(s):			
	PC:			
	Author(s):			
	Reviewer(s):			
	TE:			
	Approver(s):			
	PC:			

[1] *Letters (A, B, etc.) indicate internal revisions or draft versions sent to client for review. Numbers (0, 1, 2, etc.) are the final versions that go to the client.* ***If*** *revision logs are sent to the client, include draft internal revisions until Rev. 0 is sent; at Rev. 0, the client log should not include internal or draft revisions. The Kleinschmidt Word version should track these.*

APPENDIX C: COLLEGE HILL HYDRO PROJECT ON THE KENTUCKY RIVER - MUSSEL SURVEY REPORT

COLLEGE HILL HYDRO PROJECT ON THE KENTUCKY RIVER - MUSSEL SURVEY REPORT

MADISON AND ESTILL COUNTIES, KY

PREPARED FOR

Appalachian Hydro Associates

DATE: 10.24.24

BIOSURVEY GROUP

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Oxfortd, OH 45056
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Introduction

BioSurvey Group was contracted to provide environmental consulting services to Appalachian Hydro Associates for a mussel survey on the Kentucky River in Madison and Estill Counties, Kentucky as part of a proposed hydroelectric project at Lock and Dam 11 (Figure 1). The Project facilities will consist of a submersible powerhouse constructed in the existing abandoned lock chamber and a control building on the shore containing switchgear, controls, transformers and a main circuit breaker for the plant. The powerhouse will contain six submersible turbine generators that are unaffected by flooding. An underground cable trench will connect the powerhouse to the control building.

Project Need

The proposed construction and operation of the hydroelectric facility may impact freshwater mussels occurring within construction areas as well as downstream of the lock and dam. Several federally listed mussel species, including Clubshell (*Pleurobema clava*; endangered), Fanshell (*Cyprogenia stegaria*; endangered), Round Hickorynut (*Obovaria subrotunda*; threatened), and Salamander Mussel (*Simpsonaias ambigua*; proposed endangered) are known or believed to occur in this reach of the Kentucky River. Therefore, the U.S. Fish and Wildlife Service (USFWS) and Kentucky Department of Fish and Wildlife Resources (KDFWR) required a mussel survey be completed to obtain the regulatory permits required for this project.

Methods

Mussel Survey

The mussel survey extent was determined based on guidance from USFWS. The survey area extended from approximately 160 m to 420 m downstream of the dam and 50 m riverward from each bank. Six 50-m transects, spaced at 50-m intervals, were established perpendicular to flow on each bank, for a total transect length of 600 m (Figure 2).

Divers searched a 1-m wide swath along each survey transect which was divided into 10-m segments. Search rates included a minimum effort of 1.0 min/m^2 in areas of heterogeneous substrate and 0.5 min/m^2 in areas of homogenous substrate (bedrock, mud, silt, and sand). The visual search included moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5 cm (2 in) of substrate to better view the mussels which may be there.

Data was compiled and recorded for each 10-m transect segment, including substrate (Wentworth Scale) and depth. In each segment, mussels observed (live and dead) were bagged and brought to the surface for further processing and positive identification. Live mussels were kept cool and moist on the surface and were not out of the water for more than five minutes. Dead mussel shells were scored as fresh dead, weathered dead, or subfossil. Mussel nomenclature followed that of the Freshwater Mollusk Conservation Society (2023). Photo vouchers of all representative species collected and any odd, questionably identified individuals were taken.

Timed Searches

Timed searches were completed for the development of a species richness curve to demonstrate that most species had been recorded from the survey area. Transect data was used to inform the best location to conduct the timed searches. The goal was to collect six consecutive samples in 10 min increments within the mussel concentration area until no new species were detected.

Results

The BioSurvey Group team performed the mussel survey on October 7 – 8, 2024, led by permitted malacologist Ms. Emily Grossman. Copies of Ms. Grossman's scientific collecting permits are presented in Appendix A. Weather conditions were favorable throughout the survey effort with sunny skies and an average air temperature of approximately 23ºC (73°F). Discharge on the Kentucky River at Lock and Dam 11 (USGS 03282290) ranged from 694 cubic feet per second (cfs) to 874 cfs and stage ranged from 11.27 ft to 11.45 ft. Water temperature was approximately 20ºC (68°F) at the surface. Site and mussel photos can be found in Appendix B.

Habitat

Variable habitat conditions were encountered throughout the survey area. Substrate on the right descending bank was primarily sand, though some coarse material (boulder / cobble / gravel) was present along the bank on Transects 1 – 3 and at the far riverward ends of some transects. In contrast, substrate along Transects 7 – 10 on the left descending bank was primarily coarse gravel, cobble, and boulder, and substrate along Transects 11 – 12 was almost exclusively bedrock (Figure 3). Depths ranged from approximately 1 ft (0.3 m) near the bank to a maximum of 15 ft (4.6 m) along Transect 1, with deeper depths generally occurring on the right descending half of the channel (Figure 3). Depth and substrate data by transect segment are presented in Table 1.

Transect Survey

A total of 109 mussels were detected during the transect survey, representing 11 species. Threeridge (*Amblema plicata*; 47.7%) was the most dominant species, followed by Pink Heelsplitter (*Potamilus alatus*; 26.6%) and the federally threatened Round Hickorynut (11.0%) (Table 2). Length and age estimates for all live federally listed mussels are presented in Table 3. Four additional species were represented by dead shell material only, including a weathered dead federally endangered Sheepnose (*Plethobasus cyphyus*) (Table 2). Catch per unit effort (CPUE) was 0.19 mussels per minute of search time.

Mussels were present on both the right and left descending banks, but abundance was highest along the right descending bank (Figure 3). Patches of relatively high density were present near the right descending bank at the downstream end of the survey area (Transects 5 – 6) and at the far riverward ends of Transects 3 – 4. Round Hickorynut individuals were found on most of the right descending bank transects and at the shoreward end of Transect 7 on the left descending bank (Figure 3).

Timed Searches

A total of eight timed searches, each 10 minutes in length, were completed to supplement the transect data for the development of a species richness curve. All timed searches were conducted

along the right descending bank, focusing on areas where mussels were abundant or federally listed species were present in transect samples. An additional 71 mussels were collected in timed searches, including one species not collected in transect samples (Pink Papershell; *Potamilus ohiensis*). Pink Heelsplitter (57.7%) and Threeridge (26.8%) were the dominant species. Five additional Round Hickorynut were collected during the timed search effort, and CPUE was 0.89 mussels / min (Table 2). The species richness curve, developed using both transect and timed search data, suggests that approximately 97 more individuals would need to be collected to find one additional species (Figure 5).

Discussion

Survey efforts yielded a total of 180 live mussels representing 12 species, including 17 federally threatened Round Hickorynut and a weathered dead federally endangered Sheepnose shell. Most mussels, including federally listed species, were collected on the right descending half of the channel in sandy substrate. Given the presence of federally listed species, additional consultation with USFWS may be needed prior to construction. Data collected in this survey can be used to develop population estimates for federally listed species in the project area if needed and can serve as a pre-construction baseline to assess whether the mussel community is being affected by operation of the hydropower facility.

Tables

Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
1											
	0-10	10					10	30	60		
	10-20	12				40		60			
RDB	20-30	13				100					
	30-40	14				75	25				
	40-50	15				50	20	30			
2											
	0-10	6					30		70		
	10-20	10				80	20				
RDB	20-30	12				90	10				
	30-40	13					20	40	40		
	40-50	14						30	70		
3											
	0-10	6				10			90		
	10-20	10				50		50			
RDB	20-30	12				40	30	30			
	30-40	12					40	40	20		
	40-50	13					40	40	20		
4											
	0-10	7				100					
	10-20	8		10		90					
RDB	20-30	10		20		80					
	30-40	12				50	20	30			
	40-50	13				10	40	50			
5											
	0-10	5				100					
	10-20	7				90			5		5
RDB	20-30	8				100					
	30-40	9				40		40			20
	40-50	9				40		40			20
6											
	0-10	5				95					5
	10-20	7				90					10
RDB	20-30	8				80			5		15
	30-40	9				100					
	40-50	9				75					25
7											
	0-10	6	80					10			10
	10-20	7	70					5	5		20
LDB	20-30	7		10		10		80			
	30-40	8		10		10		80			
	40-50	8		10		10		80			

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Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
8											
LDB	0-10	6	30			30		30			10
	10-20	7	30			40					30
	20-30	7	30			30					40
	30-40	8				30		30	20		20
	40-50	8				20		60	20		
9											
LDB	0-10	3		10			40	50			
	10-20	6		10			40	50			
	20-30	7					30	40	30		
	30-40	8		10			10	30	50		
	40-50	9				10	20		40		30
10											
LDB	0-10	3					20	70	10		
	10-20	4		10				40	50		
	20-30	4		10				30	60		
	30-40	5		10				60	30		
	40-50	7		10		10	20	60			
11											
LDB	0-10	4					10	30	60		
	10-20	7					10		90		
	20-30	8								100	
	30-40	8								100	
	40-50	8								100	
12											
LDB	0-10	1								100	
	10-20	2								100	
	20-30	4								100	
	30-40	4								100	
	40-50	4								100	

Table 2. Mussels Collected Downstream of Kentucky River Lock and Dam 11

Tribe / Species	Common Name	Transects No. Live	Transects %	Timed Searches No. Live	Timed Searches %	Total	%
Amblemini							
Amblema plicata	Threeridge	52	47.7	19	26.8	71	39.4
Pleurobemini							
Fusconaia flava	Wabash Pigtoe	2	1.8	3	4.2	5	2.8
Plethobasus cyphyus	Sheepnose	WD	-	-	-	WD	-
Quadrulini							
Cyclonaias pustulosa	Pimpleback	1	0.9	-	-	1	0.6
Megalonaias nervosa	Washboard	WD	-	-	-	WD	-
Quadrula quadrula	Mapleleaf	1	0.9	-	-	1	0.6
Lampsilini							
Actinonaias ligamentina	Mucket	1	0.9	-	-	1	0.6
Ellipsaria lineolata	Butterfly	1	0.9	-	-	1	0.6
Lampsilis cardium	Plain Pocketbook	SF	-	-	-	SF	-
Lampsilis siliquoidea	Fatmucket	4	3.7	1	1.4	5	2.8
Lampsilis teres	Yellow Sandshell	1	0.9	-	-	1	0.6
Obliquaria reflexa	Threehorn Wartyback	5	4.6	-	-	5	2.8
Obovaria subrotunda	Round Hickorynut	12	11.0	5	7.0	17	9.4
Potamilus alatus	Pink Heelsplitter	29	26.6	41	57.7	70	38.9
Potamilus ohiensis	Pink Papershell	-	-	2	2.8	2	1.1
Truncilla donaciformis	Fawnsfoot	WD	-	-	-	WD	-
Total		**109**	**100.0**	**71**	**100.0**	**180**	**100.0**
Live Species		**11**		**6**		**12**	
Total Species		**15**		**6**		**16**	
CPUE (no. live / min)		**0.19**		**0.89**			

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Table 3. Length and Age Estimates for Federally Listed Species

Species	Common Name	Transect / Timed Search	Transect Segment	Est. Age (External Annuli)	Length (mm)
Obovaria subrotunda	Round Hickorynut	Transect 1	20 - 30	6	29
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	17	60
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	13	47
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	7	31
Obovaria subrotunda	Round Hickorynut	Transect 4	0 - 10	8	42
Obovaria subrotunda	Round Hickorynut	Transect 5	0 - 10	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Transect 5	30 - 40	5	33
Obovaria subrotunda	Round Hickorynut	Transect 6	0 - 10	14	44
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	23	67
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	13	41
Obovaria subrotunda	Round Hickorynut	Transect 6	20 - 30	8	41
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	24
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	23
Plethobasus cyphyus	Sheepnose	Transect 7	30 - 40	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	22	61
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	8	35
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	6	30
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	13	37
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	10	39
Total No. Live				**17**	

Figures

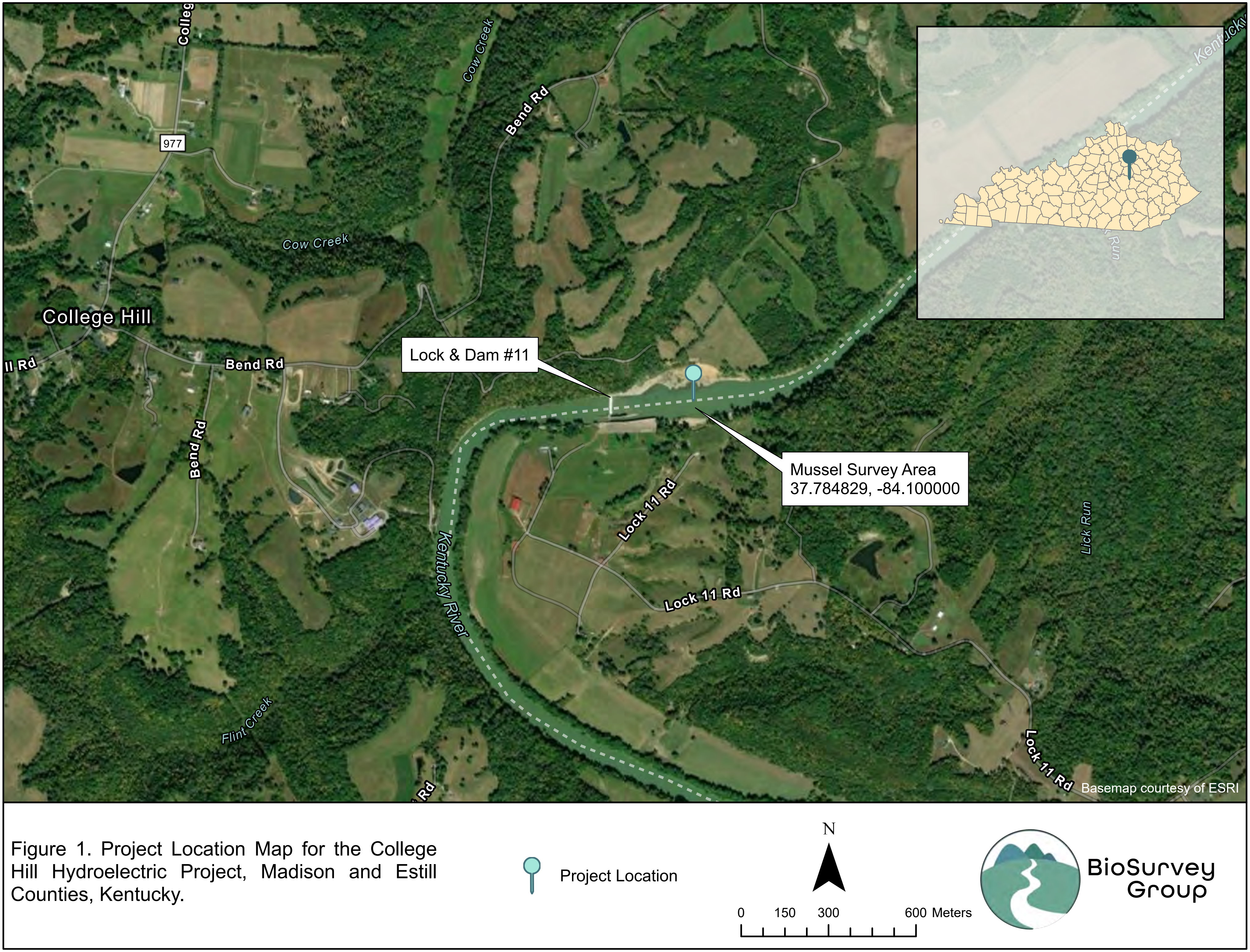


Figure 1. Project Location Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

Figure 2. Mussel Survey Design Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

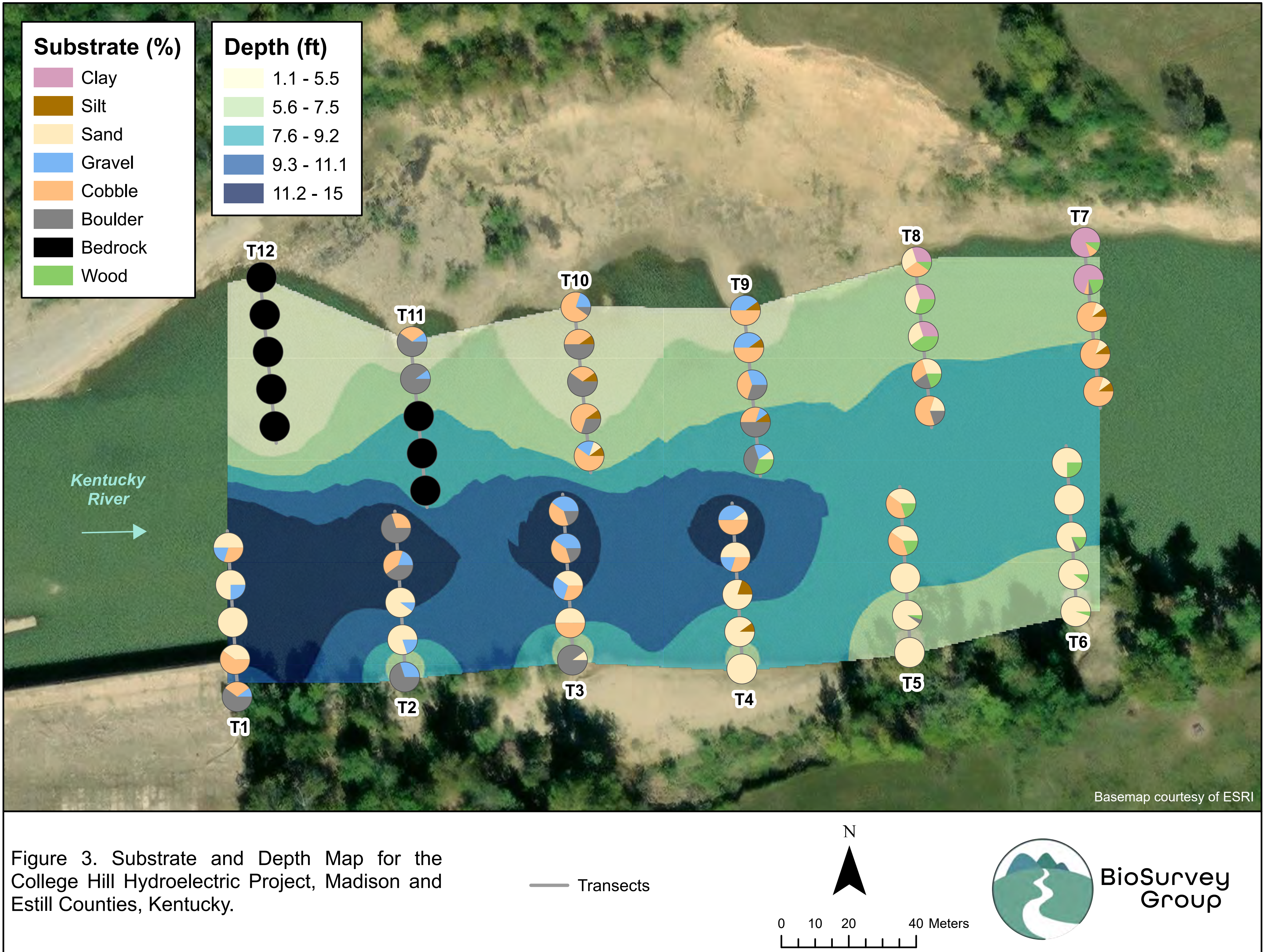


Figure 3. Substrate and Depth Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

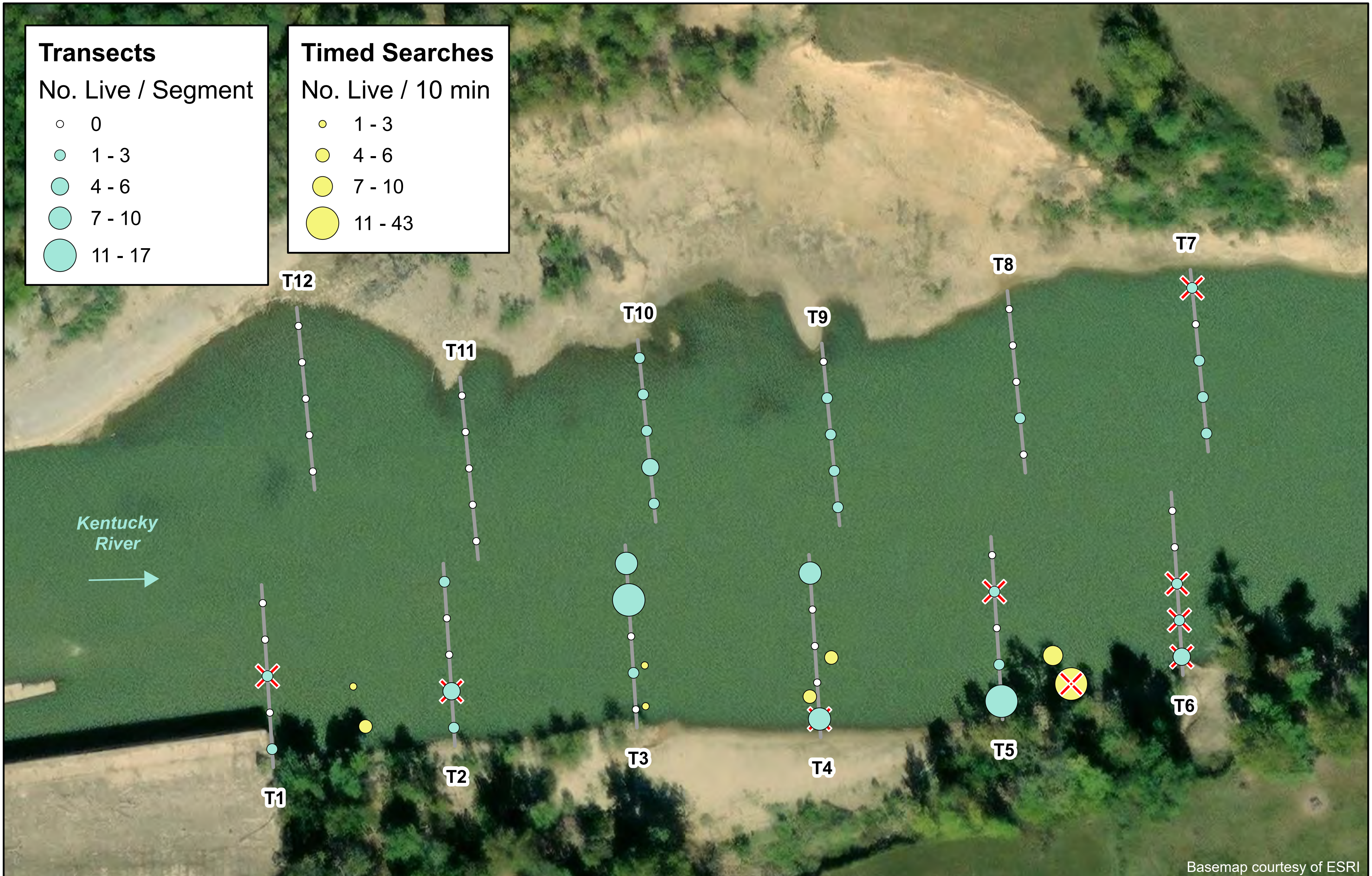


Figure 4. Mussel Abundance Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

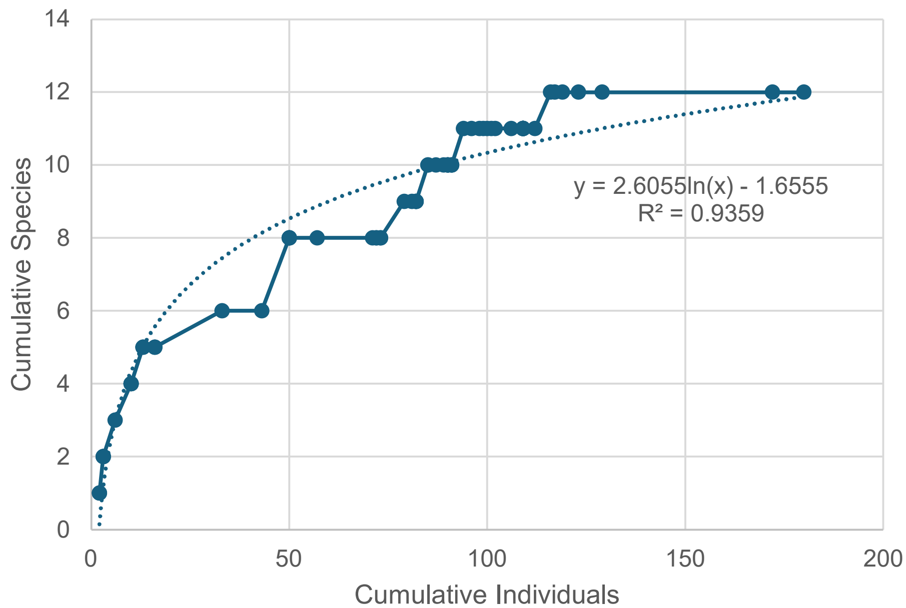
Transects
Federally Listed Species

N

0 10 20 40 Meters

BioSurvey Group

Figure 7. Species Richness Curve for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky



Appendix A

Scientific Collection Permits

Scientific Wildlife Collecting - Fed Protected

SC2411259

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

Effective: **1/1/24**
Expires: **12/31/24**
Fed Permit # ESPER0009122

This permit allows the taking and subsequent possession or release of federally-protected wildlife for the purposes of conducting scientific investigations or evaluations for which remuneration is received.

Regulated by
301 KAR 4:070

Your Scientific Wildlife Collecting - Fed Protected is attached below. Keep top portion for your records

Authorization Number: 9460
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BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

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BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

NATIVE ENDANGERED & THREATENED SP. RECOVERY

Permit Number: ESPER0009122

Version Number: 2

Effective: 2024-04-26 **Expires:** 2027-12-31

Issuing Office:

Department of the Interior

U.S. FISH AND WILDLIFE SERVICE

ES Bloomington Permit Office
5600 American Boulevard, West, Suite 990
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permitsR3ES@fws.gov

Karen Herrington Midwest Region Ecological Services Program Leader	**Digitally signed by** Karen Herrington 2024-04-25 15:27:07

Permittee:

Emily Grossman

21 Fort Zumwalt Dr.

O Fallon, Missouri 63368

U.S.A.

Authority: Statutes and Regulations: 16 U.S.C. 1539 (a), 16 U.S.C. 1533 (d) 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13

Location where authorized activity may be conducted:

ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

Reporting requirements:

DUE ANNUALLY ON 1/31

See permit conditions for reporting requirements

Appendix B
Mussel Survey Photo Log

Digital Image 1. View looking upstream toward Lock and Dam 11 from the middle of the survey area.

Digital Image 2. View looking downstream from the right descending bank.

Digital Image 3. View looking toward the left descending bank from the shoreward end of Transect 1.

Digital Image 4. View looking upstream along the left descending bank.

Digital Image 5. View looking toward the right descending bank of survey efforts on the left descending bank.

Digital Image 6. Representative photo of Mucket (*Actinonaias ligamentina*) collected in the survey.

Digital Image 7. Representative photo of Threeridge (*Amblema plicata*) collected in the survey.

Digital Image 8. Representative photo of Pimpleback (*Cyclonaias pustulosa*) collected in the survey.

Digital Image 9. Representative photo of Butterfly (*Ellipsaria lineolata*) collected in the survey.

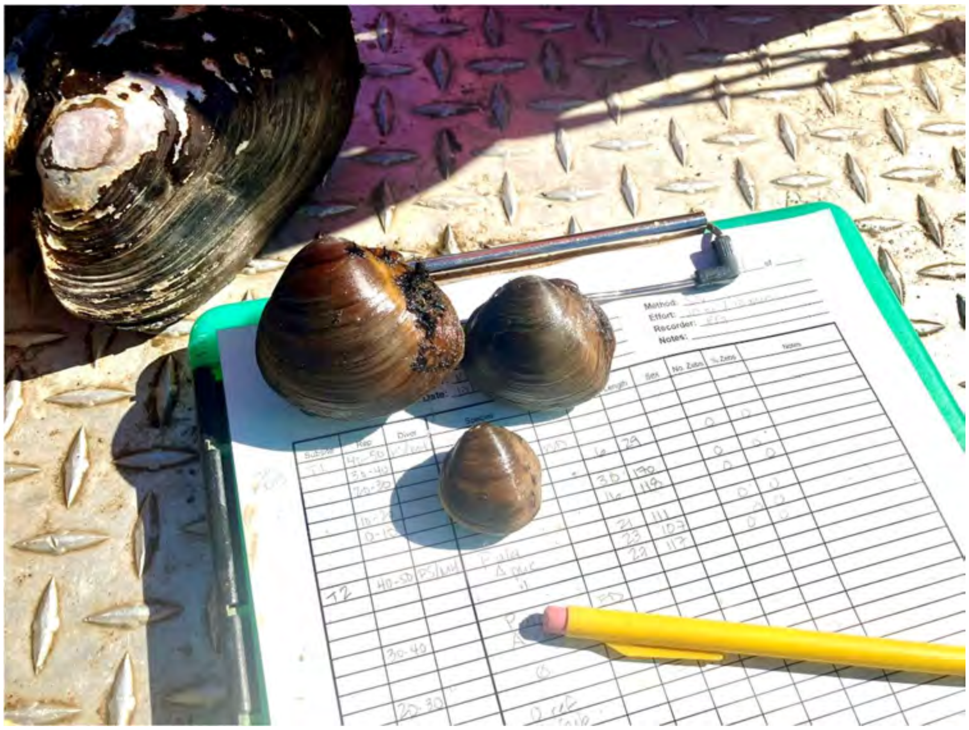
Digital Image 10. Representative photo of Wabash Pigtoe (*Fusconaia flava*) collected in the survey.

Digital Image 11. Representative photo of Fatmucket (*Lampsilis siliquoidea*) collected in the survey.

Digital Image 12. Representative photo of Yellow Sandshell (*Lampsilis teres*) collected in the survey.

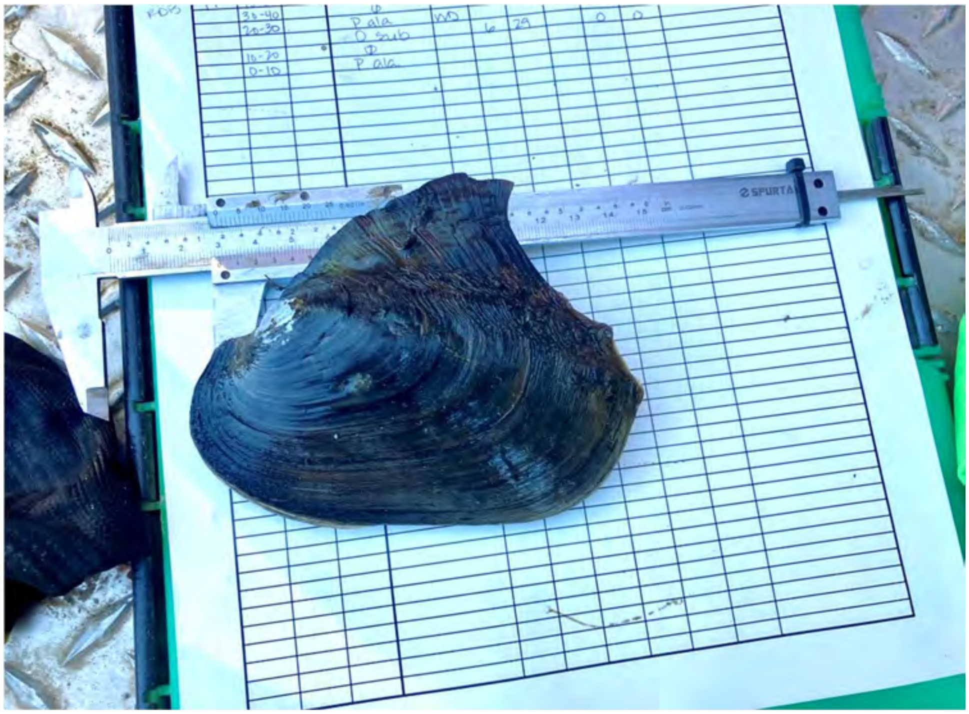
Digital Image 13. Representative photo of Threehorn Wartyback (*Obliquaria reflexa*) collected in the survey.

Digital Image 14. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 15. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.

Digital Image 16. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 17. Representative photo of Pink Heelsplitter (*Potamilus alatus*) collected in the survey.

Digital Image 18. Representative photo of Pink Papershell (*Potamilus ohiensis*) collected in the survey.

Digital Image 19. Representative photo of Mapleleaf (*Quadrula quadrula*) collected in the survey.

Digital Image 20. Representative photo of subfossil Plain Pocketbook (*Lampsilis cardium*) shell collected in the survey.

Digital Image 21. Representative photo of weathered dead Washboard (*Megalonaias nervosa*) shell collected in the survey.

Digital Image 22. Representative photo of weathered dead Sheepnose (*Plethobasus cyphyus*) shell collected in the survey.

Digital Image 23. Representative photo of weathered dead Fawnsfoot (*Truncilla donaciformis*) collected in the survey.

APPENDIX D: TECHNICAL MEMORANDUM – LOCK AND DAM NO. 11 MUSSEL HYDRAULIC REVIEW

TECHNICAL MEMORANDUM

To: Mr. David Brown Kinloch (Appalachian Hydro Associates)

From: Jill L. Davis, P.E. (Kleinschmidt Associates)

Cc: Paul D. Drew, P.E., CFM, Will Pruitt, CE (Kleinschmidt Associates)

Date: January 28, 2025 **Project No.** 1349009.03

Re: Lock and Dam No. 11 – Mussel Hydraulic Review

INTRODUCTION

Appalachian Hydro Associates contracted Kleinschmidt Associates (Kleinschmidt) to perform a hydraulic analysis to evaluate and compare the existing and proposed (post-construction) flow conditions at Lock and Dam No. 11 (Lock No. 11). The U.S. Fish and Wildlife Service (USFWS), upon review of the recent Mussel Survey Report (BioSurvey Group 2024), has three primary concerns regarding the impact from planned operations for the College Hill Hydroelectric Project (Project; FERC Project No. 14276):

1. Changes in flow conditions that would cause dislodgement of existing mussel beds.
2. Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.
3. Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.

This Technical Memorandum documents the development of a hydraulic model and the evaluation of the potential impacts of flow condition changes on federally listed mussel species and their host fish of concern downstream of the proposed Project (see Table 1).

Table 1 Federally Listed Species of Concern Downstream of the Proposed Project

Mussel Species	Host Fish Species
Round Hickorynut (*Obovaria subrotunda*) (17 live found)	Eastern Sand Darter (*Ammocrypta pellucida*)
Sheepnose (*Plethobasus cyphyus*) (1 dead, weathered shell found)	Sauger (*Sander canadensis*)

Elevations listed in this report reference the North American Vertical Datum of 1988 (NAVD 88). The spatial project is in reference to North American Datum of 1983 State Plan Kentucky South FIPS 1602 (feet US).

PROJECT DESCRIPTION

The proposed Project is located at River Mile 201 on the Kentucky River in east-central Kentucky, Madison County, near the Town of College Hill (Latitude 37° 47' 03", Longitude -84° 6' 11"), approximately 28 miles southeast of Frankfort, at Lock No. 11. The Kentucky River flows in a north-northwest direction to discharge into the Ohio River. The existing lock and dam were completed in 1906 by the United States Army Corps of Engineers (USACE) for purposes of navigation. The dam is no longer used for navigation, and use of the lock has been discontinued. In 1996, the USACE placed a concrete bulkhead on the sill of the upstream lock gate to close off the lock, and the downstream miter gates were left in the open position. The dam is currently owned and operated by the Kentucky River Authority, which took ownership from the USACE in March 2006.

The existing water retaining structures at the site span 289 feet between the guide and training walls that form the dam's north and south abutments. The structures develop a gross head of 17 feet between the upper (Elevation [El.] 582.5 feet) and lower pools (low pool condition, El. 565.5 feet). Tailwater from the downstream Lock and Dam No. 10 backs up against the dam. The passive spillway is 208 feet long, with a crest at El. 582.5 feet and a maximum height of approximately 35 feet above the foundation rock. The spillway is a concrete gravity structure, with an apron constructed of derrick stone that extends nearly 42 feet downstream of the spillway.

HYDRAULIC MODEL DEVELOPMENT

MODEL COMPUTATIONAL SETTING AND FLOW SCENARIOS

Kleinschmidt developed a two-dimensional (2D) hydraulic model using the USACE Hydraulic Engineering Center's River Analysis Software (HEC-RAS) version 6.4.1 to evaluate existing and proposed flow conditions for the Project. The model domain extends approximately 1,000 feet upstream of the Lock No. 11 spillway and 1,500 feet downstream.

The 2D model uses an unstructured computational mesh that allows computation cells with up to eight sides and a mixture of cell shapes and sizes. Each computation cell and cell face are based on the details of the underlying terrain to develop the geometric and hydraulic property tables for the flow simulations. Using RAS Mapper, one computation mesh was generated that covered the domain of the study area. The model existing conditions domain was developed using a 15-foot by 15-foot initial mesh square. The mesh was refined with several break lines to define the centerline, channel banks, hydraulic structures, and other pertinent features within the model domain. The resulting domain consists of 7,709 cells with maximum, minimum, and average cell areas equal to 4,257, 63, and 337 square feet, respectively. The proposed conditions domain used a

duplicate of the existing conditions domain, with modifications as necessary. The 2D model geometry is illustrated in Attachment 1.

The upstream boundary condition for the model was defined as a constant flow hydrograph for six flow scenarios summarized in Table 2. The downstream boundary condition was set as a rating curve using tailwater elevations developed using the one-dimensional (1D) HEC-RAS model (Kleinschmidt 2024a). The 1D HEC-RAS model uses a rating curve at the downstream Lock No. 10 spillway calibrated to flow and gage heights at U.S. Geological Survey (USGS) Gage No. 03284000 located in the Lock No. 10 headpond. Model calibration results are provided in Attachment 2. The hydraulic model was performed using the Full Momentum Shallow Water Equations with a 0.5-second timestep.

Table 2 HEC-RAS Model Scenarios

Model Scenario	Description	Flow (cfs*)
Existing Conditions		
1	Normal Flow – proposed maximum turbine capacity	2,636
2	Maximum Spillway Capacity – 20,000 cfs over the spillway only	20,000
3	Mean Annual Peak Flow (~2.3 Annual Exceedance Probability)	45,233
Proposed Conditions		
4	Maximum Turbine Capacity – maximum Project capacity before water spills over spillway	2,636
5	Maximum Spillway Capacity – 2,636 through Project; 17,364 over spillway	20,000
6	Mean Annual Peak Flow – bladder for Project lowered	45,233

* cfs = cubic feet per second

MODEL TERRAIN

The model terrain was developed using GIS and RAS Mapper (within HEC-RAS) from a combination of digital elevation models, depth sounding, and other hydraulic models. All elevation data were referenced with respect to NAVD88. The following is a comprehensive summary of data sources:

- Kentucky Light Detection and Ranging: KYFromAbove, 5-foot resolution.
- The mussel survey conducted by BioSurvey Group on October 7, 2024, included depth measurements from 12 transects (BioSurvey Group 2024). Depths were converted to elevations based on water surface elevation recorded by USGS Gage

No. 03284000 near the Lock No. 10 headpond. *Note that at low flows, the Lock No. 11 tailwater is approximately equivalent to the normal headwater elevation at Lock No. 10.*

- Upstream of the mussel survey area, channel elevations were estimated using data from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) reports for Madison and Estill counties (FEMA 2011, 2017).
- Downstream of the mussel survey area, the bathymetric surface was created using cross-sections from the effective FEMA 1D HEC-RAS model.
- Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b).

MANNING'S ROUGHNESS COEFFICIENTS (N)

The Manning's roughness coefficients (*n*) used in the model were selected based on guidance from the USACE *HEC-RAS 2D User's Manual* (USACE 2024), values reported in the FEMA FIS, and engineering judgement. Land cover regions were determined through a review of aerial imagery and manually assigned (Google 2024). The selected Manning's roughness coefficients (*n*) are summarized in Table 3.

Table 3 Manning's Roughness Coefficients (*n*)

Land Cover Type	Manning's Roughness Coefficient (*n*)
Channel	0.045
Lock	0.045
Forest	0.120
Overbanks	0.070
Pasture	0.040
Barren	0.040
Concrete	0.016

STRUCTURES

The spillway dimensions for both scenarios referenced Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b). The spillway was represented in the model as a single storage-area/2D (SA/2D) connection with a weir coefficient of 3.0. The predicted model headwater elevations were compared to the USGS gage data for each flow scenario to calibrate the weir coefficient. In the existing conditions, the upstream lock gates were assumed to remain closed during all flow scenarios. A comparison between predicted model headwater elevation and USGS gage data are provided in Attachment 2.

Proposed conditions incorporate a maintenance rubber bladder at the upstream end of the lock and an operational bladder located above the turbines. For all scenarios, the emergency bladder was fully deflated (572.5 feet). The operational bladder elevation was varied for different flow scenarios.

- In the lowest flow proposed scenario, the operational bladder is fully inflated (592.5 feet) with the turbines operating at maximum capacity (2,636 cfs), with all inflows passing through the turbines.
- In higher flow scenarios, turbines are non-operational, passing no flow, and the operational bladder is fully deflated (577.5 feet).

HYDRAULIC MODEL RESULTS

Reporting locations were selected based on mussel sampling transects in the BioSurvey report (BioSurvey Group 2024), combining collinear transects. The flood routing results at select transects are summarized in Table 4.

The model results indicate varying changes in peak velocity across different flow conditions and transects:

- The largest increase in velocity occurs at Transect 1 (immediately downstream of the lock structure) in all flow conditions (2.0 during normal flow and 0.5 feet per second [fps] during mean annual peak flow).
- **Normal Flow:** Maximum velocity increases at all transects. Under these conditions, the flow, which was previously distributed across the spillway, is now constrained to pass through the lock with a smaller cross-sectional area, leading to a relatively small (0.1 to 2.0 fps) increase in peak velocity.
- **Maximum Spillway Capacity:** In this scenario, the greatest change is an increase of 0.1 cfs at Transect 1; however, at all other transects, velocity decreases. This is due to flow passing through both the spillway and lock in the proposed condition, which allows flow to be more evenly distributed across the channel instead of only across the spillway.
- **Mean Annual Peak Flow:** At Transect 1, velocity increases by 0.5 fps, but at the remaining transects, there is little to no change. This proposed condition is most like the existing condition, where flow is distributed across both the spillway and the lock, with water overtopping both structures.

In addition to changes in velocity at each transect, flow patterns change between the existing and proposed conditions. Figure 1 through Figure 6 present plan views of velocity results at the transect locations, incorporating particle tracing to illustrate flow direction.

Under normal flow conditions, distinct differences are observed between existing and proposed conditions. In the existing conditions, flow within the main channel moves directly downstream. However, under the proposed conditions, the concentration of flow from the powerhouse outlet, combined with the absence of flow from the spillway, results in a zone of relatively low velocities directly downstream of the spillway. Additionally, a large eddy forms on the left side of the river between Transects 1 and 4.

Under maximum spillway capacity and mean annual flow conditions, flow patterns exhibit minimal changes. In both existing and proposed conditions, flow within the main channel continues to move directly downstream, with no significant alterations to flow direction or velocity distribution.

Table 4 Flood Routing Results

Reporting Location	Flow (cfs)*	Maximum Existing (fps)	Maximum Proposed (fps)	Velocity Change (fps)
Location 1	2,636	0.9	2.9	2.0
	20,000	3.1	3.2	0.1
	45,233	4.2	4.7	0.5
Location 2	2,636	0.8	2.0	1.2
	20,000	2.9	2.8	-0.1
	45,233	3.9	3.9	0.1
Location 3	2,636	0.8	1.6	0.8
	20,000	2.7	2.4	-0.3
	45,233	3.7	3.6	-0.1
Location 4	2,636	0.7	1.2	0.5
	20,000	2.5	2.1	-0.4
	45,233	3.5	3.5	0.0
Location 5	2,636	0.8	1.1	0.3
	20,000	2.5	2.2	-0.3
	45,233	3.4	3.5	0.1
Location 6	2,636	0.9	1.0	0.1
	20,000	2.6	2.5	-0.1
	45,233	3.5	3.6	0.1

* Flows of 2,636, 20,000, and 45,233 cfs correspond to the "Normal Flow," "Maximum Spillway Capacity," and "Mean Annual Peak Flow" flow scenarios, respectively.

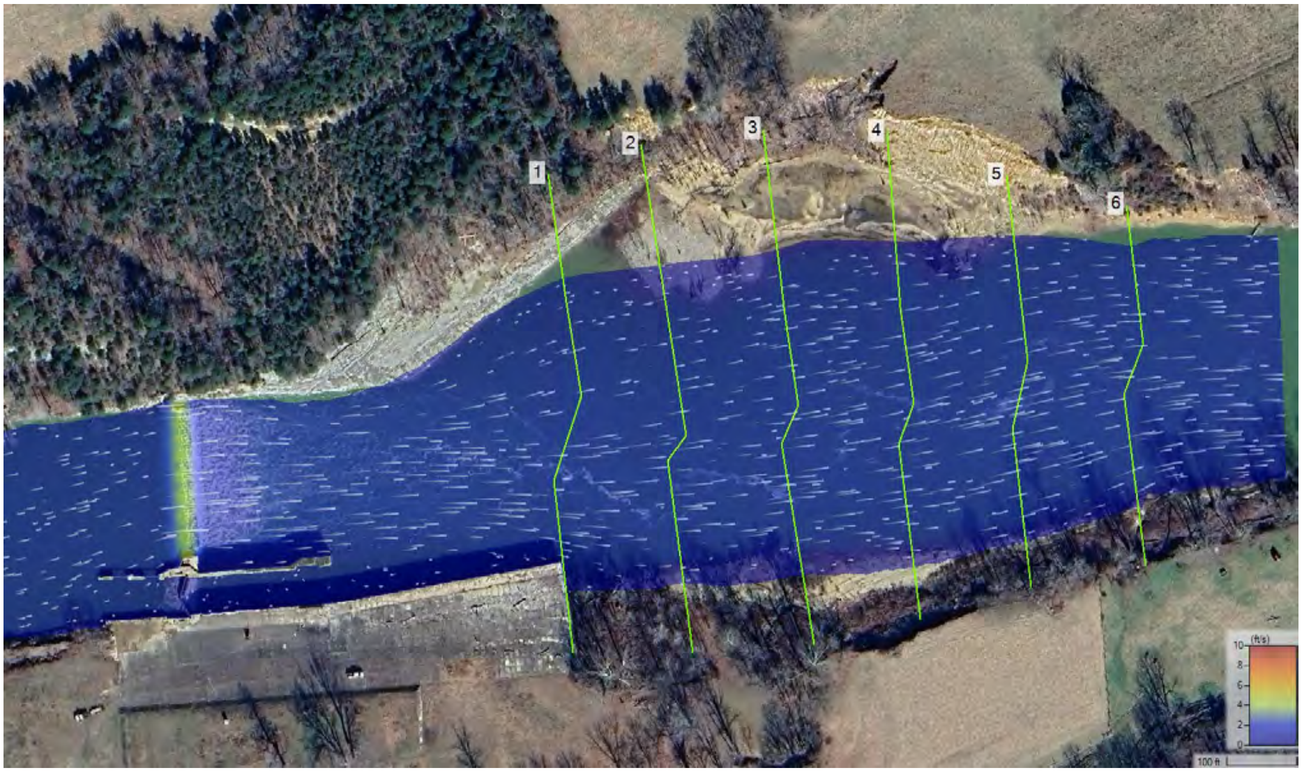


Figure 1 Existing Conditions Normal Flow

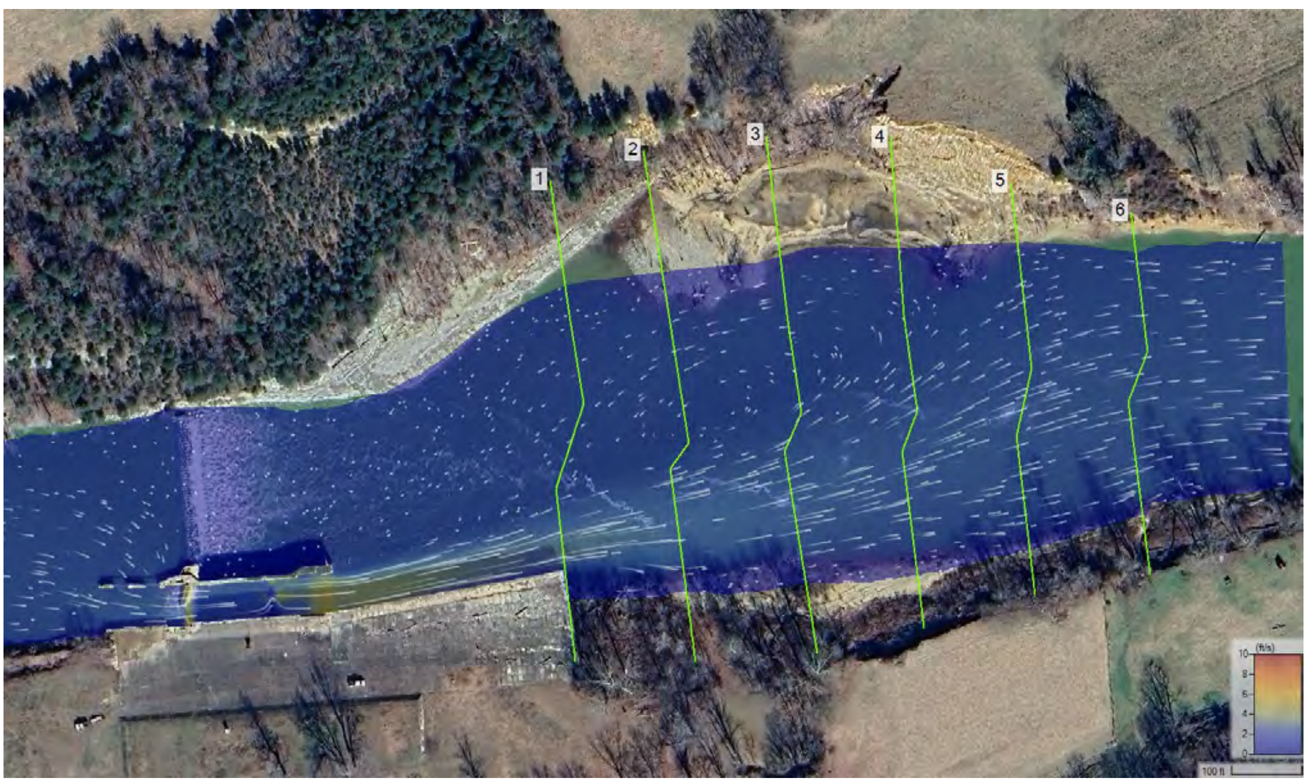


Figure 2 Proposed Conditions Normal Flow

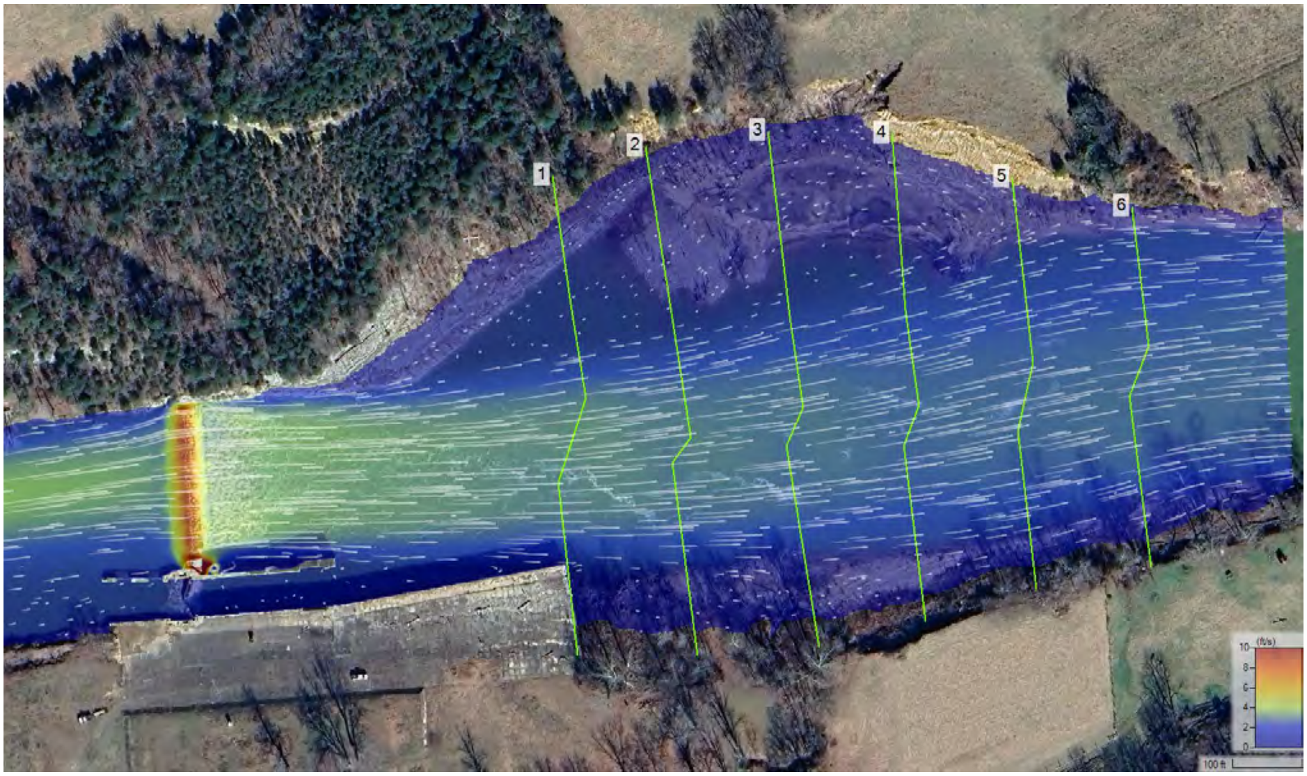


Figure 3 Existing Conditions Maximum Spillway Capacity Flow

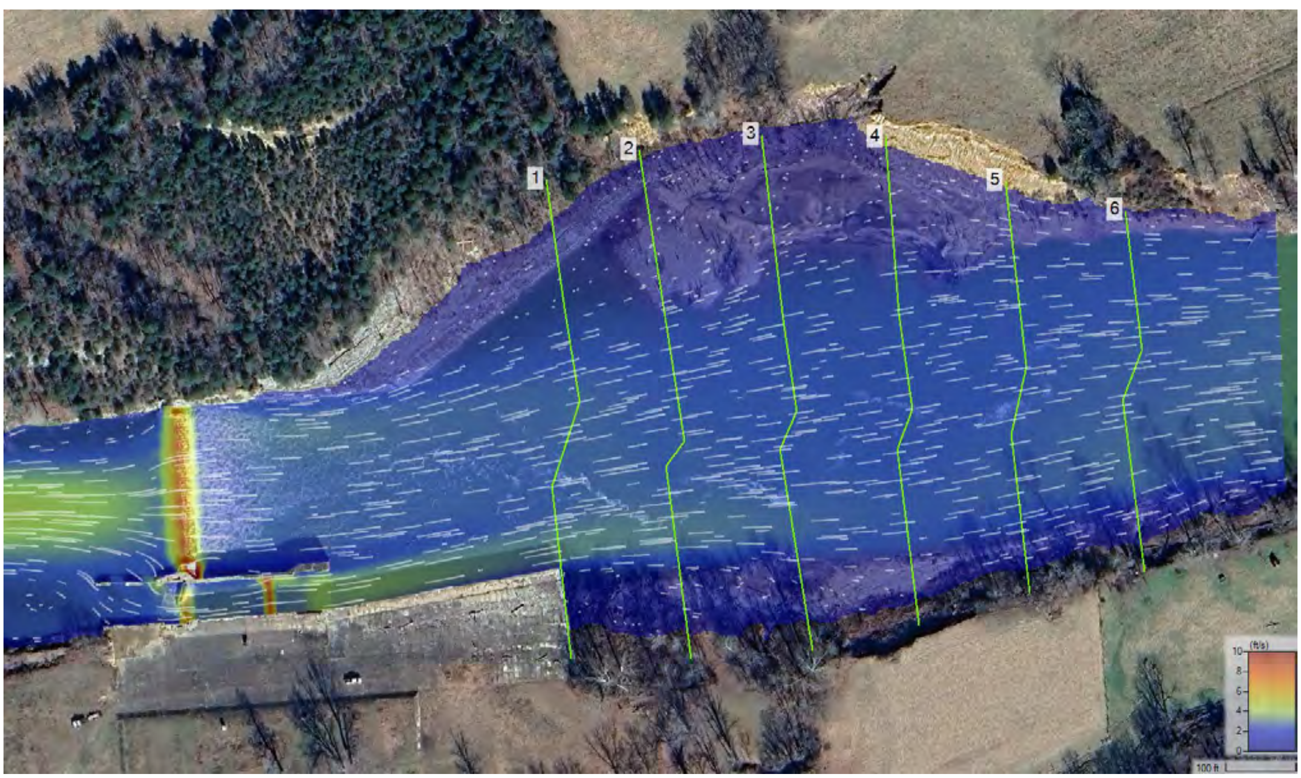


Figure 4 Proposed Conditions Maximum Spillway Capacity Flow

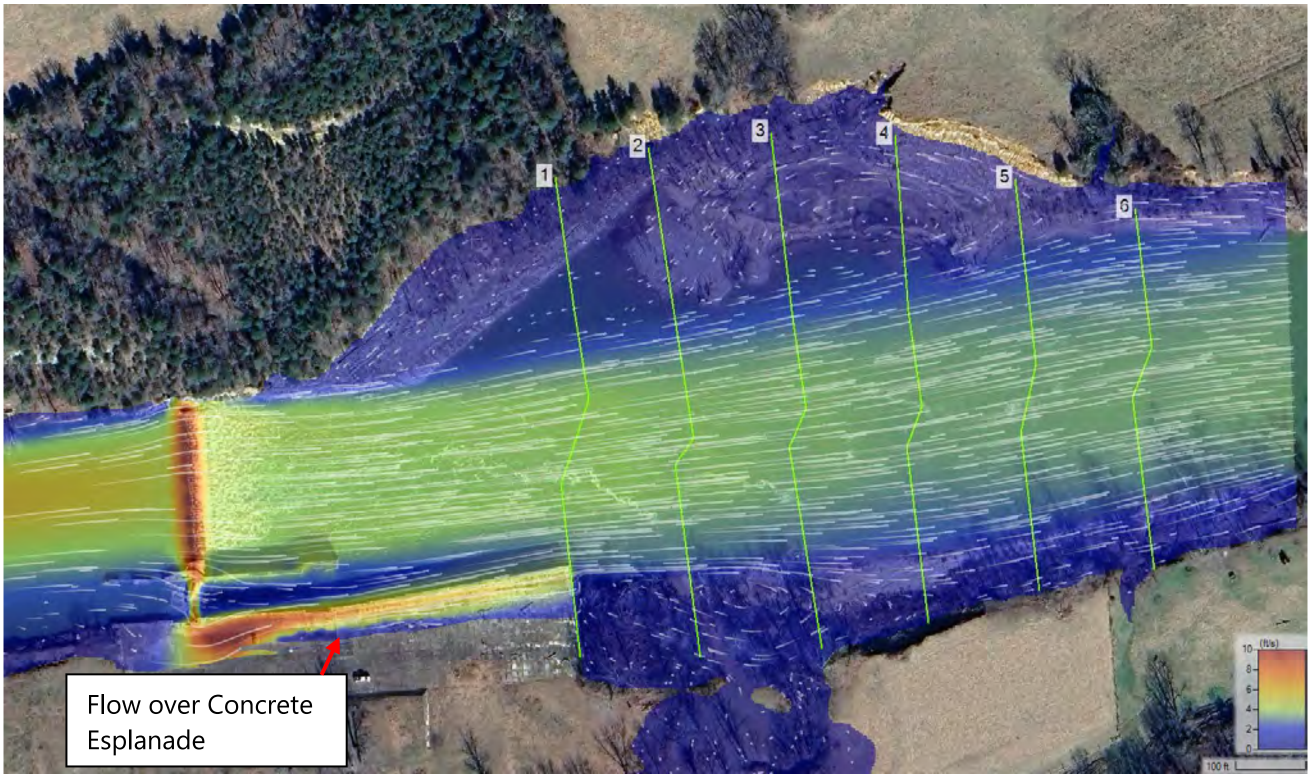


Figure 5 Existing Conditions Mean Annual Peak Flow

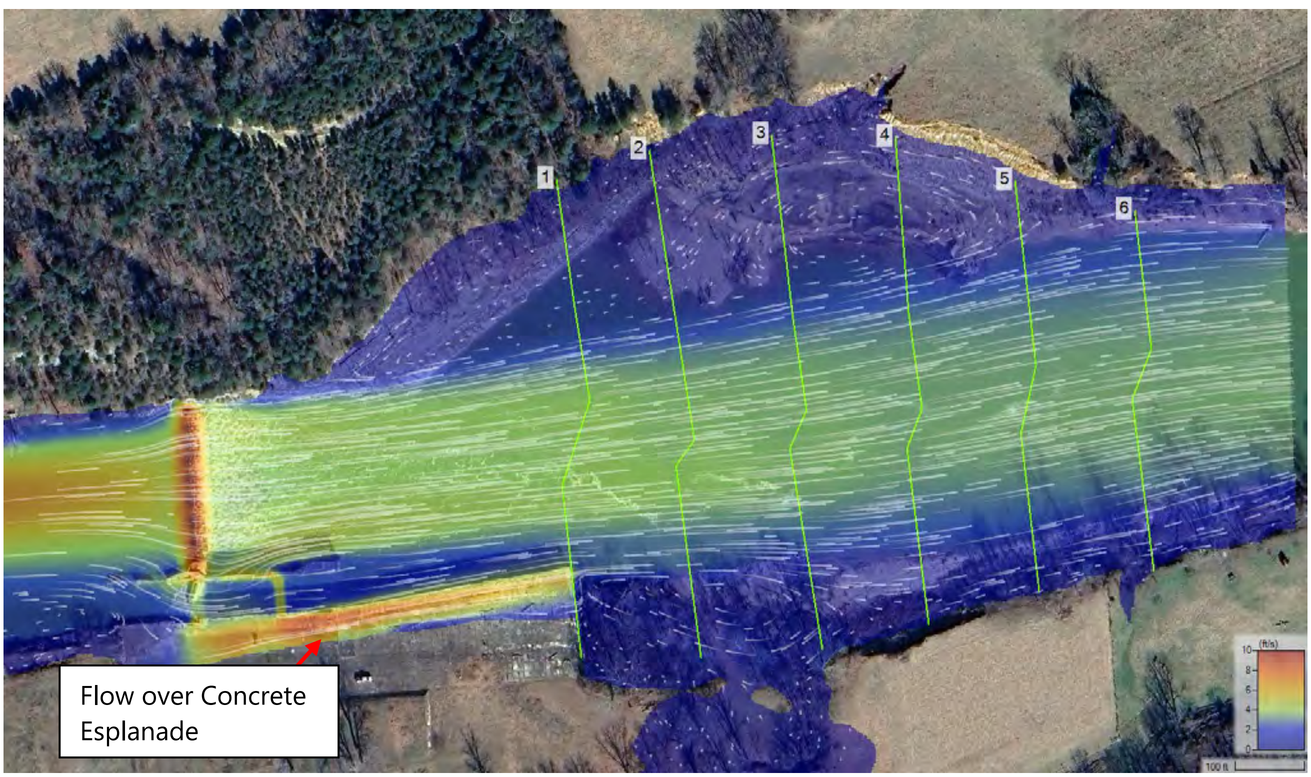


Figure 6 Proposed Conditions Mean Annual Peak Flow

MUSSEL IMPACT REVIEW

Freshwater mussel populations' susceptibility to environmental changes such as habitat fragmentation and alterations in flow regimes from dam construction and hydropower operations have been well-documented. Large-scale alteration in flow regimes, such as the series of locks and dams along the Kentucky River, had population-level effects on mussels, resulting in the listing of several species of concern. Although these past actions along the Kentucky River have altered the aquatic community throughout the basin over the last century, the focus of this discussion is at a much finer geographic scale (i.e., the potential change in hydraulic conditions at Lock No. 11 and potential effects on the mussel community). Specifically, the mussel species of concern include Round Hickorynut and Sheepnose.

As mentioned in the hydraulic model results above, the expected maximum change in peak depth-averaged velocity between existing and proposed conditions across each location/mussel transect is negligible in most flow scenarios. The most noticeable differences between existing and proposed conditions can be seen during the Normal Flow (2,636 cfs) scenario (Table 4, Figure 1, and Figure 2). In the Normal Flow scenario, most locations are not expected to have a noticeable change in peak depth-averaged velocity. However, Location 1 and Location 2 are expected to experience a 2.0 fps and a 1.2 fps change in water velocity under the proposed conditions, respectively (Table 4). In existing conditions, water is prevented from entering the lock structure, and all flow is routed over the existing spillway over a wide cross-sectional area. This allows more uniform dispersal of flows across the river channel. Conversely, under proposed conditions at normal flows, all water will be routed through the proposed powerhouse and discharged at the outlet of the existing lock structure. This creates an area of increased water velocities at the edge of the concrete esplanade at the right descending bank at Location 1 as water exits the existing lock structure (Figure 2). Continuing downstream, flow patterns begin to distribute across the river channel through Locations 3 and 4 and begin to resume "normal" flow patterns across Locations 5 and 6 and exiting the survey reach. Another potential change in flow pattern under the Normal Flow scenario includes the creation of an eddy along the left bank during base flow conditions. This eddy may allow fine sediments to settle when normal flows resume post-high event. The area is predominately bedrock substrates and generally unsuitable for mussels.

For proposed conditions, increased water velocity in Locations 1 and 2 (i.e., a maximum depth-averaged velocity of 2 fps) and change to flow patterns under Normal Flow scenario have the potential to affect the mussels in the immediate vicinity. The area at the outlet of the existing lock structure is expected to be most affected. Coincidentally, this is also the deepest part of the river that contains boulder, cobble, and gravel substrates. The water column depth and coarse substrate types are likely the result of this area continually

receiving the majority of discharge during high-water events. As such, these coarse substrates are not expected to scour under the proposed normal flow conditions. Some sand is present in Location 1, which may potentially be mobilized once the proposed project is in full operation, ultimately leaving more coarse substrates (i.e., boulder, cobble, and gravel) behind, as seen in Locations 2 and 3. However, this potential change is expected to be a one-time occurrence until a new equilibrium is reached.

In the Maximum Spillway Capacity (20,000 cfs) scenario (Figure 3 and Figure 4), there are some slight variations in flow patterns between existing and proposed conditions. This is the result of the modeled flows passing both through the powerhouse/lock structure and over the existing spillway. Although there may be a slight increase in water velocity exiting the lock in proposed conditions, the flow distribution across the river channel is relatively uniform and is not expected to affect substrates and in-river habitat conditions. Further, the flow of approximately 20,000 cfs occurs annually if not more frequently during the winter and springs months. As a result, there are no anticipated risks of mussel dislodgement or scouring of habitats, smothering of existing mussel beds, or alterations of habitats for fish hosts (i.e., Eastern Sand Darter and Sauger).

In the Mean Annual Peak Flow (45,233 cfs) scenario (Figure 5 and Figure 6), there is virtually no change in expected flow dynamics between existing and proposed conditions. The design and operation of the proposed gates would allow flows over the top of the turbine and through the lock structure during the Mean Annual Peak Flow. Because changes in flow pattern are essentially imperceivable, there are no anticipated impacts to mussels, their habitats, or host fishes in the Mean Annual Peak Flow proposed conditions.

It is important to understand the limitations of the modeling exercise and its 2D approach. As it stands, the existing model can produce a peak depth-averaged water velocity. Because this model is not three-dimensional, the expected velocities at various depths cannot be estimated. As such, the model cannot predict changes in velocities at the surface versus velocities at the substrate.

REVIEW SUMMARY

Based on the results of the hydraulic model and the evaluation of the potential impacts of these flow condition changes on the federally listed mussel species and their host fish of concern, the responses to the USFWS three primary concerns are as follows:

1. *Changes in flow conditions that would cause dislodgement of existing mussel beds.*

   During the Normal Flow scenario, flow conditions are expected to change at Locations 1 and 2. However, due to the existing depth and coarse substrate types, the expected increase in water velocity is unlikely to dislodge existing mussel beds

when compared to the yearly flow velocity changes that already exist. An important consideration when examining potential project effects are the flow conditions and river fluctuations that are currently experienced. This reach of the river frequently experiences flashy flows, particularly in the winter and spring months. As observed within the Mean Peak Flow scenario under existing conditions, water velocities increase 4.2 fps in Location 1 compared to the Normal Flow scenario. These flows pose a greater risk to mussel dislodgment than the expected increase of 2.0 fps at Normal Flow once the hydropower facility is in operation. In summary, the risk of mussel dislodgement and the movement of sediment occurs during high-flow events, which frequently happen under existing conditions. Under the proposed conditions, there is no observable difference in flow condition during the Mean Peak Annual Flow and is not likely to increase the risk of dislodgment that the existing mussel community currently faces. However, the substrates between Lock No. 11 and Location 1, presumed to be finer sediments, may potentially shift to coarser types after project implementation. This is due to the increased water velocity keeping the substrates in this deeper channel free of finer sediments, which is expected to stabilize post-project operation.

2. *Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.*

   The sandy areas between Lock No. 11 and Location 1 (approximately 200-foot-long reach along the right bank) will likely be mobilized once power generation is online. This movement of substrates is expected to be a one-time occurrence until a new equilibrium is reached post-project implementation. Any mobilized soft sediments are expected to settle within or immediately downstream of the assessment area. Therefore, while initial scour and sediment deposition may occur, the volume is not expected to smother the mussel beds. The volume of sediment is not expected to exceed what is naturally scoured, transported, and deposited annually as the river continually fluctuates between base flow and peak flow conditions. As stated in Item 1 above, the risk of sediment scour or deposition is greatest during high-flow conditions and is not tied to the hydropower operations.

3. *Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.*

   Although some flow patterns are expected at the Project location during normal flow conditions at Locations 1 and 2, the changes in water velocity and flow patterns are not expected to alter habitats in a way that would affect the presence of known or potential fish host species.

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ATTACHMENT 1

HEC-RAS MODEL GEOMETRY

ATTACHMENT 2

MODEL CALIBRATION RESULTS

RECORD OF REVIEWS

For internal purposes only. The following table is maintained within MS Word and removed prior to client submission via PDF.

Revision[1]	Document Team	Initials	Date	Notes
A	Author(s):	CAK & WAP	1/16/25	For AHA Review
	Reviewer(s):	PDD	1/16/25	
	TE:	LL	1/20/25	
	Approver(s):	JLD	1/17/25	
	PC:	SCB	1/17/25	
0	Author(s):	CAK & WAP	1/27/25	Finalized, AHA will share w/ USFWS
	Reviewer(s):	PDD	1/25/25	
	TE:	n/a	n/a	
	Approver(s):	JLD	1/28/25	
	PC:	SCB	1/28/25	
	Author(s):			
	Reviewer(s):			
	TE:			
	Approver(s):			
	PC:			
	Author(s):			
	Reviewer(s):			
	TE:			
	Approver(s):			
	PC:			

[1] *Letters (A, B, etc.) indicate internal revisions or draft versions sent to client for review. Numbers (0, 1, 2, etc.) are the final versions that go to the client.* ***If*** *revision logs are sent to the client, include draft internal revisions until Rev. 0 is sent; at Rev. 0, the client log should not include internal or draft revisions. The Kleinschmidt Word version should track these.*

APPENDIX E: USFWS BIOLOGICAL OPINION and INFORMAL CONSULTATION LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

May 27, 2025

Joseph Ranson
U.S. Department of Agriculture
Rural Utilities Service
1400 Independence Ave SW, Room 4121
Stop 1510
Washington, DC 20250

Subject: FWS 2024-0023535; Kentucky River Lock and Dam #11 Hydroelectric Project; Estill and Madison Counties, Kentucky

Dear Joseph Ranson:

The U.S. Fish and Wildlife Service's (Service) Kentucky Field Office (KFO) reviewed the Biological Assessment (BA) and request for formal consultation regarding three mussel species and informal consultation regarding additional bat, plant, and one federally proposed mussel species received by our office on April 3, 2025. A Biological Opinion regarding the three mussel species will be issued along with this informal consultation letter.

The U.S. Department of Agriculture (USDA) Rural Utilities Service (RUS) is proposing to authorize financial assistance associated with the installation of a hydroelectric facility in an existing lock and dam structure in Estill and Madison Counties, Kentucky. The KFO offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Project Description

The proposed project would be located at Lock and Dam Number 11 at river mile (RM) 201.0 on the Kentucky River. Lock and Dam Number 11 is owned by the Commonwealth of Kentucky and operated by the Kentucky River Authority (KRA) for water supply. The existing 208-foot-long fixed crest concrete dam has a 148-foot-long by 52-foot-wide lock chamber. The 482-acre reservoir provides approximately 4,820 acre-feet of storage and only operates at run-of-river levels (i.e., does not draw water from below its crest). The existing lock chamber of the structure is abandoned, and a concrete bulkhead has been placed in the lock chamber, below the upper miter gates, to prevent failure and loss of pool.

Lock 11 Hydro partners would remove the concrete bulkhead and construct a 28.4-foot by 52-foot by 49.5-foot steel and reinforced concrete powerhouse. A 58-foot by 52-foot horizontal trash rack would be installed to sit three feet below the normal pool level from the lock chamber upper sill to the back wall of the powerhouse. An inflatable rubber dam would be installed on top of the powerhouse wall to maintain the pool during normal operating conditions.

Lock 11 Hydro Partners would install four 642-kW Voith 14.9 and two 222-kW Voith 8.95 StreamDiver turbine-generators into the existing lock chamber of Lock and Dam Number 11. These submersible units directly couple permanent magnet generators with turbines, eliminating the need for a gearbox and associated oil lubrication. A prefabricated-steel and reinforced 42-foot by 20-foot by 28-foot concrete control building would be installed atop a concrete foundation at the edge of the existing concrete esplanade and would be connected to the powerhouse via an underground cable trench. The control building would house the switchgear, controls, transformers, and the main circuit breaker for the plant. The control building would be interconnected to the existing 15-kV overhead distribution line which runs to the site from Madison County, which will be re-conductored to three-phase. No tree clearing is proposed.

Federally Listed Species
The USDA has determined that the proposed project would have “no effect” on the gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and short’s bladderpod (*Physaria globosa*). There is no requirement to request concurrence with a “no effect” determination; however, the KFO acknowledges this determination and has no additional comments or concerns regarding these species. The USDA has also determined that the proposed project “may affect, and likely to adversely affect” the round hickorynut (*Obovaria subrotunda*), sheepnose (*Plethobasus cyphyus*), and snuffbox mussel (*Epioblasma triquetra*). As previously mentioned, these three mussel species are addressed in a Biological Opinion issued along with this informal consultation letter, as a result, these species will not be addressed further in this letter.

Federally Proposed Species
The USDA has determined that the proposed project has the potential to affect the federally proposed endangered salamander mussel (*Simpsonaias ambigua*). A mussel survey was performed by BioSurvey Group on October 7 - 8, 2024.

<u>Salamander Mussel</u>
A total of 109 mussels were detected during the mussel survey, representing 11 species. Threeridge (*Amblema plicata*; 47.7%) was the most dominant species, followed by pink heelsplitter (*Potamilus alatus*; 26.6%) and the federally threatened round hickorynut (11.0%). Four additional species were represented by dead shell material only, including a weathered dead federally endangered Sheepnose (*Plethobasus cyphyus*). Catch per unit effort (CPUE) was 0.19 mussels per minute of search time. No salamander mussel individuals were found alive or as relic shell material.

Variable habitat conditions were encountered throughout the survey area. Substrate on the right descending bank was primarily sand, though some coarse material (boulder/cobble/gravel) was present along the bank on Transects 1 - 3 and at the far riverward ends of some transects. In contrast, substrate along Transects 7 – 10 on the left descending bank was primarily coarse gravel, cobble, and boulder, and substrate along Transects 11 – 12 was almost exclusively bedrock. Depths ranged from approximately 1 ft (0.3 m) near the bank to a maximum of 15 ft (4.6 m) along Transect 1, with deeper depths generally occurring on the right descending half of the channel.

The salamander mussel is the only mussel known to specializes in an amphibian host, the mudpuppy (*Necturus maculosus*); therefore, it is typically found in mudpuppy habitats such as under large, flat, unembedded rocks, often in deep water and/or slow-moving currents. The mussel survey found large boulders along with fine sediments suggesting the large boulders are somewhat embedded, unsuitable for the species. Additionally, most of the course material was found in swift current not frequented by its host, the mudpuppy. Given the species was not found alive or as dead shell material and the habitat appears unsuitable for its host, the KFO considers impacts to this species as insignificant. As a result, the KFO agrees that the proposed project "may affect, but is not likely to adversely affect" the salamander mussel.

Summary

The USDA has determined that the proposed project would have "no effect" on the gray bat, Indiana bat, northern long-eared bat, Virginia big-eared bat, and the short's bladderpod. The KFO agrees that the proposed action "may affect, but is not likely to adversely affect" the federally proposed salamander mussel. In view of these findings, we believe that the section 7 requirements of the Endangered Species Act for this project are fulfilled. The USDA should reconsider its section 7 obligation, if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities that were not considered during this consultation, or (3) new species are listed or critical habitat is designated.

We appreciate the opportunity to review the proposed project. If you have any questions, please contact Taylor Fagin of my staff at taylor_fagin@fws.gov.

Sincerely,

Joshua Lillpop
Acting Field Supervisor

Kentucky River Lock and Dam # 11 Hydroelectric Dam Project

Biological Opinion on the Round Hickorynut (*Obovaria subrotunda*) Sheepnose (*Plethobasus cyphyus*), and Snuffbox (*Epioblasma triquetra*)

FWS #: 2024-0023535

Prepared by:

U.S. Fish and Wildlife Service
Southeast Region
1875 Century Boulevard
Atlanta, GA 30345

May 27, 2025

Joshua Lillpop
Acting Field Supervisor

Date

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CONSULTATION HISTORY

This section lists key events and correspondence during the course of this consultation. A complete administrative record of this consultation is on file in the U.S. Fish and Wildlife Service's (Service) Kentucky Field Office (KFO).

July 29, 2024: The United States Department of Agriculture **(**USDA) Rural Utilities Service (RUS) submitted an informal consultation request to the Kentucky Field Office for review and concurrence regarding the construction of a hydropower facility in an existing lock and dam structure on the Kentucky River.

September 9, 2024: The KFO reviewed and submitted a follow-up request for additional mussel habitat information.

October 31, 2024: A mussel survey report was provided to the KFO detailing the finding that 17 live federally threatened round hickorynut individuals and one recently dead/weathered dead federally endangered sheepnose individual was found immediately downstream of the existing dam.

November 8, 2024: USDA hosted a meeting with the KFO, ICF International, Inc. (ICF) and Appalachian Hydro Associates to discuss the results of the mussel survey report. Appalachian Hydro Associates suggested they perform a hydraulic analysis of the area to determine the scope of impacts.

February 18, 2025: USDA hosted a meeting with the KFO, ICF, Appalachian Hydro Associates, and Kleinschmidt Associates (Kleinschmidt) to discuss the results of a hydraulic analysis conducted by Kleinschmidt. Based on these results, USDA determined the project could adversely affect listed mussel species.

April 4, 2025: On behalf of the USDA, ICF provided a final draft BA to the KFO for review and comment. The KFO had no additional comments.

April 7, 2025: The USDA submitted the final BA to the KFO that determined the proposed action "may affect and is likely to adversely affect" the round hickorynut (*Obovaria subrotunda*), sheepnose (*Plethobasus cyphyus*), and snuffbox mussel (*Epioblasma triquetra*). The USDA requested initiation of formal consultation on the round hickorynut, sheepnose, and snuffbox.

The USDA also determined that the proposed action would have "no effect" on the gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and short's bladderpod (*Physaria globosa*) and a "may affect, but is not likely to adversely affect" the salamander mussel (*Simpsonaias ambigua*). Potential adverse effects to these species would be addressed under a separate consultation process.

April 28, 2025: The KFO concurred that the proposed action "may affect, and is likely to adversely affect" the round hickorynut, sheepnose, and snuffbox mussel.

May 05, 2025: The KFO provided a draft biological opinion (BO) to the USDA for review and comment.

May 20, 2025: The USDA provided comments on the draft BO and the KFO incorporated those comments.

May 27, 2025: The final BO was provided to the USDA.

BIOLOGICAL OPINION AND CONFERENCE OPINION

INTRODUCTION

A biological opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) under the Endangered Species Act of 1973, as amended (ESA), as to whether a federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened, or
b) result in the destruction or adverse modification of designated critical habitat.

The United States Department of Agriculture (USDA) Rural Development's Rural Utilities Service proposes financial assistance for the installation of turbines in the Kentucky River at Lock and Dam #11 (KRLD11) to generate hydropower (the Action). A BO that concludes a proposed Federal action is not likely to jeopardize the continued existence of listed species and is not likely to result in the destruction or adverse modification of critical habitat fulfills the Federal agency's responsibilities under §7(a)(2) of the ESA. "Jeopardize the continued existence means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02). "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR §402.02). There is no designated critical habitat within the Action Area, therefore, this BO does not address critical habitat.

1.0 PROPOSED ACTION

The proposed project would be located at KRLD11 at river mile (RM) 201.0 on the Kentucky River (Figure 1). KRLD11 is owned by the Commonwealth of Kentucky and operated by the Kentucky River Authority (KRA) for water supply. The existing 208-foot-long fixed crest concrete dam has a 148-foot-long by 52-foot-wide lock chamber. The 482-acre reservoir provides approximately 4,820 acre-feet of storage and only operates at run-of-river levels (i.e., does not draw water from below its crest). The existing lock chamber of the structure is abandoned, and a concrete bulkhead has been placed in the lock chamber, below the upper miter gates, to prevent failure and loss of pool.

Lock 11 Hydro Partners would remove the concrete bulkhead and construct a 28.4-foot by 52-foot by 49.5-foot steel reinforced concrete powerhouse. A 58-foot by 52-foot horizontal trash rack would be installed from the lock chamber upper sill to the back wall of the powerhouse at three feet below the normal pool level. An inflatable rubber dam would be installed on top of the powerhouse wall to maintain the pool during normal operating conditions.

Lock 11 Hydro Partners would install four 642-kW Voith 14.9 and two 222-kW Voith 8.95 StreamDiver turbine-generators into the existing lock chamber of KRLD11. These submersible units directly couple permanent magnet generators with turbines, eliminating the need for a gearbox and associated oil lubrication. A prefabricated-steel and reinforced 42-foot by 20-foot by 28-foot concrete control building would be installed atop a concrete foundation at the edge of the existing concrete esplanade and would be connected to the powerhouse via an underground cable trench. The control building would house the switchgear, controls, transformers, and the main circuit breaker for the plant. The control building would be interconnected to the existing 15-kV overhead distribution line which runs to the site from Madison County, which will be re-conductored to three-phase.

1.1 Components of the Action

The Action includes a planning component, construction component, and operation component.

Planning Component

Planning is the first component of the proposed Action and includes all necessary activities prior to construction activities. These activities include, but are not limited to, securing project funding; developing project timeframes and schedules; designing project plans; performing site visits; preparing preliminary assessments and reports; completing required consultations and permitting; and coordinating with the project team. The planning component is considered an administrative action only and will not result in potential impacts to any federally listed species. As a result, this component will have no effect on listed species and is not discussed further.

Construction Component

Construction is the second component of the proposed Action and includes three separate activities: 1.) site preparation, 2.) control building, and 3.) powerhouse concrete and draft tubes.

1. Site preparation is the first construction component. Activities associated with site preparation include:
    - installation of erosion prevention and sediment control (EPSC) measures
    - installation of a temporary access road
    - installation of all rock anchors and cofferdam
    - dewatering of the lock
    - grouting of north and south walls needed to prevent water seepage
    - establishment of staging areas
    - improvement and construction of access roads

EPSC measures will be installed prior to construction activities to minimize erosion and sedimentation into the Kentucky River. Next a temporary cofferdam will be installed and sealed on the downstream miter gate sill to block off water from entering the lock chamber. Next, the lock chamber will be dewatered and cleaned down to bedrock.

2. The control building work scope includes:
    - control building excavation
    - construction of the control building concrete structure
    - backfilling and grading around control building
    - fabrication and installation of structural steel
    - installation of the pre-fabricated metal building

3. Powerhouse work scope includes:

- installation of rock dowels along the powerhouse base
- installation of forms and rebar for mass concrete placement
- placement of mass concrete in lifts up to 565.0' to accommodate installation of embedded steel draft tubes, stoplog slots and conduits

Once clean bedrock is exposed, concrete construction can begin in the lock chamber of the powerhouse. The powerhouse is a mass concrete pour with embedded horizontal draft tubes. The trash rack system and rubber dams are then installed. The final installation is the turbine generators with shut-off valves, which are bolted to the receiving plates on the front of the draft tubes. Once all the equipment is installed, the upper concrete bulkhead and lower temporary cofferdam is removed, allowing water into the new plant.

Additionally, to provide recreational opportunities at the project, Lock 11 Hydro Partners proposes to: implement a Recreation Resources Management Plan to direct construction, operation, and maintenance of recreational resources at the project that includes the following:

- construction of a new portage trail around the lock and dam
- providing designated bank-fishing access to the tailrace
- construction of a new parking area for four to six vehicles, adjacent to an existing access road on KRA-owned land

Operation Component

The proposed project would operate in run-of-river using flows between 196 cubic feet per second (cfs) and 2,636 cfs for power generation. The turbines would be operated sequentially, based on inflow, and would maintain run-of-river operation levels. Lock 11 Hydro Partners proposes to install monitoring equipment in the lock chamber and headwater pool that is designed to shut down the generating units when water levels in the impoundment fall below 617.38 feet.

The proposed project would generate 13,556 MWh annually. Power would be transmitted from the powerhouse to the Clark Energy/East Kentucky Power Cooperative Hunt Substation. All power generated would be sold to the East Kentucky Power Cooperative at approved tariff rates based on spot-market pricing.

Trash-rack maintenance would be periodically performed by deflating the rubber dam atop the powerhouse and allowing water to wash accumulated debris downstream. Once the trash rack is cleared of debris, the rubber dam would be re-inflated to restore operating pool levels.

In addition to run-of-river operation, Lock 11 Hydro Partners proposes measures to ensure that the project does not affect municipal water withdrawals from the Kentucky River. The proposed project would not operate when flow limits on the Kentucky River are below thresholds required by the KDEP Division of Water, which may occur during severe droughts. Similarly, the project would not operate if KRA were to implement bypass valve releases in order to increase water levels downstream.

1.2 Action Area

For purposes of consultation under ESA §7, the Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). The 10.7-acre Action Area includes KRLD11and the Kentucky river downstream of the dam for approximately 1,190 feet where changes in normal flow between existing and proposed conditions are predicted to occur. All construction activities will be limited to a work area within the lock chamber below the upper miter gates, concrete esplanade, and adjacent KRA property (Figure 2).

1.3 Conservation Measures

Conservation measures (CM) are those proposed actions taken to minimize incidental take and benefit or promote the recovery of the species under review. Conservation measures are included as an integral portion of the Action. The USDA, Lock 11 Hydro Partners, and the Service have committed to implement the following conservation measures, specific to the affected freshwater mussels, as part of the Action:

CM 1: Implementation of EPSC measures in the work area, including but not limited to: Stabilization of disturbed areas as soon as practicable but no more than seven (7) days after construction activities have temporarily or permanently ceased in any portion of the work area. At a minimum, interim and permanent practices implemented to stabilize disturbed areas will include temporary and/or permanent seeding, erosion control matting, mulching, and/or sodding, and silt fencing.

CM 2: Development of a spill response plan in case of an emergency spill.

CM 3: Implementation of BMPs when operating machinery on the lock chamber or within the riparian area to avoid and minimize the potential for accidental spills.

CM 4: Prior to project operation, mussels will be salvaged from the zone of predicted highest impact and relocated immediately downstream of the Action Area (Figure 3).

CM 5: Prior to relocation efforts a year 0 mussel survey will be conducted. Survey methods and survey extent will follow BioSurvey Group's October 2024 mussel survey (Appendix A).

CM 6: Mussel monitoring will be conducted in years 1, 3, and 5 post project operation. Monitoring methods and survey extent will follow BioSurvey Group's October 2024 mussel survey for direct comparison of any changes (Figure 4).

2.0 STATUS OF THE SPECIES

This section summarizes the best available data about the biology and current condition of the round hickorynut, sheepnose, and snuffbox mussels throughout their range that are relevant to formulating an opinion about the Action.

2.1 Round Hickorynut

The round hickorynut (*Obovaria subrotunda*) is a small- to medium-sized mussel up to 3 inches (75 millimeters) in size, which lives up to 15 years. Round hickorynut adults are greenish olive to dark or chestnut brown, sometimes blackish in older individuals, and may have a yellowish band. The shell is thick, solid, and up to three inches long, but usually is less than 2.4 inches. A distinctive characteristic is that the shell is round, nearly circular. The foot can be pale tan to pale pinkish orange.

The round hickorynut is found in small streams to large rivers, and prefers a mixture of sand, gravel, and cobble substrates. The species is wide-ranging and was historically known from 12 states; however, it now only occurs in 9 states, as well as the Canadian province of Ontario. It is currently found in five major basins: the Great Lakes, Ohio (where it is most prevalent), Cumberland, Tennessee, and Lower Mississippi. The number of known populations in the U.S. has declined by 77 percent, from 301 historically documented populations to 69 today (USFWS 2019).

In Kentucky, the round hickorynut was historically found in most medium to large streams but the species does not adapt well to impoundments leaving only a few small populations in Kentucky. The species can be found sporadically in the Green, Barren, Kentucky, Licking, and Rockcastle Rivers as well as Buck Creek. The only notable exceptions are the Red River and the South Fork of the Kentucky River where the species is generally distributed throughout those systems (Haag and Cicerello 2016).

2.2 Sheepnose

The sheepnose is a medium-sized species, elongate quadrate to ovate in shape, that is thick-shelled and reaches nearly 5.5 inches in length. There is a row of large, broad tubercular swellings on the center of the shell extending from the beak to the ventral margin and the periostracum (external shell surface) is generally light yellow to dull yellowish brown in color. The species is generally considered a large-river species; however, it also inhabits medium-sized rivers. The species is typically found in deep water (greater than two meters) with slight to swift currents and mud, sand, or gravel bottoms. The sheepnose may also inhabit riffles with gravel/cobble substrates and appears capable of surviving in reservoirs (NatureServe 2020).

The sheepnose was listed as endangered under the ESA on April 12, 2012, throughout its entire range in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin (USFWS 2012). Historically, the sheepnose was known to occur throughout much of the Mississippi River system; however, this species has been extirpated from over 65 percent of its historical range (25 streams currently from 77 streams historically), including thousands of miles of the Mississippi, Wisconsin, Illinois, Ohio, Cumberland, and Tennessee Rivers and their tributaries. Of the 25 extant populations, nine are considered stable, eight are considered declining, and six others are considered extant, although the status of these six populations is unknown. The remaining two populations are located in the Allegheny River (Ohio) and Green River (Kentucky) and are the only two locations where the species is thought to be improving in population status.

In Kentucky, populations persist in the Ohio, Licking, Kentucky, and Green Rivers (USFWS 2012). Only a single record exists from the Kentucky River, a fresh dead individual found in Garrard County in the late 1990's. A recently deceased individual of the species, estimated to have died within the last 1-2 years, was identified by BioSurvey Group during the mussel survey conducted for this project. Therefore, there are only two known records of this species within the entire Kentucky River basin.

2.3 Snuffbox

The snuffbox is a small- to medium-sized mussel, with males reaching up to 2.8 in length The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated. The umbo is located somewhat anterior of the middle, and is swollen, turned forward and inward, and extended above the hinge line. The anterior end of the shell is rounded, and the posterior end is truncated, highly so in females. The posterior ridge is prominent, being high and rounded, while the posterior slope is widely flattened. The posterior ridge and slope in females are covered with fine ridges and grooves, and the posterioventral shell edge is finely toothed. The shell is yellow or yellowish green and covered with dark green rays or chevrons. The nacre is white or with a slightly iridescent bluish white. The cardinal teeth are relatively large and serrated; lateral teeth are thick and short.

The snuffbox was listed as endangered by the USFWS on February 14, 2012. The snuffbox historically occurred in 210 streams and lakes in 18 States and 1 Canadian province: Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin; and Ontario, Canada. The major watersheds of historical streams and lakes of occurrence include: the upper Great Lakes sub-basin (Lake Michigan drainage), lower Great Lakes sub-basin (Lakes Huron, Erie, and Ontario drainages), upper Mississippi River sub-basin, lower Missouri River system, Ohio River system, Cumberland River system, Tennessee River system, lower Mississippi River sub-basin, and White River system. Extant populations of the snuffbox are known from 79 streams in 14 States and 1 Canadian province, representing a 62% decline in occupied streams.

In Kentucky, the snuffbox has declined dramatically in many basins. The species is presumed extirpated from the Cumberland and Green River basins, rare or potentially extirpated in Kinniconick and Tygarts creeks, and extant in the Licking, Rolling Fork, and multiple tributaries of the Kentucky River including the South Fork Kentucky, Middle Fork Kentucky, and Red River. This species was not found during the mussel survey, either alive or as a relic shell; however, the species co-occurs with the round hickorynut in the tributaries of the Kentucky River, so we presume that the species is likely to occur in this area. Additionally, the species can be buried most of the year and primarily comes to the surface for spawning in the early spring. Therefore, a mussel survey conducted in the fall, like the one completed for this project, is unlikely to result in finding individuals of the species that may be present in the area; thus, presence of the species was assumed.

3.0 ENVIRONMENTAL BASELINE

In accordance with 50 CFR 402.02, the environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

3.1 Species Status within the Action Area

A mussel survey was conducted by BioSurvey Group in October of 2024 (Appendix A) which observed 17 live round hickorynut and a weathered dead sheepnose shell. The survey area extended from approximately 160 m to 420 m downstream of the dam and 50 m riverward from each bank. Patches of relatively high density were present near the right descending bank at the downstream end of the survey area (Transects 5 – 6) and at the far riverward ends of Transects 3 – 4. Round hickorynut individuals were found on most of the right descending bank transects and at the shoreward end of Transect 7 on the left descending bank. Additionally, on August 30, 2023, a mussel survey contractor found a round hickorynut mussel on the right descending bank approximately 845 meters (~0.5 mile) downstream of KRLD11 on the Kentucky River suggesting habitats are favorable for these mussel species below multiple Kentucky River dams.

As previously mentioned in Section 2.2, only a single record of the sheepnose existed from the Kentucky River until the fresh dead/ slightly weathered shell was found during the mussel survey for this project. As a result, there are only two known records of this species within the entire Kentucky River basin. Additionally, snuffbox was not found during the mussel survey either live or as a relic shell; however, the species is known to co-occur with the round hickorynut in the tributaries of the Kentucky River. Additionally, the species can be buried most of the year and primarily comes to the surface for spawning in the early spring. Therefore, a fall mussel survey, like the one completed for this project, is unlikely to result in finding individuals of the species that may be present in the area; thus, presence of the species was assumed.

3.2 Action Area Numbers

Semi-quantitative data from the 2024 BioSurvey Group survey was used to calculate mussel densities downstream of KRLD11 (Appendix A). During the survey, 109 mussels were found along the six 50-meter transects, which included an area of 600 square meters. Based on these results, a density of 0.81 mussels per square meter is present in the semi-quantitative survey area. A total of 17 round hickorynut individuals were found during the semi-quantitative survey; therefore, the estimated density for this species is 0.0283 mussels per square meter (17 individuals ÷ 600 m^2 in survey area = 0.0283 mussels/m^2). One dead sheepnose individual was also encountered during the survey, resulting in an estimated density of 0.0016 mussels per square meter.

As mentioned previously, no snuffbox were found during the survey; therefore, we assume one individual of snuffbox is likely to be present in the semi-quantitative survey area. The estimated density for snuffbox would be 0.0016 mussels per square meter. The estimated density for each species in the semi-quantitative survey area downstream of KRLD11 is summarized below.

Species	Estimated Density in Survey Area (mussels/m^2)
Round hickorynut	0.0283
Sheepnose	0.0016
Snuffbox	0.0016

The estimated density for each species within the semi-quantitative survey area is assumed to be similar throughout the Action Area downstream of KRLD11; therefore, we used these values to estimate the number of individuals of each species within the Action Area. The portion of the Action Area downstream of KRLD11 totals approximately 43,301 square meters. To calculate the estimated number of individuals of each species in the Action Area, the Action Area size was multiplied by the estimated density for each species. The calculation for the estimated number of round hickorynut individuals is 0.0283 mussels/m^2 x 43,301 m^2 = 1,225.41 round hickorynut individuals. The calculation for the estimated number of sheepnose and snuffbox individuals is 0.0016 mussels/m^2 x 43,301 m^2 = 69.28. In summary, we estimate that 1,225 round hickorynut, 69 sheepnose, and 69 snuffbox individuals occur within the downstream portion of the Action Area.

Species	Estimated Individuals in Action Area
Round hickorynut	1,225
Sheepnose	69
Snuffbox	69

3.3 Action Area Conservation Needs and Threats

The primary factor affecting the three mussel species in the Action Area is the presence of Kentucky River Lock and Dam #10 and #11 which act as a barrier in the Kentucky River affecting flow, sediment deposition, water quality, and the movement of aquatic organisms. As a result of the lock and dams, a large portion of the Kentucky river became pooled and the natural flow regime was altered, causing riffles and shoals with clean sand and gravel bed materials to be replaced by slow-flowing, silt bottomed pools that do not provide suitable habitat for the listed mussel species. These conditions have been present in this portion of the Kentucky River since construction of the lock and dams in the early 1900's. The presence of the dams also acts as a barrier to fish movement, potentially limiting contact between mussels and fish hosts and restricting reproduction.

Other factors that could affect the three mussel species in the Action Area include increased sedimentation and the introduction of contaminants. Runoff associated with agricultural and logging activities contributes to the influx of sediment, suspended solids, pesticides, herbicides, fertilizers, petroleum-based products, and other contaminants into the Kentucky River. Additionally, point source releases from wastewater treatment and stormwater discharge further contribute to contamination, particularly when petroleum-based products, such as fuel, oil, and hydraulic fluid from vehicles, trains, and heavy equipment enter the system. Sediments can smother mussel beds, disrupt their feeding processes, and impede their ability to reproduce. Contaminants can significantly impact freshwater mussels by causing toxicity, bioaccumulation, impaired feeding, disrupted reproductive processes, habitat degradation, increased susceptibility to disease, and changes in behavior, ultimately threatening their health and survival in aquatic ecosystems.

4.0 EFFECTS OF THE ACTION

In accordance with 50 CFR 402.02, effects of the Action are all consequences to listed species or critical habitat that are caused by the Action, including the consequences of other activities that are caused by the Action. A consequence is caused by the proposed action if it would not occur "but for" the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the Action (see § 402.17).

The following sections include an analysis of effects that may occur as a result of the proposed Action to the three mussel species. As previously mentioned, the Action Area includes KRLD11 and the Kentucky River downstream of the dam for approximately 1,190 feet. The upstream extent of the Action Area includes the top of the dam and the upper miter gates (Figure 2). Therefore, no effects on mussels or their habitat are anticipated upstream of the Action Area. Based on activities associated with the proposed Action and known threats to these species, the following stressors have been identified: 1) sediment disturbance; 2) changes to flow; and 3) displacement of individuals.

Kleinschmidt Associates performed a hydraulic analysis to evaluate and compare the existing and proposed (operation) flow conditions at KRLD11. The results of this hydraulic model provide a prediction for where downstream changes in flow and water velocity may occur (Appendix B). We then used these predicted changes in flow to evaluate potential impacts to the federally listed mussel species and their host fish in our analysis of the following stressors.

4.1 Sediment Disturbance

Site preparation, construction of the powerhouse, control building, site stabilization, and project operation (may) result in sediment disturbance along the adjacent bank during construction and within the river during operation. Sediment disturbance within the lock chamber, along the riverbanks and adjacent areas could expose soil and increase erosion by allowing sediment to enter the Kentucky River through runoff. Sediment disturbance from hydropower operations within the river could displace sediment in one location and deposit it in another location, potentially exposing or burying mussels. Potential impacts to the three mussel species from sediment disturbance in the work area and the Action Area downstream of the work area are discussed in the following sections.

4.1.1 Work Area

The construction of a temporary access road and parking lot during site preparation will disturb soil near the Kentucky River. Prior to site preparation, EPSC measures will be implemented and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. Vehicles and equipment used during site preparation will be limited to the riverbanks and adjacent areas and will not enter the river. The project will not require tree removal and sediment displacement associated with site preparation will be minimal.

During construction, the lock chamber will be sealed at the upstream end using the existing concreted miter gate at the upstream end, and a cofferdam will be installed on the downstream side. The water will then be pumped out, and all sediments will be removed down to the bedrock to prepare for concrete and the powerhouse. Given all the sediments will be removed from the chamber, no release of sediments is anticipated post construction.

During periods when the river level is too high to work on the powerhouse in the lock chamber, work will commence to build the adjacent control building and conduit trench. Control building construction (excavation, backfill, grade) and conduit trench excavation will temporarily disturb soil adjacent to the river. EPSC measures will reduce the potential for sediment to enter the river and affect downstream mussels. Additionally, listed mussels are unlikely to be present in the adjacent lock chamber due to lack of suitable habitat, reducing the potential for sediment disturbance to impact individuals in this area. Site stabilization activities after construction will reduce the potential for sediment to enter the Kentucky River through seeding of disturbed areas and dressing of the access road and parking area. EPSC measures will also be maintained until the site is stabilized. As a result, sediment disturbance from this construction component is expected to be minimal and will not smother mussels or render habitat unsuitable.

4.1.2 Action Area Downstream of Work Area

As discussed above, site preparation, project construction, and stabilization activities are not expected to cause inputs of sediment beyond the work area due to the use of EPSC measures. Inputs that do occur are anticipated to be minimal and will be dispersed quickly over a large area due to the flow of the river.

Sediment disturbance is anticipated in the immediate downstream vicinity of the lock chamber during the initial weeks or months following the commencement of power generation. Fine sediments identified at Location 1 and 2 during the BioSurvey Group's mussel survey are likely to be disturbed and transported further downstream, potentially covering and/or smothering mussels or rendering their habitat unsuitable. This sediment movement is expected to be a one-time event; however, it may take several weeks to months for a new equilibrium to be established. Once the stream has reached an equilibrium, sedimentation is anticipated to be similar to existing conditions. While mussels may be able to adapt to minimal, temporary sediment deposition, the initial sediment movement from downstream of the lock chamber may lead to significant deposition that could hinder the ability of all individuals to adjust. Moreover, sediment deposition occurring during periods of low water temperatures and reduced mussel activity will further limit their capacity to respond effectively to these deposition events.

The sediment disturbance could also result in impacts to habitat for fish hosts for the three mussel species. Sediment displacement and deposition may damage or bury suitable habitat used by fish hosts for foraging, reproduction, and sheltering. The alteration or loss of habitat could cause the host fish to move from the area, limiting their exposure to the mussel species and potentially affecting mussel reproduction and recruitment.

During normal hydropower operations, the river's natural sediment transport will remain unaffected by the hydropower facility. Sediments within the water column will pass through the powerhouse and lock chamber, settling downstream of the facility. Since the mussels located downstream of KRLD11 are already exposed to this level of sedimentation due to natural sediment transport during both high and low flow conditions, the three mussel species are not anticipated to be impacted beyond the existing conditions.

4.1.3 Applicable Science

Sedimentation is believed to adversely affect mussel populations that require clean, stable streams and has contributed to the decline of mussel populations nationwide (Vannote and Minshall 1982, Brim-Box and Mossa 1999). Specific biological effects to mussels from sedimentation include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms (Vannote and Minshall 1982, Waters 1995, Hartfield and Hartfield 1996). In addition, mussels may be indirectly affected if high turbidity levels significantly reduce the amount of light available for photosynthesis by potential food items or impede the ability of mussels to attract host fishes (Kanehl and Lyons 1992). Sedimentation can also eliminate or reduce the recruitment of juvenile mussels by clogging interstitial spaces, interfering with feeding activity, and acting as a vector in delivering contaminants to streams (Brim-Box and Mossa 1999).

Effects Pathway #1	
Activity: Site Preparation, Site Stabilization	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Construction
Exposure (space)	Work Area, Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Revegetate disturbed areas immediately following completion of ground disturbing activities.
Interpretation	Appropriate EPSC measures will be installed and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. No construction components will occur upstream of the Action Area or downstream of the work area. Inputs of sediment into these areas are not expected due to the use of EPSC measures, and inputs that do occur are anticipated to be minimal. Effects from sediment disturbance caused by construction of the access road and parking lot are considered insignificant.
Effect	Insignificant

Effects Pathway #2
Activity: Construction of the Powerhouse, Conduit Bank, & Control Building

Effects Pathway #2	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Construction
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Revegetate disturbed areas immediately following completion of ground disturbing activities. • Perform powerhouse activities during periods of normal or low flows.
Interpretation	Appropriate EPSC measures will be installed and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. Vehicles and equipment will not enter the river, and all river work will occur within the lock chamber. Effects from sediment disturbance caused by construction of the conduit bank and control building are considered insignificant. In addition, the areas immediately adjacent to the work area where the potential for impacts is highest do not provide suitable habitat for the three mussel species.
Effect	Insignificant

Effects Pathway #3	
Activity: Site Preparation, Site Stabilization	
Stressor: Sediment Disturbance	
Exposure (time)	Duration of Construction
Exposure (space)	Work Area, Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Implement EPSC measures in the work area. • Revegetate disturbed areas immediately following completion of ground disturbing activities.

Effects Pathway #3	
Interpretation	Appropriate EPSC measures will be installed and maintained throughout the work area to reduce erosion and minimize sediment inputs into the Kentucky River. No construction components will occur upstream of the Action Area or downstream of the work area. Inputs of sediment into these areas are not expected due to the use of EPSC measures, and inputs that do occur are anticipated to be minimal. Effects from sediment disturbance caused by construction of the access road and parking lot are considered insignificant.
Effect	Insignificant

Effects Pathway #4	
Activity: Hydropower Operation	
Stressor: Sediment Disturbance	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	N/A
Interpretation	The proposed project would operate in run-of-river using flows for power generation and no effects due to sediment disturbance will occur upstream of the Action Area or in the work area. Additionally, the work area does not provide suitable habitat for the listed mussel species.
Effect	Insignificant

Effects Pathway #5	
Activity: Hydropower Operation	
Stressor: Sediment Disturbance	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles

Effects Pathway #5	
	• Movement due to alteration or loss of habitat • Displacement of fish hosts due to alteration or loss of habitat
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Interpretation	The movement and deposition of sediment during hydropower operation could smother mussels or make habitat unsuitable, causing individuals to move to other areas.
Effect	Adverse (harm, mortality)

4.2 Changes to Flow

Run-of-river hydroelectric plant operation is the only proposed Action component that could result in changes to flow in the Kentucky River. Site preparation and stabilization will not result in changes to flow due to the lack of in-stream activities associated with these components. Changes to flow from hydropower operations could impact mussels and their habitat by altering the morphology of the river channel, changing the hydrology of the stream, cause sediment disturbance, and displacement of individuals.

<u>4.2.1 Work Area</u>
The hydroelectric plant (powerhouse) will be installed entirely within the upper portion of the abandoned lock chamber. The powerhouse is the only construction component located within the Action Area. The hydroelectric plant will operate in run-of-river using flows between 196 cfs and 2,636 cfs for power generation. The turbines would be operated sequentially, based on inflow, and would maintain run-of-river operation levels. Units will turn on to operate as the upstream pool level increases and water flow in the river justifies additional generation. The units will cycle off to continually maintain some water running over the spillway. Lock 11 Hydro Partners proposes to install monitoring equipment in the lock chamber and headwater pool that is designed to shut down the generating units when water levels in the impoundment fall below 617.38 feet. The work area (powerhouse) is unsuitable for mussels. As a result, impacts to mussels in this area are not anticipated.

<u>4.2.2 Action Area Downstream of Work Area</u>
Changes to the hydraulic conditions below KRLD11 in the Kentucky River during existing and proposed (operation) flow conditions were analyzed by Kleinschmidt Associates (Appendix B). Changes in flow conditions over and near the existing mussel beds that could alter the likely presence of host fish species for the round hickorynut and sheepnose were evaluated. Suitable host fish species for the round hickorynut were identified through laboratory trials and include multiple darter species and the banded sculpin (*Cottus carolinae*). No natural infestation has been documented for this species, but the eastern sand darter (*Ammocrypta pellucida*) appears to be highly correlated with round hickorynut populations in Kentucky streams. More than 30 species of fish have been identified as suitable host for sheepnose through laboratory trials; however, only the sauger (*Sander canadensis*) has been identified through a natural infestation.

According to the results of the hydraulic model, the expected maximum change in peak depth-averaged velocity between existing and proposed conditions across the Action Area was found to be negligible in most flow scenarios. The most noticeable differences between existing and proposed conditions are during the Normal Flow (2,636 cfs) scenario. In the Normal Flow scenario, most locations are not expected to have a noticeable change in peak depth-averaged velocity. However, Locations 1 and 2 are expected to experience a 2.0 feet per second (fps) and a 1.2 fps change in water velocity under the proposed conditions, respectively. During existing normal flows, water is prevented from entering the lock structure, and all flow is routed over the existing spillway over a wide cross-sectional area. This allows more uniform dispersal of flows across the river channel. Conversely, under proposed conditions at normal flows, water will be routed through the proposed powerhouse and discharged at the outlet of the existing lock structure. This creates an area of increased water velocities at the edge of the concrete esplanade along the right descending bank at Location 1 as water exits the lock structure. Continuing downstream, flow patterns begin to distribute across the river channel through Locations 3 and 4 and begin to resume "normal" flow patterns across Locations 5 and 6 and exiting the survey reach (Figure 4).

Another potential change in flow pattern under the Normal Flow scenario includes the creation of an eddy along the left descending bank during normal flow conditions. This eddy may allow fine sediments to settle when normal flows resume after a post-high event. The area near the dam is predominately bedrock substrates and generally unsuitable for mussels however, mussels were found about halfway through the Action Area including one round hickorynut individual.

Under hydropower operations, increased water velocities in Locations 1 and 2 and the creation of an eddy is unlikely to directly affect the mussel species as they can typically tolerate higher flows; however, the change in the flow regime could alter the fish hosts' habitat causing the fish to move from the area, limiting their exposure to the mussel species and potentially affecting mussel reproduction and recruitment.

4.2.3 Applicable Science

Dams alter flow by impounding or pooling long reaches of free-flowing rivers, resulting in changes to hydrology and channel morphology, increased sediment deposition, altered water quality, decreased habitat heterogeneity, altered flood patterns, and decreased movement of mussels and fish (Neves et al. 1997, Watters 2000). Habitat heterogeneity is often reduced from six to seven habitat types to three or four, some of which are highly modified from the existing habitat or new to the river system (Watters 2000). Although the original channel remains upstream of the dam, increased depth and slower flow can rapidly alter existing habitats. Decreased flow reduces sediment transport, causing fine sediment to settle and blanket the substrate with silt. Siltation of the river bottom can affect mussels through smothering, diminishing food supply by limiting light penetration, altering temperatures, and reducing recruitment (Watters 2000). Siltation can also change species composition in the impounded or pooled areas by reducing the presence of species intolerant of silt with silt-tolerant species (Holland-Bartels 1990, Parmalee and Hughes 1993).

Changes in flow downstream of dams leads to scouring and bank erosion, reduced dissolved oxygen, temperature fluctuations, and changes in mussel and fish composition (Neves et al. 1997, Watters 2000). The acceleration of water as it flows over a run-of-river dam results in scour of the stream bed and banks, often producing a scour area or plunge pool at the base of the dam (Csiki and Rhoads 2014, Pearson and Pizzuto 2015). Scouring at the base of the dam mobilizes fine sediments and smaller coarse sediments, leaving only cobble, boulders, and bedrock (Skalak et al. 2009, Csiki and Rhoads 2014). A mid-channel bar often forms downstream of the dam that consists of scoured materials (Csiki and Rhoads 2014). Scouring immediately below dams can be extensive and can eliminate or prevent mussels from inhabiting these areas (Miller and Payne 1992).

Effects Pathway #6	
Activity: Hydropower Operation	
Stressor: Changes to Flow	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Mortality due to alteration of loss of flow regime • Reduction or loss of fish hosts due to changes to flow regime
Conservation Measures	None
Interpretation	The project will operate as a run-of-river facility and will not attenuate flows upstream beyond existing conditions. Additionally, work area contains unsuitable habitat for the three mussel species.
Effect	Insignificant

Effects Pathway #7	
Activity: Hydropower Operation	
Stressor: Changes to Flow	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of the Work Area
Resource affected	Individuals (adults, juveniles), Habitat, Fish Hosts
Individual response	• Mortality due to alteration of loss of flow regime • Reduction or loss of fish hosts due to changes to flow regime
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Interpretation	Increased water velocity and changes to flow patterns during normal flows directly downstream of the lock chamber have the potential to affect fish host distribution and consequently, mussel reproduction.
Effect	Adverse (harm, mortality)

4.3 Displacement of Individuals

Run-of-river hydroelectric plant operation is the only proposed Action component that could result in displacement of individuals. Site preparation and stabilization will not displace individuals due to the lack of in-stream activities associated with these components. Changes to the hydraulic conditions that could cause displacement of mussels below KRLD11 in the

Kentucky River during proposed (hydropower operations) flow conditions were additionally analyzed by Kleinschmidt (Appendix B).

4.3.1 Work Area

The hydroelectric plant will be installed entirely within the upper portion of the abandoned lock chamber. The work area (powerhouse) is unsuitable for mussels and is unlikely to displace individuals. As a result, the displacement of individuals in this area is not anticipated as a result of the project.

4.3.2 Action Area Downstream of Work Area

According to the results of the hydraulic model, during the Normal Flow scenario, flow conditions are expected to change at Locations 1 and 2. Changes to flow from hydropower operations could disturb the downstream river substrate and individuals. Displaced mussels could be moved to an area of unsuitable habitat, requiring the individual to move to a more suitable area and expend energy. Displacement may also lead to harm or mortality if the mussel is unable to find suitable habitat quickly.

Conversely, the area does have large, coarse bed materials such as the cobble and boulders found during the mussel survey. This coarse bed material is unlikely to be scoured and displaced and could be stable enough for some individuals to sustain themselves in this habitat. However, based on the best available data, the mussels are utilizing the finer sediments to bury and shelter, and that material is anticipated to be scoured and moved downstream which will likely displace the mussels as well.

4.3.3 Applicable Science

Published data on the displacement of mussels from hydroelectric dams is lacking; however, mussel displacement from turbulence created by boats has been noted. Studies have shown that turbulence generated by the surge of large vessels as they pass by or over mussels and from boat propellers (i.e., propeller wash) can displace mussels from the substrate (Sparks and Blodgett 1985, Aldridge et al. 1987, Millar and Mahaffy 1989, Watters 2000). The potential for displacement is highest in shallow areas, particularly near riverbanks. Based on these studies, concentrated flows of turbulent water, such as those that may occur during initial dam operations, have the potential to displace mussels from the substrate.

Effects Pathway #8	
Activity: Hydropower Operation	
Stressor: Displacement of Individuals	
Exposure (time)	Indefinite
Exposure (space)	Work Area
Resource affected	Individuals (adults, juveniles)
Individual response	• Harm or mortality if displaced to unsuitable habitat • Movement of displaced individuals to suitable habitat, which may lead to increased energy expenditure and decreased fitness
Conservation Measures	N/A

Effects Pathway #8	
Interpretation	The project will operate as a run-of-river facility and will not attenuate flows upstream beyond existing conditions. The work area contains unsuitable habitat for the three mussel species.
Effect	Insignificant

Effects Pathway #9	
Activity: Hydropower Operation	
Stressor: Displacement of Individuals	
Exposure (time)	Indefinite
Exposure (space)	Action Area Downstream of Work Area
Resource affected	Individuals (adults, juveniles)
Individual response	• Harm or mortality if displaced to unsuitable habitat • Movement of displaced individuals to suitable habitat, which may lead to increased energy expenditure and decreased fitness
Conservation Measures	• Mussel relocation (salvage) to areas of downstream suitable habitat prior to project operation. • Post operation mussel monitoring in the Action Area for three years.
Interpretation	The hydraulic model indicates that changes in flow conditions during the Normal Flow scenario at Locations 1 and 2 could disturb the downstream substrate and displace mussels, potentially forcing them into unsuitable habitats and risking harm or mortality if they are transported to unsuitable habitat. While the area contains stable, coarse bed materials such as large cobble and boulder, which may support some individuals, the finer sediments that most mussel bury into will be displaced consequently displacing the mussels as well.
Effect	Insignificant

4.4 Summary of Effects

The proposed Action could expose the three mussel species to the stressors evaluated in the previous section. Anticipated adverse effects to the three mussel species are anticipated to be: sediment disturbance, changes to flow, and displacement of individuals in the Action Area downstream (DS) of the work area (powerhouse) during hydropower operations under normal flow conditions. Potential effects to the three mussel species are summarized below.

Stressor	Action Component	Location	Effect	
			Adverse	Insignificant
Sediment Disturbance	Site Preparation & Stabilization	Work Area & Action Area DS of Work Area		X
	Project Construction	Work Area		X
		Action Area DS of Work Area		X
	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	
Changes to Flow	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	
Displacement of Individuals	Hydropower Operation	Work Area		X
		Action Area DS of Work Area	X	

5.0 Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation. The purpose of the proposed Action is to generate clean carbon-free renewable electricity to help combat climate change and generate distributed power near the locations where power is used. Future activities, such as increased residential or commercial development, agricultural practices, increased traffic, or tourism in the area are not reasonably certain to occur as a result of the Action. Based on these factors, no cumulative effects to the three mussel species are anticipated as a result of the proposed Action.

6.0 INCIDENTAL TAKE STATEMENT

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term “take” in the ESA means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (ESA §3). “Harm in the definition of “take” in the Act means an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering” (50 CFR 17.3). Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited, provided that such taking is in compliance with the terms and conditions of an incidental take statement (ITS).

For the exemption in ESA §7(o)(2) to apply to the proposed Action considered in this BO, the USDA must undertake the non-discretionary measures described in this ITS, and these measures must become binding conditions of any permit, contract, or grant issued for implementing the Action.

The USDA has a continuing duty to regulate the activity covered by this ITS. The protective coverage of §7(o)(2) may lapse if the USDA fails to:
assume and implement the terms and conditions; or

- require a permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract, or grant document.

To monitor the impact of incidental take, the USDA must report the progress of the Action and its impact on the species to the Service as specified in this ITS.

6.1 Amount or Extent of Take Anticipated

This section specifies the amount or extent of take of the round hickorynut, sheepnose, and snuffbox mussels that the Action is reasonably certain to cause, which we estimated using the best available data in the "Effects of the Action" section of this Biological Opinion.

We estimated the number of individuals reasonably certain to occur in the Action Area (Section 3.0, Environmental Baseline). We then evaluated the potential for these individuals to be exposed to the stressors resulting from the proposed Action which included sediment disturbance, changes in flow, and displacement of individuals. Finally, we evaluated how the individuals' responses from exposure to these stressors would apply to the statutory and regulatory definition of take (Section 4.0, Effects of the Action). From our evaluation, the proposed Action is reasonably certain to cause the incidental take of the round hickorynut, sheepnose, and snuffbox mussels within the Action Area and is consistent with the definition of harm (Table 2). We estimate the incidental take of all individuals of the round hickorynut, sheepnose, and snuffbox mussels occurring downstream of KRLD11 using the density calculations detailed in Section 3.2 Action Area Numbers. See Table 2 below for expected incidental take of each of the three mussel species.

Table 2. Expected Incidental Take

Species	# of Individuals	Take Type
round hickorynut	1225	Harm
sheepnose	69	Harm
snuffbox	69	Harm

We anticipate that monitoring the incidental take using the number of individuals is not practical for the following reasons:

- The size and depth of the aquatic environment within the Action Area is difficult to monitor in its entirety.
- The mussel species are relatively small, cryptic, and not easily detected.
- Finding dead or injured specimens during the majority of project implementation is unlikely due to the riverine environment.
- The majority of incidental take is expected to be in the form of non-lethal harm, such as reduced feeding or reproductive efficiency due to increased turbidity, which is difficult to observe.

When it is not practical to monitor take in terms of individuals, the regulations at 50 CFR §402.14(i)(1)(i) indicate that an ITS may express the amount or extent of take using a surrogate provided that the Service also describes the causal link between the surrogate and take of the listed species and sets a clear standard for determining when the level of anticipated take has been exceeded.

Therefore, we have determined that it is appropriate to monitor the square meters of suitable habitat that will be affected by the Action to ensure the amount of incidental take is not exceeded. Our opinion is that this is appropriate because the mussel species are expected to occur in all areas of suitable habitat within the Action Area, square meters of suitable habitat was used to quantify the number of individuals within the Action Area for each species, and most incidental take associated with the Action is a result of habitat alteration/degradation. Incidental take is considered exceeded if the Action impacts more than the proposed 43,301 m^2 of downstream suitable habitat. We describe the procedures for monitoring in Section 6.4.

Table 3. Surrogate Measures for Monitoring Incidental Take

Species	Life Stages	Surrogate	Quantity
round hickorynut, sheepnose, snuffbox	All	Suitable habitat (m^2) within the Action Area downstream of KRLD4	43,301 m^2

6.2 Reasonable and Prudent Measures

The Action includes conservation measures to avoid and minimize impacts to the subject mussel species. The analysis of effects of the Action in this BO considers that the USDA will authorize, fund, or carry out all activities under the Action in a manner that is consistent with the description of activities provided in BA, including all applicable conservation measures. Due to the aforementioned commitments, our review of the Action, and Conservation Measures, the Service concludes that no reasonable and prudent measures are necessary or appropriate to minimize incidental take of the round hickorynut, sheepnose, and snuffbox caused by the Action.

6.3 Terms and Conditions

No reasonable and prudent measures to minimize incidental take caused by the Action are provided in this BO; therefore, no terms and conditions for carrying out such measures are necessary.

6.4 Monitoring and Reporting Requirements

The USDA will (1) ensure that all of the identified Conservation Measures are implemented and (2) inform the Service as soon as possible if the amount of take is exceeded or if any of the mussel species are observed, injured, or crushed within the Action Area. In order to monitor the impacts of incidental take, the USDA must report the progress of the Action and its impact on the species to the Service as specified in the ITS (50 CFR §402.14(i)(3)). The USDA should notify the Service once construction activities have commenced and should also provide a quarterly (~ every 3 months) project status summary that includes a brief summary of all activities that have been completed to date.

7.0 CONSERVATION RECOMMENDATIONS

§7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service has not identified any conservation recommendations for this BO.

8.0 RE-INITIATION NOTICE

Formal consultation for the Action considered in this BO is concluded. Reinitiating consultation is required if the USDA retains discretionary involvement or control over the Action (or is authorized by law) when:

a) the amount or extent of incidental take is exceeded;
b) new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c) the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d) a new species is listed or critical habitat designated that the Action may affect.

This consultation was assigned FWS ID 2024-0023535. Please refer to this number in any correspondence concerning this consultation.

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FIGURES

Figure 1. Project Location

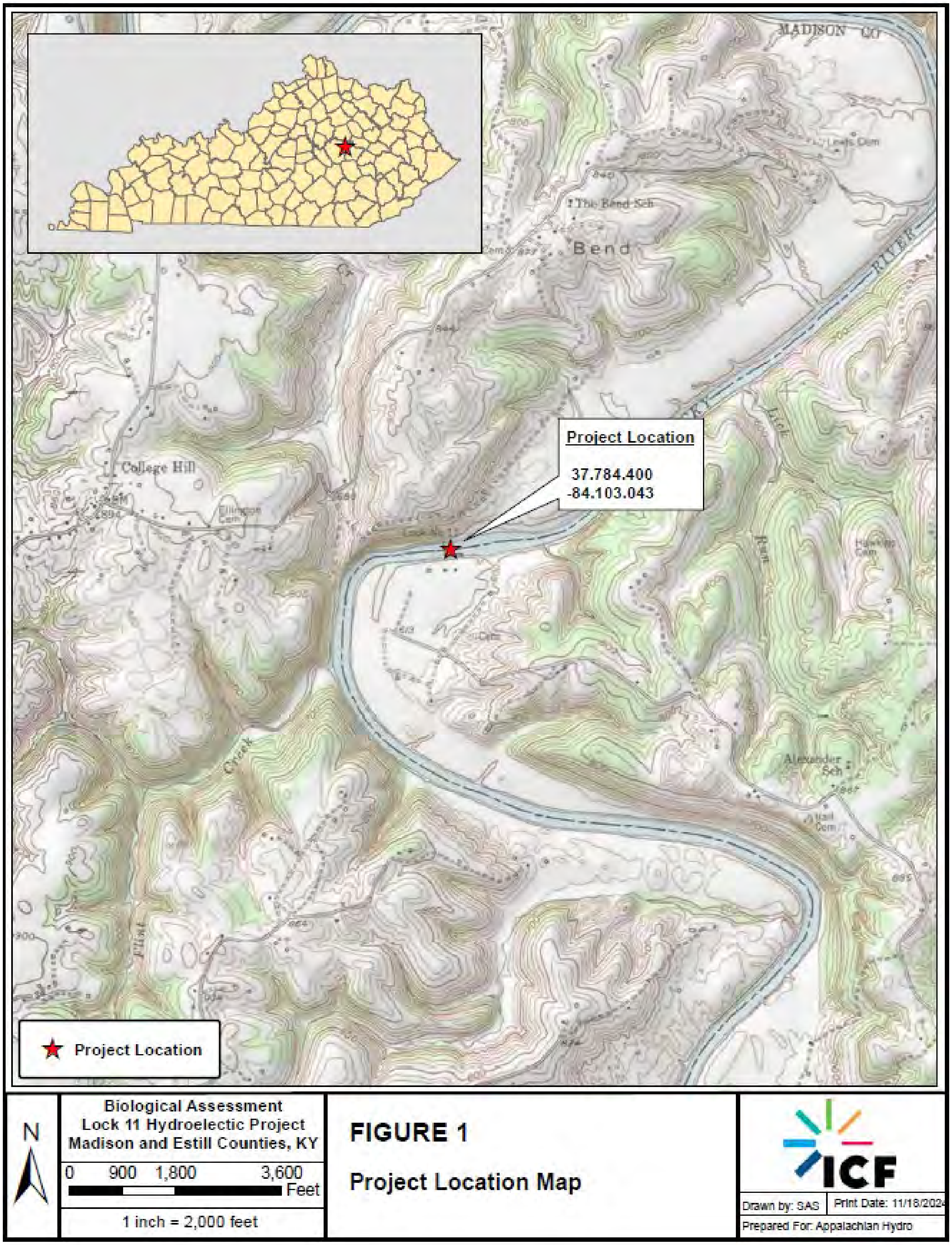

Figure 2. Work Area

Figure 3. Mussel Salvage and Relocation Map

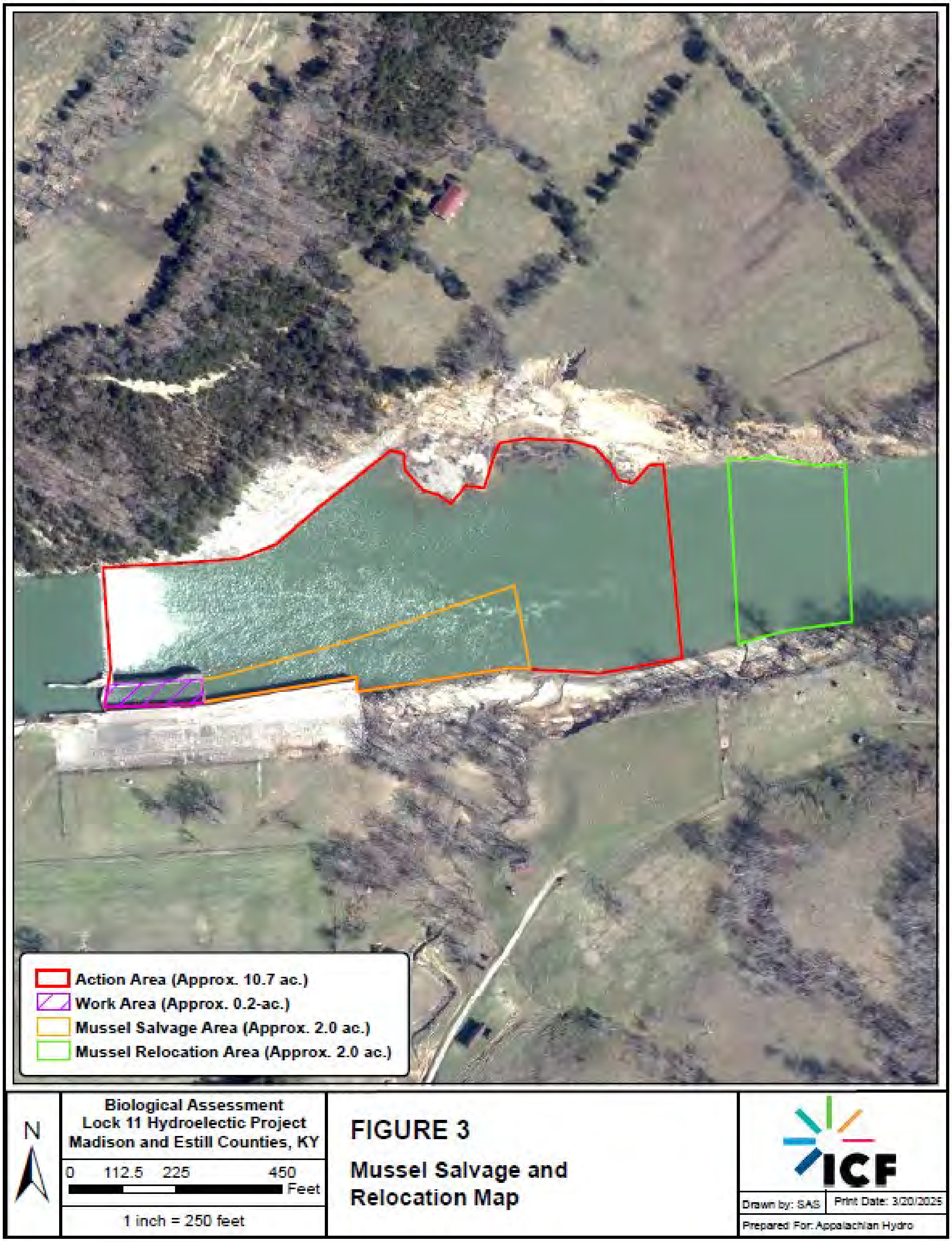

Figure 4. Mussel Survey Map

APPENDIX A

BioSurvey Group Mussel Survey Report

COLLEGE HILL HYDRO PROJECT ON THE KENTUCKY RIVER - MUSSEL SURVEY REPORT

MADISON AND ESTILL COUNTIES, KY

PREPARED FOR

Appalachian Hydro Associates

DATE: 10.24.24

BIOSURVEY GROUP

PO Box 61
Oxfortd, OH 45056
(513) 839-0123

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Figures

Appendices

Introduction

BioSurvey Group was contracted to provide environmental consulting services to Appalachian Hydro Associates for a mussel survey on the Kentucky River in Madison and Estill Counties, Kentucky as part of a proposed hydroelectric project at Lock and Dam 11 (Figure 1). The Project facilities will consist of a submersible powerhouse constructed in the existing abandoned lock chamber and a control building on the shore containing switchgear, controls, transformers and a main circuit breaker for the plant. The powerhouse will contain six submersible turbine generators that are unaffected by flooding. An underground cable trench will connect the powerhouse to the control building.

Project Need

The proposed construction and operation of the hydroelectric facility may impact freshwater mussels occurring within construction areas as well as downstream of the lock and dam. Several federally listed mussel species, including Clubshell (*Pleurobema clava*; endangered), Fanshell (*Cyprogenia stegaria*; endangered), Round Hickorynut (*Obovaria subrotunda*; threatened), and Salamander Mussel (*Simpsonaias ambigua*; proposed endangered) are known or believed to occur in this reach of the Kentucky River. Therefore, the U.S. Fish and Wildlife Service (USFWS) and Kentucky Department of Fish and Wildlife Resources (KDFWR) required a mussel survey be completed to obtain the regulatory permits required for this project.

Methods

Mussel Survey

The mussel survey extent was determined based on guidance from USFWS. The survey area extended from approximately 160 m to 420 m downstream of the dam and 50 m riverward from each bank. Six 50-m transects, spaced at 50-m intervals, were established perpendicular to flow on each bank, for a total transect length of 600 m (Figure 2).

Divers searched a 1-m wide swath along each survey transect which was divided into 10-m segments. Search rates included a minimum effort of 1.0 min/m^2 in areas of heterogeneous substrate and 0.5 min/m^2 in areas of homogenous substrate (bedrock, mud, silt, and sand). The visual search included moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5 cm (2 in) of substrate to better view the mussels which may be there.

Data was compiled and recorded for each 10-m transect segment, including substrate (Wentworth Scale) and depth. In each segment, mussels observed (live and dead) were bagged and brought to the surface for further processing and positive identification. Live mussels were kept cool and moist on the surface and were not out of the water for more than five minutes. Dead mussel shells were scored as fresh dead, weathered dead, or subfossil. Mussel nomenclature followed that of the Freshwater Mollusk Conservation Society (2023). Photo vouchers of all representative species collected and any odd, questionably identified individuals were taken.

Timed Searches

Timed searches were completed for the development of a species richness curve to demonstrate that most species had been recorded from the survey area. Transect data was used to inform the best location to conduct the timed searches. The goal was to collect six consecutive samples in 10 min increments within the mussel concentration area until no new species were detected.

Results

The BioSurvey Group team performed the mussel survey on October 7 – 8, 2024, led by permitted malacologist Ms. Emily Grossman. Copies of Ms. Grossman's scientific collecting permits are presented in Appendix A. Weather conditions were favorable throughout the survey effort with sunny skies and an average air temperature of approximately 23ºC (73°F). Discharge on the Kentucky River at Lock and Dam 11 (USGS 03282290) ranged from 694 cubic feet per second (cfs) to 874 cfs and stage ranged from 11.27 ft to 11.45 ft. Water temperature was approximately 20ºC (68°F) at the surface. Site and mussel photos can be found in Appendix B.

Habitat

Variable habitat conditions were encountered throughout the survey area. Substrate on the right descending bank was primarily sand, though some coarse material (boulder / cobble / gravel) was present along the bank on Transects 1 – 3 and at the far riverward ends of some transects. In contrast, substrate along Transects 7 – 10 on the left descending bank was primarily coarse gravel, cobble, and boulder, and substrate along Transects 11 – 12 was almost exclusively bedrock (Figure 3). Depths ranged from approximately 1 ft (0.3 m) near the bank to a maximum of 15 ft (4.6 m) along Transect 1, with deeper depths generally occurring on the right descending half of the channel (Figure 3). Depth and substrate data by transect segment are presented in Table 1.

Transect Survey

A total of 109 mussels were detected during the transect survey, representing 11 species. Threeridge (*Amblema plicata*; 47.7%) was the most dominant species, followed by Pink Heelsplitter (*Potamilus alatus*; 26.6%) and the federally threatened Round Hickorynut (11.0%) (Table 2). Length and age estimates for all live federally listed mussels are presented in Table 3. Four additional species were represented by dead shell material only, including a weathered dead federally endangered Sheepnose (*Plethobasus cyphyus*) (Table 2). Catch per unit effort (CPUE) was 0.19 mussels per minute of search time.

Mussels were present on both the right and left descending banks, but abundance was highest along the right descending bank (Figure 3). Patches of relatively high density were present near the right descending bank at the downstream end of the survey area (Transects 5 – 6) and at the far riverward ends of Transects 3 – 4. Round Hickorynut individuals were found on most of the right descending bank transects and at the shoreward end of Transect 7 on the left descending bank (Figure 3).

Timed Searches

A total of eight timed searches, each 10 minutes in length, were completed to supplement the transect data for the development of a species richness curve. All timed searches were conducted

along the right descending bank, focusing on areas where mussels were abundant or federally listed species were present in transect samples. An additional 71 mussels were collected in timed searches, including one species not collected in transect samples (Pink Papershell; *Potamilus ohiensis*). Pink Heelsplitter (57.7%) and Threeridge (26.8%) were the dominant species. Five additional Round Hickorynut were collected during the timed search effort, and CPUE was 0.89 mussels / min (Table 2). The species richness curve, developed using both transect and timed search data, suggests that approximately 97 more individuals would need to be collected to find one additional species (Figure 5).

Discussion

Survey efforts yielded a total of 180 live mussels representing 12 species, including 17 federally threatened Round Hickorynut and a weathered dead federally endangered Sheepnose shell. Most mussels, including federally listed species, were collected on the right descending half of the channel in sandy substrate. Given the presence of federally listed species, additional consultation with USFWS may be needed prior to construction. Data collected in this survey can be used to develop population estimates for federally listed species in the project area if needed and can serve as a pre-construction baseline to assess whether the mussel community is being affected by operation of the hydropower facility.

Tables

Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
1											
RDB	0-10	10					10	30	60		
	10-20	12				40		60			
	20-30	13				100					
	30-40	14				75	25				
	40-50	15				50	20	30			
2											
RDB	0-10	6					30		70		
	10-20	10				80	20				
	20-30	12				90	10				
	30-40	13					20	40	40		
	40-50	14						30	70		
3											
RDB	0-10	6				10			90		
	10-20	10				50		50			
	20-30	12				40	30	30			
	30-40	12					40	40	20		
	40-50	13					40	40	20		
4											
RDB	0-10	7				100					
	10-20	8		10		90					
	20-30	10		20		80					
	30-40	12				50	20	30			
	40-50	13				10	40	50			
5											
RDB	0-10	5				100					
	10-20	7				90			5		5
	20-30	8				100					
	30-40	9				40		40			20
	40-50	9				40		40			20
6											
RDB	0-10	5				95					5
	10-20	7				90					10
	20-30	8				80			5		15
	30-40	9				100					
	40-50	9				75					25
7											
LDB	0-10	6	80					10			10
	10-20	7	70					5	5		20
	20-30	7		10		10		80			
	30-40	8		10		10		80			
	40-50	8		10		10		80			

BioSurvey Group

Table 1. Mussel Habitat by Transect Segment

Transect	Segment	Max Depth (ft)	% Clay	% Silt	% Mud	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	% Wood
8											
LDB	0-10	6	30			30		30			10
	10-20	7	30			40					30
	20-30	7	30			30					40
	30-40	8				30		30	20		20
	40-50	8				20		60	20		
9											
LDB	0-10	3		10			40	50			
	10-20	6		10			40	50			
	20-30	7					30	40	30		
	30-40	8		10			10	30	50		
	40-50	9				10	20		40		30
10											
LDB	0-10	3					20	70	10		
	10-20	4		10				40	50		
	20-30	4		10				30	60		
	30-40	5		10				60	30		
	40-50	7		10		10	20	60			
11											
LDB	0-10	4					10	30	60		
	10-20	7					10		90		
	20-30	8								100	
	30-40	8								100	
	40-50	8								100	
12											
LDB	0-10	1								100	
	10-20	2								100	
	20-30	4								100	
	30-40	4								100	
	40-50	4								100	

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Table 2. Mussels Collected Downstream of Kentucky River Lock and Dam 11

		Transects		Timed Searches			
Tribe / Species	**Common Name**	**No. Live**	**%**	**No. Live**	**%**	**Total**	**%**
Amblemini							
Amblema plicata	Threeridge	52	47.7	19	26.8	71	39.4
Pleurobemini							
Fusconaia flava	Wabash Pigtoe	2	1.8	3	4.2	5	2.8
Plethobasus cyphyus	Sheepnose	WD	-	-	-	WD	-
Quadrulini							
Cyclonaias pustulosa	Pimpleback	1	0.9	-	-	1	0.6
Megalonaias nervosa	Washboard	WD	-	-	-	WD	-
Quadrula quadrula	Mapleleaf	1	0.9	-	-	1	0.6
Lampsilini							
Actinonaias ligamentina	Mucket	1	0.9	-	-	1	0.6
Ellipsaria lineolata	Butterfly	1	0.9	-	-	1	0.6
Lampsilis cardium	Plain Pocketbook	SF	-	-	-	SF	-
Lampsilis siliquoidea	Fatmucket	4	3.7	1	1.4	5	2.8
Lampsilis teres	Yellow Sandshell	1	0.9	-	-	1	0.6
Obliquaria reflexa	Threehorn Wartyback	5	4.6	-	-	5	2.8
Obovaria subrotunda	Round Hickorynut	12	11.0	5	7.0	17	9.4
Potamilus alatus	Pink Heelsplitter	29	26.6	41	57.7	70	38.9
Potamilus ohiensis	Pink Papershell	-	-	2	2.8	2	1.1
Truncilla donaciformis	Fawnsfoot	WD	-	-	-	WD	-
Total		**109**	**100.0**	**71**	**100.0**	**180**	**100.0**
Live Species		**11**		**6**		**12**	
Total Species		**15**		**6**		**16**	
CPUE (no. live / min)		**0.19**		**0.89**			

Table 3. Length and Age Estimates for Federally Listed Species

Species	Common Name	Transect / Timed Search	Transect Segment	Est. Age (External Annuli)	Length (mm)
Obovaria subrotunda	Round Hickorynut	Transect 1	20 - 30	6	29
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	17	60
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	13	47
Obovaria subrotunda	Round Hickorynut	Transect 2	10 - 20	7	31
Obovaria subrotunda	Round Hickorynut	Transect 4	0 - 10	8	42
Obovaria subrotunda	Round Hickorynut	Transect 5	0 - 10	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Transect 5	30 - 40	5	33
Obovaria subrotunda	Round Hickorynut	Transect 6	0 - 10	14	44
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	23	67
Obovaria subrotunda	Round Hickorynut	Transect 6	10 - 20	13	41
Obovaria subrotunda	Round Hickorynut	Transect 6	20 - 30	8	41
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	24
Obovaria subrotunda	Round Hickorynut	Transect 7	0 - 10	3	23
Plethobasus cyphyus	Sheepnose	Transect 7	30 - 40	(weathered dead)	
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	22	61
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	8	35
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	6	30
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	13	37
Obovaria subrotunda	Round Hickorynut	Timed Search 7	-	10	39
Total No. Live				**17**	

BioSurvey Group

Figures

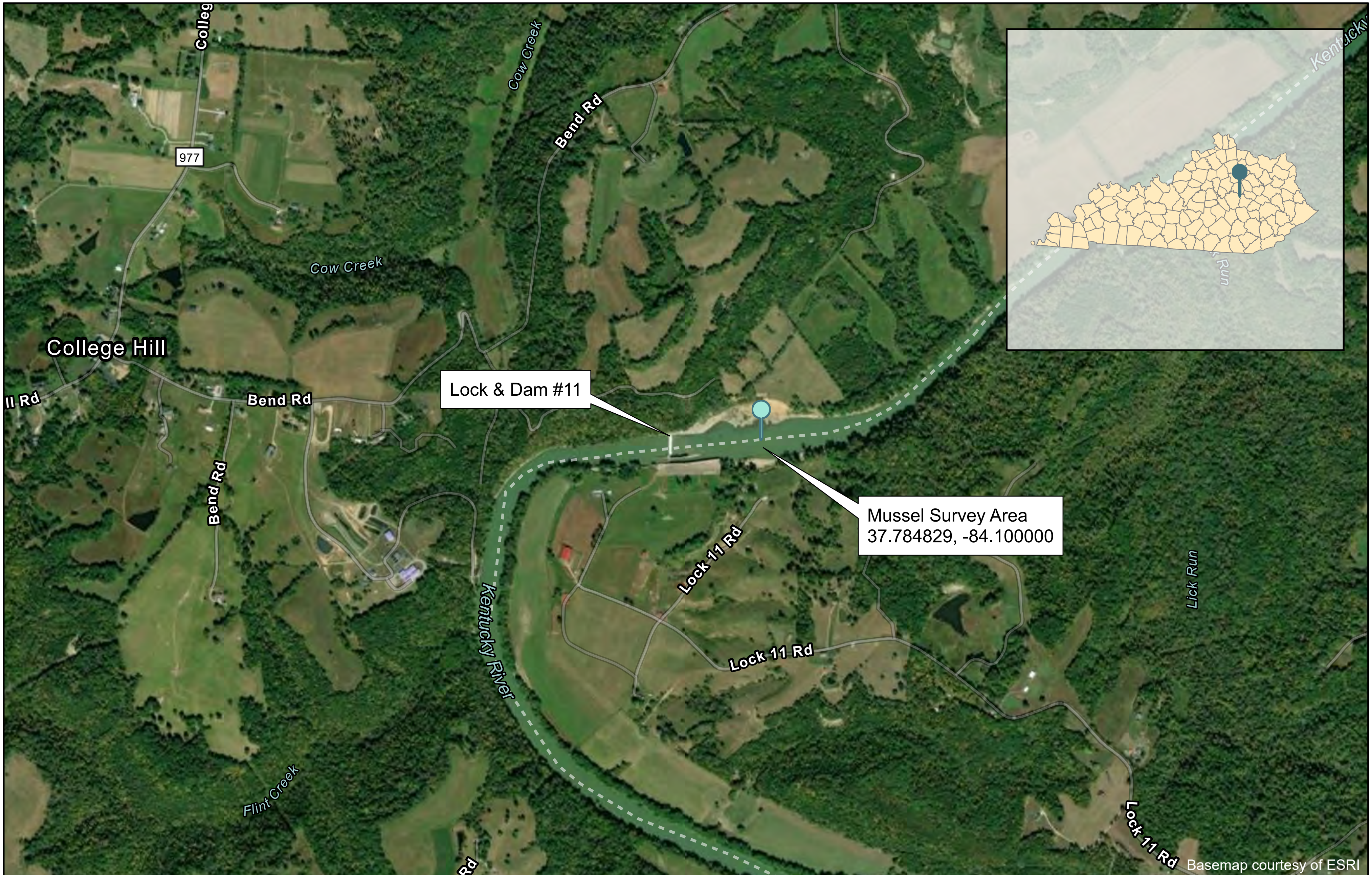


Figure 1. Project Location Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

Project Location

N

0 150 300 600 Meters

BioSurvey Group

Figure 2. Mussel Survey Design Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

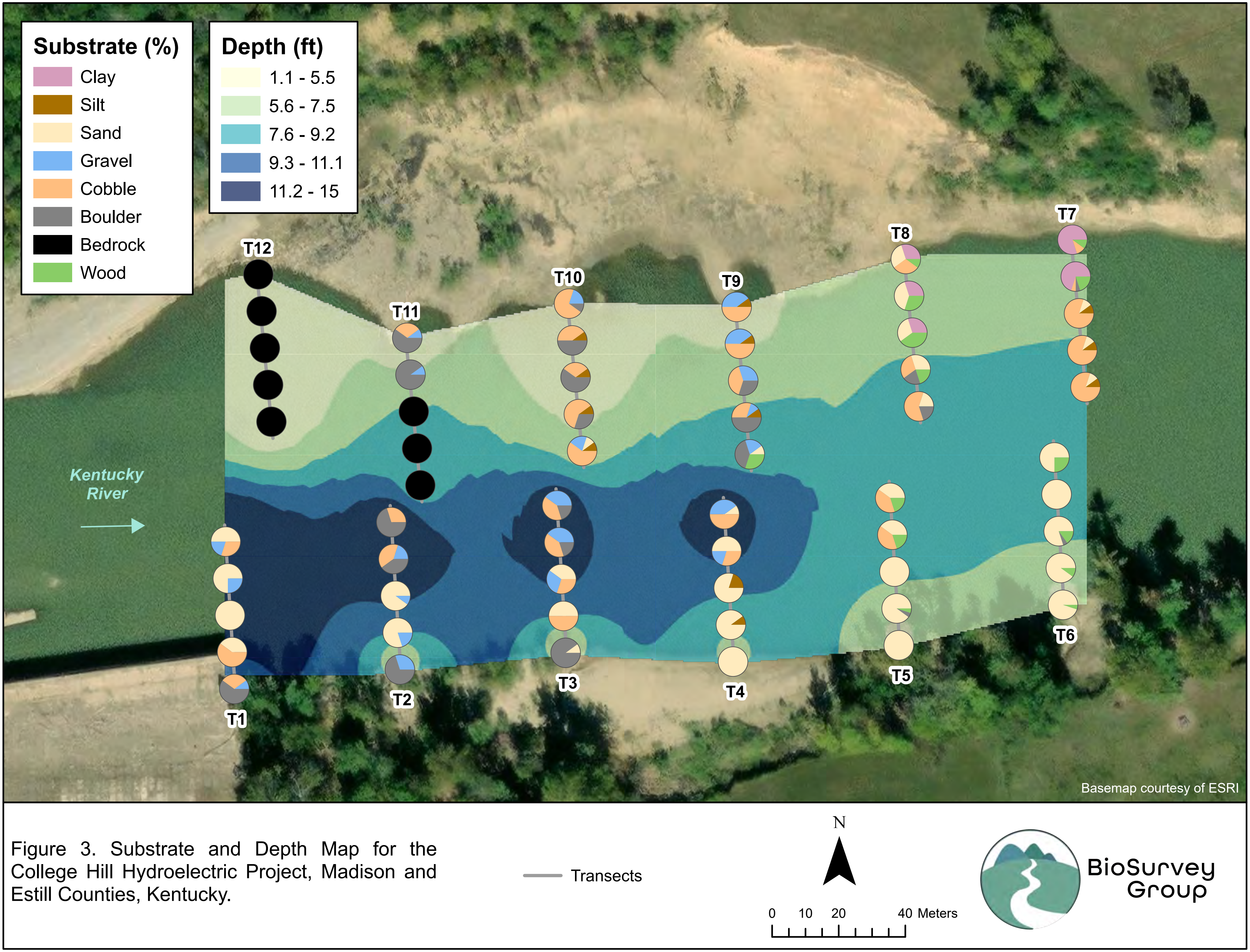


Figure 3. Substrate and Depth Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

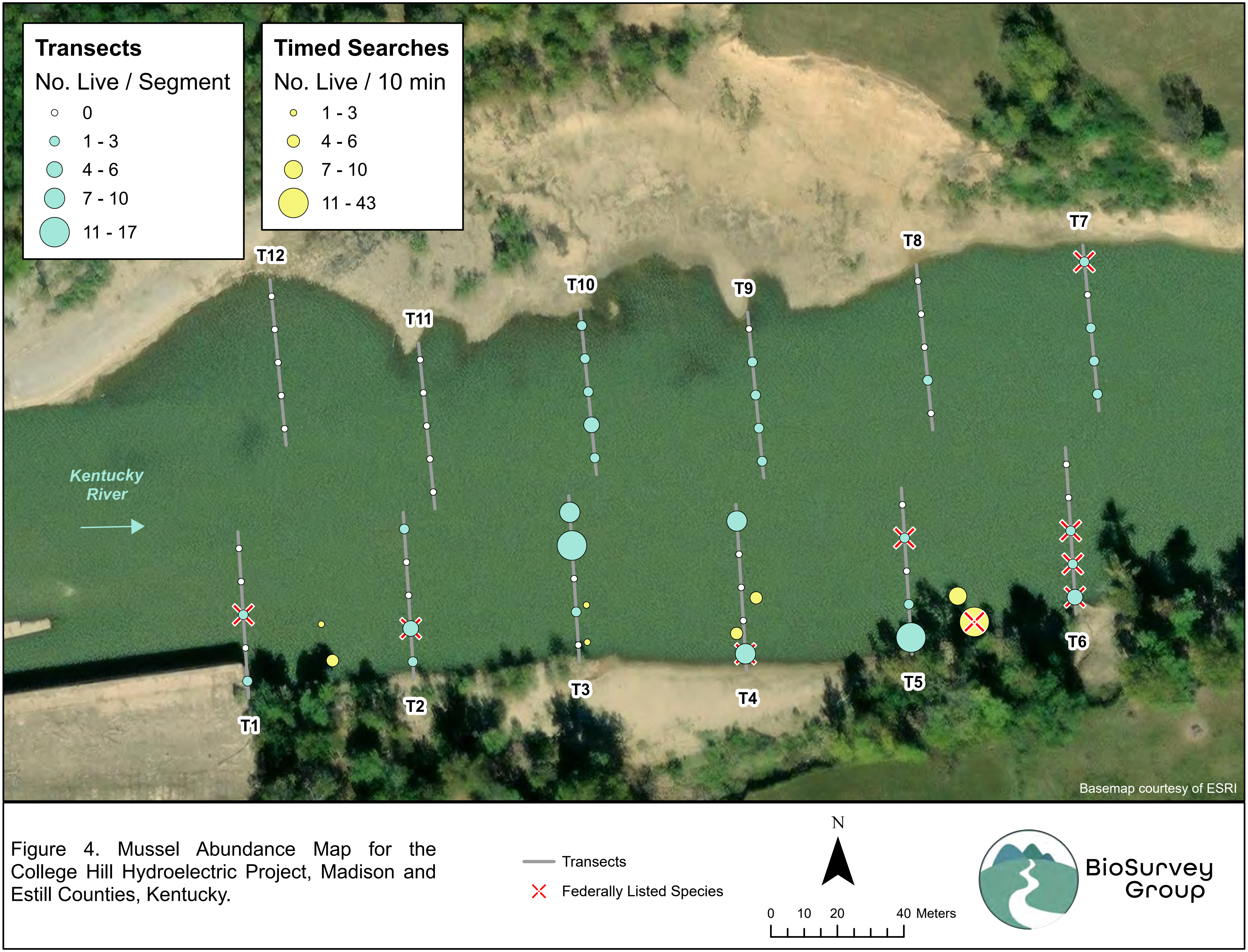
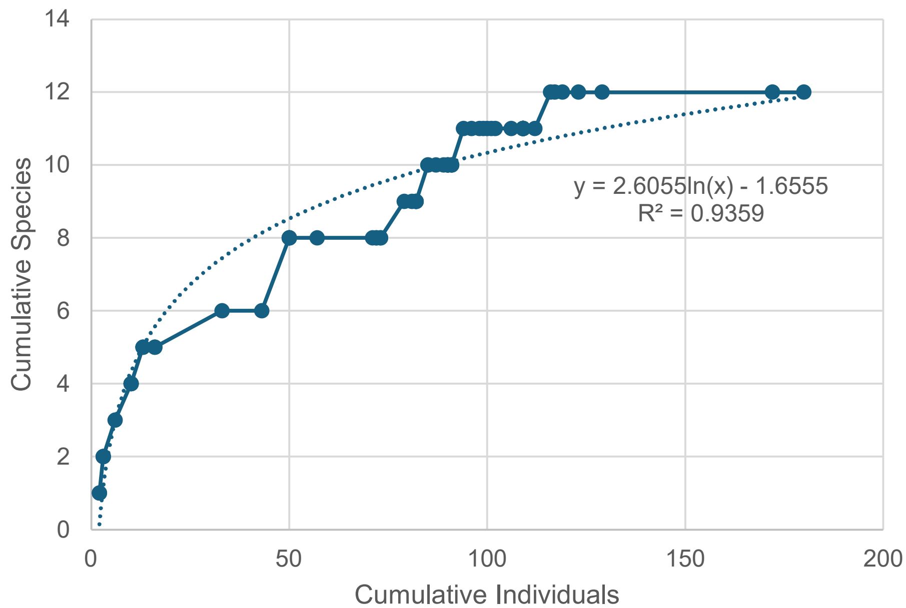


Figure 4. Mussel Abundance Map for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky.

Figure 7. Species Richness Curve for the College Hill Hydroelectric Project, Madison and Estill Counties, Kentucky



Appendix A
Scientific Collection Permits

Scientific Wildlife Collecting - Fed Protected

SC2411259

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

Effective: **1/1/24**
Expires: **12/31/24**
Fed Permit # ESPER0009122

This permit allows the taking and subsequent possession or release of federally-protected wildlife for the purposes of conducting scientific investigations or evaluations for which remuneration is received.

Regulated by
301 KAR 4:070

Your Scientific Wildlife Collecting - Fed Protected is attached below. Keep top portion for your records

Authorization Number: 9460
Issued on date: 03-Oct-2024

Kentucky Dept. of Fish and Wildlife Resources

Scientific Wildlife Collecting - Fed Protected
SC2411259 **Valid:** 1/1/24 **to** 12/31/24

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

ESPER0009122

Authorized by KDFWR

The Kentucky Department of Fish and Wildlife Resources is funded through the sale of hunting and fishing licenses. KDFWR receives no general tax dollars.

REPORT-A-POACHER 1-800-25ALERT

Have a question?   Call 1-800-858-1549

Visit us on the web at fw.ky.gov

Important Document

Enclosed

BioSurvey Group
Emily Grossman
21 Fort Zumwalt Drive

O'Fallon, MO 63366

NATIVE ENDANGERED & THREATENED SP. RECOVERY

Permit Number: ESPER0009122

Version Number: 2

Effective: 2024-04-26 **Expires:** 2027-12-31

Issuing Office:

Department of the Interior

U.S. FISH AND WILDLIFE SERVICE

ES Bloomington Permit Office
5600 American Boulevard, West, Suite 990
Bloomington, Minnesota 55437-1458
permitsR3ES@fws.gov

Karen Herrington

Digitally signed by
Karen Herrington
2024-04-25 15:27:07

Midwest Region Ecological Services Program Leader

Permittee:

Emily Grossman

21 Fort Zumwalt Dr.

O Fallon, Missouri 63368

U.S.A.

Authority: Statutes and Regulations: 16 U.S.C. 1539 (a), 16 U.S.C. 1533 (d) 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13

Location where authorized activity may be conducted:

ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

Reporting requirements:

DUE ANNUALLY ON 1/31

See permit conditions for reporting requirements

Appendix B
Mussel Survey Photo Log

Digital Image 1. View looking upstream toward Lock and Dam 11 from the middle of the survey area.

Digital Image 2. View looking downstream from the right descending bank.

Digital Image 3. View looking toward the left descending bank from the shoreward end of Transect 1.

Digital Image 4. View looking upstream along the left descending bank.

Digital Image 5. View looking toward the right descending bank of survey efforts on the left descending bank.

Digital Image 6. Representative photo of Mucket (*Actinonaias ligamentina*) collected in the survey.

Digital Image 7. Representative photo of Threeridge (*Amblema plicata*) collected in the survey.

Digital Image 8. Representative photo of Pimpleback (*Cyclonaias pustulosa*) collected in the survey.

Digital Image 9. Representative photo of Butterfly (*Ellipsaria lineolata*) collected in the survey.

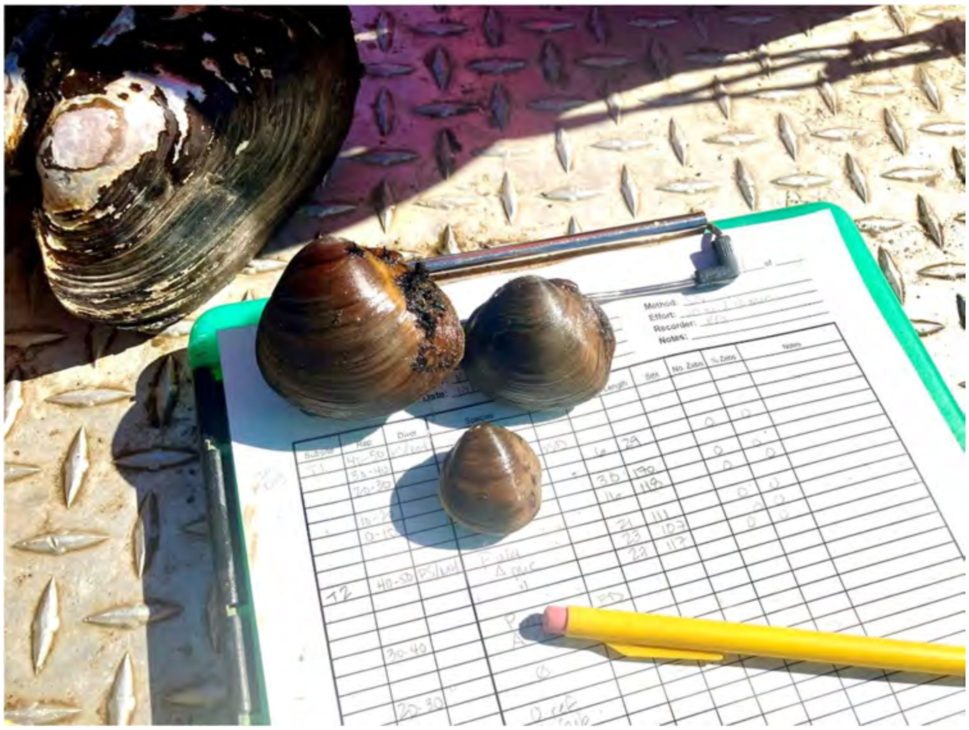
Digital Image 10. Representative photo of Wabash Pigtoe (*Fusconaia flava*) collected in the survey.

Digital Image 11. Representative photo of Fatmucket (*Lampsilis siliquoidea*) collected in the survey.

Digital Image 12. Representative photo of Yellow Sandshell (*Lampsilis teres*) collected in the survey.

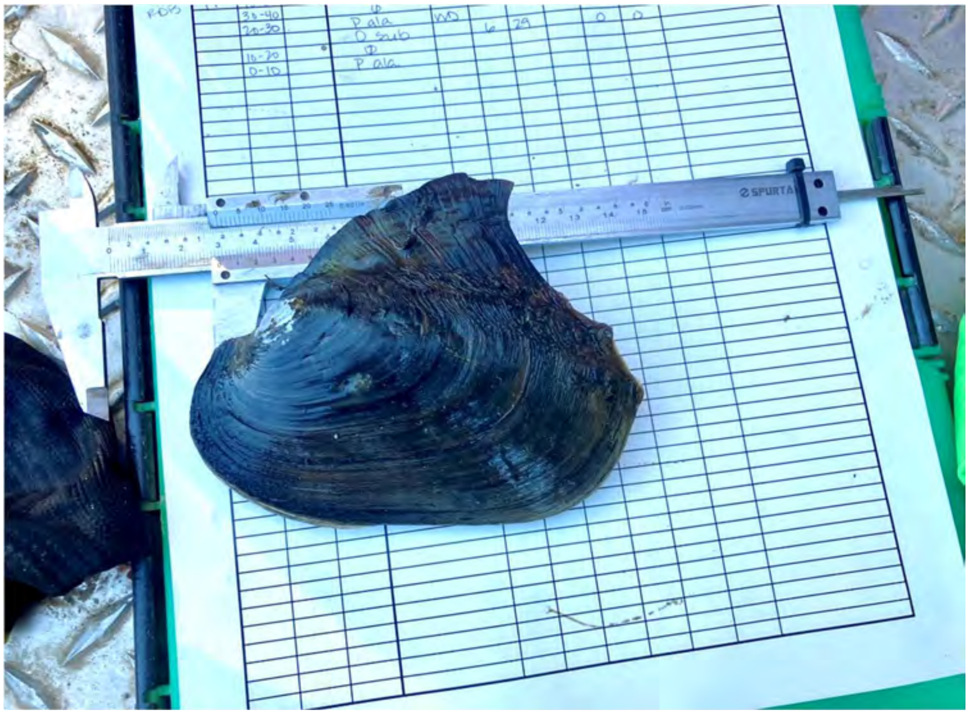
Digital Image 13. Representative photo of Threehorn Wartyback (*Obliquaria reflexa*) collected in the survey.

Digital Image 14. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 15. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.

Digital Image 16. Representative photo of Round Hickorynut (*Obovaria subrotunda*) collected in the survey.



Digital Image 17. Representative photo of Pink Heelsplitter (*Potamilus alatus*) collected in the survey.

Digital Image 18. Representative photo of Pink Papershell (*Potamilus ohiensis*) collected in the survey.

Digital Image 19. Representative photo of Mapleleaf (*Quadrula quadrula*) collected in the survey.

Digital Image 20. Representative photo of subfossil Plain Pocketbook (*Lampsilis cardium*) shell collected in the survey.

Digital Image 21. Representative photo of weathered dead Washboard (*Megalonaias nervosa*) shell collected in the survey.

Digital Image 22. Representative photo of weathered dead Sheepnose (*Plethobasus cyphyus*) shell collected in the survey.

Digital Image 23. Representative photo of weathered dead Fawnsfoot (*Truncilla donaciformis*) collected in the survey.

APPENDIX B

Kleinschmidt Associates Hydraulic Study Memorandum

TECHNICAL MEMORANDUM

To: Mr. David Brown Kinloch (Appalachian Hydro Associates)

From: Jill L. Davis, P.E. (Kleinschmidt Associates)

Cc: Paul D. Drew, P.E., CFM, Will Pruitt, CE (Kleinschmidt Associates)

Date: January 28, 2025 **Project No.** 1349009.03

Re: Lock and Dam No. 11 – Mussel Hydraulic Review

INTRODUCTION

Appalachian Hydro Associates contracted Kleinschmidt Associates (Kleinschmidt) to perform a hydraulic analysis to evaluate and compare the existing and proposed (post-construction) flow conditions at Lock and Dam No. 11 (Lock No. 11). The U.S. Fish and Wildlife Service (USFWS), upon review of the recent Mussel Survey Report (BioSurvey Group 2024), has three primary concerns regarding the impact from planned operations for the College Hill Hydroelectric Project (Project; FERC Project No. 14276):

1. Changes in flow conditions that would cause dislodgement of existing mussel beds.
2. Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.
3. Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.

This Technical Memorandum documents the development of a hydraulic model and the evaluation of the potential impacts of flow condition changes on federally listed mussel species and their host fish of concern downstream of the proposed Project (see Table 1).

Table 1 Federally Listed Species of Concern Downstream of the Proposed Project

Mussel Species	Host Fish Species
Round Hickorynut (*Obovaria subrotunda*) (17 live found)	Eastern Sand Darter (*Ammocrypta pellucida*)
Sheepnose (*Plethobasus cyphyus*) (1 dead, weathered shell found)	Sauger (*Sander canadensis*)

Elevations listed in this report reference the North American Vertical Datum of 1988 (NAVD 88). The spatial project is in reference to North American Datum of 1983 State Plan Kentucky South FIPS 1602 (feet US).

PROJECT DESCRIPTION

The proposed Project is located at River Mile 201 on the Kentucky River in east-central Kentucky, Madison County, near the Town of College Hill (Latitude 37° 47' 03", Longitude -84° 6' 11"), approximately 28 miles southeast of Frankfort, at Lock No. 11. The Kentucky River flows in a north-northwest direction to discharge into the Ohio River. The existing lock and dam were completed in 1906 by the United States Army Corps of Engineers (USACE) for purposes of navigation. The dam is no longer used for navigation, and use of the lock has been discontinued. In 1996, the USACE placed a concrete bulkhead on the sill of the upstream lock gate to close off the lock, and the downstream miter gates were left in the open position. The dam is currently owned and operated by the Kentucky River Authority, which took ownership from the USACE in March 2006.

The existing water retaining structures at the site span 289 feet between the guide and training walls that form the dam's north and south abutments. The structures develop a gross head of 17 feet between the upper (Elevation [El.] 582.5 feet) and lower pools (low pool condition, El. 565.5 feet). Tailwater from the downstream Lock and Dam No. 10 backs up against the dam. The passive spillway is 208 feet long, with a crest at El. 582.5 feet and a maximum height of approximately 35 feet above the foundation rock. The spillway is a concrete gravity structure, with an apron constructed of derrick stone that extends nearly 42 feet downstream of the spillway.

HYDRAULIC MODEL DEVELOPMENT

MODEL COMPUTATIONAL SETTING AND FLOW SCENARIOS

Kleinschmidt developed a two-dimensional (2D) hydraulic model using the USACE Hydraulic Engineering Center's River Analysis Software (HEC-RAS) version 6.4.1 to evaluate existing and proposed flow conditions for the Project. The model domain extends approximately 1,000 feet upstream of the Lock No. 11 spillway and 1,500 feet downstream.

The 2D model uses an unstructured computational mesh that allows computation cells with up to eight sides and a mixture of cell shapes and sizes. Each computation cell and cell face are based on the details of the underlying terrain to develop the geometric and hydraulic property tables for the flow simulations. Using RAS Mapper, one computation mesh was generated that covered the domain of the study area. The model existing conditions domain was developed using a 15-foot by 15-foot initial mesh square. The mesh was refined with several break lines to define the centerline, channel banks, hydraulic structures, and other pertinent features within the model domain. The resulting domain consists of 7,709 cells with maximum, minimum, and average cell areas equal to 4,257, 63, and 337 square feet, respectively. The proposed conditions domain used a

duplicate of the existing conditions domain, with modifications as necessary. The 2D model geometry is illustrated in Attachment 1.

The upstream boundary condition for the model was defined as a constant flow hydrograph for six flow scenarios summarized in Table 2. The downstream boundary condition was set as a rating curve using tailwater elevations developed using the one-dimensional (1D) HEC-RAS model (Kleinschmidt 2024a). The 1D HEC-RAS model uses a rating curve at the downstream Lock No. 10 spillway calibrated to flow and gage heights at U.S. Geological Survey (USGS) Gage No. 03284000 located in the Lock No. 10 headpond. Model calibration results are provided in Attachment 2. The hydraulic model was performed using the Full Momentum Shallow Water Equations with a 0.5-second timestep.

Table 2 HEC-RAS Model Scenarios

Model Scenario	Description	Flow (cfs*)
Existing Conditions		
1	Normal Flow – proposed maximum turbine capacity	2,636
2	Maximum Spillway Capacity – 20,000 cfs over the spillway only	20,000
3	Mean Annual Peak Flow (~2.3 Annual Exceedance Probability)	45,233
Proposed Conditions		
4	Maximum Turbine Capacity – maximum Project capacity before water spills over spillway	2,636
5	Maximum Spillway Capacity – 2,636 through Project; 17,364 over spillway	20,000
6	Mean Annual Peak Flow – bladder for Project lowered	45,233

* cfs = cubic feet per second

MODEL TERRAIN

The model terrain was developed using GIS and RAS Mapper (within HEC-RAS) from a combination of digital elevation models, depth sounding, and other hydraulic models. All elevation data were referenced with respect to NAVD88. The following is a comprehensive summary of data sources:

- Kentucky Light Detection and Ranging: KYFromAbove, 5-foot resolution.
- The mussel survey conducted by BioSurvey Group on October 7, 2024, included depth measurements from 12 transects (BioSurvey Group 2024). Depths were converted to elevations based on water surface elevation recorded by USGS Gage

No. 03284000 near the Lock No. 10 headpond. *Note that at low flows, the Lock No. 11 tailwater is approximately equivalent to the normal headwater elevation at Lock No. 10.*

- Upstream of the mussel survey area, channel elevations were estimated using data from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) reports for Madison and Estill counties (FEMA 2011, 2017).
- Downstream of the mussel survey area, the bathymetric surface was created using cross-sections from the effective FEMA 1D HEC-RAS model.
- Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b).

MANNING'S ROUGHNESS COEFFICIENTS (N)

The Manning's roughness coefficients (*n*) used in the model were selected based on guidance from the USACE *HEC-RAS 2D User's Manual* (USACE 2024), values reported in the FEMA FIS, and engineering judgement. Land cover regions were determined through a review of aerial imagery and manually assigned (Google 2024). The selected Manning's roughness coefficients (*n*) are summarized in Table 3.

Table 3 Manning's Roughness Coefficients (*n*)

Land Cover Type	Manning's Roughness Coefficient (*n*)
Channel	0.045
Lock	0.045
Forest	0.120
Overbanks	0.070
Pasture	0.040
Barren	0.040
Concrete	0.016

STRUCTURES

The spillway dimensions for both scenarios referenced Kleinschmidt drawings for the *Revised Phase 1 Submittal for the College Hill Hydroelectric Develop at Lock No. 11* (Kleinschmidt 2024b). The spillway was represented in the model as a single storage-area/2D (SA/2D) connection with a weir coefficient of 3.0. The predicted model headwater elevations were compared to the USGS gage data for each flow scenario to calibrate the weir coefficient. In the existing conditions, the upstream lock gates were assumed to remain closed during all flow scenarios. A comparison between predicted model headwater elevation and USGS gage data are provided in Attachment 2.

Proposed conditions incorporate a maintenance rubber bladder at the upstream end of the lock and an operational bladder located above the turbines. For all scenarios, the emergency bladder was fully deflated (572.5 feet). The operational bladder elevation was varied for different flow scenarios.

- In the lowest flow proposed scenario, the operational bladder is fully inflated (592.5 feet) with the turbines operating at maximum capacity (2,636 cfs), with all inflows passing through the turbines.
- In higher flow scenarios, turbines are non-operational, passing no flow, and the operational bladder is fully deflated (577.5 feet).

HYDRAULIC MODEL RESULTS

Reporting locations were selected based on mussel sampling transects in the BioSurvey report (BioSurvey Group 2024), combining collinear transects. The flood routing results at select transects are summarized in Table 4.

The model results indicate varying changes in peak velocity across different flow conditions and transects:

- The largest increase in velocity occurs at Transect 1 (immediately downstream of the lock structure) in all flow conditions (2.0 during normal flow and 0.5 feet per second [fps] during mean annual peak flow).
- **Normal Flow:** Maximum velocity increases at all transects. Under these conditions, the flow, which was previously distributed across the spillway, is now constrained to pass through the lock with a smaller cross-sectional area, leading to a relatively small (0.1 to 2.0 fps) increase in peak velocity.
- **Maximum Spillway Capacity:** In this scenario, the greatest change is an increase of 0.1 cfs at Transect 1; however, at all other transects, velocity decreases. This is due to flow passing through both the spillway and lock in the proposed condition, which allows flow to be more evenly distributed across the channel instead of only across the spillway.
- **Mean Annual Peak Flow:** At Transect 1, velocity increases by 0.5 fps, but at the remaining transects, there is little to no change. This proposed condition is most like the existing condition, where flow is distributed across both the spillway and the lock, with water overtopping both structures.

In addition to changes in velocity at each transect, flow patterns change between the existing and proposed conditions. Figure 1 through Figure 6 present plan views of velocity results at the transect locations, incorporating particle tracing to illustrate flow direction.

Under normal flow conditions, distinct differences are observed between existing and proposed conditions. In the existing conditions, flow within the main channel moves directly downstream. However, under the proposed conditions, the concentration of flow from the powerhouse outlet, combined with the absence of flow from the spillway, results in a zone of relatively low velocities directly downstream of the spillway. Additionally, a large eddy forms on the left side of the river between Transects 1 and 4.

Under maximum spillway capacity and mean annual flow conditions, flow patterns exhibit minimal changes. In both existing and proposed conditions, flow within the main channel continues to move directly downstream, with no significant alterations to flow direction or velocity distribution.

Table 4 Flood Routing Results

Reporting Location	Flow (cfs)*	Maximum Existing (fps)	Maximum Proposed (fps)	Velocity Change (fps)
Location 1	2,636	0.9	2.9	2.0
	20,000	3.1	3.2	0.1
	45,233	4.2	4.7	0.5
Location 2	2,636	0.8	2.0	1.2
	20,000	2.9	2.8	-0.1
	45,233	3.9	3.9	0.1
Location 3	2,636	0.8	1.6	0.8
	20,000	2.7	2.4	-0.3
	45,233	3.7	3.6	-0.1
Location 4	2,636	0.7	1.2	0.5
	20,000	2.5	2.1	-0.4
	45,233	3.5	3.5	0.0
Location 5	2,636	0.8	1.1	0.3
	20,000	2.5	2.2	-0.3
	45,233	3.4	3.5	0.1
Location 6	2,636	0.9	1.0	0.1
	20,000	2.6	2.5	-0.1
	45,233	3.5	3.6	0.1

* Flows of 2,636, 20,000, and 45,233 cfs correspond to the “Normal Flow,” “Maximum Spillway Capacity,” and “Mean Annual Peak Flow” flow scenarios, respectively.

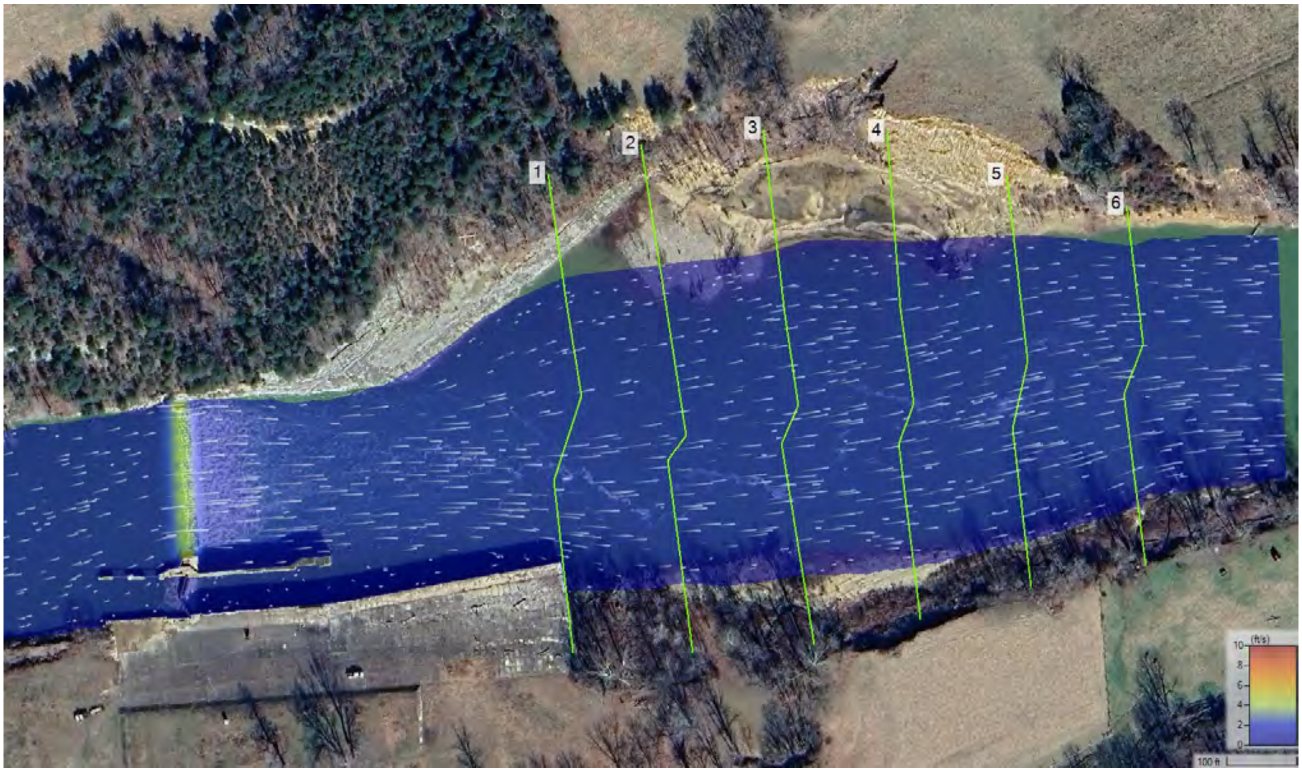


Figure 1 Existing Conditions Normal Flow

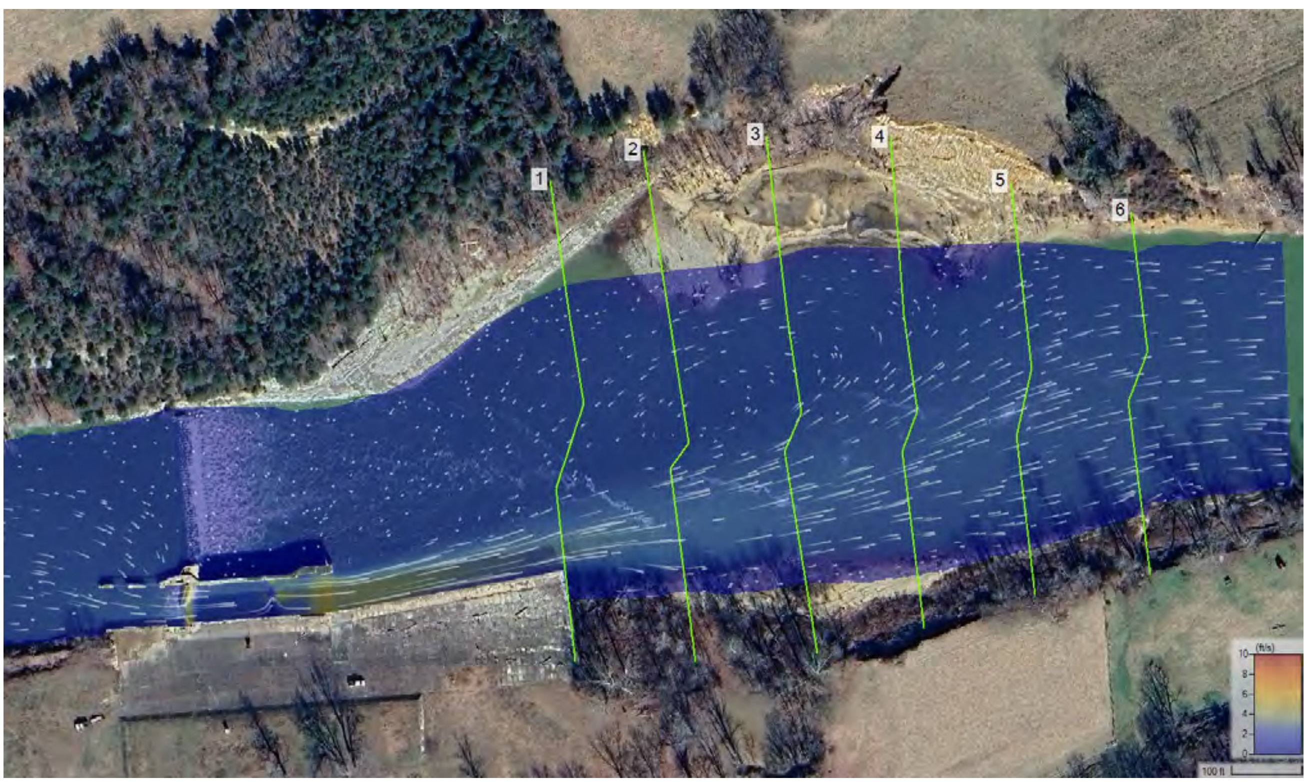


Figure 2 Proposed Conditions Normal Flow

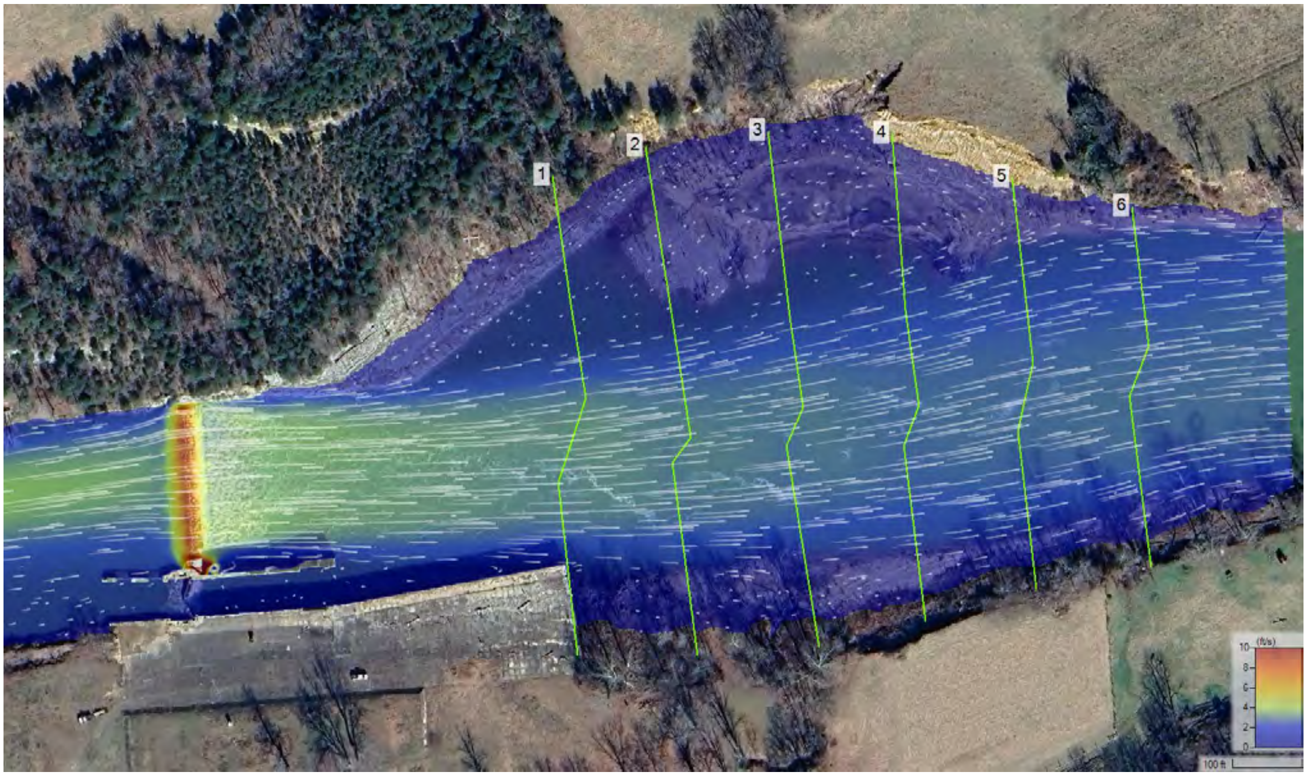


Figure 3 Existing Conditions Maximum Spillway Capacity Flow

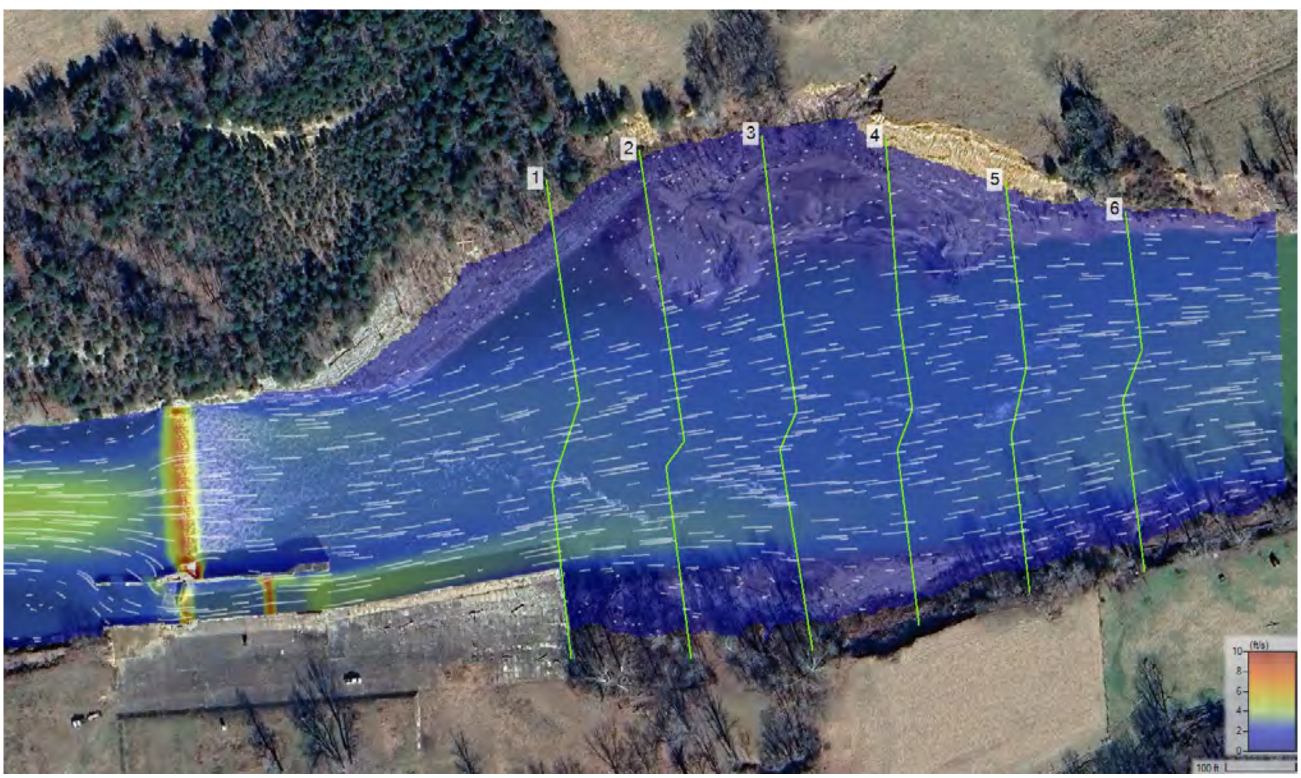


Figure 4 Proposed Conditions Maximum Spillway Capacity Flow

Kleinschmidt

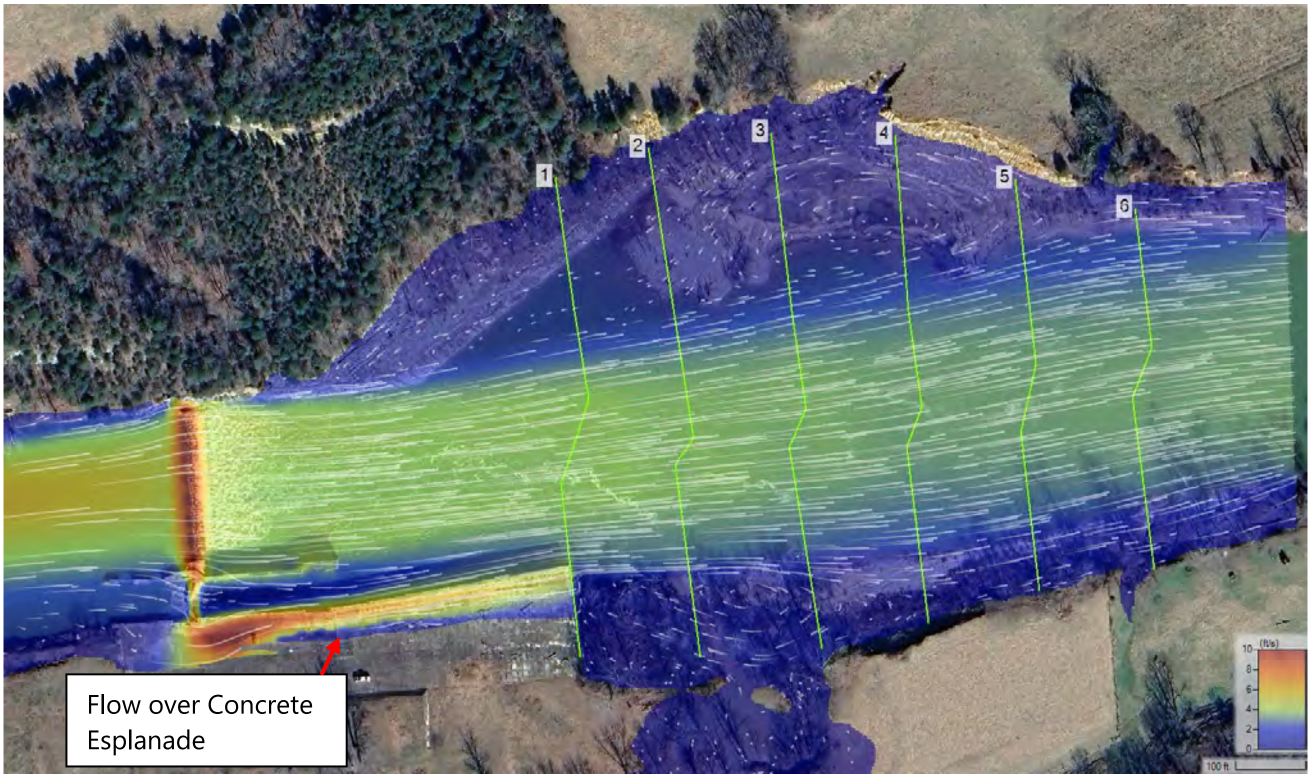


Figure 5 Existing Conditions Mean Annual Peak Flow

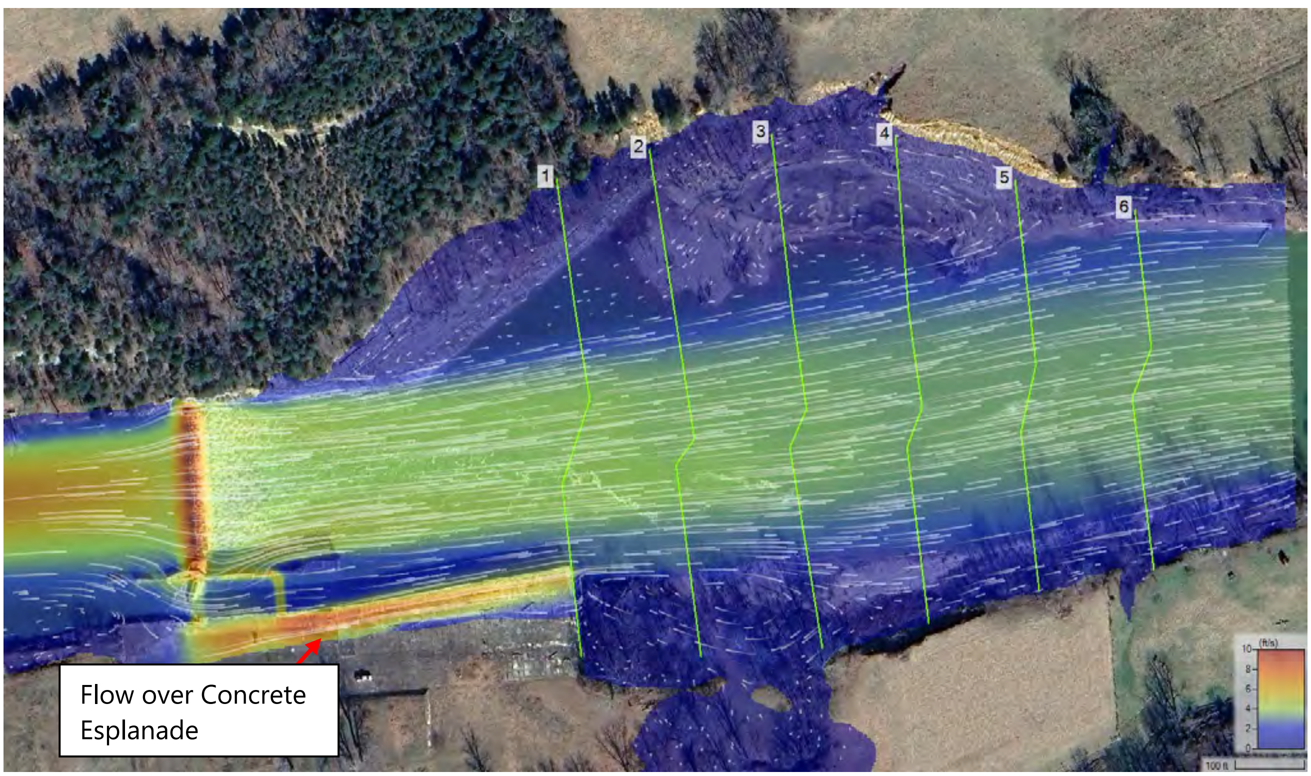


Figure 6 Proposed Conditions Mean Annual Peak Flow

MUSSEL IMPACT REVIEW

Freshwater mussel populations' susceptibility to environmental changes such as habitat fragmentation and alterations in flow regimes from dam construction and hydropower operations have been well-documented. Large-scale alteration in flow regimes, such as the series of locks and dams along the Kentucky River, had population-level effects on mussels, resulting in the listing of several species of concern. Although these past actions along the Kentucky River have altered the aquatic community throughout the basin over the last century, the focus of this discussion is at a much finer geographic scale (i.e., the potential change in hydraulic conditions at Lock No. 11 and potential effects on the mussel community). Specifically, the mussel species of concern include Round Hickorynut and Sheepnose.

As mentioned in the hydraulic model results above, the expected maximum change in peak depth-averaged velocity between existing and proposed conditions across each location/mussel transect is negligible in most flow scenarios. The most noticeable differences between existing and proposed conditions can be seen during the Normal Flow (2,636 cfs) scenario (Table 4, Figure 1, and Figure 2). In the Normal Flow scenario, most locations are not expected to have a noticeable change in peak depth-averaged velocity. However, Location 1 and Location 2 are expected to experience a 2.0 fps and a 1.2 fps change in water velocity under the proposed conditions, respectively (Table 4). In existing conditions, water is prevented from entering the lock structure, and all flow is routed over the existing spillway over a wide cross-sectional area. This allows more uniform dispersal of flows across the river channel. Conversely, under proposed conditions at normal flows, all water will be routed through the proposed powerhouse and discharged at the outlet of the existing lock structure. This creates an area of increased water velocities at the edge of the concrete esplanade at the right descending bank at Location 1 as water exits the existing lock structure (Figure 2). Continuing downstream, flow patterns begin to distribute across the river channel through Locations 3 and 4 and begin to resume "normal" flow patterns across Locations 5 and 6 and exiting the survey reach. Another potential change in flow pattern under the Normal Flow scenario includes the creation of an eddy along the left bank during base flow conditions. This eddy may allow fine sediments to settle when normal flows resume post-high event. The area is predominately bedrock substrates and generally unsuitable for mussels.

For proposed conditions, increased water velocity in Locations 1 and 2 (i.e., a maximum depth-averaged velocity of 2 fps) and change to flow patterns under Normal Flow scenario have the potential to affect the mussels in the immediate vicinity. The area at the outlet of the existing lock structure is expected to be most affected. Coincidentally, this is also the deepest part of the river that contains boulder, cobble, and gravel substrates. The water column depth and coarse substrate types are likely the result of this area continually

receiving the majority of discharge during high-water events. As such, these coarse substrates are not expected to scour under the proposed normal flow conditions. Some sand is present in Location 1, which may potentially be mobilized once the proposed project is in full operation, ultimately leaving more coarse substrates (i.e., boulder, cobble, and gravel) behind, as seen in Locations 2 and 3. However, this potential change is expected to be a one-time occurrence until a new equilibrium is reached.

In the Maximum Spillway Capacity (20,000 cfs) scenario (Figure 3 and Figure 4), there are some slight variations in flow patterns between existing and proposed conditions. This is the result of the modeled flows passing both through the powerhouse/lock structure and over the existing spillway. Although there may be a slight increase in water velocity exiting the lock in proposed conditions, the flow distribution across the river channel is relatively uniform and is not expected to affect substrates and in-river habitat conditions. Further, the flow of approximately 20,000 cfs occurs annually if not more frequently during the winter and springs months. As a result, there are no anticipated risks of mussel dislodgement or scouring of habitats, smothering of existing mussel beds, or alterations of habitats for fish hosts (i.e., Eastern Sand Darter and Sauger).

In the Mean Annual Peak Flow (45,233 cfs) scenario (Figure 5 and Figure 6), there is virtually no change in expected flow dynamics between existing and proposed conditions. The design and operation of the proposed gates would allow flows over the top of the turbine and through the lock structure during the Mean Annual Peak Flow. Because changes in flow pattern are essentially imperceivable, there are no anticipated impacts to mussels, their habitats, or host fishes in the Mean Annual Peak Flow proposed conditions.

It is important to understand the limitations of the modeling exercise and its 2D approach. As it stands, the existing model can produce a peak depth-averaged water velocity. Because this model is not three-dimensional, the expected velocities at various depths cannot be estimated. As such, the model cannot predict changes in velocities at the surface versus velocities at the substrate.

REVIEW SUMMARY

Based on the results of the hydraulic model and the evaluation of the potential impacts of these flow condition changes on the federally listed mussel species and their host fish of concern, the responses to the USFWS three primary concerns are as follows:

1. *Changes in flow conditions that would cause dislodgement of existing mussel beds.*

   During the Normal Flow scenario, flow conditions are expected to change at Locations 1 and 2. However, due to the existing depth and coarse substrate types, the expected increase in water velocity is unlikely to dislodge existing mussel beds

when compared to the yearly flow velocity changes that already exist. An important consideration when examining potential project effects are the flow conditions and river fluctuations that are currently experienced. This reach of the river frequently experiences flashy flows, particularly in the winter and spring months. As observed within the Mean Peak Flow scenario under existing conditions, water velocities increase 4.2 fps in Location 1 compared to the Normal Flow scenario. These flows pose a greater risk to mussel dislodgment than the expected increase of 2.0 fps at Normal Flow once the hydropower facility is in operation. In summary, the risk of mussel dislodgement and the movement of sediment occurs during high-flow events, which frequently happen under existing conditions. Under the proposed conditions, there is no observable difference in flow condition during the Mean Peak Annual Flow and is not likely to increase the risk of dislodgment that the existing mussel community currently faces. However, the substrates between Lock No. 11 and Location 1, presumed to be finer sediments, may potentially shift to coarser types after project implementation. This is due to the increased water velocity keeping the substrates in this deeper channel free of finer sediments, which is expected to stabilize post-project operation.

2. *Sediment transport through the lock or scouring of sediment from the immediate vicinity of the Project that may deposit and bury the existing mussel beds.*

   The sandy areas between Lock No. 11 and Location 1 (approximately 200-foot-long reach along the right bank) will likely be mobilized once power generation is online. This movement of substrates is expected to be a one-time occurrence until a new equilibrium is reached post-project implementation. Any mobilized soft sediments are expected to settle within or immediately downstream of the assessment area. Therefore, while initial scour and sediment deposition may occur, the volume is not expected to smother the mussel beds. The volume of sediment is not expected to exceed what is naturally scoured, transported, and deposited annually as the river continually fluctuates between base flow and peak flow conditions. As stated in Item 1 above, the risk of sediment scour or deposition is greatest during high-flow conditions and is not tied to the hydropower operations.

3. *Changes in flow conditions over/near mussel beds that alter the likely presence of host fish species.*

   Although some flow patterns are expected at the Project location during normal flow conditions at Locations 1 and 2, the changes in water velocity and flow patterns are not expected to alter habitats in a way that would affect the presence of known or potential fish host species.

REFERENCES

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APPENDIX F: 401 WATER QUALITY CERTIFICATION KENTUCKY RIVER LOCK & DAM 11

September 11, 2024

Hydro Partners LLC.
c/o: David Brown Kinlock
414 S. Wenzel Street
Louisville, Kentucky, 40204

Re: §401 Water Quality Certification
KY River Lock & Dam No 11
AI No.: 51764; Activity ID: APE20240004
WQC No: WQC2024-142-F
USACE ID No.: LRL-2015-00321
Kentucky River
Estill County, Kentucky

Dear Mr. Kinlock:

Pursuant to Section 401 of the Clean Water Act (CWA) and 40 CFR 121.7(c), the Commonwealth of Kentucky certifies it has reasonable assurances that applicable water quality standards under Kentucky Administrative Regulations Title 401, Chapter 10, established pursuant to Sections 301, 302, 303, 304, 306, and 307 of the CWA, will not be violated by the above referenced project provided that the U.S. Army Corps of Engineers authorizes the activity under a federal license or permit, and the attached conditions are met.

Other permits from the Division of Water may be required for this activity. Activities within a floodplain may require a Permit to Construct Across or Along a Stream; contact the Floodplain Management Section (502-564-3410). Projects that disturb one acre or more of land or is part of a larger common plan of development or sale that will ultimately disturb one acre or more of land require a Kentucky Pollution Discharge Elimination System (KPDES) Stormwater Permit; contact the Surface Water Permits Branch (502-564-3410 or SWPBSupport@ky.gov). A Groundwater Protection Plan is required if activities listed in Section 2(2) of 401 KAR 5:037 are conducted. A Water Withdrawal Application is required for activities proposing raw water withdrawals of 10,000 gallons per day or more; contact the Watershed Management Branch (502-564-3410).

All future correspondence on this project must reference AI No. **51764**. **The attached document is your official Water Quality Certification; please read it carefully**. Please contact Conner Flora by phone at 502-782-3531 or email at conner.flora@ky.gov if you have any questions.

Sincerely,

Samantha Vogeler

Samantha Vogeler, Supervisor
Water Quality Certification Section
Kentucky Division of Water

SV:CF
Attachment

cc: Meagan Knuckles, USACE: Louisville (via email: meagan.l.knuckles@usace.army.mil)
Lee Andrews, USFWS: Frankfort (via email: kentuckyes@fws.gov)
Andrea Drayer, Kentucky River Basin Coordinator: (via email: andrea.drayer@uky.edu)
Rob Daniell, Frankfort Regional Field Office: (via email: robert.daniell@ky.gov)

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Submittal/Action Requirements:

Condition No.	Condition
S-1	Prior to any construction activity, Hydro Partners, LLC shall submit copy of the final issued FERC license to the Water Quality Section Project Manager or Supervisor. This condition is necessary for the Division of Water to be informed of the ongoing activity for the purposes of site visits to ensure implementation of Kentucky Regulatory Statutes and Administrative Regulations; the Division will monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [40 CFR 230, 401 KAR 10:031 Section 2(1)(a)]
S-2	Hydro Partners, LLC shall notify the Water Quality Certification Project Manager or Supervisor of the scheduled start of construction activities at least two weeks before the start of construction. This condition is necessary for the Division of Water to be informed of the ongoing activity for the purposes of site visits to ensure implementation of Kentucky Regulatory Statutes and Administrative Regulations; the Division will monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
S-3	Hydro Partners, LLC shall notify the Water Quality Certification Project Manager or Supervisor of substantial completion of construction no later than two weeks post-construction. This condition is necessary for the Division of Water to be informed of the ongoing activity for the purposes of site visits to ensure implementation of Kentucky Regulatory Statutes and Administrative Regulations; the Division will monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 2, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
S-4	Hydro Partners, LLC shall submit as-built drawings within 90 days after substantial completion of construction to the Water Quality Certification Section Project Manager or Supervisor. This condition is necessary for the Division of Water to monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 3, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
S-5	Hydro Partners, LLC shall notify the Water Quality Certification Project Manager or Supervisor of the scheduled start of facility operation at least two weeks before the start of operation. This condition is necessary for the Division of Water to be informed of the ongoing activity for the purposes of site visits to ensure implementation of Kentucky Regulatory Statutes and Administrative Regulations; the Division will monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 4, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Submittal/Action Requirements:

Condition No.	Condition
S-6	Hydro Partners, LLC shall submit an Annual Monitoring Report for not less than 10 years to the Kentucky Division of Water by March 31st of the following year for each Monitoring Year as required in the Water Quality Plans for the College Hill Hydroelectric Station-FERC project No. 14276. The Annual Report will summarize the results of the Water Quality Monitoring for the year during the 6 months that monitoring is required, May through October, and shall include the following information: - A summary for each month that Dissolve Oxygen (DO) levels were measured. Include in the summary the following information: a) The average DO for each month b) Whether or not the average DO fell below the 5 mg/l level for a 24-hour period for each month c) Whether or not any DO readings fell below the 4 mg/l instantaneous level for each month d) Whether or not the facility shut down its operations at any point within the Monitoring Year and the reason(s) why it shut down e) Whether any Corrective Actions were required during each month to improve or record DO. [Clean Water Act]

Narrative Requirements:

Condition No.	Condition
T-1	The work approved by this certification shall be limited to: 37.784010, -84.103290. The project will impact 246 linear feet of perennial stream to create a hydropower production facility at Kentucky River Lock and Dam 11. This project will be completed within the existing footprint of the lock structure. This condition is necessary to confirm the activity approved under this certification. [401 KAR 10:030 Section 1, 401 KAR 9:010 Section 1(a)(2), KRS 224.10-100, KRS 224.70-110]
T-2	All work performed under this certification shall adhere to the design and specifications set forth in the following document(s): Application for Permit to Construct Across or Along a Stream and/or Water Quality Certification received on 4/25/2024, a Pre-Filling Meeting Request on 5/23/2024, and a Certification Request on 8/6/2024. Lock 11 Drawings PHASE 1-041924-P-14276.pdf StreamConstruction_Application – Lock 11 – Phase 1.pdf 427731.html

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Narrative Requirements:

Condition No.	Condition
	1349009_Lock 11 No Rise Cert 04-09-24-P-14276.pdf 1349009_Lock 11 SDR 04-09-24-P-14276.pdf NOD#1.pdf P-14276 License Order KY 11 5-5-16.pdf 1349009_Lock 11 QCIP Phase I Rev0_04.19.24 – P-14276.pdf Detailed Description of Phase 1.pdf PFMR.pdf NOD#1 RE.pdf NOD#2 RE.pdf Corp to FERC MOU 03-25-2011.pdf Pump Info NOD#2 RE.pdf NOD#3.pdf SiteVisit.pdf This condition is necessary to confirm the activity approved under this certification. [401 KAR 10:030 Section 1, 401 KAR 9:010 Section 1(a)(2), KRS 224.10-100,

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Narrative Requirements:

Condition No.	Condition
	KRS 224.70-110]
T-3	Hydro Partners shall abide by the following Mitigation of Potential Impacts indicated in the Memorandum of Agreement (Draft FERC Application for College Hill Hydroelectric Project, FERC project no. 14276): - The licensee shall be required to do Dissolved Oxygen monitoring in the months of May through October. If measured oxygen levels drop below a minimum level of 4 mg/l instantaneous or 5 mg/l averaged over a 24 hour period, the hydro plant must be shut down until unit measured oxygen levels are again above minimum levels. The licensee shall also provide dissolved oxygen level minimums. - The licensee must operate the plant in a run-of-river mode. This shall be accomplished by shutting down generating units in order to maintain a pool water level at or above the crest of the dam. The U.S. Geological Survey already has gage for the pool that can be used to verify that the hydro plant does not pull the pool down below the crest of the dam. - The licensee shall cease operation during low flow restricted periods declared by the Kentucky Division of Water or the Kentucky River Authority. Upon the request of either of these agencies, the hydro plant shall shut down during the flow emergency and not resume operation until it is notified that the low flow restriction has been lifted. This condition is necessary for the Division of Water to monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 5, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-4	Hydro Partners, LLC is responsible for preventing degradation of waters of the Commonwealth from soil erosion. An erosion and sedimentation control plan must be designed, implemented, and maintained in effective operating condition at all times during construction. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-5	Heavy equipment (e.g. bulldozers, backhoes, draglines, etc.), if required for this project, should not be used or operated within the stream channel. In those instances where such in-stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize re-suspension of sediments and disturbance to the channel, banks, or riparian vegetation. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-6	Erosion and sedimentation pollution control plans and Best Management Practices must be designed, installed, and maintained in effective operating condition at all times during construction activities so that violations of state water quality standards do not occur. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Narrative Requirements:

Condition No.	Condition
T-7	Remove all sediment and erosion control measures after re-vegetation has become well-established. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-8	Any fill or riprap shall be of a composition that shall not cause violations of water quality standards by adversely affecting the biological, chemical, or physical properties of waters of the Commonwealth. If riprap is used, it shall be of a weight and size that bank stress or slump conditions shall not occur. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-9	Sediment and erosion control measures (e.g., check-dams, silt fencing, or hay bales) shall not be placed within surface waters of the Commonwealth, either temporarily or permanently, without prior approval by the Kentucky Division of Water's Water Quality Certification Section. If placement of sediment and erosion control measures in surface waters is unavoidable, placement shall not be conducted in such a manner that may cause instability of streams that are adjacent to, upstream, or downstream of the structures. All sediment and erosion control measures shall be removed and the natural grade restored prior to withdrawal from the site. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-10	Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction from entering the watercourse. This condition is necessary to prevent water pollution as prohibited by statute. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-11	To the maximum extent practicable, all in-stream work under this certification shall be performed during low flow. This condition is necessary to prevent and minimize objectionable deposits and pollution and protect the use of the stream. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-12	Removal of existing riparian vegetation should be restricted to the minimum necessary for project construction. This condition is necessary to minimize negative effects to the environment. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]
T-13	Should stream pollution, wetland impairment, and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling 800/564-2380. This condition is necessary for the Division of Water to monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems, and to warn of emergency conditions. [401 KAR 10:030 Section 1, 401 KAR 10:031 Section 2(1)(a), KRS 224.10-100, KRS 224.70-110]

ACTV0000000004 (AI 51764 APE20240004) Hydro-Power Plant:

Narrative Requirements:

Condition No.	Condition
T-14	The authorization of this certification coincides with the duration of authorization by the issued federal FERC license. This condition is necessary for the issuance of the certification. [KRS 224.10-100, KRS 224.16-050(2), KRS 224.70-110]
T-15	If there is a transfer or conveyance of the project site during the issued WQC term for the approved activity, the Hydro Partners, LLC shall submit written notice to the Water Quality Certification Section Project Manager or Supervisor of the transfer or conveyance of the project site or any part of the project site at least 60 days prior to the transfer or conveyance of the project site. The notification shall include the WQC number; the Agency Interest (AI) No.; the name, mailing address, email address, and telephone number of the current owner; the name, mailing address, email address, and telephone number of the prospective transferee; the proposed effective date of transfer/conveyance; and a copy of the documentation evidencing the transfer/conveyance. Failure to comply with this condition does not negate the validity or enforceability of this certification. This condition is necessary for confirm authorized impacts, the appropriate responsible party, monitor the aquatic resources, minimize impact to aquatic resources, protect the use and designation of resources, allow more effective and efficient control practices, identify changes and conditions in ecological systems as a result of activities, and to warn of emergency conditions. [401 KAR 10:030 Section 1, 401 KAR 9:010 Section 1(a)(2), KRS 224.10-100, KRS 224.70-110]
T-16	Other permits from the Division of Water may be required for this activity. If this activity occurs within a floodplain, a Permit to Construct Across or Along a Stream may be required. Please contact the Floodplain Management Section Supervisor (502-564-3410) for more information. If the project will disturb one acre or more of land, or is part of a larger common plan of development or sale that will ultimately disturb one acre or more of land, a Kentucky Pollution Discharge Elimination System (KPDES) Stormwater Permit shall be required. Please contact the Surface Water Permits Branch (502-564-3410 or SWPBSupport@ky.gov) for more information. A Groundwater Protection Plan is required if any of the activities listed in Section 2(2) of 401 KAR 5:037 are conducted. A Water Withdrawal Application is required for any activities proposing raw water withdrawals of 10,000 gallons per day or more. For technical assistance contact the Watershed Management Branch at 502-564-3410 or visit eec.ky.gov. This condition is necessary for confirm authorized impacts, the appropriate responsible party, monitor the aquatic resources, minimize impact to aquatic resources, protect the use and designation of resources, allow more effective and efficient control practices, identify changes and conditions in ecological systems as a result of activities, and to warn of emergency conditions. [KRS 224.10-100, KRS 224.16-050(2), KRS 224.70-110]