



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
STREAM CHANNEL ALTERATION
PERMIT APPLICATION

For Official Use Only:

Instructions: Please print in ink or type and send one (1) completed hardcopy and one (1) digital copy of the application with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. Applications must be accompanied by a non-refundable filing fee of **\$25.00** payable to the Department of Land and Natural Resources. The Commission may not accept incomplete applications without the required signatures. For assistance, call the Stream Protection and Management Branch at **587-0234**. For further information and updates to this application form, visit <http://dlnr.hawaii.gov/cwrm>.

☒ Check here to allow Commission staff to communicate primarily via e-mail.
Legally required and other key correspondence will still be transmitted via postal mail.

PERMIT TYPE:

1. **Permit Applying For:** ☒ New ☐ After-The-Fact
2. **Type of Construction:** ☐ Installation ☒ Modification ☐ Removal

APPLICANT INFORMATION

3. APPLICANT'S NAME / COMPANY Ernest Y. K Lau P. E.	Applicant's Contact Person Kathryn Fujikami	Applicant's Phone (808)748 5744
Applicant's Mailing Address 630 South Beretania Street, Honolulu, HI 96843	Applicant's E-mail Address kfujikami@hbws.org	

☐ Check here if project will impact multiple landowners. If project impacts multiple landowners, skip **Item 4** below, then complete and attach **Form LND-APP** to identify and verify landowner's approval of proposed stream channel alteration work.

4. LANDOWNER'S NAME / COMPANY City and County of Honolulu	Landowner's Contact Person Kathryn Fujikami	Landowner's Phone 808 748 5744
Landowner's Mailing Address 630 S. Beretanis Strett 96843	Landowner's E-mail Address kfujikami@hbws.org	

5. CONSULTANT'S NAME / COMPANY David B. Bills/Bills Engineering Inc.	Consultant's Contact Person David B. Bills	Consultant's Phone (808) 781-1660
Consultant's Mailing Address 1108 Fort Street Mall Suite 4, Honolulu, HI 96813	Consultant's E-mail Address dbills@billsengineering.com	

6. CONTRACTOR'S NAME / COMPANY TBD	Contractor's Contact Person TBD	Contractor's Phone TBD
Contractor's Mailing Address TBD	Contractor's E-mail Address TBD	

STREAM INFORMATION

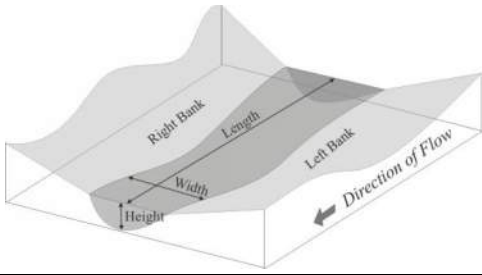
7. **Island:** (Check only one) ☐ Kauai ☐ Oahu ☐ Molokai ☐ Lanai ☐ Maui ☐ Hawaii

8. **Tax Map Key(s)** List all affected tax map key parcels.
8-4-030: 004

9. **Stream / Gulch Name(s)** List all affected streams and/or gulches.
Makaha Stream

FOR OFFICIAL USE ONLY:

LAT: _____	SWHU ID: _____	FILE ID: _____
LON: _____	GWHU ID: _____	DOC ID: _____
	REACH ID: _____	

GENERAL PROJECT INFORMATION									
10. Project Type: <i>Check all that apply.</i> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 33%;"><input type="checkbox"/> Bank Stabilization</div> <div style="width: 33%;"><input checked="" type="checkbox"/> Bridge</div> <div style="width: 33%;"><input type="checkbox"/> Channel Alignment</div> <div style="width: 33%;"><input checked="" type="checkbox"/> Channel Lining</div> <div style="width: 33%;"><input type="checkbox"/> Culvert</div> <div style="width: 33%;"><input type="checkbox"/> Dam / Dike / Weir</div> <div style="width: 33%;"><input type="checkbox"/> Desilting Area</div> <div style="width: 33%;"><input type="checkbox"/> Drainage Outlet</div> <div style="width: 33%;"><input checked="" type="checkbox"/> Dredging</div> <div style="width: 33%;"><input type="checkbox"/> Ford Crossing</div> <div style="width: 33%;"><input checked="" type="checkbox"/> Grading</div> <div style="width: 33%;"><input type="checkbox"/> Levee / Flood Wall</div> <div style="width: 33%;"><input type="checkbox"/> Restoration</div> <div style="width: 33%;"><input type="checkbox"/> Retaining Wall</div> <div style="width: 33%;"><input checked="" type="checkbox"/> Retention Basin</div> <div style="width: 33%;"><input type="checkbox"/> Stream Gage</div> <div style="width: 33%;"><input type="checkbox"/> Sewer Line</div> <div style="width: 33%;"><input type="checkbox"/> Water Line</div> <div style="width: 33%;"><input type="checkbox"/> Other - Describe:</div> </div>									
11. Project Site Location(s): <i>Provide site coordinates of downstream-most point of project in degrees, minutes, seconds (NAD83).</i> <div style="display: flex; justify-content: space-between;"> Latitude: 21° 29' 45.19" Longitude: (-) 158° 11' 07.94" Elevation: 1750 ft. above mean sea level </div>									
12. Structure Dimensions: <i>(feet)</i> <i>Provide generalized dimensions for the entire project / structure area. If the project includes a pipe (e.g., culvert, drain, etc.), provide the pipe diameter.</i> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Width:</td> <td style="border: 1px solid black; text-align: center;">65</td> </tr> <tr> <td>Height:</td> <td style="border: 1px solid black; text-align: center;">15</td> </tr> <tr> <td>Length:</td> <td style="border: 1px solid black; text-align: center;">100</td> </tr> <tr> <td>Diameter:</td> <td style="border: 1px solid black; text-align: center;">NA</td> </tr> </table>	Width:	65	Height:	15	Length:	100	Diameter:	NA	
Width:	65								
Height:	15								
Length:	100								
Diameter:	NA								
13. Structure Location: <i>Provide the general location of the stream channel alteration structure in relation to the streambank.</i> <div style="display: flex;"> <input type="checkbox"/> Left bank (downstream view) <input type="checkbox"/> Right bank (downstream view) <input checked="" type="checkbox"/> Across entire stream channel </div>									
14. State Land Use Classification: <i>(Check all that apply)</i> <div style="display: flex; justify-content: space-around;"> <input type="checkbox"/> Agriculture <input checked="" type="checkbox"/> Conservation <input type="checkbox"/> Rural <input type="checkbox"/> Urban </div>									
LEGAL REQUIREMENTS									
<p><i>If required, the permits or approvals below must be obtained before the Commission on Water Resource Management can legally issue a permit. Visit the Commission's Applications & Forms webpage (http://dlnr.hawaii.gov/cwrm/info/forms/) for links to agency websites/contact information.</i></p> <p>15. Conservation District Use Permit (CDUP): <i>To find out if your stream channel alteration project is located in a Conservation District (CD), you may visit to the Land Use Commission (LUC) website at http://luc.hawaii.gov/maps to view Land Use District Boundary maps. If the stream channel alteration will be located in a CD, contact the Department of Land and Natural Resources' Office of Conservation and Coastal Lands (OCCL) at (808) 587-0377 to determine if a CDUP is required.</i></p> <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Stream channel alteration is in a Conservation District. <div style="margin-left: 20px;"> <input type="checkbox"/> Required. CDUP #: <u>Pending</u> Date CDUP approved: <u>Pending</u> </div> <input type="checkbox"/> Not Required. <i>Attach documentation from Office of Conservation and Coastal Lands (OCCL), Department of Land and Natural Resources.</i> <input type="checkbox"/> I have not checked with the OCCL about whether or not a CDUP is required. <input type="checkbox"/> Stream channel alteration is <u>not</u> in a Conservation District. </div>									
<p>16. Special Management Area Permit (SMAP): <i>To determine if an SMAP is necessary, contact your County Planning Department.</i></p> <div style="margin-left: 20px;"> <input type="checkbox"/> Required. SMAP #: <u>N/A</u> Date SMAP approved: <u>Not Required See Appendix A</u> </div> <input checked="" type="checkbox"/> Not Required. <i>Attach documentation from applicable County agency.</i> <input type="checkbox"/> I have not checked with the County about whether or not an SMA Permit is required.									
<p>17. State Historic Preservation Division (SHPD), Department of Land and Natural Resources: <i>If the parcel(s) affected by the stream alteration has been reviewed by the State Department of Land and Natural Resources Historic Preservation Division (SHPD or through an OEQC Environmental Review, Special Management Area Permit, etc.), check "yes" and attach any relevant documentation from SHPD. If the affected parcel(s) has not undergone SHPD review, attach a photograph of the affected area, a schematic diagram (showing the location, access road and infrastructure for the alteration), and a short description of the prior use(s) of the land on which the alteration resides.</i></p> <p><i>*Please note: You are strongly advised to contact the SHPD to obtain a pre-review of your project. In the event that you do not get an HP pre-review and if during the course of either review or the permit itself it is determined that you need SHPD's concurrence, your application or permit may be held in abeyance or denied until issues with HP are resolved. To contact SHPD, please call (808) 692-8015.</i></p> <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> I have consulted the SHPD regarding potential impacts of stream channel alteration activities on historic sites. I have attached applicable documentation from the SHPD. <input type="checkbox"/> I have not consulted with the SHPD regarding potential impacts of stream channel alteration activities on historic sites. </div>									
<p>18. Chapter 343, Hawaii Revised Statutes, Hawaii Environmental Policy Act:</p> <div style="margin-left: 20px;"> <input type="checkbox"/> An Environmental Assessment was completed, and <input type="checkbox"/> An Environmental Impact Statement was required and has been accepted (attach letter of acceptance). Publication date in The Environmental Notice: <u>See Appendix B BWS Exemption List</u> </div> <input type="checkbox"/> A Finding of No Significant Impact has been determined (attach letter). Publication date in The Environmental Notice: _____									
<p>This project proposes:</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input checked="" type="checkbox"/> Use of state or county lands, or use of state or county funds <input type="checkbox"/> Use within a state conservation district <input type="checkbox"/> Use within a shoreline setback area <input type="checkbox"/> Use within a national or Hawaii registered historic site <input type="checkbox"/> Use within the Waikiki Special District <input type="checkbox"/> The construction, expansion or modification of helicopter facility </div> <div style="width: 50%;"> <input type="checkbox"/> A wastewater treatment unit <input type="checkbox"/> Waste-to-energy facility <input type="checkbox"/> Landfill <input type="checkbox"/> Oil refinery <input type="checkbox"/> Power-generating facility <input type="checkbox"/> None of the above 11 items </div> </div>									

OTHER REGULATORY REQUIREMENTS

If the proposed stream channel alteration is subject to the following permits or approvals, indicate by checking the appropriate box below and submit either the approval letter from the appropriate agency or attach a copy of the application form. If the proposed stream channel alteration is not subject to the following permits or approvals, indicate by checking the "N/A" (Not Applicable) field.

	<u>Attached</u> Submitted 9/11/2023 -Not Attached	<u>N/A</u> Submitted 9/11/2023 - Part of ACE Not Attached
19. U.S. Army Corps of Engineers (Harbors and Rivers Act, Section 404, Clean Water Act)		
20. State Department of Health, Clean Water Branch (Section 401, Clean Water Act, Water Quality Certification, Best Management Practices Plan)		
21. Right-of-Entry or Right-of-Way Permit if the proposed stream channel alteration includes State lands. (Chapter 171, Hawaii Revised Statutes)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22. Hawaii Environmental Policy Act (Chapter 343, Hawaii Revised Statutes; Title 11, Chapter 200, Hawaii Administrative Rules)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
23. Soil and Water Conservation District	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24. County Certification of "No-Rise"	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25. County Grading Permit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
26. County Discretionary Permit(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

CULTURAL IMPACTS

Articles IX and XII of the State Constitution, other state laws, and the courts of the State, require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. If there is not enough space available, please make a note in the field (e.g., "See attached") and attach all information with this application as requested.

27. Please provide the identity and scope of cultural, historical, and natural resources in which traditional and customary native Hawaiian rights are exercised in the area.

A SHPD 6E application was prepared and submitted to the Office of Historic Preservation. While the SHPD 6E primarily does a field investigation and literature review (FILR) the artifacts identified also provide an insight to the cultural and native Hawaiian practices. Every feature identified in the SHPD 6E application refers to a site representing agriculture and even a potential agricultural shrine.

It seems logical to conclude the most significant cultural activity was directly related to agricultural practices. The SHPD 6E submittal is attached as Appendix C.

28. Identify the extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action.

According to the SHPD 6E there are three (3) sites of particular interest. One site is in the proposed project staging area (TS-1) may be an agricultural shrine and subject to preservation. Two (2) other sites (TS-2 and TS-6) have not been assigned an integrity designation. Parts of TS-2 are in the area or close enough that the project would cause disturbance. TS-6 is not within the actual work area but is at the top of a slope that will be excavated and the excavation vibration could cause disturbance of TS-6.

29. What feasible action, if any, could be taken by the Commission on Water Resource Management in regards to your application to reasonably protect Native Hawaiian rights?

Due to the critical nature of the staging area, the design Consultant in consultation with the Archaeologist prepared an AIS early in the project planning stages. Site TS-1 was found in the staging area. It can easily be marked off allowing no disturbance.

Site TS-2 and TS-6 are proposed for an AIS.

It has been proposed the whole project site be subject to Archaeological monitoring during construction.

NOTE: SHPD has not reviewed the SHPD for the project or the AIS already conducted at the staging area. All mitigation proposed herein is subject to change pending the SHPD 6E review and comments.

PROJECT DESCRIPTION

Please complete the following sections by providing detailed information on the project components identified below. If there is not enough space available, please make a note in the field (e.g., "See attached") and attach all information with this application as requested.

30. Describe the overall project scope and objectives.

See Attachment for Item 30

31. Describe existing stream channel and streamflow conditions at the site of the proposed stream channel alteration.

See Attachment for Item 31

32. Identify and describe the project components outlined below

A. Materials

Panel Truss Bridge - 1
New Ductile iron pipe for Temporary and Permanent water lines - 300 LF
Geoterra GTO construction matting - 1,800 SF
Gabuion baskets - 4 (6' x 3')
Trench Shields for Diversion Ditch - 25 Total (Assuming 6-foot pe shield)
Soil Nail System for cut bank - 1,500 SF with Soil Nails 4-foot on center with 120 CY Shotcrete
New Electrical and Communications line for Temporary and Permanent - 300 LF
Erosion Control (Bio-Sock/Filter Sock - 500 LF, 3' x3' super sacks - 20 EA)

B. Quantities

See Item 32.A for Materials
See Item 32.C for Excavation
See Item 32.D for Fill
See Item 32.E for

C. Excavation

Diversion ditch - 200 CY
Soil Nailed Slope - 800 CY
Grading Phase 3 - 500 CY
Grading Phase 4 - 275 CY
Grading Phase 5 - 45 CY

D. Fill

Backfill after Diversion Ditch no longer required - 160 CY
Grouted Rubble Pavement (Bridge Abutment Protection - 170 CY

E. Disposal

Clearing and Grubbing- 1000 CY (Estimate)
Grading Phase 3 - 500 CY
Grading Phase 4 - 275 CY
Grading Phase 5 - 45 CY

F. Construction methods

Clearing and Grubbing
Water line Installation
Electric and Communications Installation
Excavation with Back Hoe Loader
Disposal Haul Trucks (Dump Trucks w/ Covers)
Truck Mounted Crane Operation to set Panel Truss Bridge

G. Temporary facilities

Staging Area
Temporary Access Road
Temporary Water Line
Temporary Electrical and Communications lines
Diversion Ditch

H Expected period of time required for construction

365 Days (1 Year)
NOTE: No Grubbing trees over 15-foot tall between June 1 and September 15.

I. Liability during construction

As far as with respect to DLNR there should be no liability since BWS will have to sign indemnity to obtain DLNR signature on application.

As far as Contractor the liability would be almost the same for any construction project and the Contract Documents will require standard insurance coverage.

33. Describe the project's consistency with county zoning and development plans.

The project is totally within the Conservation District and a Conservation District Use Permit will be required. As of this date a Request for a Jurisdictional Determination (RFJ) has been submitted on August 21, 2023. No response has been received. However, based on dealings with DLNR-OCCL a requirement for a Board approved CDUP is anticipated. The RFJ is attached as Appendix D.

Since the project is totally within the Conservation District County Zoning and Development Plans do not apply. However, it is anticipated the project's bridge structure will require a Building Permit. It is also anticipated a C & C Grading Permit will be required.

34. Identify potential alternatives to the project and describe the relative costs and benefits of each alternative.

Item 30 has already described the alternatives for this project. They were:

The access road to the Makaha Wells II, III, and IV is important to the vitality of the BWS Leeward water system and supply. The only means to correct the existing deficiency is to provide a stream crossing that can handle a 100-year design flow. A culvert was considered but it would have to be 8-foot tall by 24-foot wide operating under 3-foot of backwater head on the culvert. In order to not utilize any backwater head on the upstream side of the culvert, the culvert would have to be 8-foot tall and 34-foot long. Due to the fact it is still a culvert, even though much bigger, there is no guarantee that maintenance would keep the culvert open and eliminate clogging.

The anticipated cost of the 8-foot tall and 34-foot long box culvert would be approximately \$4.5 million dollars. There is no guarantee this will not run into maintenance problems (clogging) that currently occur. It is assumed the maintenance requirements for a much larger culvert would be substantially reduced but not completely eliminated.

A panel truss bridge has been selected to replace the crossing of Makaha Stream since stream flow would always have freeboard and flow would never be impeded.

The projected cost for the panel truss bridge \$5.3 million dollars.

As a secondary concern the bridge option would be more environmentally friendly to aquatic species and migration. A Natural Resources Assessment was prepared to the project and is contained in Appendix E.

SUBMITTALS

Please submit the following plans, maps, or drawings in legible form, preferably on 8.5" by 11" sheets.

35. Location Map: Provide a location map of the proposed project relative to major roadways.

36. Plans / Elevations / Sections: Provide a plan view of the proposed stream channel alteration structure in relation to the stream channel and property boundaries. Elevation and section views of the structure in relation to the stream channel should also be provided if available.

SIGNATURES

Signing below indicates that the signatories understand and swear that the information provided is accurate and true to the best of their knowledge. Further, the signatories understand that if the permit requested is granted by the Commission on Water Resource Management (Commission), the permit shall be subject to the following conditions:

- 1) The proposed work is to be completed within two (2) years from the date of permit approval.
- 2) The permittee shall notify the Commission, by letter, of the actual dates of project initiation and completion.
- 3) The permittee shall submit a set of as-built plans and photographs to the Commission upon completion of the project.
- 4) The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months.
- 5) If the commencement or completion date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

37. APPLICANT

Print Name:

Ernest Y. K. Lau Manager and Chief
Engineer (RWS)

Signature:



Date:

10.17.2023

38. CONSULTANT

Print Name:

David B. Bills

Signature:



Date:

10/10/2023

39. CONTRACTOR

Print Name:

TBD

Signature:

Date:

40. LANDOWNER (If multiple landowners, skip **Section 53**, then complete and attach **Form SCAP-LND** with appropriate landowner signatures.)

Print Name:

Ernest Y. K. Lau Manager and Chief
Engineer (RWS)

Signature:



Date:

10.17.2023

CHECKLIST FOR A COMPLETE APPLICATION and ITEM DESCRIPTIONS (ITEMS 1 - 14)

- ☒ Fill in the most recent application form (check <http://dlnr.hawaii.gov/cwrm> or call 587-0234 for updates).
- ☒ Fill in every line which includes Items 1-40, as indicated (total 8 pages).
- ☒ Enclose a check for \$25 payable to the Department of Land and Natural Resources.
- ☒ Mark the proposed stream channel alteration location on: the appropriate USGS quad map, TMK map, photo and schematic, and attach to the application.
- ☐ Attach Form LND-APP to identify and obtain authorizations for the project if multiple landowners will be impacted.
- ☒ Attach a grading plan and cross section profiles showing existing and finish grades, if available.
- ☒ Attach documentation from CDUP, SMAP, SHPD when applicable regarding Items 15-17.
- ☐ Attach letters from U.S. Army Corps of Engineers, Hawaii Department of Health, Office of Conservation and Coastal Lands, and appropriate county agencies regarding Items 18-26.
- ☒ Provide digital copies on CD-ROM or via e-mail, if available.
- ☒ Obtain the necessary signatures for the application form.

Send the application and maps, copies, and the filing fee to:

Commission on Water Resource Management

P.O. Box 621

Honolulu, HI 96809

PERMIT TYPE

1. **Permit Status:** Indicate whether this application is for a new stream channel alteration project (including medication or abandonment) or if the project has already been completed and an after-the-fact permit is being applied for.
2. **Type of Construction:** Is the permit application for the installation of a new stream channel alteration, or modification or removal of an existing stream channel structure.

APPLICANT INFORMATION

3. **Applicant's Information:** Fill in the information for the applicant. This should be the entity that will be responsible for the maintenance of the stream channel alteration when the project is completed.
4. **Landowner's Information:** Fill in the information for the landowner of the property where the stream channel alteration will be located.
5. **Consultant's Information:** Fill in the information for the consultant who will assist with plan and design preparation for the subject project.
6. **Contractor's information:** Fill in the information for the contractor who will perform the work on the subject stream channel alteration project.

STREAM INFORMATION

7. **Island:** The island name where the stream channel alteration will be located.
8. **TMK:** Tax Map Key number (generally there is no lot number, but where a parcel is divided into two lots, fill in the lot number)
9. **Stream / Gulch Name:** Name of the stream or gulch where the stream channel alteration will be located.

GENERAL PROJECT INFORMATION

10. **Project Type:** Identify the type of work being performed, and select all that apply to the project.
11. **Project Site Location(s):** Fill in stream channel alteration location coordinates taken from a GPS unit at the project site. Units are Degrees, Minutes and Seconds (seconds should be filled out to at least one decimal place; e.g. 19°59'32.8"N, 155°14'51.5"W). If more than one site, attach separate sheet. Elevations should be provided in feet above mean sea level.
12. **Structure Dimensions:** What are the physical dimensions of the stream channel alteration structure that will be located in or adjacent to the stream channel?
13. **Structure Location:** Will the structure be located on the right or left bank (facing downstream) or across the entire stream channel?
14. **State Land Use Classification:** Identify the current State Land Use Classification.

Please see header descriptions for remaining Sections in completing Items 15 to 40.

ATTACHMENT FOR ITEM 30

(All Exhibits at End of This Section)

Objective

The access road to the Makaha Wells II, III, and IV is important to the vitality of the BWS Leeward water system and supply. The only means to correct the existing deficiency is to provide a stream crossing that can handle a 100-year design flow. A culvert was considered but it would have to be 8-foot tall by 24-foot wide operating under 3-foot of backwater head on the culvert. In order to not utilize any backwater head on the upstream side of the culvert, the culvert would have to be 8-foot tall and 34-foot wide. Due to the fact it is still a culvert, even though much bigger, there is no guarantee that maintenance would keep the culvert open and eliminate clogging.

A panel truss bridge has been selected to replace the crossing of Makaha Stream since stream flow would always have freeboard and flow would never be impeded.

The profile of Makaha Stream at present is shown on Exhibit 7. The existing grade is highlighted and the bridge has not been built as of this date. It is obvious that the six existing culverts lost capacity and water was stored on the upstream side of the bridge until the area completely filled with rock and soil.

Description of Proposed Activities

Exhibit 1 provided a location and island map. Exhibit 8 provides a closer view of Makaha Valley and more specifically locates the project site. Exhibit 9 is the Project Site Plan and shows all of the elements of the project. Construction steps are as follows:

1. The existing access road is a winding access road leading to Makaha Valley Well II, III and IV. A temporary access road section must be installed to allow vehicle access to the well sites above during construction.
2. In order to construct the temporary access road, there is a bank that has to be cut and soil nailed. The soil nailed slope (outside of the Makaha stream limits) is shown on Exhibit 10.
3. A Makaha stream diversion ditch will be constructed next. It is shown stretching from upstream of the existing stream crossing and runs to a discharge point below the existing crossing and back into Makaha stream downstream of the work area. The design capacity will exceed a 2-year, 24-hour storm (2-year, 24-hour storm = 270 cfs: Provided 500 cfs See Appendix A). The diversion bypass will be constructed of trench shields with a tremie poured basin to minimize or eliminate erosion while flow is within the diversion ditch and allow continuity of flow in Makaha Stream for aquatic species. Excavated material from the diversion ditch (only) will be stockpiled adjacent to the site with a silt fence / filter sock perimeter and neoprene cover, to be used to backfill the diversion ditch (only), outside of the stream, at the completion of the project. A profile of the diversion ditch is shown on Exhibit 11 and sections of the diversion ditch are shown on Exhibit 12.
4. With the Makaha Stream flow diverted, the bulk of the project can be completed. The first item after diversion would be to install the temporary access road and temporary water main. A pipe

trench will be dug under the temporary road alignment to maintain water supply during construction. After the trench is filled, the access road will be constructed as shown on the constructions using a Geoterra™ GTO construction road system and gabions at low points in the mid-point of the temporary access road.

5. The temporary power would be strung over Makaha Stream on poles and would not affect any portion of Makaha Stream.
6. The major undertaking after all the prior work has occurred is removing the existing ford crossing (including the removal of the existing culvert crossing, the existing 12-inch culverts and the existing 16-inch water supply main). Grading within Makaha Stream is required. The grading will occur in two phases. The diversion ditch will be in place for the duration of any work in the Makaha Stream channel.

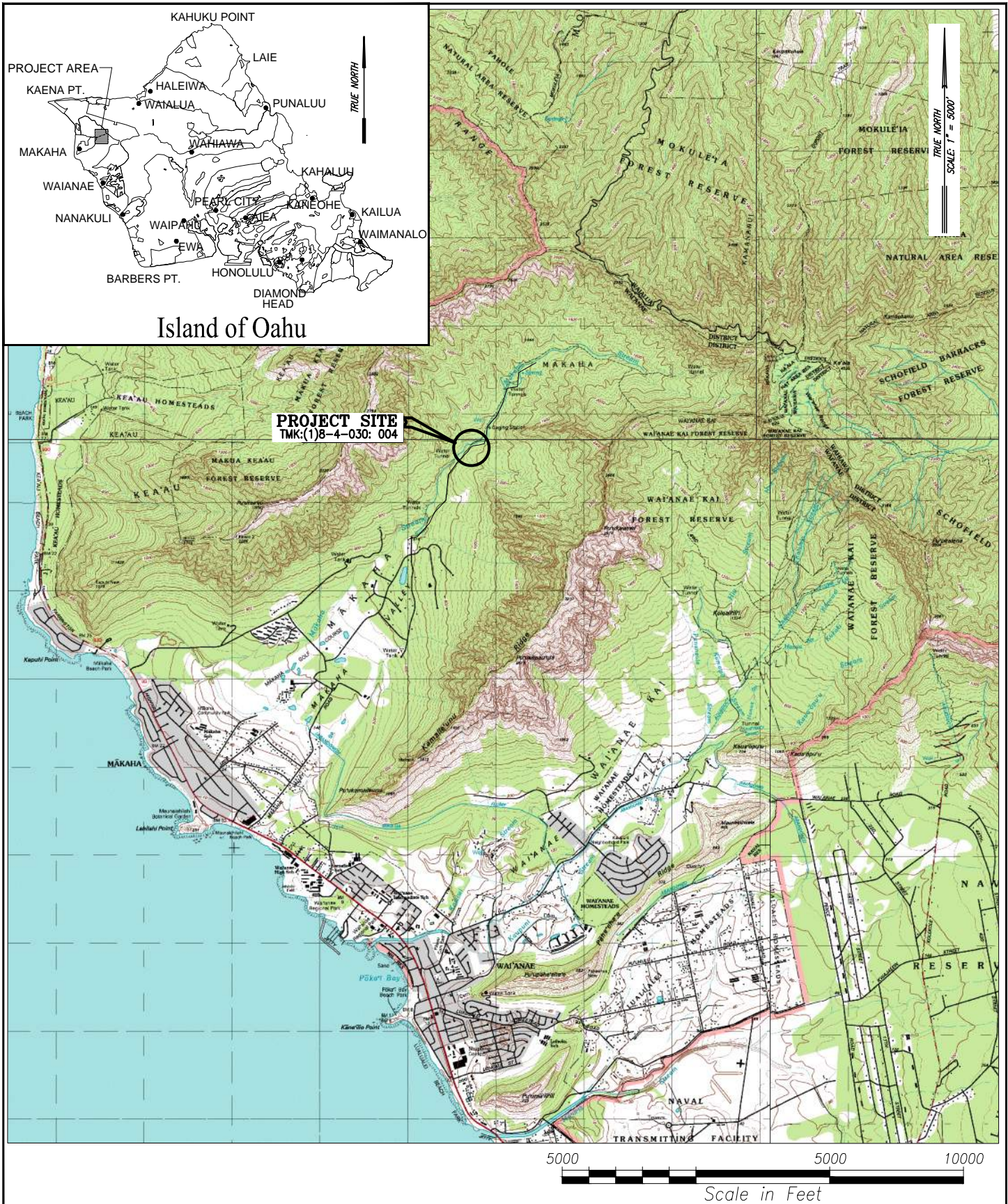
The first phase of grading focuses on the culvert removal by earthwork activities consisting primarily of excavation to reach the subgrade elevation of a new 3-foot-thick grout rubble masonry (GRP) that will act as the cutoff wall for the invert of the new bridge channel section. The 3-foot (GRP) will also form the side slopes up to the actual bridge abutment for abutment protection. All material excavated from the stream will leave the site and not re-enter any of Makaha Stream. Exhibit 13 shows the GRP for the bridge in a cross-section view. Exhibit 14 shows a stream profile and the limits of GRP for the new bridge. The quantity of GRP required for the bridge invert and bridge sidewalls to protect the footings is approximately 150 cubic yards. The amount of excavation for the initial grading phase is shown on Exhibit 14 and it is 500 cubic yards.

After the first phase of grading and the bridge foundation protected by CRM is in place, the actual panel truss bridge can be installed. The bridge is assembled on the upper side of the bridge footing (See the Site Plan in Exhibit 9). The bridge is then rolled into place by a crane sliding and lifting the downstream side of the bridge to the downstream footing. Once in place there are finishing activities to secure the bridge.

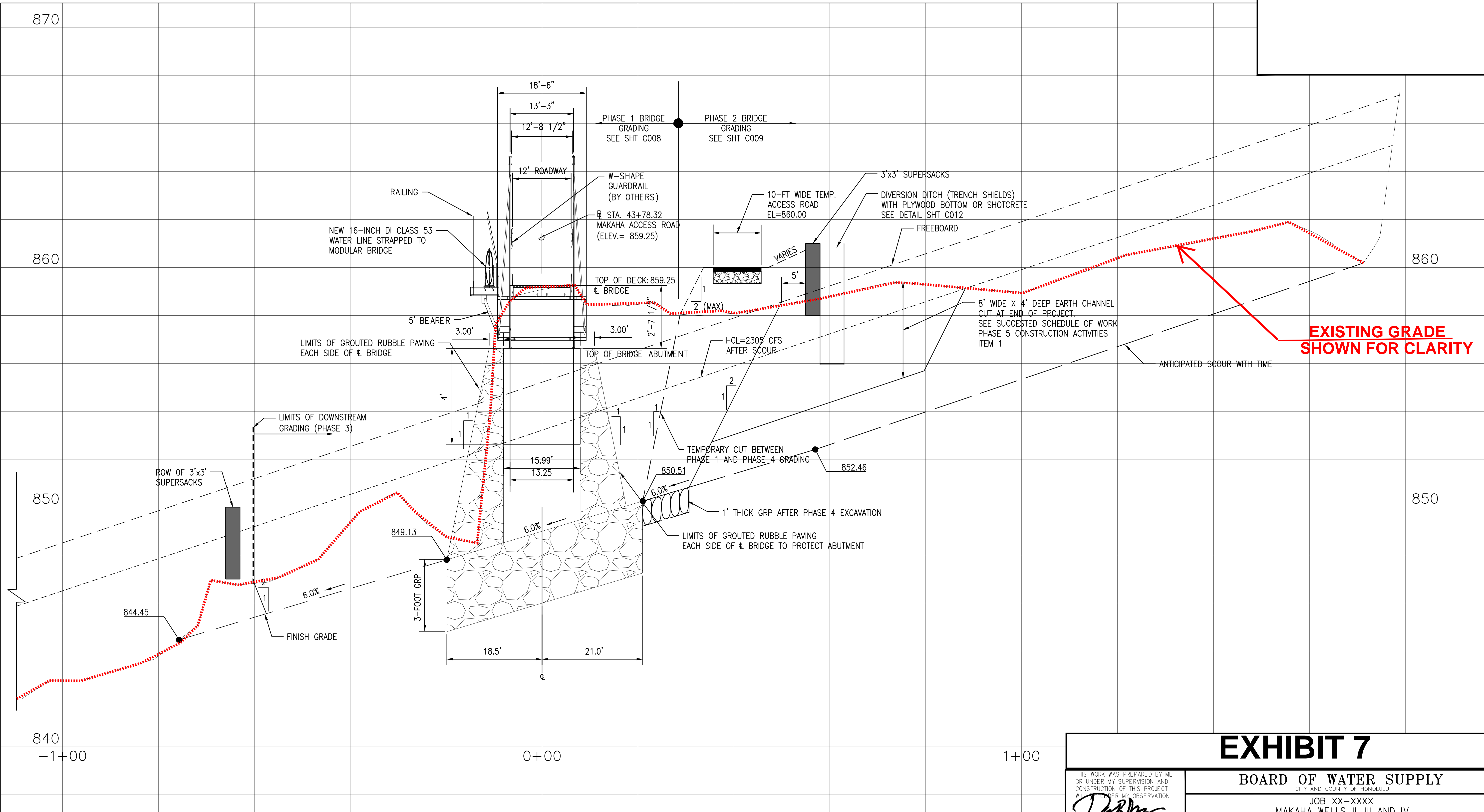
7. After the bridge is secure, electric/communications conduits and the new 16-inch water line can be strapped to the side of the bridge and will be re-connected to the existing utilities above the higher side of the bridge. This also means the temporary electric/communications strung by poles across Makaha Stream can be removed. After completion of Item 8 the new bridge crossing should be completely functional.
8. The temporary access road and temporary water line can then be removed. The temporary access road and waterline will no longer be needed since the permanent bridge will be in full operation.
9. The next major construction item is to remove all of the accumulated sediment deposited on the upstream side of the access road crossing. The excavation starts at the temporary bank from Phase 1 grading area and continues approximately 35 feet upstream (See Exhibit 14). The amount of accumulated silt and rock on the upstream side of the crossing is approximately 275 cubic yards of excavation. The diversion ditch will still be in place for this grading activity.
10. The last stream excavation work will consist of cutting and excavating an 8-foot wide by 4-foot deep through the remainder of stream silt and deposits (45 cubic yards) caused by the failing existing box culvert.

11. The cut will ultimately allow Makaha Stream to return to natural stream flow. This will be an enhancement for aquatic species. After the completion of this grading Makaha Stream flow will be completely within the Makaha Stream Channel and completely under the new bridge crossing. With time it is expected that natural stream banks will be re-established to a condition similar to that which existed prior to the installation of the pipe culvert crossing as represented by the scour line on Exhibit 14.
12. The final project activity will be restoring all now unnecessary and temporary construction support facilities. This would include disassembling the diversion ditch by removing the trench shields and filling with proper fill material followed by re-establishment of native plants at the surface. The site would need a general overall clean up to restore the area as close to pre-construction as possible.

Mon, 02 Oct 2023 - 10:58am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Exhibits\MAKAHA\EXHIBIT 1_LOCATION MAP_MAKAHA.dwg



JOB NO. 641-00	Bills Engineering Inc. Civil/Environmental Engineering 1108 Fort Street Mall, Suite 4 Honolulu, HI 96813	MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS TMK: (1) 8-4-030: 004	EXHIBIT 1
SCALE: AS NOTED		LOCATION MAP	
DATE: OCTOBER 2023			



EXTENDED STREAM SECTION

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE _____

C017



EXHIBIT 7

BOARD OF WATER SUPPLY

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

EXTENDED STREAM SECTION AT CENTERLINE
OF STREAM WITH ACROW BRIDGE

APPROVED: _____			DATE: _____		
MANAGER AND CHIEF ENGINEER, BWS					
DRAWN BY: RE		ENGINEER: DB		CHECKED BY: DB	
		FILE NO: _____			
FIELD BOOK NO: _____		SCALE: AS INDICATED		SHEET 21 OF 49 SHEETS	


THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION AND
CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION

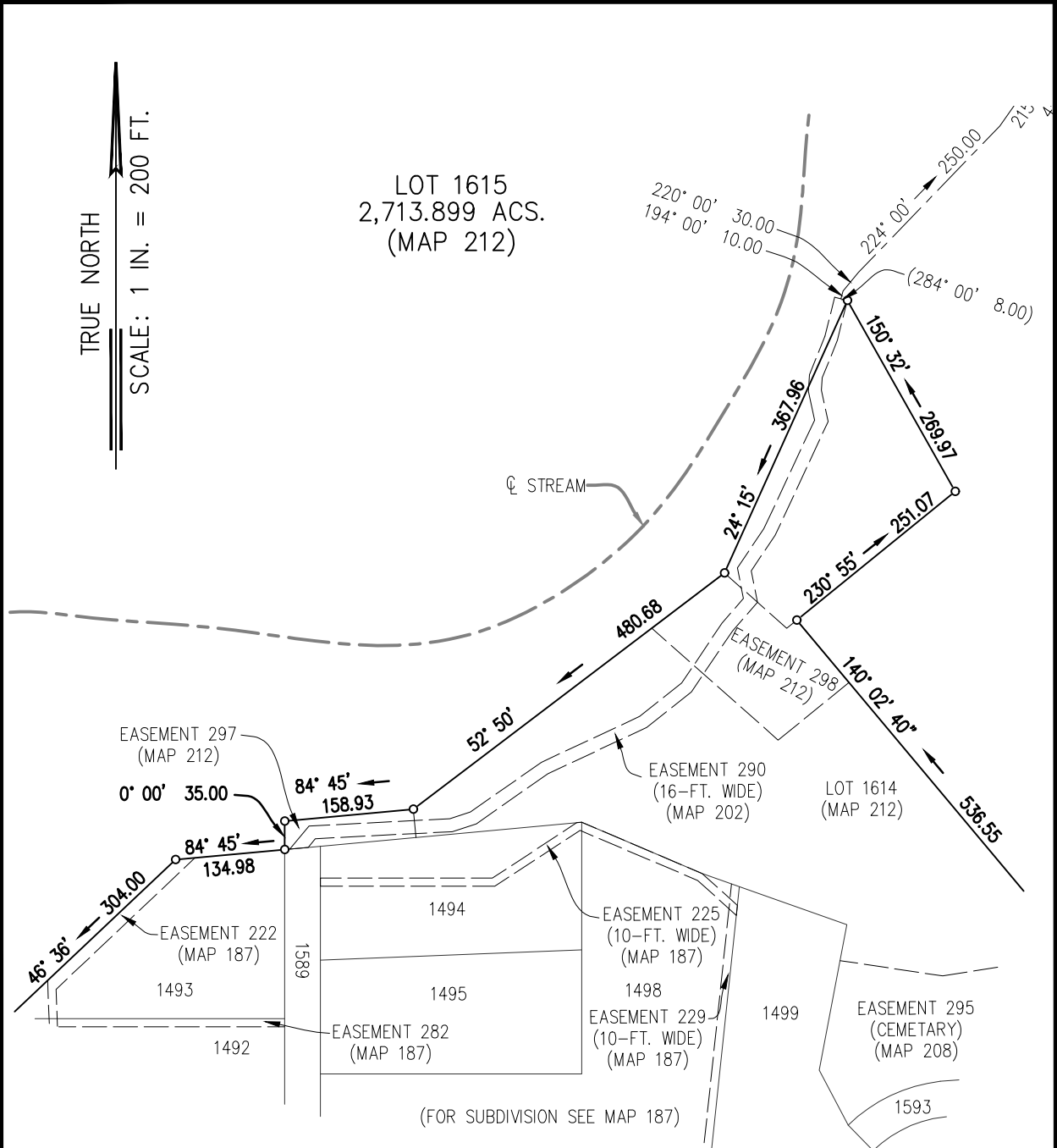
WILL BE UNDER MY OBSERVATION



SIGNATURE

Exp: 4/30/24

A circular professional engineer seal for David B. Bills. The outer ring contains the text "DAVID B. BILLS" at the top and "HAWAII, U.S.A." at the bottom, separated by two stars. The center of the seal contains the text "LICENSED PROFESSIONAL ENGINEER" and "No. 4516-C".

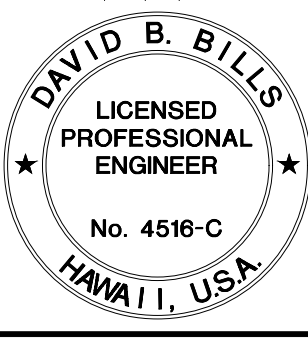


BOARD OF WATER SUPPLY

BUILDING PERMIT SITE PLAN

FILE	POCKET	FOLDER	NO.

SIGNATURE
Exp: 4/30/24



APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP	DATE	COO1
--------------------------------------	------	------

F:\1_08 Sep 2023 - 10:52am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C004 SITE PLAN.dwg

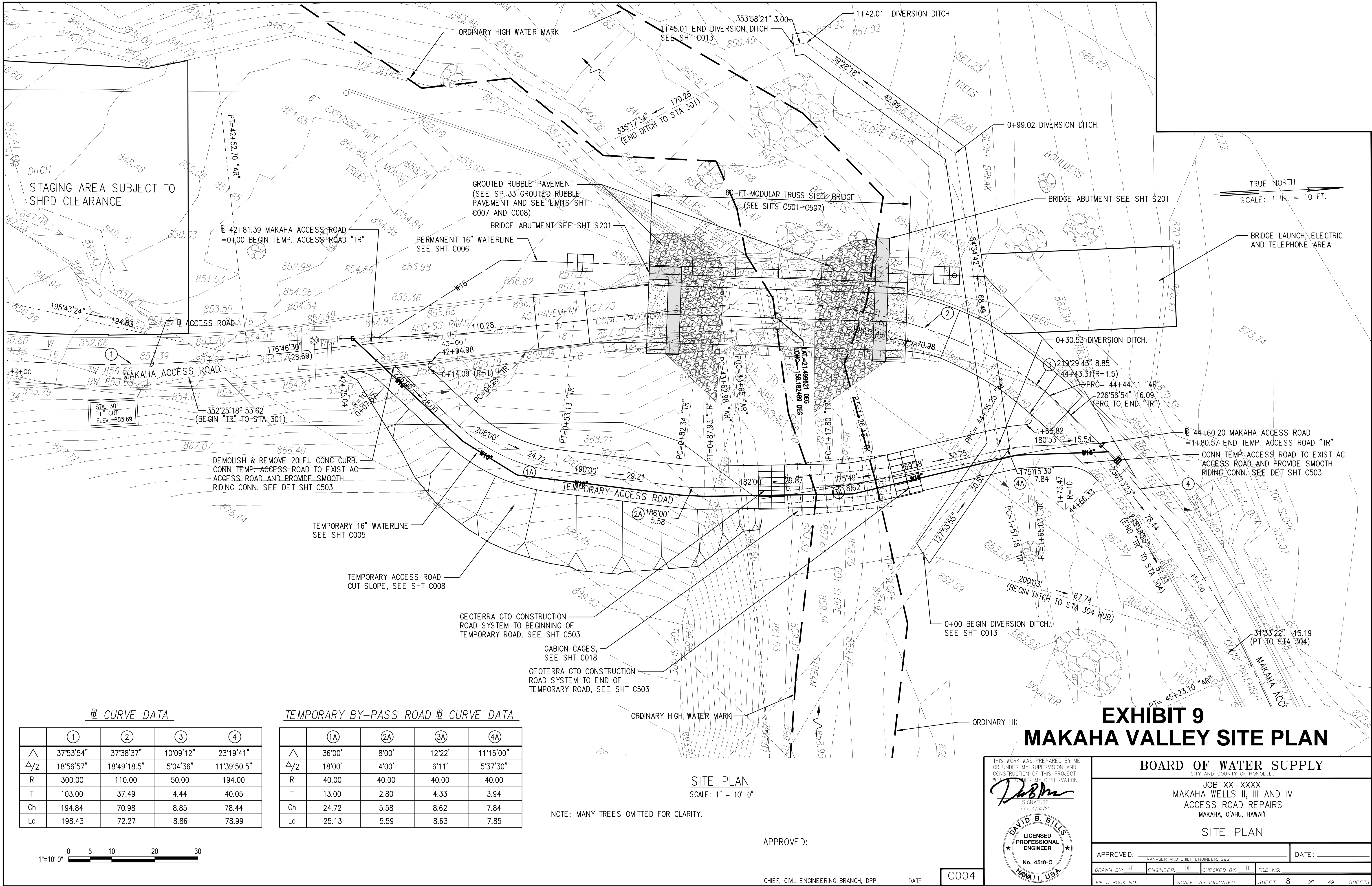


EXHIBIT 9 MAKAHA VALLEY SITE PLAN

@ CURVE DATA				
	①	②	③	④
△	37°53'54"	37°38'37"	10°09'12"	23°19'41"
△/2	18°56'57"	18°49'18.5"	5°04'36"	11°39'50.5"
R	300.00	110.00	50.00	194.00
T	103.00	37.49	4.44	40.05
Ch	194.84	70.98	8.85	78.44
Lc	198.43	72.27	8.86	78.99

TEMPORARY BY-PASS ROAD @ CURVE DATA				
	①A	②A	③A	④A
△	36°00'	8°00'	12°22'	11°15'00"
△/2	18°00'	4°00'	6°11'	5°37'30"
R	40.00	40.00	40.00	40.00
T	13.00	2.80	4.33	3.94
Ch	24.72	5.58	8.62	7.84
Lc	25.13	5.59	8.63	7.85

SITE PLAN
SCALE: 1" = 10'-0"

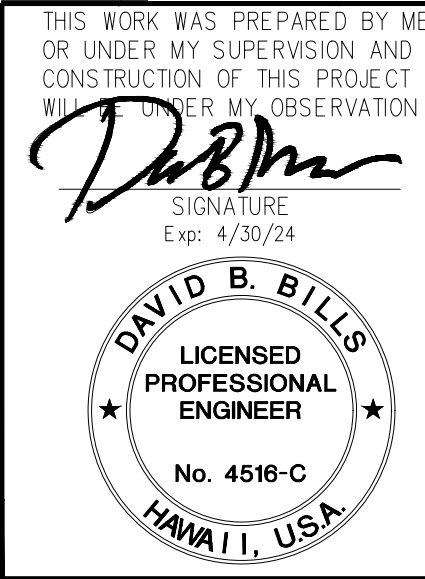
NOTE: MANY TREES OMITTED FOR CLARITY.

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

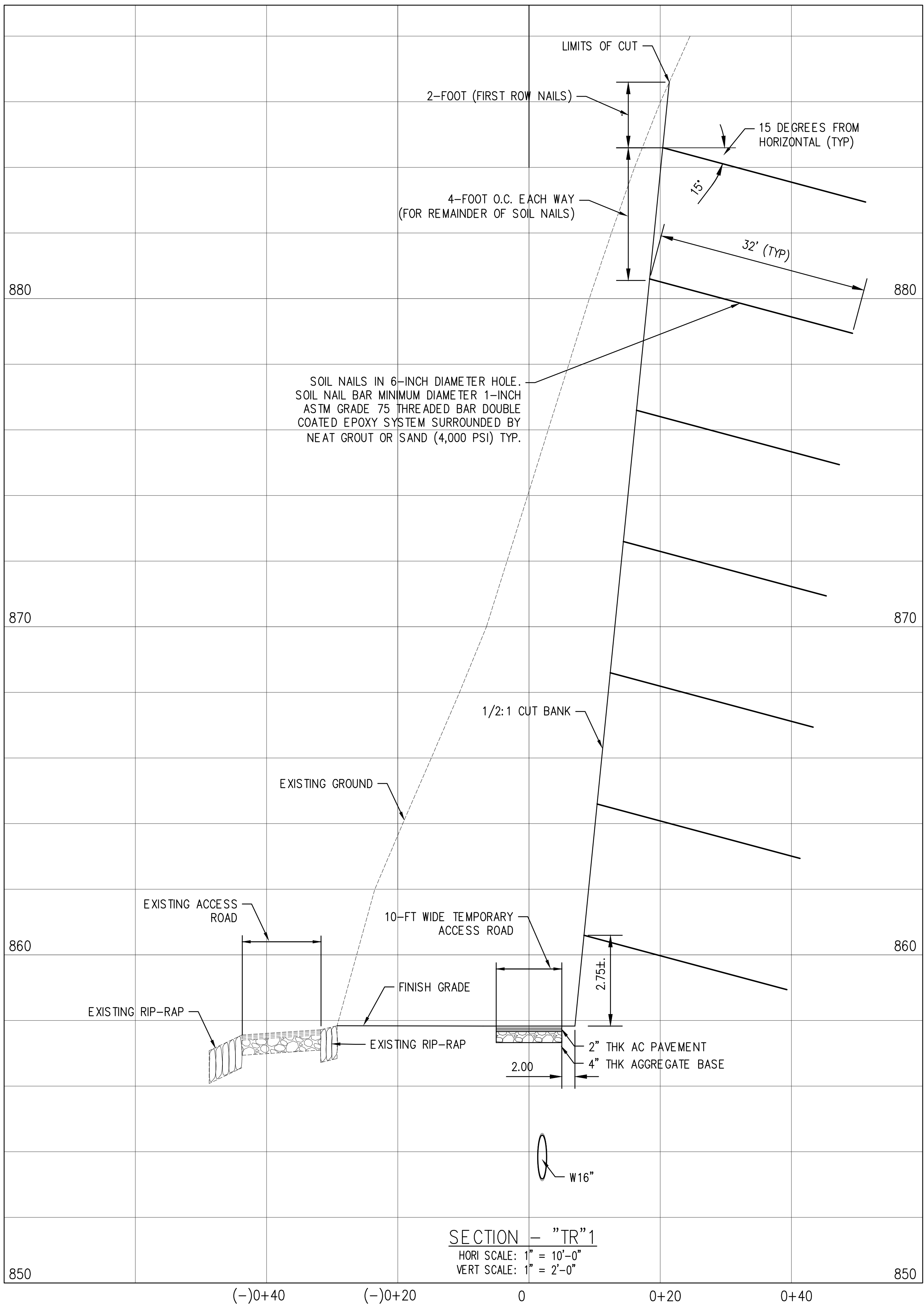
C004



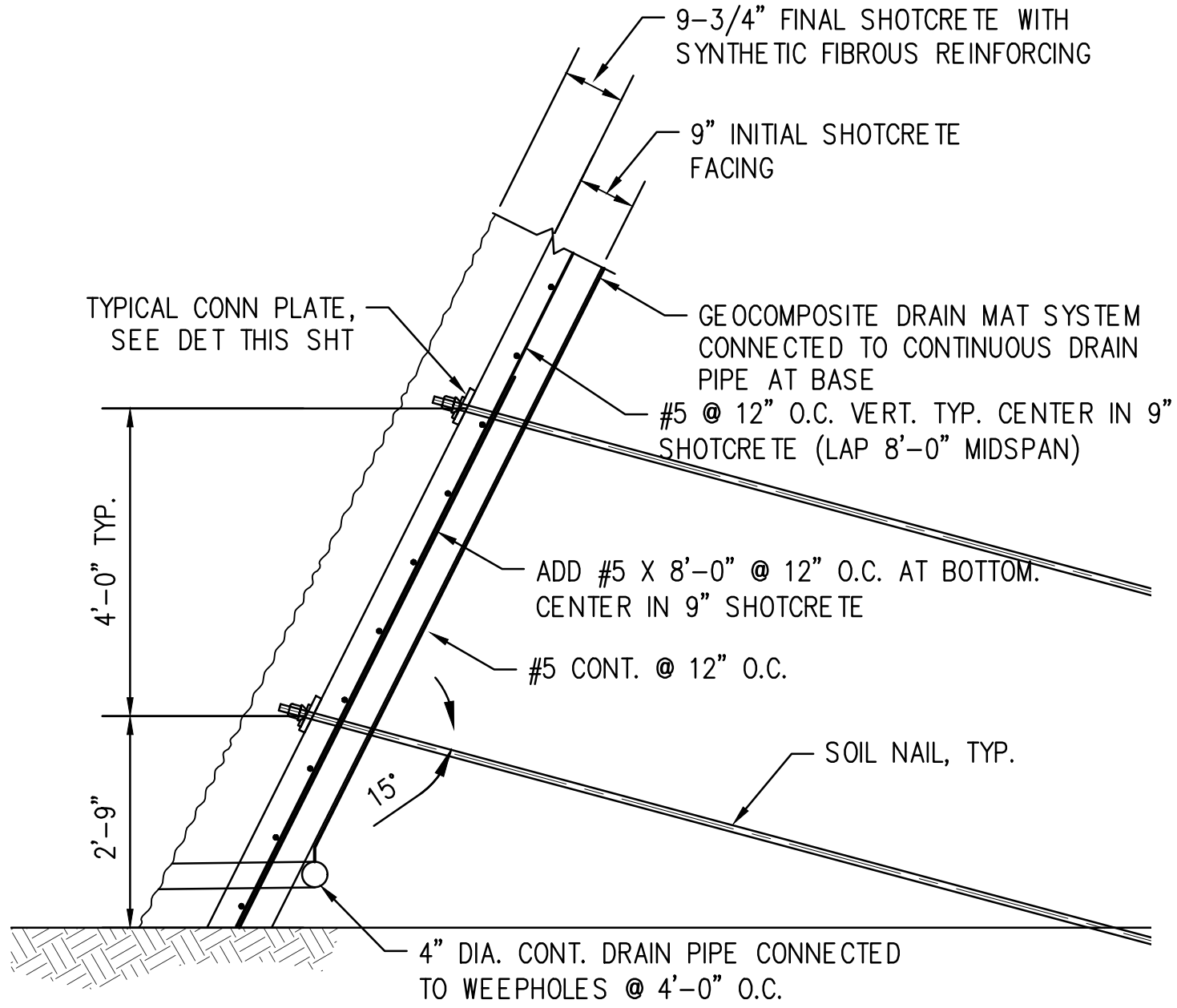
BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU			
JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
SITE PLAN			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: _____	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 8 OF 49 SHEETS

FILE	POCKET	FOLDER	NO.

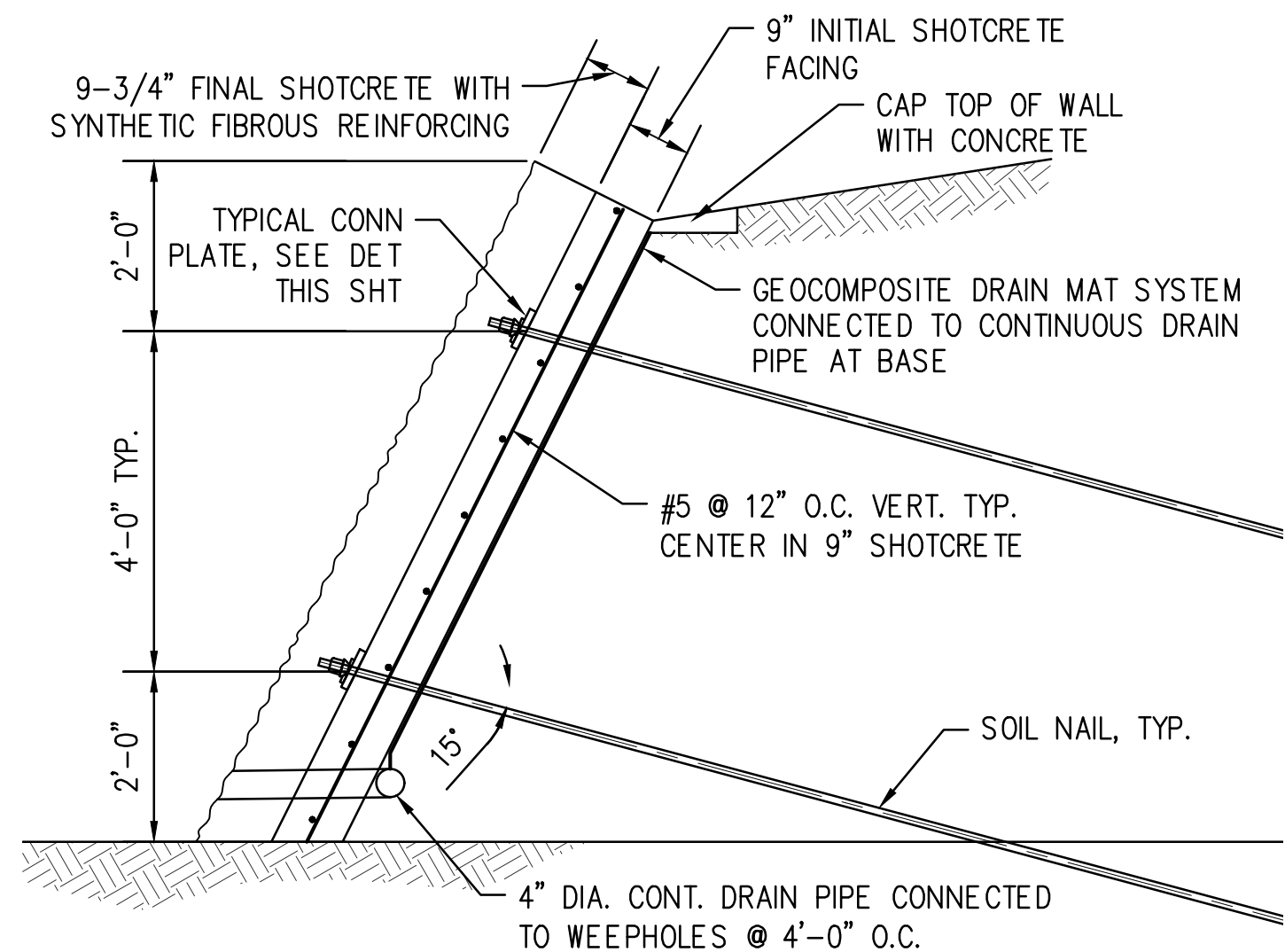
Fri, 08 Sep 2023 - 12:55pm
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Corset Plans\MAKAHA\641-00 C012 SECTION - TR 1 AND DETAILS.dwg



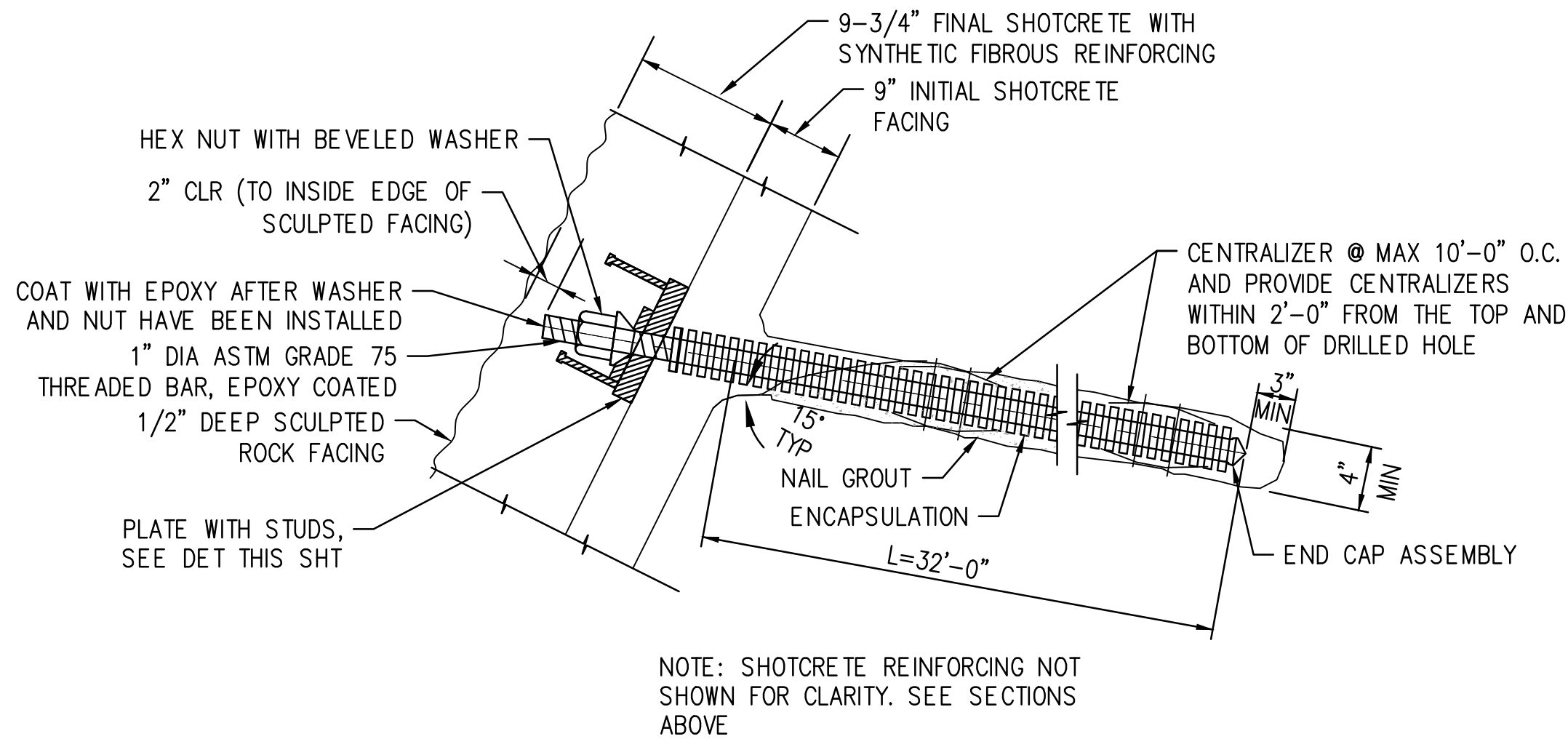
SECTION - "TR" 1
HORI SCALE: 1" = 10'-0"
VERT SCALE: 1" = 2'-0"



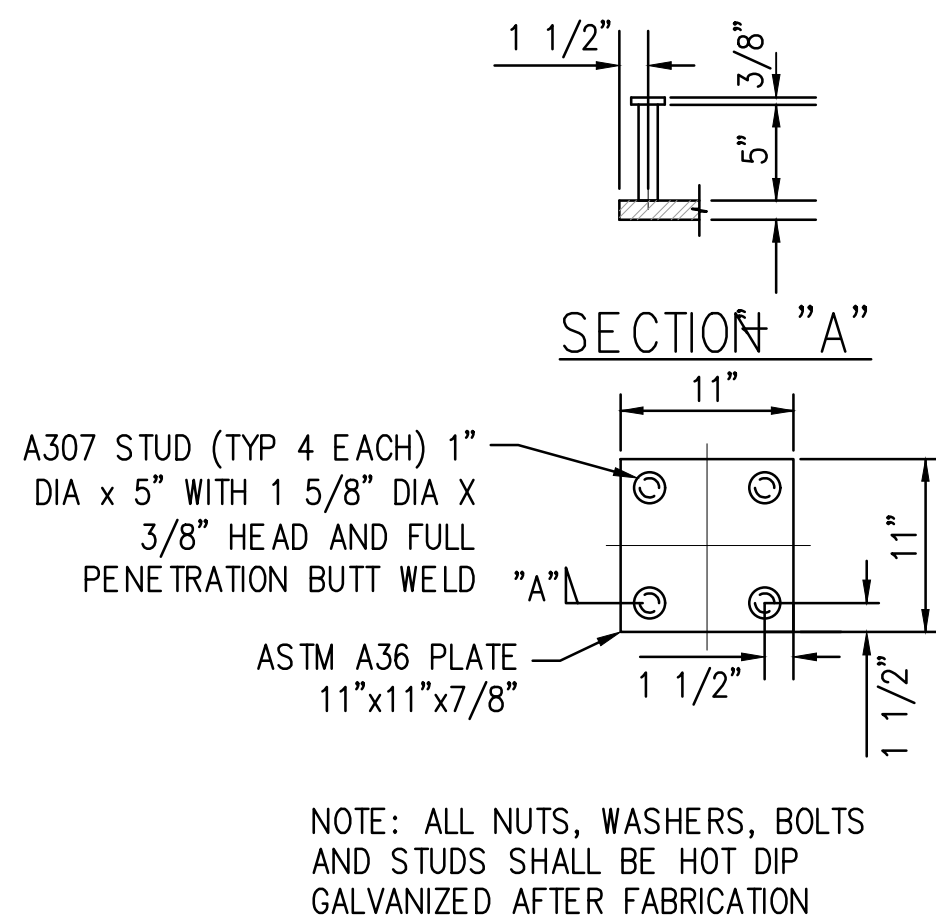
SECTION OF SHOTCRETE FACE DETAIL
SCALE: 1/2" = 1'-0"



SECTION OF SHORT SHOTCRETE FACE DETAIL
SCALE: 1/2" = 1'-0"



ENCAPSULATED PRODUCTION SOIL/ROCK ANCHOR DETAIL
NOT TO SCALE



CONNECTION PLATE WITH STUD DETAIL
SCALE: 1" = 1'-0"

EXHIBIT 10 SOIL NAILED BANK FOR TEMPORARY ACCESS ROAD

SOIL NAIL NOTES:

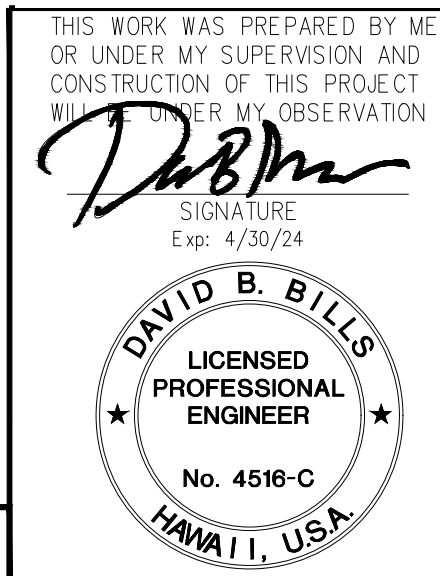
- REFER TO GEOTECHNICAL REPORT ON SHEET SP150 GEOTECHNICAL REPORT, SECTION 1 SOIL NAILED RETAINING WALL SYSTEM AND THE COMPLETE GEOTECHNICAL REPORT.
- CONTRACTOR SHALL PROVIDE SOIL NAIL PATTERN ON FACE OF SLOPE FOR GEOTECHNICAL REVIEW PRIOR TO COMMENCEMENT OF SOIL NAIL INSTALLATION.

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C012



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

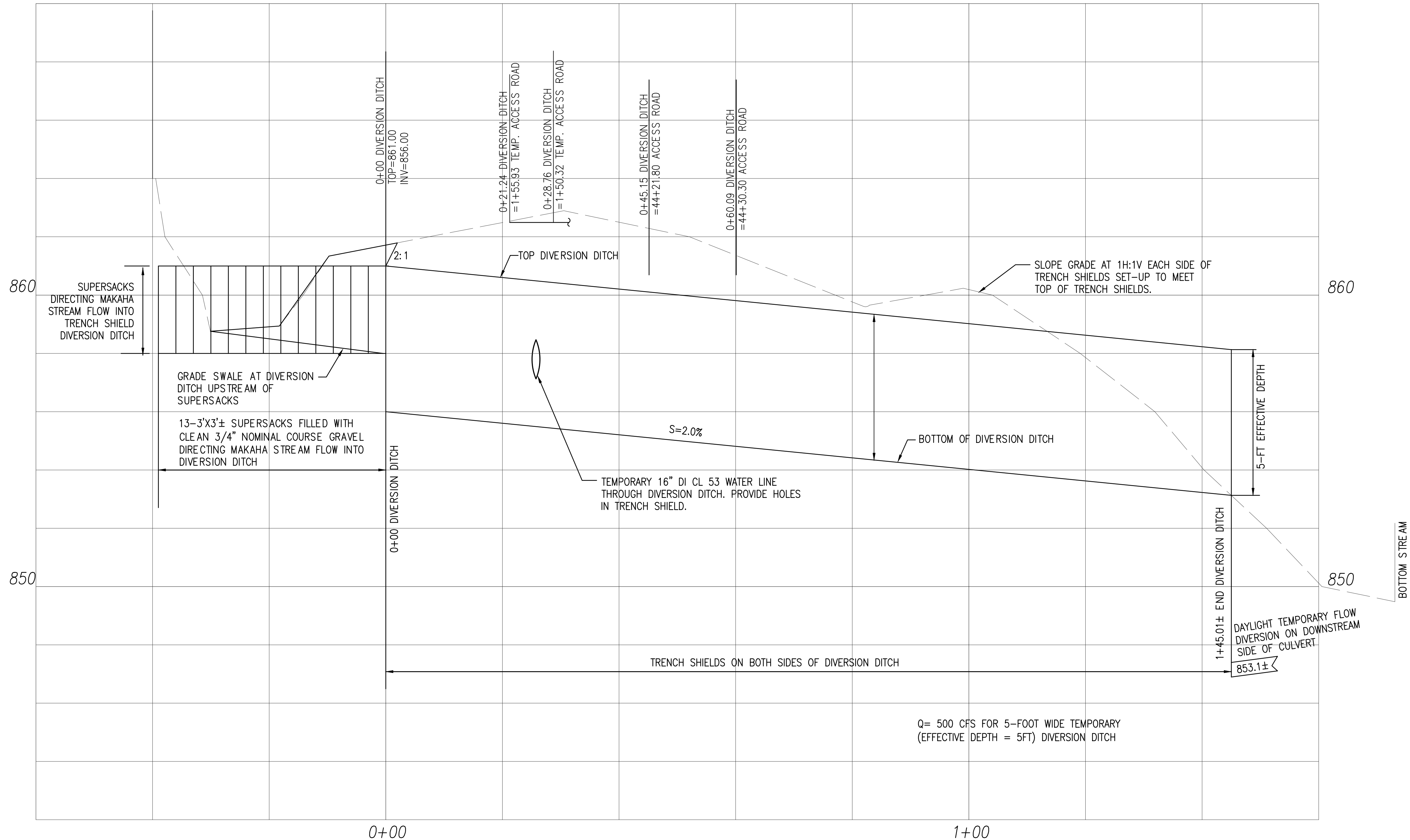
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

SECTION "TR" 1 AND DETAILS

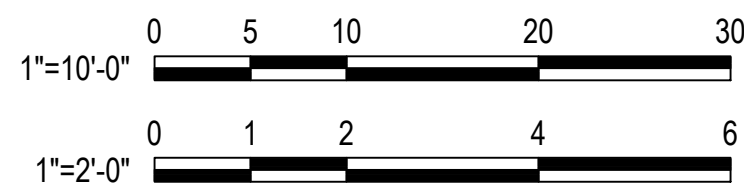
APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:		SCALE:	AS INDICATED
SHEET	16	OF	49
SHEETS			

FILE	POCKET	FOLDER	NO.

F:_08 Sep 2023 - 1:32pm
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Corer Plans\MAKAHA\641-00 C013 DIVERSION DITCH PROFILE.dwg



NOTE:
FOR DIVERSION DETAILS, SEE SHT C014



DIVERSION DITCH PROFILE
SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C013

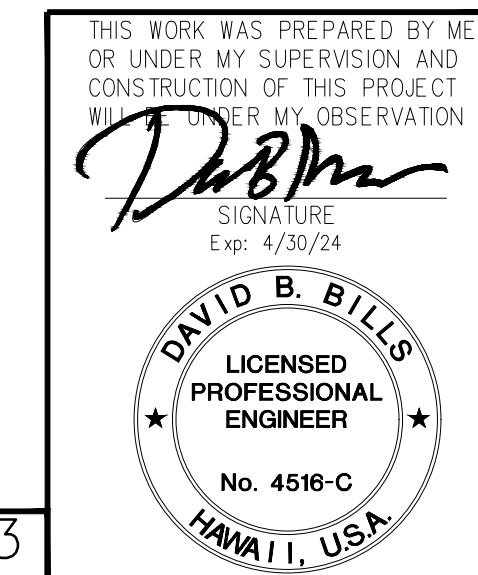
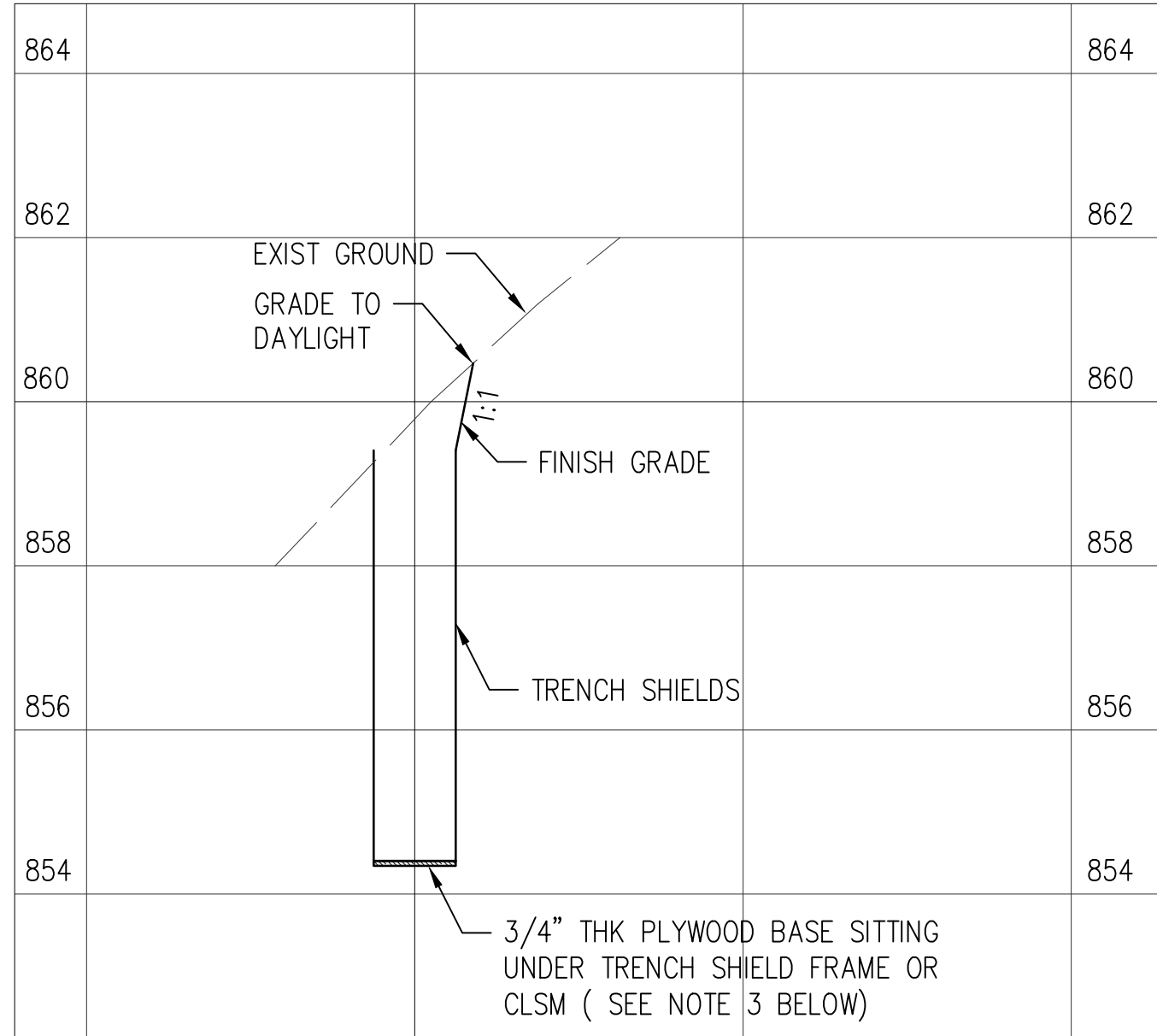
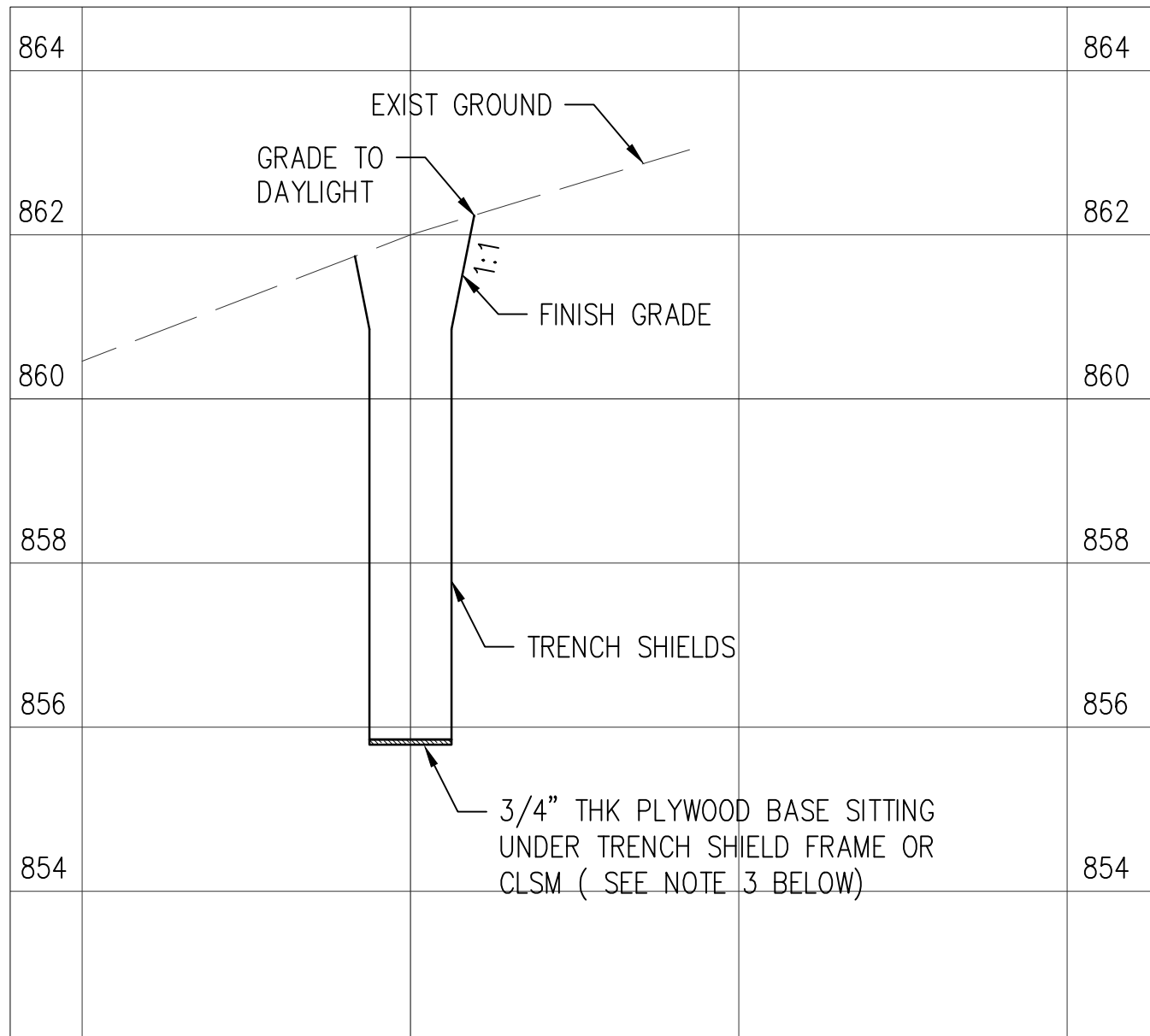


EXHIBIT 11 DIVERSION DITCH PROFILE

BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU			
JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
DIVERSION DITCH PROFILE			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: _____	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 17 OF 49 SHEETS
FILE	POCKET	FOLDER	NO.

Wed, 06 Sep 2023 - 3:05pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C014 SECTIONS & DIVERSION DITCH DETAILS.dwg



- NOTES:
- THE DIVERSION DITCH SHALL BE EXCAVATED AND THE EXCAVATED MATERIAL SHALL BE STOCKPILED AND PROTECTED WITH TEMPORARY COVER AND FILTER SOCK AROUND THE BASE OF THE COVER. THIS STOCKPILE FILL WILL BE USED TO RESTORE DIVERSION DITCH EXCAVATION TO ITS ORIGINAL CONDITION OR BETTER.
 - INSTALL DIVERSION DITCH PER DETAILS THIS SHEET AND SHT CO.
 - AN ALTERNATIVE TO PLYWOOD IS PLACING A 6-INCH LAYER OF 1500 PSI CLSM AT CHANNEL FLOOR. USE BOND BREAKER BETWEEN CLSM AND SHIELD TO ALLOW SALVAGE OF SHIELDS.
 - JOINT BETWEEN SHIELDS SHALL BE WATERPROOFED TO PREVENT WATER OUT MIGRATION FROM DIVERSION DITCH OR OVERLAPPED AS SHOWN IN PLAN VIEW OF DIVERSION DITCH DETAIL THIS SHEET.
 - AFTER DIVERSION DITCH IS NO LONGER NEEDED THE TRENCH SHIELDS SHALL BE REMOVED AND PLYWOOD FLOOR (CLSM CAN BE ABANDONED IN PLACE).
 - STOCKPILED DIVERSION DITCH EXCAVATION SHALL BE USED FOR DIVERSION TRENCH BACKFILL. PLACE LIFTS NO MORE THAN 12-INCHES AND COMPACT TO 85% (ASTM D1557).

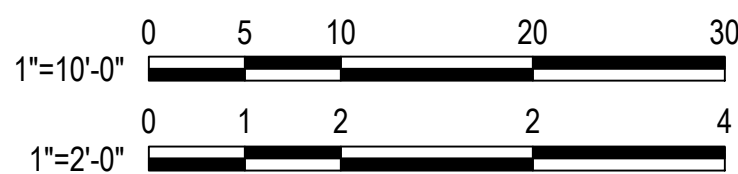
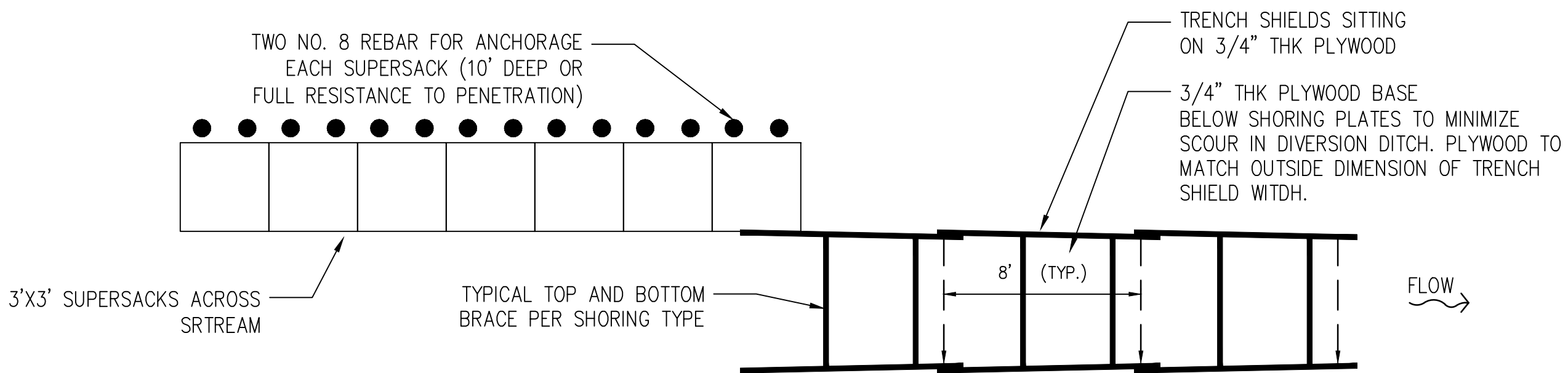


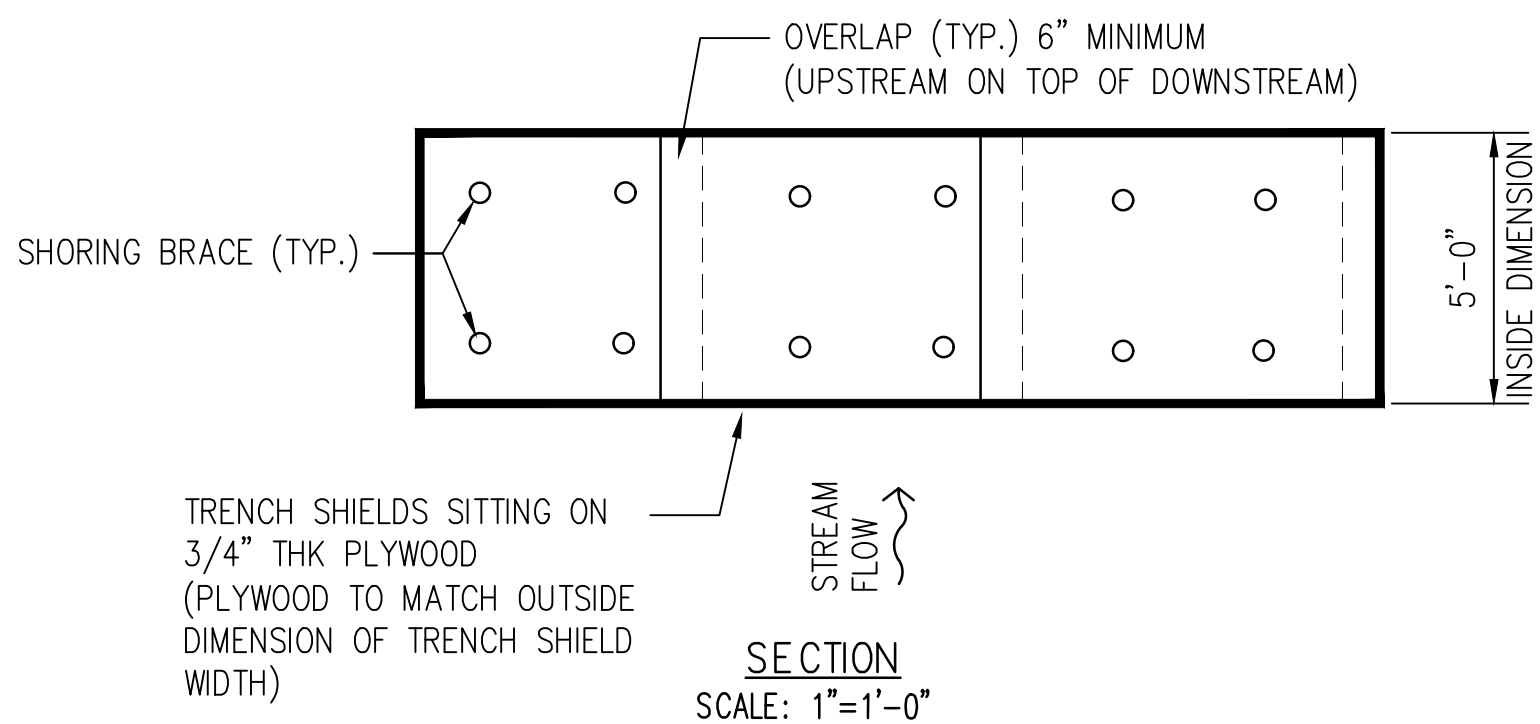
EXHIBIT 12 SECTIONS OF THE DIVERSION DITCH



TYPICAL TRENCH SHIELDS
NOT TO SCALE



PLAN
SCALE: 1/4"=1'-0"



NOTE:

TOTAL LENGTH OF DIVERSION TRENCH IS 185± LINEAR FEET

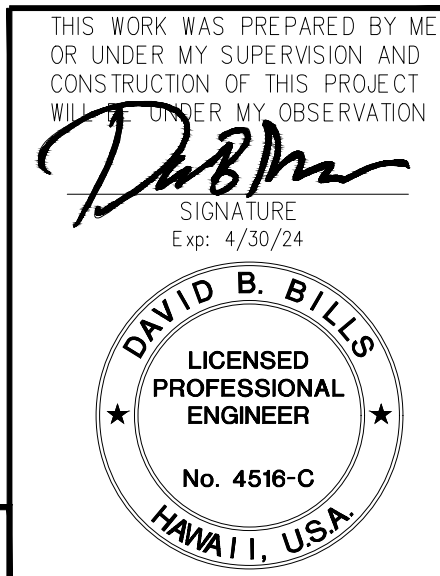
DIVERSION DITCH USING SHORING PLATES
SCALE: AS SHOWN

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C014



BOARD OF WATER SUPPLY			
CITY AND COUNTY OF HONOLULU			
JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
SECTIONS & DIVERSION DITCH DETAILS			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS			DATE: _____
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 18 OF 49 SHEETS
FILE	POCKET	FOLDER	NO.



C006

FILE	POCKET	FOLDER	NO.

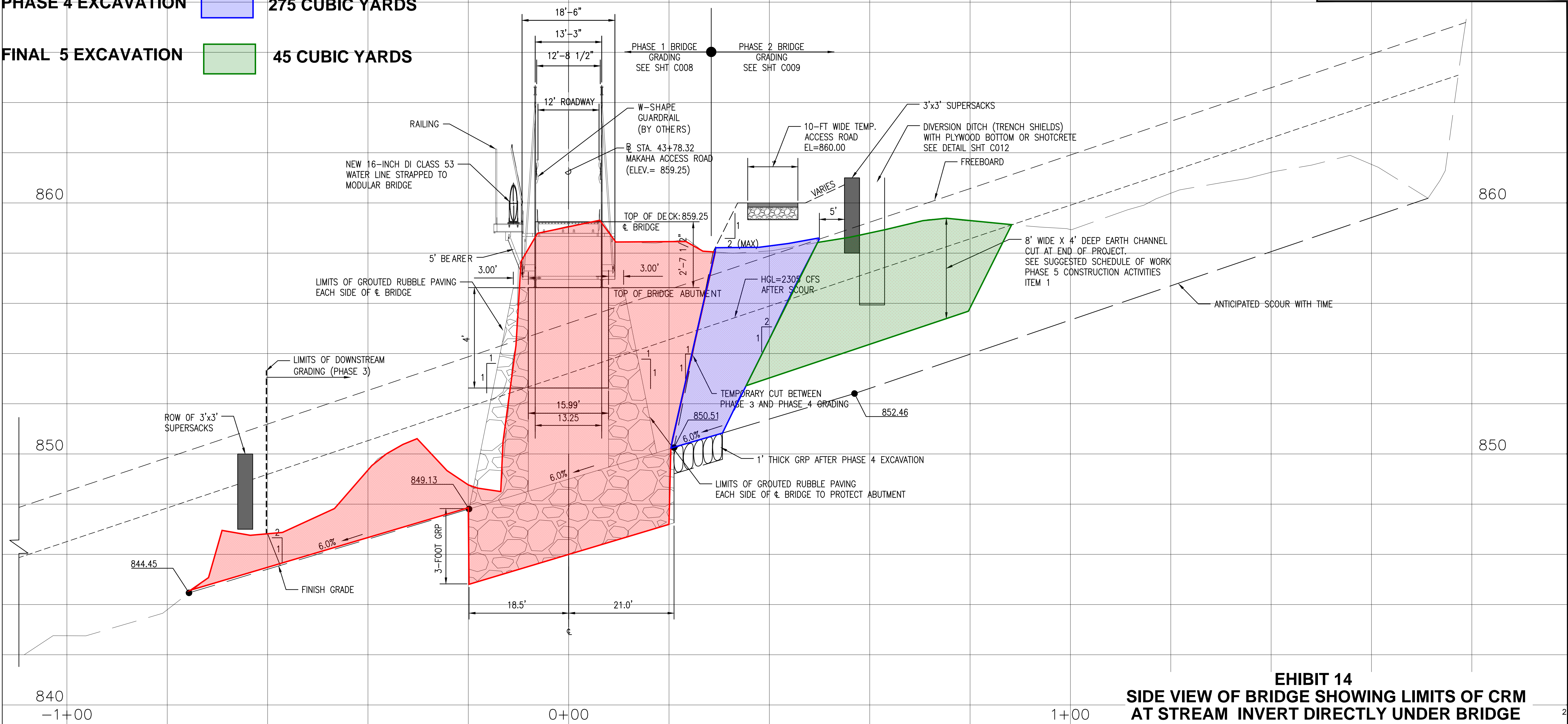
- PHASE 3 EXCAVATION

870

500 CUBIC YARDS
- PHASE 4 EXCAVATION

275 CUBIC YARDS
- FINAL 5 EXCAVATION

45 CUBIC YARDS



EXTENDED STREAM SECTION
SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C017

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

Signature

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, U.S.A.

Exp: 4/30/24

EHIBIT 14
SIDE VIEW OF BRIDGE SHOWING LIMITS OF CRM
AT STREAM INVERT DIRECTLY UNDER BRIDGE

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

EXTENDED STREAM SECTION AT CENTERLINE
OF STREAM WITH ACROW BRIDGE

APPROVED: _____ DATE: _____
MANAGER AND CHIEF ENGINEER, BWS

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 21 OF 49 SHEETS

FILE	POCKET	FOLDER	NO.

ATTACHMENT FOR ITEM 31

1. The Board of Water Supply maintains the Makaha Wells II, III, and IV. These wells are located deep in Makaha Valley and utilize a 10-foot (+/-) asphaltic and reinforced concrete road to get from the end of Alahele Street (84-1229 Alahele Street) up to the well sites. Access to the BWS Access Road has controlled access with gate and lock. A Location Map and Island Map are shown on Exhibit 1.

The access road is in relatively good condition except for the Makaha Valley Stream crossing. The last improvements to the Access Road were completed in 1987. The existing Makaha Stream crossing acts as a ford crossing with six (6) 12-inch diameter pipes passing from upstream to downstream under the access road approximately 3-foot below the access road surface. The plan and profile details from the construction of the original ford crossing are shown in Exhibit 2. A ford crossing can handle smaller flows but when larger flows occur the runoff spills over the roadway surface. The capacity of six 12-inch pipes is approximately 50 cfs as measured by pipe entrance control. By comparison the Exhibit 3 shows flows for various design storms.

EXHIBIT 3
MAKAHA STREAM FLOWS

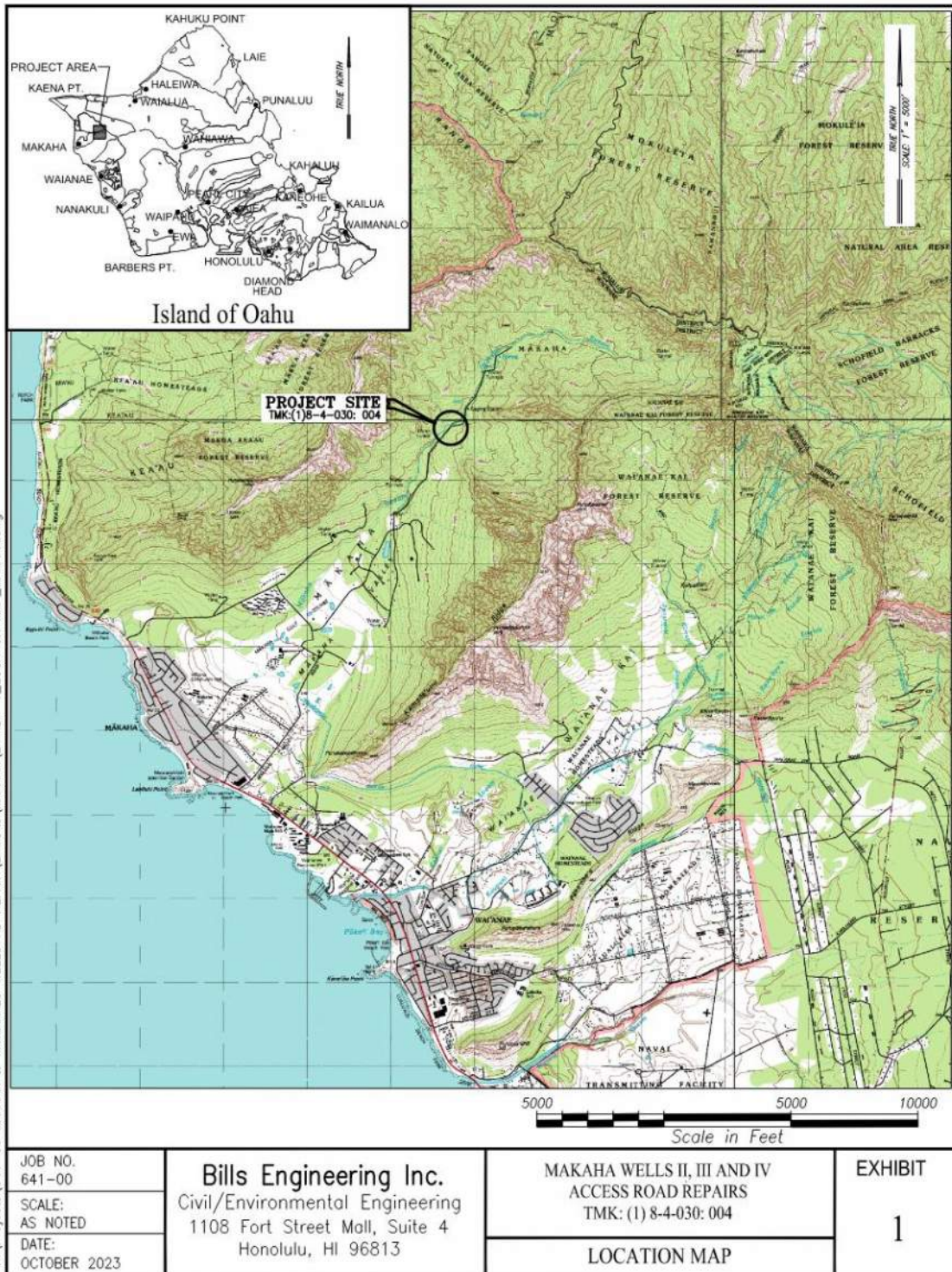
Location	Computed Peak Discharge (cfs) at Gage				
	10-yr	25-yr	50-yr	100-yr	500-yr
Mākaha Stream	900	1,385	1,820	2,305	3,670

It is more than clear that discharge of the stream is significantly more than the capacity of the six 12-inch pipes, which result in frequent surcharge conditions overtopping the constructed ford crossing.

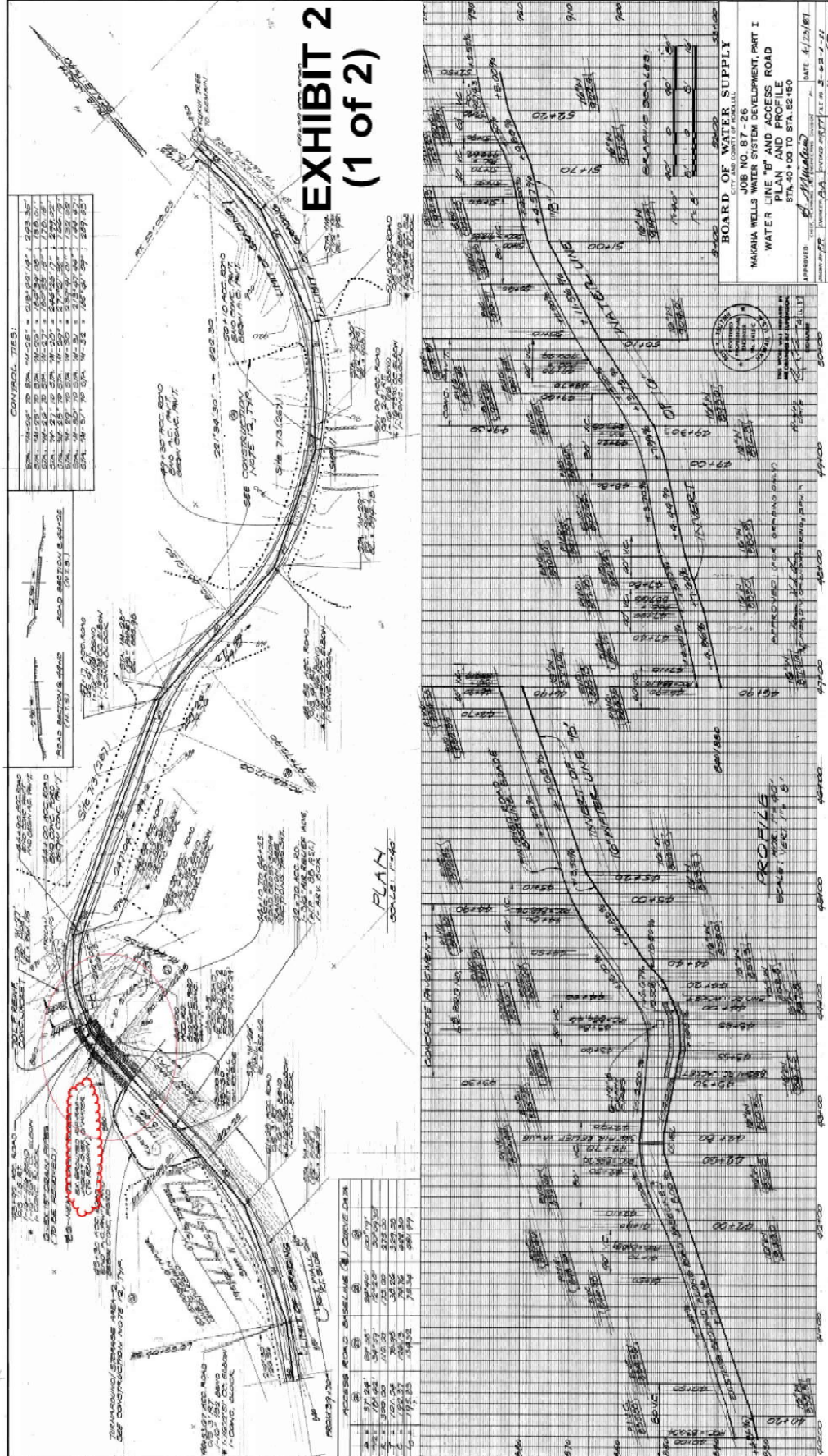
In addition, the ford crossing has received little or no maintenance and the upstream side of the ford crossing has completely filled up with silt, rocks, and debris. The frequent overtopping of the access road has additionally resulted in severe erosion on the downstream side and critical undermining of the access road. The result is an almost complete failure of the Makaha Stream crossing as evidenced by photographic Exhibits 4 and 5 below.

A third consequence of the ford crossing is that runoff overtopping the access road crossing also spills down the access road outside of the immediate stream limits (See Photographic Exhibit 6).

Mon, 02 Oct 2023 - 10:58am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Exhibits\MAKAHA\EXHIBIT 1_LOCATION MAP_MAKAHA.dwg



PLAN
SCALE: 1"=40'



FIELD NO. 87-026 SCALE 1:50,000 SHEET 11 OF 12 DATE 12-17-84

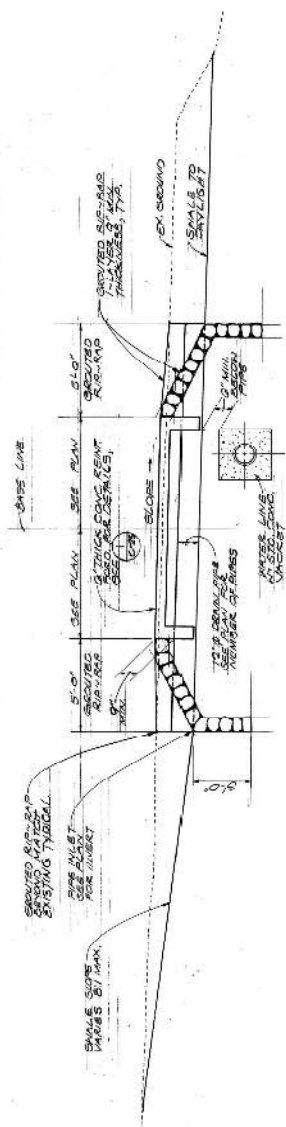
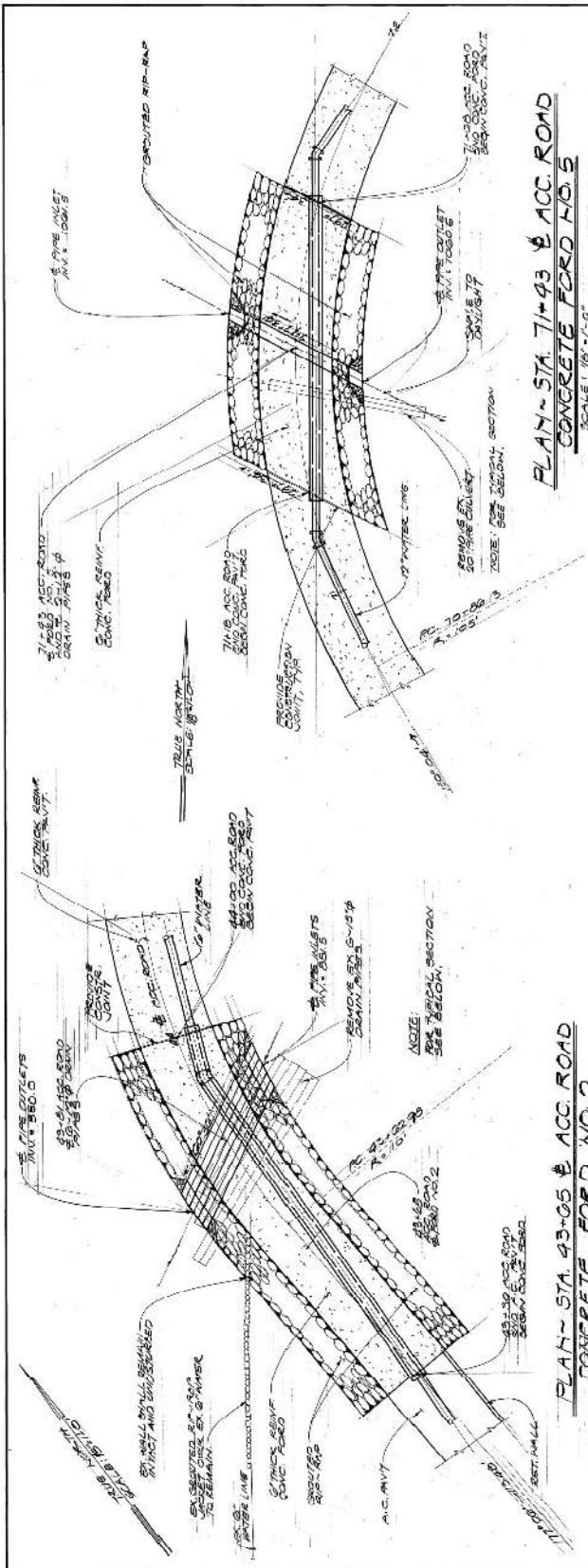


EXHIBIT 2
(2 of 2)

ATTENDING SOCIAL WORKER:

James H. L. Cherry
JAMES H. L. CHERRY, JR., JR.
CHERRY

87-026



EXHIBIT 4
DOWNSTREAM VIEW OF EXISTING MAKAHA STREAM CROSSING¹



EXHIBIT 5
UPSTREAM VIEW OF FORD CROSSING POOLING AND FULL OF ROCKS AND SILTS



EXHIBIT 6
WATER FLOWING OVER ACCESS ROAD DUE TO BLOCKED PIPES

A Hydrologic Study “Makaha Wells Access Road & Makaha Stream - H&H Report (2021-12-06)” has been prepared for this project and is contained in Appendix D.

APPENDIX

Makaha Wells Access Road & Makaha Stream
H&H Report (2021-12-06)



DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honolulu.gov/pp • CITY WEB SITE: www.honolulu.gov

RICK BLANGIARDI
MAYOR



DEAN UCHIDA
DIRECTOR

DAWN TAKEUCHI APUNA
DEPUTY DIRECTOR

EUGENE H. TAKAHASHI
DEPUTY DIRECTOR

November 5, 2021

2021/ELOG-2289(MAK)

Mr. David Bills
Bills Engineering Inc.
1124 Fort Street Mall, Suite 200
Honolulu, Hawaii 96813

Dear Mr. Bills:

SUBJECT: Special Management Area (SMA) Inquiry
84-800 Kili Drive - Makaha
Tax Map Key 8-4-030: 004

This is in response to your letter, received October 29, 2021, requesting confirmation that the subject property is not located within the SMA or along the regulatory shoreline as part of a requirement for an upcoming Board of Water Supply project. Our records show that the subject property is outside of the SMA and not a shoreline lot. Therefore, the site is not subject to Chapters 23 or 25 of the Revised Ordinances of Honolulu.

Should you have any questions, please contact Michael Kat, of our Zoning Regulations and Permits Branch, at (808) 768-8013 or via email at michael.kat@honolulu.gov.

Very truly yours,

A handwritten signature in blue ink, appearing to read "Dean Uchida", with a stylized flourish at the end.

for Dean Uchida
Director

APPENDIX

BWS EXEMPTION LETTER FOR MAKAHA WELLS
II, III AND IV ACCESS ROAD REPAIRS



B

August 9, 2023

Mr. Ernest Y. W. Lau, P.E.
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843



Attention: Ms. Kathryn Fujikami

641-00

Project: Makaha Wells II, III and IV Access Road Repairs

Mr. Lau::

We, Bills Engineering Inc. (BEI) have reviewed your "*Comprehensive Exemption List for the City and County of Honolulu Board of Water Supply as Reviewed and Concurred Upon by the Environmental Council on April 5, 2022*" and it is our opinion that the exemptions highlighted with red box apply to the Makaha Wells II, III and IV Access Road Repairs (See Attachment 1).

Should you concur with our evaluation we understand BWS will complete the Declaration of Exemption form and DOH's Exempt Project Certification form for Makaha Wells II, III and IV Access Road Repairs Project.

Should you have any questions regarding this matter please contact David Bills at dbills@billsengineering.com or at 808-792-2022.

Very truly yours,

BILLS ENGINEERING INC.

By: 

David B. Bills, P.E.
President

DBB:lk

Enclosures

cc: Environmental Review Program (ERP)

ATTACHMENT 1

COMPREHENSIVE EXEMPTION LIST FOR THE CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY

Amended April 5, 2022

Pursuant to HAR §11-200.1-8, all exemptions under Subchapter 8 are inapplicable when the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.

Part 1 - De Minimis Actions:

Routine activities and ordinary functions within the jurisdiction or expertise of the agency that by their nature do not have the potential to individually or cumulatively adversely affect the environment more than negligibly and that the agency considers to not rise to the level of requiring chapter 343, HRS, environmental review. Examples of routine activities and ordinary functions may include, among others: routine repair, routine maintenance, purchase of supplies, and continuing administrative activities involving personnel only, nondestructive data collection, installation of routine signs and markers, financial transactions, personnel-related matters, construction or placement of minor structures accessory to existing facilities; interior alterations involving things such as partitions, plumbing, and electrical conveyances.

(1) Operations, repairs or maintenance of existing structures, facilities, equipment, or topographical features, involving negligible or no expansion or change of use beyond that previously existing;

1. Painting of structure exterior or interior
2. Repair of damage to structure exterior or interior caused by termites, dry rot, spalling, cracking, delaminating, and so forth
3. Fumigation and treatment of building for termites, cockroaches, ants, vermin, and other pests using pesticides registered by the State Department of Agriculture and the EPA
4. Floodlighting less than 15 feet in height for security, safety, and decorative purposes, which is low blue spectrum lighting, shielded to minimize fugitive light
5. Litter container pick up
6. Manhole and meter box adjustment

7. Parking lot cleaning
8. Parking lot resurfacing and striping
9. Reroofing
10. Maintenance of spillway channels and streams by use of hand tools and light equipment, but not by use of herbicides
11. Storm drain cleaning
12. Vegetation clearing from vacant lots, except by use of herbicides
13. Repair of vehicles, equipment and tools including testing and maintenance of compressors, generators, tapping and boring machines, pipe cutters, small water pumps, welding and soldering equipment, electrical testing equipment, water analysis equipment, and telemetering equipment
14. Wellsealing
15. Repair and maintenance of pipeline tunnels
16. Repair and maintenance of access roads and pathways
17. Mechanical control of vegetation along roadways, trails, and building sites
18. Repair and maintenance of water mains, meters, fire hydrants, fire standpipes, valves, manholes, stream gages, and monitor wells
19. Repair and maintenance of water treatment equipment and facilities
20. Repair and maintenance of water well and booster pumps, pressure breaker tanks, surface and ground water intakes, remote control valves, chlorination equipment, and appurtenances
21. Repair and maintenance of electrical equipment
22. Repair and maintenance of cable cars, tracks and winches
23. Repair and maintenance of elevators
24. Repair and maintenance of fencing and gates
25. Repair of curbs and sidewalks

26. Repair and maintenance of tank reservoirs and pump buildings
27. Repair and maintenance of retaining walls and screen walls
28. Repair and maintenance of air conditioning and ventilator equipment
29. Repair and maintenance of telemetered circuits and communications systems
30. Repair and maintenance of microwave reflectors, antennas, towers and poles
31. Repair of berms
32. Repair of bridging for pipeline support
33. Repair of drainage structures and storm drain lines
34. Repair and maintenance of footbridges
35. Repair and maintenance of guardrails
36. Repair and maintenance of electrical equipment
37. Repair of fuel tanks
38. Maintenance of dams
39. Acquisition of land or easements required for existing facilities
40. Maintenance of grounds by such means as mowing, trimming and weeding
41. Spot control and treatment of plant growth, insects and weeds of landscaped grounds of the department using pesticides and herbicides approved by the State Department of Agriculture and the EPA, where mowing, trimming, weeding and other means or methods are not feasible
42. Temporary and permanent road patching for repair and maintenance of water facilities
43. Rock removal to stabilize slopes
44. Slope stabilization using rip-rap, shotcrete, net drapery, rockfall impact barrier, or other methods
45. Hydro-mulching or using other methods to prevent soil erosion

(2) Replacement or reconstruction of existing structures and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height, and dimensions as the structure replaced;

1. Replacement or reconstruction:

a. Buildings provided there would be no substantial change in use

b. Bridging for pipeline support

c. Berms

d. Drainage structures

e. Driveways

f. Bridges

g. Curbs and sidewalks

h. Wells

i. Booster pumps

j. Pressure breaker tanks

k. Surface and groundwater intakes

l. Remote control valves

m. Chlorination and water treatment

2. Replacement of:

a. Equipment, including electrical and water treatment

b. Partitions, doors, windows, and plumbing

c. Guardrails

d. Fuel tanks and associated infrastructure related to its spill prevention control and countermeasures

e. Water meters, fire hydrants, fire standpipes, manholes, stream gages, and monitor wells

- f. Water well and booster pumps and appurtenances
 - g. Cable cars, tracks and winches
 - h. Elevators
 - i. Fencing and gates
 - j. Telemetered circuits and communications systems
 - k. Microwave reflectors, antennas, towers, and poles
- 3. Replacement of signs
 - 4. Replacement of vehicles, equipment, tools including compressors, generators, tapping and boring machines, small water pumps, welding and soldering equipment, electrical testing equipment, water analysis equipment, and telemetering equipment

(3) Construction and location of single, new, small facilities or structures and the alteration and modification of same and installation of new small equipment and facilities and the alteration and modification of same including but not limited to: (a) single family residences less than 3,500 square feet, if not in conjunction with the building of two (2) or more such units; (b) multi-unit structures design for not more than four (4) dwelling units, if not in conjunction with the building of two (2) or more such structures; (c) stores, offices and restaurants designed for total occupant load of twenty (20) persons or less, if not in conjunction with the building of two (2) or more such structures; (d) water, sewage, electrical, gas, telephone, and other essential public utility services extensions to serve such structures or facilities; and (e) accessory or appurtenance structures including garages, carports, patios, swimming pools, and fences; and acquisition of utility easements;

- 1. Construction and alteration of:
 - a. Carports and garages (less than 3500 square feet) on or at existing BWS parcels or facilities
 - b. Cement rubble masonry, hollow block, or reinforced concrete walls not more than six feet in height
 - c. Fencing
 - d. Guardrails
 - e. Sidewalks and covered walkways

- f. Observation well shelters (kiosks)
 - g. Stream gauging stations
 - h. Rain gauging stations
 - i. Telemetry and remote control (**SCADA**) equipment and appurtenances including interior or exterior cabinets, solar power equipment, antenna, electronic equipment, and telemetry equipment
 - j. Shelters for emergency generators at existing pump stations
 - k. Site security upgrades including fencing, access controls, intrusion alarms, security cameras, and telemetry
 - l. Existing building and facilities to comply with the Americans with Disabilities Act (ADA) requirements
 - m. Construction at existing facilities of small new building or small building additions, such as storage sheds, offices or shower/locker rooms
 - n. Construction or location of portable field buildings
 - o. Construction or location of temporary field buildings
2. Installation and modification of:
 - a. Office air conditioning and ventilation
 - b. Equipment in existing building, such as emergency electric generators in existing water pump stations
 - c. Intrusion alarm systems
 - d. Monitoring devices
 - e. Water meters and service laterals
 - f. Motor control centers and chlorinator buildings
 - g. Telemetry and other monitoring and control equipment
 3. Installation of new water service connections off existing mains
 4. Extension of water laterals
 5. Installation of temporary emergency water well pumping, filtration and water treatment equipment

6. Construction of additional storage tank capacity not to exceed 100,000 gallons, on or at existing BWS parcels or facility
7. Alterations to water well pumping equipment including installation of control valves, chlorination systems or alterations of pump
8. Utility connections for electricity, gas and sewage
9. Window modifications
10. Installation of telemetering equipment and wires
11. Installation of signs
12. Installation of filtration and water treatment equipment
13. Installation of monitoring equipment and facilitators for measuring physical, chemical and biological parameters of water quality
14. Installation of pressure regulating equipment such as booster pumps, pressure reducers, pressure relief valves, etc. where the intent is to route water from one pressure zone to the next; including associated infrastructure to house the equipment.
15. Installation of exterior lights designed to mitigate impacts to wildlife and aesthetics. Exterior lights will be 15 feet or less above ground level, and will be low blue spectrum lighting, shielded to minimize fugitive light

(4) Minor alterations in the condition of land, water or vegetation;

1. Construction of berms
2. Tree trimming and removal of trimmings, grubbing and mowing of lawn area, planting of trees, other plants and sods, and pruning of trees and shrubs
3. Construction of drainage ditches
4. Construction of footpaths
5. Landscaping and installation of irrigation systems
6. Construction of seepage drains, including dry wells for groundwater recharge
7. Minor adjustments for landscaping purposes or for leveling grounds for which grading permits are not required

8. Temporary access roads with minimal grading and tree removal to repair and maintain existing facilities
9. Incidental clearing of land and preliminary work sites for surveying, engineering design, and geologic and hydrologic studies

(5) Basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource;

1. Chemical, biological and viral laboratory analyses
2. Fresh and saline water sampling
3. Recycling of wastewater studies
4. Stream studies and surveys
5. Subsurface exploration soil boring and archaeological investigation. Archaeological investigation includes historical research and archaeological inventory surveys, including subsurface pits
6. Collection of geologic samples
7. Leak detection surveys
8. Use at any one time of not more than 5.0 curies of Americium 241 and Beryllium and the storage of the same radioactive material for well logging purposes in accordance with the requirement of the USA Nuclear Regulatory Commission
9. Surveying, engineering design, and geologic and hydraulic studies with minor trimming of vegetation
10. Surveying work to verify control points and topographic work
11. Drilling and testing of monitor wells as defined by the Commission on Water Resources management. The wells shall not be capable of being used or intended to be used to withdraw groundwater for the purposes of exploring or developing groundwater
12. Collection of water samples for bacteriological and chemical analysis

(6) Demolition of structures, except those structures that are listed on the national register or Hawaii Register of Historic Places;

1. Removal of architectural features
2. Demolition of abandoned buildings and structures
3. Demolition of tank reservoirs and other abandoned watersystem appurtenances
4. Removal and disposal of demolition materials
5. Demolition of sidewalks and curbs

(7) Zoning variances except shoreline setback variances;

1. Building setback variances

(8) Continuing administrative activities including

1. Purchases of supplies, services and equipment to support existing operations
2. Personnel-related actions
3. Subdivision of Board of Water Supply property to accommodate State or County road improvement projects
4. Consolidation of existing parcels acquired over a period of time
5. Acquisition of land easements on which water system facilities and appurtenances are presently situated or under construction

(9) Acquisition of land and existing structures, including single or multi-unit dwelling units, for the provision of affordable housing, involving no material change of use beyond previously existing uses, and for which the legislature has appropriated or otherwise authorized funding

None

(10) New construction of affordable housing, where affordable housing is defined by the controlling law applicable for the state or county proposing agency or approving agency, that meets the following:

- (a) Has the use of state or county lands or funds or is within Waikiki as the sole triggers for compliance with Chapter 343, HRS;**

- (b) As proposed conforms with the existing state urban land use classification;**
- (c) As proposed is consistent with the existing county zoning classification that allows housing; and**
- (d) As proposed does not require variances for shoreline setbacks or siting in an environmentally sensitive area, as stated in section 11-200.1-13(b)(II);**

None

Part 2 – General types of actions for exemption

Types of actions that the agency considers to be included within the exempt general types listed in Section 11-200.1-15 of the Hawaii Administrative rules

- (1) Operations, repairs or maintenance of existing structures, facilities, equipment, or topographical features, involving negligible or no expansion or change of use beyond that previously existing;**

None

- (2) Replacement or reconstruction of existing structures and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height, and dimensions as the structure replaced;**

- 1. Replacement or reconstruction:

- a. Stream retaining walls
- b. Baseyards
- c. Tank Reservoirs

- 2. Replacement of waterlines and appurtenances including concrete jackets within existing rights-of-way where no change in purpose is intended. Replacement may be size for size, or may involve an increase in pipe diameter if the existing waterline is inadequate to meet current Water System Standards and current zoning requirements

(3) Construction and location of single, new, small facilities or structures and the alteration and modification of same and installation of new small equipment and facilities and the alteration and modification of same including but not limited to:

(a) single family residences less than 3,500 square feet, if not in conjunction with the building of two (2) or more such units;

None

(b) multi-unit structures design for not more than four (4) dwelling units, if not in conjunction with the building of two (2) or more such structures;

None

(c) stores, offices and restaurants designed for total occupant load of twenty (20) persons or less, if not in conjunction with the building of two (2) or more such structures; and

1. modular trailer structures
2. modifications to expand for occupant load within the existing facilities

(d) water, sewage, electrical, gas, telephone, and other essential public utility services extensions to serve such structures or facilities; and (e) accessory or appurtenance structures including garages, carports, patios, swimming pools, and fences; and acquisition of utility easements;

1. Installation and modification of:
 - a. Storm drain lines
2. Extension of existing waterlines to complete grid within existing rights-of-way and easements
3. Oversizing of new pipelines within existing rights-of-way as allowed by BWS Rules pertaining to extensions of mains (non-growth related)
4. Oversizing of new pipelines within existing rights-of-way for redundancy and water system reliability
5. Extension of existing storm drains

6. Expansion of existing well and booster pump stations to master planned capacity, including installation of filtration, water treatment and additional pumping equipment and appurtenances, provided circumstances have not changed substantively from the time the master plan was prepared
7. Installation of new water mains, fire standpipes and fire hydrants to provide fire protection
8. Installation of new water mains, fire standpipes and fire hydrants to improve water system reliability
9. Installation of new water mains for redundancy and system reliability
10. Installation of underground fuel tanks and dispensers not to exceed 2,000-gallon capacity
11. Construction of carports and garages in excess of 3500 square feet
12. Installation of new hydrants off existing pipeline to provide fire protection
13. Relocations of fire hydrants or fire standpipe to clear new construction such as driveway, or to eliminate a hazardous condition
14. Installation of temporary emergency water well pumping, filtration and water treatment equipment
15. Installation of water sampling stations connected off an existing main
16. Construction of Pressure Reducing Valve (PRV) housing structures

(4) Minor alterations in the condition of land, water or vegetation;

None

(5) Basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource;

None

(6) Demolition of structures, except those structures that are listed on the national register or Hawaii Register of Historic Places;

None

(7) Zoning variances except shoreline setback variances;

None

(8) Continuing administrative activities;

None

(9) Acquisition of land and existing structures, including single or multi-unit dwelling units, for the provision of affordable housing, involving no material change of use beyond previously existing uses, and for which the legislature has appropriated or otherwise authorized funding; and

None

(10) New construction of affordable housing, where affordable housing is defined by the controlling law applicable for the state or county proposing agency or approving agency, that meets the following:

(a) Has the use of state or county lands or funds or is within Waikiki as the sole triggers for compliance with Chapter 343, HRS;

(b) As proposed conforms with the existing state urban land use classification;

(c) As proposed is consistent with the existing county zoning classification that allows housing; and

(d) As proposed does not require variances for shoreline setbacks or siting in an environmentally sensitive area, as stated in section 11-200.1-13(b)(II);

None



APPENDIX

SHPD 6E



C

PROJECT SUMMARY AND EFFECT DETERMINATION

The **Board of Water Supply (BWS)** submits this project summary for State Historic Preservation (SHPD) review per 6E-8, HRS in connection with the following project:

Makaha Wells, II, III, and IV Access Road Repairs

The proposed scope of work includes:

The concrete culvert crossing under the BWS access road to Makaha Wells at Makaha Stream has failed and its degrading state has existed for more than 10 years. The east side of the culvert is filled with basalt pebbles and cobbles to a vertical point to where the top of the Makaha Stream deposited fill is within a foot below the surface of the BWS access road. Thus, when heavy rains fall, the water from the Makaha Stream overflows onto the BWS access road. On the west side of the existing culvert, the imported fill and access road's cemented basalt cobble and boulder shoulder used to secure the existing culvert pipes is being undermined by the Makaha Stream's rushing water caused by heavy rains. The culvert crossing will not be able to provide 24/7 access to the Makaha Wells II, III and IV. A new, modular truss bridge crossing is proposed to span the stream banks.

In preparation for the construction of a new, modular truss bridge crossing, several major tasks need to be accomplished. Short portions of the existing BWS asphalt access road will be replaced with the construction of a new, 60-foot long, modular truss bridge. The existing, active 16-inch diameter water line will be tapped on each side of the new bridge and then strapped onto the bridge with re-connection to the existing waterline on each side of the new bridge. There will be a new, short wall constructed on the upstream side of the bridge (and on the far side of bridge) for grade adjustment. Where the traditional Hawaiian agricultural system (SCS Site TS-1) is located south of the culvert crossing, a critical project construction staging area to make the project viable will be placed which will require clearance of existing vegetation and ground leveling. SCS Site TS-2, a cluster of traditional Hawaiian basalt rock terraces, constructed for either slope retention or agricultural purposes, are located just west and northwest of the proposed bridge construction area and may be physically impacted by ground disturbing activities. A second archaeological site, SCS Site TS-6, is located on the top edge of a steep slope of which the lower portion of the same slope will be mechanically removed, likely through hydraulic hammering of the basalt bedrock.

Other tasks that will need to be accomplished prior to the construction of a new, modular truss bridge crossing include:

1. Mass excavation for downstream work in Makaha Stream consists of removing stream material is 275 Cubic Yards. It extends the whole width of the channel bottom (50-feet) and 35-feet downstream of the bridge. The amount of excavation is not uniform with the deepest excavation being 3.5 feet.
2. Mass Excavation on the upstream side of the bridge is essentially deposited sediment and rocks resulting from the failure of the existing pipe culvert stream crossing. The length upstream from the bridge is 35-feet and the width is 50-feet. The total amount of upstream excavation is 475 Cubic Yards with a relatively uniform depth of 7-feet.
3. A channel is being cut into the remaining upstream fill within the Makaha Stream Channel. The cut section is 8-feet wide and 60-feet long. The quantity of this cut section is 70 Cubic Yards.
4. The temporary road will be built using Geoterra GTO units. Gabion baskets will be placed in soft or areas of standing water. The total amount of fill is 10 Cubic Yards, and the maximum depth will be 0.5-Feet.
5. The diversion ditch is a mandatory feature to allow the bridge to be installed and re-route stream water around the bridge work area, The diversion ditch is 145-Feet long, 7-Feet wide and 5-Feet deep and the excavated area is 190-Feet.
6. In order to place the bridge in its final location a "launch area" is required on the upstream side of the BWS Access Road. The launch area is 30-Feet wide and 80-Feet long. The lower end of the launch area matches the existing grade, and the top end of the launching range is 7-Feet deep. The total excavated area is 360 Cubic Yards.
7. The temporary access road will have a 16-inch water line passing underneath it. The trench width will be 4-Feet, the depth will be 5-Feet and the length will be 190-Feet. The excavated quantity will be 140 Cubic Yards. One quarter (50-Feet) will be within the silt and rock laden portion above the existing culvert crossing.

8. The pedestal bases to suspend the permanent 16-inch water line from the lower side of the bridge to the upper side bridge are 4-Feet wide, 6'-6" Feet long and the pedestals will be buried 3-Feet deep. The amount of excavation will be 3.0 Cubic Yards.

The Board of Water Supply offers the following documentation:

Identification and Inventory of Historic Properties

*[The **Board of Water Supply** shall determine whether historic properties are present in the project area and, if so, it shall ensure that these properties are properly identified and inventoried.]*

Full pedestrian survey of the proposed construction staging area and the proposed bridge construction area project area as part of a Literature Review/Field Inspection (LRFI) resulted in the identification of a previously undocumented archaeological site tentatively labeled as SCS Site TS-1 (33 archaeological surface features representing an agricultural complex with a possible agricultural shrine; all were constructed of basalt boulders and cobbles) in the proposed construction staging area. SCS Site TS-1 was subjected to an archaeological inventory survey in 2021. SCS Site TS-2 (five archaeological surface features representing a second traditional Hawaiian agricultural complex) was found during the August 2023 archaeological Field Inspection of the proposed bridge construction area. SCS Site TS-2 was found in and very near the proposed bridge construction area west perimeter. An additional two traditional Hawaiian sites were found during the same Field Inspection, SCS Sites TS-3 and TS-6, are located outside of the proposed bridge construction area. Based on being located on the top edge of a steep slope, SCS Site TS-6 may be physically impacted by vibrations caused by the mass slope excavation in preparation for the construction of the temporary BWS bypass road. SCS Site TS-3 will not be impacted by the proposed bridge construction area.

Evaluation of Significance

SCS Site TS-1 has yielded information under Criterion D. SCS Site TS-1 Feature 16B is being recommended for preservation as the feature is being interpreted as a possible traditional Hawaiian agricultural shrine. SCS Sites TS-2 and TS-6 have the potential to yield information under Criterion D. The assessment of SCS Sites TS-2 and TS-6 may change when the features are investigated via mapping, recording, and subsurface testing.

SCS Sites TS-1 falls under the Integrity aspects of Location, Setting, Design, Materials, Feeling, and Association. Since SCS Sites TS-2 and TS-6 were found during an archaeological field inspection, aspects of Integrity were not assigned. Given that the features of SCS Sites TS-2 and TS-6 are like the features of SCS Site TS-1 with regards to construction and function, it is likely that the same Integrity aspects applied to SCS Site TS-1 are applicable to SCS Sites TS-2 and TS-6.

Effect Determination

BWS recommendation for the proposed bridge construction area: effect with agreed upon mitigation commitment (AIS) for SCS Sites TS-2 and TS-6. Archaeological inventory survey report writing in progress for SCS Site TS-1 with regards to the proposed construction staging area.

Mitigation

Mitigation involves archaeological inventory survey (AIS) of the proposed bridge construction area. Archaeological monitoring for the proposed construction staging area and the proposed bridge construction area post-SHPD acceptance of the archaeological inventory survey. The presence of the possible agricultural shrine identified as SCS Site TS-1 Feature 16B and the nearby historic burials (N=3) of SIHP Site 50-80-07-00758 give reason to conduct archaeological monitoring of the proposed construction staging area and the proposed bridge construction area.

State Historic Preservation Division
HRS 6E Submittal Form

Per §6E, Hawai'i Revised Statutes, if the Project requires review by the State Historic Preservation Division (SHPD), please review and fill out this form and submit all requested information to SHPD. Please submit this form and project documentation **electronically** to:

dlnr.intake.shpd@hawaii.gov

If you are unable to submit electronically, please contact SHPD at (808) 692-8015. Mahalo.

The submission date of this form is:

1. APPLICANT (select one)

☐ Property Owner ☐ Government Agency

2. AGENCY (select one)

☐ Planning Department ☐ Department of Public Works ☐ Other (specify):

Type of Permit Applied For:

3. APPLICANT CONTACT

3.1) Name: 3.2) Title:
3.3) Street Address:
3.4) County: 3.5) State: 3.6) Zip Code:
3.7) Phone: 3.8) Email:

4. PROJECT DATA

4.1) Permit Number (if applicable):
4.2) TMK [e.g. (3) 1-2-003:004]:
4.3) Street Address:
4.4) County: 4.5) State: 4.6) Zip Code:
4.7) Total Property Acreage:
4.8) Project Area (acreage, square feet):
4.9) List any previous SHPD correspondence (LOG Number & DOC Number, if applicable):
LOG NO. DOC NO.

5. PROJECT INFORMATION

5.1) Does the Project involve a Historic Property? A Historic Property is any building, structure, object,

district, area, or site, including heiau and underwater site, **which is over 50 years old** (HRS §6E-2).

☐ Yes ☐ No

5.2) The date(s) of construction for the historic property (building, structure, object, district, area, or site, including heiau and underwater site) is

5.3) Is the Property listed on the Hawai'i and or National Register of Historic Places? To check:
<http://dlnr.hawaii.gov/shpd/>

☐ Yes ☐ No

5.4) Detailed Project Description and Scope of Work:

5.5) Description of **previous** ground disturbance (e.g. previous grading and grubbing):

5.6) Description of **proposed** ground disturbance (e.g. # of trenches, Length x Width x Depth):

5.7) The Agency shall ensure whether historic properties are present in the project area, and, if so, it shall ensure that these properties are properly identified and inventoried. Identify all known historic properties:

5.8) Once a historic property is identified, then an assessment of significance shall occur.

Integrity (check all that apply):

☐ Location ☐ Design ☐ Setting ☐ Materials ☐ Workmanship ☐ Feeling ☐ Association

Criteria (check all that apply):

- ☐ a – associated with events that have made an important contribution to the broad patterns of our history
- ☐ b – associated with the lives of persons important in our past
- ☐ c – embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value
- ☐ d – have yielded, or is likely to yield, information important for research on prehistory or history
- ☐ e – have an important value to the Native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts - - these associations being important to the group's history and cultural identity

5.9) The effects or impacts of a project on significant historic properties shall be determined by the agency.

Effect Determination (select one):

- ☐ No Historic Properties Affected
- ☐ Effect, with Agreed Upon Mitigation Commitments (§6E-42, HRS)
- ☐ Effect, with Proposed Mitigation Commitments (§6E-8, HRS)

5.10) This project is (check all that apply, if applicable):

- ☐ an activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency;
- ☐ carried out with Federal financial assistance; and or
- ☐ requiring a Federal permit, license or approval.

If any of these boxes are checked, then the Project may also be subject to compliance with Section 106 of the National Historic Preservation Act (NHPA).

6. PROJECT SUBMITTALS

- 6.1) Please submit a copy of the Tax Map Key (TMK) map See Attachment for Project Submittal 6.1 (Tax Map)
- 6.2) Please submit a copy of the property map showing the project area and indicate if the project area is smaller than the property area. See Attachment for Project Submittal 6.2 (Construction Plan Sheet C001 (Building Permit Site Plan))
- 6.3) Please submit a permit set of drawings. A permit set is a set of drawings prepared and signed by a licensed architect or engineer and is at least 65% complete. See Attachment for Project Submittal 6.3 (Construction Plans for Makaha Wells II, III and IV Access Road Repairs)
- 6.4) Are you submitting a survey?

☐ Yes ☐ No

Specify Survey:

6.5) Did SHPD request the survey?

☐ Yes ☐ No

If 'Yes', then please provide the date, SHPD LOG NO, and DOC NO:

Date:

LOG NO.

DOC NO.

6.6) **SURVEY REVIEW FEES.** Fee for Review of Reports and Plans (§§13-275-4 and 284-4). A filing fee will be charged for all reports and plans submitted to our office for review. Please go to:

<http://dlnr.hawaii.gov/shpd/about/branches/archaeology/filing-fee-schedule/>

A check payable to the Hawaii Historic Preservation Special Fund should accompany all reports or plans submitted.

6.7) Please submit color photos/images of the Historic Property (any building, structure, object, district, area, or site, including heiau and underwater site) that will be affected by the Project.

The following are the minimum number and type of color photographs required:

Quantity	Description
1-2	Street view(s) of the resource and surrounding area
1-2	Over view of exterior work area
1	exterior photo of the North elevation (if applicable)
1	exterior photo of the South elevation (if applicable)
1	exterior photo of the East elevation (if applicable)
1	exterior photo of the West elevation (if applicable)
1-2	interior photos(s) of areas affected (if applicable)

CHECKLIST

- ☐ **SHPD FORM 6E** (this form)
- ☐ **PROJECT SUBMITTALS** (any requested documentation for items 6.1 - 6.7 of this form)
- ☐ **FILING FEE FORM** (if applicable) Under separate cover

ATTACHMENT FOR ITEM 5.6

The following provides dimensions and quantities for Project elements (and Item 5.6)

1. Mass excavation for downstream work in Makaha Stream consists of removing Stream material is 275 Cubic Yards. It extends the whole width of the channel bottom (50-feet) and 35-feet downstream of the bridge. The amount of excavation is not uniform with the deepest excavation being 3.5 feet.
2. Mass Excavation on the upstream side of the bridge is essentially deposited sediment and rocks resulting from the failure of the existing pipe culvert stream crossing. The length upstream from the bridge is 35-feet and the width is 50-feet. The total amount of upstream excavation is 475 Cubic Yards with a relatively uniform depth of 7-feet.
3. A channel is being cut into the remaining upstream fill within the Makaha Stream Channel. The cut section is 8-feet wide and 60-feet long. The quantity of this cut section is 70 Cubic Yards.
4. The temporary road will be built using Geoterra GTO units. Gabion baskets will be placed in soft or areas of standing water. The total amount of fill is 10 Cubic Yards and the maximum depth will be 0.5-Feet.
5. The diversion ditch is a mandatory feature to allow the bridge to be installed and re-route stream water around the bridge work area, The diversion ditch is 145-Feet long, 7-Feet wide and 5-Feet deep and the excavated area is 190-Feet.
6. In order to place the bridge in its final location a "launch area" is required on the upstream side of the BWS Access Road. The launch area is 30-Feet wide and 80-Feet long. The lower end of the launch area matches the existing grade and the top end of the launching range is 7-Feet deep. The total excavated area is 360 Cubic Yards.
7. The temporary access road will have a 16-inch water line passing underneath it. The trench width will be 4-Feet, the depth will be 5-Feet and the length will be 190-Feet. The excavated quantity will be 140 Cubic Yards. One quarter (50-Feet) will be within the silt and rock laden portion above the existing culvert crossing.
8. The pedestal bases to suspend the permanent 16-inch water line from the lower side of the bridge to the upper side bridge are 4-Feet wide, 6'-6" Feet long and the pedestals will be buried 3-Feet deep. The amount of excavation will be 3.0 Cubic Yards.

Item 5.6 Supplemental

SUGGESTED SEQUENCE OF WORK

THE MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS HAS FIVE (5) MAIN PHASES. EACH PHASE HAS A BMP INSTALLATION PLAN TO ALLOW THE WORK TO BE COMPLETED IN THAT PROJECT PHASE FOLLOWED BY A DESCRIPTION OF WORK TO BE PERFORMED DURING THAT PHASE.

PHASE 1 CLEARING AND GRUBBING AND CUT SECTION FOR "TR1"

BMP'S PHASE 1 (SHT C008)

1. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND STAGING AREA. (SEE SHT C008)
2. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AT THE TOP AND BOTTOM OF CUT SECTION FOR "TR1". (SEE SHT C008)
3. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND THE MODULAR TRUSS BRIDGE LAUNCH SITE. (SEE SHT C008)
4. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND TEMPORARY DIVERSION DITCH (SEE SHT C008)
5. SET 3' X 3' SUPER SACKS AT HEAD END OF DIVERSION DITCH (STA 0 + 00) TO ROUTE ANY STREAM FLOW FROM ENTERING DIVERSION DITCH

CONSTRUCTION ACTIVITIES PHASE 1

1. ALL CLEARING AND GRUBBING FOR TREES OVER 15-FOOT TALL SHALL NOT OCCUR BETWEEN JUNE 1 AND SEPTEMBER 15 WHICH IS THE HOARY BAT PUPPING SEASON. (SP 39 NATURAL RESOURCES ASSESSMENT-PAGE 22).
2. CLEAR AND GRUBB AND SET-UP STAGING AREA (SEE SHT C008)
3. CLEAR AND GRUBB MODULAR TRUSS BRIDGE LAUNCH SITE. EXCAVATION OF THE BRIDGE LAUNCH SITE CAN COMMENCE. EXCAVATED MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. (SEE SHT C008)
4. CLEAR AND GRUBB CUT BANK SITE FOR ("TR1"). EXCAVATION FOR "TR1" CAN COMMENCE (250 CU. YD). EXCAVATED MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. THE CUT WILL RECEIVE SOIL NAILS AND A SHOTCRETE FACING. (SEE SHT C008 AND C012)
5. CLEAR AND GRUB AREA FOR TEMPORARY DIVERSION DITCH (50 CU YD+/-). EXCAVATION FOR DIVERSION DITCH CAN COMMENCE WITH INSTALLATION OF TRENCH BOTTOM AND TRENCH SHIELDS. EXCAVATED MATERIAL CAN BE STOCKPILED IN THE VICINITY OF THE DIVERSION DITCH WITH FILTER-SOCK PROTECTION AND TARP TYPE COVER AND USED FOR DIVERSION DITCH RESTORATION. (SEE SHT C008, C013 AND C0014)
6. ALL CLEARED AND GRUBBED MATERIAL SHALL BE PLACED IN TRUCKS WITH TREES CUT TO TRANSPORTABLE SIZE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS
7. EXCAVATION FOR LAUNCH AREA (500 CU. YD.+/-) CAN COMMENCE. SEED LAUNCH SITE AFTER GRADING. (SEE SHT C008)

PHASE 2 BEGIN DIVERSION DITCH FLOW AND INSTALL TEMPORARY ACCESS ROAD WITH TEMPORARY 16-INCH WATER DI CL53 WATER LINE.

BMP'S PHASE 2 SHT (C009)

1. ALL PHASE 1 BMP'S TO BE KEPT IN PLACE.
2. PLACE 3' X 3' SUPERSACKS ACROSS STREAM TO DIRECT MAKAHA STREAM WATER INTO THE TEMPORARY DIVERSION DITCH FOR DURATION OF PROJECT. DIVERSION DITCH IS DESIGNED FOR 500 CFS FLOW. THE 2-YEAR 24-HOUR MAKAHA STREAM FLOW IS 270 CFS. THE PLANS CALL FOR 2-NO. 8 REBARS ON THE DOWN STREAM SIDE OF THE 3 X 3 SUPERSACKS FOR ANCHORAGE. (SEE SHT C009, C013 AND C014)
3. EXTEND 12-INCH FILTER-SOCK FROM BOTTOM OF "TR1" CUT ALONG THE DOWNSTREAM SIDE OF THE TEMPORARY ACCESS ROAD. (SEE SHT COO9)

CONSTRUCTION ACTIVITIES PHASE 2

1. DRY UP THE DOWNSTREAM SIDE OF THE SUPERSACKS DIVERTING STREAM FLOW AND UPSTREAM EDGE OF EXISTING ACCESS ROAD. DISPOSE OF WATER AS DUST CONTROL WATER WITH NO DISCHARGE BACK INTO MAKAHA STREAM.
2. EXCAVATE AND INSTALL 16-INCH DI PIPE CL 53 WITH CUSHION PER BWS WSS BETWEEN TEMPORARY POINTS OF CONNECTION (STA 42+77.25 EXISTING ACCESS ROAD AND 44 +63.02 EXISTING ACCESS ROAD. (SEE SHT C005, C005 AND C015)
3. GRADE FOR TEMPORARY ACCESS ROAD (10 CU. YD.) (SEE SHTS C009, C015 AND c020)
4. PLACE GABIONS IN LOW AREA OF TEMPORARY ACCESS ROAD (SEE SHT C019)
5. PLACE GEOTERRA GTO CONSTRUCTION ROAD SYSTEM, OR EQUAL, AS THE TEMPORARY ACCESS ROAD SURFACE. INSTALL GEOTERRA GTO UNITS WITH ALL BOLT CONNECTORS AND AUGER ANCHORS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. FABRICATE TEMPORARY WATER LINE CONNECTIONS INCLUDING STRUCTURAL STRUTS WITH SUFFICIENT CURING TIME TO ALLOW BOTH CONNECTIONS IN A MAXIMUM WATER OUTAGE TIME OF __ HOURS. (SEE SHT C005)
7. DEMOLISH ELECTRICAL AND COMMUNICATIONS AS SHOWN ON SHTS E101 AND E102
8. SET-UP TEMPORARY ELECTRIC AND COMMUNICATIONS. (SEE SHTS E103 & E104).

PHASE 3 MAJORITY OF STREAM EXCAVATION TO PLACE GROUTED RUBBLE PAVEMENT, BUILD BRIDGE ABUTMENTS AND SET MODULAR PANEL TRUSS BRIDGE.

BMP'S PHASE 3 SHT (C010)

1. KEEP ALL PHASE 1 AND PHASE 2 BMP'S IN PLACE
2. PLACE A ROW OF 3' X 3' SUPERSACKS DOWNSTREAM OF THE LIMITS OF GRADING. (SEE SHT C010)

CONSTRUCTION ACTIVITIES PHASE 3

1. EXCAVATE PER PHASE 3 GRADING (500 CU. YD) WITH ALL EXCAVATED MATERIAL PLACED IN LOCATION FOR TRANSFER TO TRUCK FOR DISPOSAL OFF-SITE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL

FROM A CONSTRUCTION SITE. ALTERNATE IS TO PLACE EXCAVATED MATERIAL DIRECTLY INTO TRANSFER TRUCK. (SEE SHT C007, C010 AND C017)

2. INSTALL BRIDGE ABUTMENTS. (SEE SHT C007, SHTCO10, SHT S101 AND SHT S201)
3. PLACE GROUTED RUBBLE PAVEMENT (SEE SHT C009, C007 AND C017)
4. TRANSFER PRE-CONSTRUCTED MODULAR PANEL TRUSS BRIDGE TO LAUNCH SITE. (NOTE: USE SUPPLIER'S ON-SITE ASSIST TIME TO THE MAXIMUM EXTENT POSSIBLE (4 DAYS) FROM TIME OF ABUTMENT COMPLETION AND GROUTED RUBBLE PAVEMENT IS COMPLETE AND ITEMS 5 AND 6 ARE COMPLETED (SEE SHT C010)
5. LAUNCH BRIDGE ONTO ABUTMENTS (SEE 010)
6. COMPLETE ASSEMBLY OF MODULAR PANEL TRUSS BRIDGE TO THE SATISFACTION OF BRIDGE SUPPLIER INCLUDING FOOT WALKER PANELS. MODULAR TRUSS PANEL BRIDGE SUPPLIER TO ISSUE LETTER THAT BRIDGE HAS BEEN ERECTED AND INSTALLED IN ACCORDANCE SUPPLIERS' APPROVAL. SEE SHT CO10 AND C501 THROUGH C507)
7. PLACE NEW 16-INCH WATER LINE ON BRIDGE AND THROUGH ABUTMENTS ON EACH SIDE OF BRIDGE UP TO THE VICINITY OF THE WATER LINE RECONNECTIONS ON THE LOW SIDE OF THE BRIDGE (STA 42 + 85.23) TO THE EXISTING 16-INCH WATER LINE ON THE UPPER SIDE OF BRIDGE (STA 44 + 71.58) (SEE SHTS C006 AND C007)
8. FABRICATE TEMPORARY WATER LINE CONNECTIONS INCLUDING STRUCTURAL STRUTS WITH SUFFICIENT CURING TIME TO ALLOW BOTH CONNECTIONS TO BE MADE IN A MAXIMUM WATER OUTAGE TIME OF ___ HOURS. (SEE C006 AND C007 AND S203)
9. PLACE PERMANENT ELECTRIC AND COMMUNICATIONS ON BRIDGE WITH CONNECTIONS TO EXISTING ELECTRIC AND COMMUNICATIONS ON BOTH SIDES OF BRIDGE (SEE SHTS E105 AND E106)
10. AFTER NEW ELECTRICAL AND COMMUNICATIONS IS OPERABLE DISMANTLE TEMPORARY ELECTRICAL AND COMMUNICATION OVERHEAD LINES.
11. AFTER COMPLETION OF PHASE 3 CONSTRUCTION THE PERMANENT MODULAR TRUSS BRIDGE SHOULD BE FULLY OPERATIONAL.

PHASE 4 REMAINDER OF STREAM EXCAVATION AND PROJECT REMEDIAL WORK

BMP'S PHASE 4 (SHT CO11)

1. REMOVE FILTER-SOCK FROM MODULAR PANEL BRIDGE LAUNCH SITE AFTER SEED HAS TAKEN HOLD. (SEE SHT C008)
2. REMOVE FILTER-SOCK FROM TOP OF TR"1" CUT AND DOWN THE EXISTING LEFT SIDE OF BWS ACCESS ROAD. SEE SHT (C009)
3. DIVERSION DITCH TO REMAIN IN PLACE
4. THE ROW OF 3' X 3' SUPER SACKS BELOW PHASE 3 STREAM EXCAVATION TO REMAIN IN PLACE. (SEE C010)

CONSTRUCTION ACTIVITIES PHASE 4 (CO11)

1. EXCAVATE PER PHASE 4 GRADING (275 CU. YD.) WITH ALL EXCAVATED MATERIAL PLACED IN LOCATION FOR TRANSFER TO TRUCK FOR DISPOSAL OFF-SITE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL

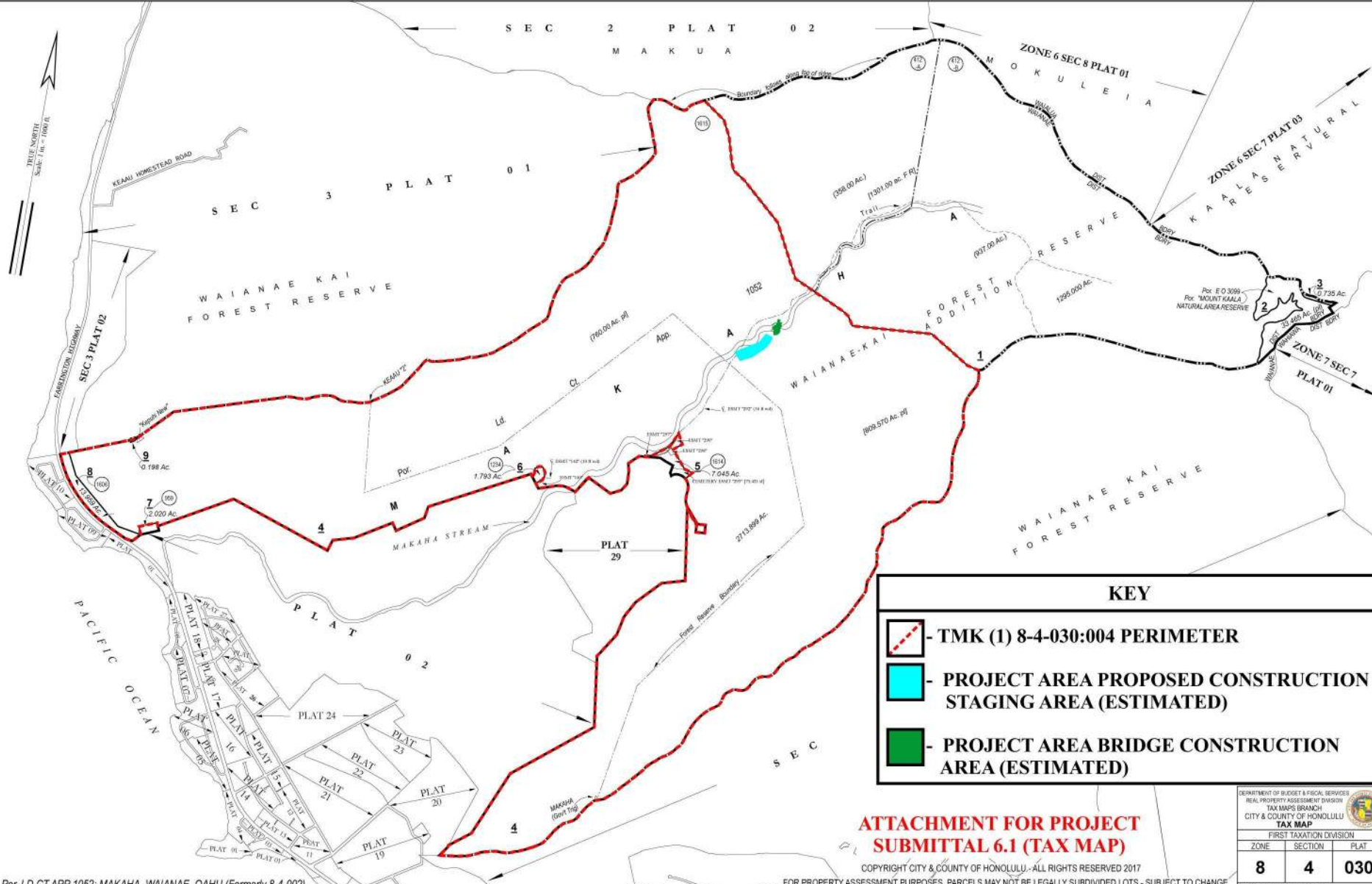
FROM A CONSTRUCTION SITE. ALTERNATE IS TO PLACE EXCAVATED MATERIAL DIRECTLY INTO TRANSFER TRUCK. (SEE SHT C011)

2. AFTER PHASE 4 GRADING IS COMPLETE INSTALL A 12-INCH LAYER OF GROUTED RUBBLE PAVEMENT BETWEEN UPSTREAM SIDE OF GROUTED RUBBLE PAVEMENT PROVIDING BRIDGE ABUTMENT PROTECTION AND THE TOE OF THE 2H:1V BANK OF PHASE 4 GRADING. (SEE SHT C017)

PHASE 5 MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS RESTORATION

CONSTRUCTION ACTIVITIES

1. AFTER CONCRETE RUBBLE MASONRY OF ITEM 2-CONSTRUCTION ACTIVITIES PHASE 4 ABOVE HAS SET SIMULTANEOUSLY, RE-ADJUST 3' X 3' SUPERSACKS TO BLOCK ANY FLOW INTO THE DIVERSION DITCH AND EXCAVATE A 8-FOOT WIDE AND 4-FOOT-DEEP CUT (45 CU. YD0 FROM THE TOP OF THE 2H:1V PHASE 4 BANK TO AN UPSTREAM ELEVATION OF APPROXIMATELY 860.0 FEET. THIS CUT WILL LET MAKAHA STREAM GRADUALLY RETURN TO ITS TYPICAL STREAM FLOW BEFORE THE BWS CULVERT WAS CONSTRUCTED. (C012)
2. DISASSEMBLE DIVERSION DITCH BY REMOVING ALL TRENCH SHIELDS AND WOOD BOTTOM. CLSM BOTTOM CAN BE ABANDONED IN PLACE. USE STOCKPILED DIVERSION DITCH EXCAVATION FOR DIVERSION DITCH BACKFILL. PLACE IN LIFTS OF NO MORE THAN 12-INCHES AND COMPACT TO 85 PERCENT COMPACTION. (SEE SHT CO08)
3. PLACE GRASS SEED AND MULCH AT THE TOP DIVERSION DITCH TRENCH BACKFILL AND GRADED BRIDGE LAUNCH SITE.
4. DISASSEMBLE STAGING AREA AND LEAVE IN A NATURAL STATE LESS THE CLEARING AND GRUBBING THAT OCCURRED PRIOR.



KEY

- TMK (1) 8-4-030:004 PERIMETER
- PROJECT AREA PROPOSED CONSTRUCTION STAGING AREA (ESTIMATED)
- PROJECT AREA BRIDGE CONSTRUCTION AREA (ESTIMATED)

ATTACHMENT FOR PROJECT SUBMITTAL 6.1 (TAX MAP)

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FOR PROPERTY ASSESSMENT PURPOSES, PARCELS MAY NOT BE LEGALLY SUBDIVIDED LOTS - SUBJECT TO CHANGE

DEPARTMENT OF BUDGET & FISCAL SERVICES
REAL PROPERTY ASSESSMENT DIVISION
TAX MAPS BRANCH
CITY & COUNTY OF HONOLULU
TAX MAP

FIRST TAXATION DIVISION		
ZONE	SECTION	PLAT
8	4	030

SCALE: 1 INCH = 1,000 FEET

KEY



- PROPERTY PERIMETER

- PROJECT SITE GENERAL LOCATION

TRUE NORTH
SCALE: 1 IN. = 1000 FT.

PROJECT SITE
TMC(1) 9-4-030 004
LAT.=21.499621 DEG
LONG.=(-158.142489 DEG)

LOT 1615
2,713.899 ACS.
(MAP 212)

SEE INSET 1

SEE INSET 2

EXISTING MAKAHA
525' RESERVOIR

RESERVOIR ACCESS ROAD

EXISTING MAKAHA
875' RESERVOIR

SHERATON MAKAHA RESORT

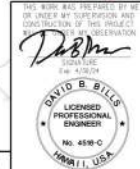
MAKHA VALLEY COUNTRY CLUB

Attachment for
Project Submittal
6.2 (SITE PLAN)

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, OPP

C001



BOARD OF WATER SUPPLY

JOB XX-XXXX
MAKHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKHA, OAHU, HAWAII

BUILDING PERMIT SITE PLAN

APPROVED: [Signature] DATE: [Blank]
DESIGNED BY: [Blank] CHECKED BY: [Blank] DATE: [Blank]
SCALE: AS SHOWN SHEET 5 OF 5

MAKAHA WELLS II, III, AND IV ACCESS ROAD REPAIRS

ATTACHMENT FOR ITEM 6.3



DATE

Tue, 12 Sep 2023 - 2:33pm
NA\Projects\641-00 MAKAHA & WAIANALOA WELLS RD REPAIR\Const Plans\MAKAHA\641-00 T002 GEN NOTES - 1.dwg

CONSTRUCTION NOTES

1. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1986 AND STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1984, AS AMENDED, OF THE DEPARTMENT OF PUBLIC WORKS, CITY AND COUNTY OF HONOLULU AND THE COUNTIES OF KAUAI, MAUI AND HAWAII.
2. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.
3. NO CONTRACTOR SHALL PERFORM ANY CONSTRUCTION OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW INTO EXISTING CITY DRAINAGE SYSTEMS, OR ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.
4. THE GENERAL CONTRACTOR OF THE PROJECT SHALL BE RESPONSIBLE FOR CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS" AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL", AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
- THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGES(S) FOR THE FOLLOWING:

1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND

2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.
- IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT [HTTP://HEALTH.HAWAII.GOV/CWB](http://health.hawaii.gov/cwb). THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.
5. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (808-692-8015). FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.
6. FOR BENCHMARK, SEE SHT C002.

GRADING NOTES

1. ALL GRADING WORK SHALL BE DONE IN ACCORDANCE WITH CHAPTER 14, ARTICLES 13, 14, 15 & 16 AS RELATED TO GRADING, SOIL EROSION AND SEDIMENT CONTROL OF THE REVISED ORDINANCES OF HONOLULU, 1990, AS AMENDED, & SOILS REPORTS BY GEOLABS, INC. ENTITLED "MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS, MAKAHA, OAHU, HAWAII DATED NOVEMBER 19, 2021.
2. NO CONTRACTOR SHALL PERFORM ANY GRADING OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW ONTO ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.
3. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 60.1, "AIR POLLUTION CONTROL".
4. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.
5. ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SURFACE WATERS FROM DAMAGING THE CUT FACE OF AN EXCAVATION OR THE SLOPED SURFACES OF A FILL. FURTHERMORE, ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SEDIMENT-LADEN RUNOFF FROM LEAVING THE SITE.
6. ALL SLOPES AND EXPOSED AREAS SHALL BE SODDED OR PLANTED AS SOON AS FINAL GRADES HAVE BEEN ESTABLISHED. PLANTING SHALL NOT BE DELAYED UNTIL ALL GRADING WORK HAS BEEN COMPLETED. GRADING TO FINAL GRADE SHALL BE CONTINUOUS, AND ANY AREA WITHIN WHICH WORK HAS BEEN INTERRUPTED OR DELAYED SHALL BE PLANTED.
7. FILLS IN SLOPES STEEPER THAN 5:1 SHALL BE KEYED.

GRADING NOTES, CONT'D

8. THE CITY SHALL BE INFORMED OF THE LOCATION OF THE BORROW/DISPOSAL SITE FOR THE PROJECT WHEN THE APPLICATION FOR A GRADING PERMIT IS MADE. THE BORROW/DISPOSAL SITE MUST ALSO FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.
9. NO GRADING WORK SHALL BE DONE ON SATURDAYS, SUNDAYS AND HOLIDAYS AT ANY TIME WITHOUT PRIOR NOTICE TO THE DIRECTOR D.P.P., PROVIDED SUCH GRADING WORK IS ALSO IN CONFORMANCE WITH THE COMMUNITY NOISE CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 46, "COMMUNITY NOISE CONTROL".
10. THE LIMITS OF THE AREA TO BE GRADED SHALL BE FLAGGED BEFORE THE COMMENCEMENT OF THE GRADING WORK.
11. THE GENERAL CONTRACTOR OF THE PROJECT SHALL BE RESPONSIBLE FOR ALL GRADING OPERATIONS TO BE PERFORMED IN CONFORMANCE WITH APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS" AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL", AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
- THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGES(S) FOR THE FOLLOWING:

1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND

2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.
- IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT [HTTP://HEALTH.HAWAII.GOV/CWB](http://health.hawaii.gov/cwb). THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.
12. WHERE APPLICABLE AND FEASIBLE THE MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTH MOVING PHASE OF THE GRADING IS INITIATED.
13. TEMPORARY EROSION CONTROLS SHALL NOT BE REMOVED BEFORE PERMANENT EROSION CONTROLS ARE IN-PLACE AND ESTABLISHED.
14. TEMPORARY EROSION CONTROL PROCEDURES SHALL BE SUBMITTED FOR APPROVAL PRIOR TO APPLICATION FOR GRADING PERMIT.
15. IF THE GRADING WORK INVOLVES CONTAMINATED SOIL, THEN ALL GRADING WORK SHALL BE DONE IN CONFORMANCE WITH APPLICABLE STATE AND FEDERAL REQUIREMENTS.
16. BUILDING PERMIT FOR RETAINING WALLS SHALL BE OBTAINED PRIOR TO COMMENCEMENT OF GRADING WORK ON SITE.
17. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (808-692-8015). FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.
18. FOR ALL PROJECTS, WHICH WILL DISTURB ONE (1) ACRE OR MORE OF LAND, THE CONTRACTOR SHALL NOT START CONSTRUCTION UNTIL A NOTICE OF GENERAL PERMIT COVERAGE (NGPC) IS RECEIVED FROM THE DEPARTMENT OF HEALTH, STATE OF HAWAII, AND HAS SATISFIED ANY OTHER APPLICABLE REQUIREMENTS OF THE NPDES PERMIT PROGRAM. ALSO, FOR NON-CITY AND OTHER NON-GOVERNMENTAL AGENCY PROJECTS, THE CONTRACTOR SHALL PROVIDE A WRITTEN COPY OF THE NGPC TO THE PERMITTING AND INSPECTION SECTION, CIVIL ENGINEERING BRANCH, D.P.P., AT LEAST SEVEN (7) CALENDAR DAYS BEFORE THE START OF THE CONSTRUCTION. FOR CITY OR OTHER GOVERNMENTAL PROJECTS, THE CONTRACTOR SHOULD PROVIDE A WRITTEN COPY OF THE NGPC TO THE APPROPRIATE CITY DEPARTMENT OR GOVERNMENTAL AGENCY PER THEIR REQUIREMENTS.
19. ALL GRADING AND CONSTRUCTION WORK SHALL IMPLEMENT MEASURES TO ENSURE THAT THE DISCHARGE OF POLLUTANTS FROM THE CONSTRUCTION SITE WILL BE REDUCED TO THE MAXIMUM EXTENT PRACTICABLE AND WILL NOT CAUSE OR CONTRIBUTE TO AN EXCEEDANCE OF WATER QUALITY STANDARDS.
20. NON-COMPLIANCE TO ANY OF THE ABOVE REQUIREMENTS SHALL MEAN IMMEDIATE SUSPENSION OF ALL WORK, AND REMEDIAL WORK SHOULD COMMENCE IMMEDIATELY. ALL COSTS INCURRED SHALL BE BILLED TO THE VIOLATORS. FURTHERMORE, VIOLATORS SHALL BE SUBJECTED TO ADMINISTRATIVE, CIVIL AND/OR CRIMINAL PENALTIES.
21. FOR BENCHMARK SEE SHEET C002.

INDEX TO DRAWINGS		
DRAWING NO.	SHEET NO.	DESCRIPTION
T001	1	TITLE SHEET
T002	2	GENERAL NOTES - 1
T003	3	GENERAL NOTES - 2
T004	4	GENERAL NOTES - 3
C001	5	BUILDING PERMIT SITE PLAN
C002	6	EXISTING CONDITIONS PLANS
C003	7	GENERAL PLAN
C004	8	SITE PLAN
C005	9	TEMPORARY UTILITY PLAN FOR CONSTRUCTION PERIOD
C006	10	PERMANENT 16-INCH WATER LINE PLAN
C007	11	ACCESS ROAD PROFILE/CENTERLINE OF BRIDGE/NEW 16" WL PROFILE
C008	12	GRADING & ESCP - PHASE 1
C009	13	GRADING & ESCP - PHASE 2
C010	14	GRADING & ESCP - PHASE 3
C011	15	GRADING & ESCP - PHASE 4
C012	16	GRADING & ESCP - PHASE 5
C013	17	SECTION "TR" 1 AND DETAILS
C014	18	DIVERSION DITCH PROFILE
C015	19	SECTIONS & DIVERSION DITCH DETAILS
C016	20	TEMPORARY ACCESS ROAD AND TEMPORARY 16" WL PROFILE
C017	21	EROSION & SEDIMENT CONTROL PLAN NOTES AND DETAILS
C018	22	EXTENDED STREAM SECTION CENTER LINE OF STREAM WITH ACROW BRIDGE
C019	23	GABION DETAILS
C020	24	SIGN POST, TYPICAL PAVEMENT AND GEOTERRA DETAILS
C501	25	MODULAR PANEL TRUSS STEEL BRIDGE ISOMETRIC VIEW
C502	26	MODULAR PANEL TRUSS STEEL BRIDGE GENERAL NOTES AND SPECIFICATIONS
C503	27	MODULAR PANEL TRUSS STEEL BRIDGE GENERAL PLAN ELEVATION AND SECTION
C504	28	MODULAR PANEL TRUSS STEEL BRIDGE TYPICAL CONNECTION DETAILS
C505	29	MODULAR PANEL TRUSS STEEL BRIDGE BEARING LAYOUT AND DETAILS
C506	30	WATER LINE TIE-DOWN STRAP DETAILS
B001	31	BORING LOCATION PLAN
B002	32	BORING LOG LEGENDS
B003	33	ROCK LOG LEGEND & NOTES
B004	34	BORING LOGS
E001	35	ELECTRICAL SYMBOLS, GENERAL NOTES, DUCT SECTIONS
E002	36	HECO NOTES
E003	37	HECO NOTES 2 & HECO NOTES
E004	38	DUCT SECTION DETAILS
E101	39	DEMOLITION ELECTRICAL SITE PLAN 1
E102	40	DEMOLITION ELECTRICAL SITE PLAN 2
E103	41	TEMPORARY ELECTRICAL SITE PLAN 1
E104	42	TEMPORARY ELECTRICAL SITE PLAN 2
E105	43	ELECTRICAL SITE PLAN 1
E106	44	ELECTRICAL SITE PLAN 2
E201	45	MISCELLANEOUS DETAILS
S001	46	GENERAL NOTES AND TYPICAL DETAIL
S101	47	TYPICAL DETAILS
S201	48	BRIDGE FOUNDATION PLAN
S202	49	PIPE COVER PLAN AND DETAILS
S203	50	REACTION BLOCKS

DISABILITY AND COMMUNICATION ACCESS BOARD (DCAB) REQUIREMENTS:

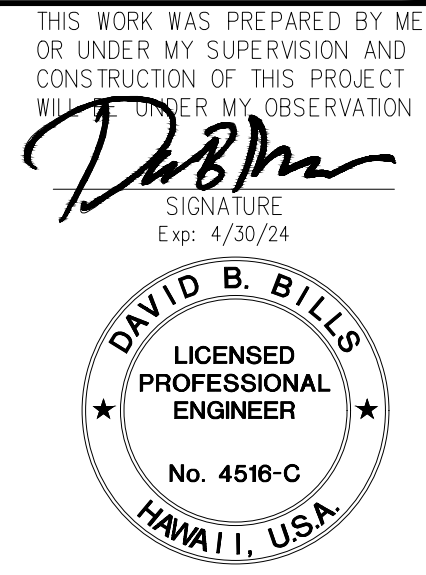
THIS PROJECT SHALL MEET THE ACCESSIBILITY REQUIREMENTS OF HAWAII REVISED STATUTES (HRS) 103-50 AND AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAA6) SECTIONS 4.1.1(4) AND 4.3.

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

T002



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

GENERAL NOTES - 1

APPROVED: _____			DATE: _____
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
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WATER NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND CONSTRUCTION OF WATER SYSTEM FACILITIES AND APPURTENANCES SHALL BE IN ACCORDANCE WITH THE CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY'S "WATER SYSTEM STANDARDS", DATED 2002, THE "WATER SYSTEM EXTERNAL CORROSION CONTROL STANDARDS", VOLUME 3, DATED 2021, AND ALL SUBSEQUENT AMENDMENTS AND ADDITIONS.
2. NO DEVIATION TO THE BOARD OF WATER SUPPLY 2002 WATER SYSTEM STANDARDS AS AMENDED, SHALL BE ALLOWED WITHOUT THE MANAGER AND CHIEF ENGINEER'S APPROVAL.
3. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES AND STRUCTURES AS SHOWN ON THE PLANS ARE FROM THE LATEST AVAILABLE DATA, BUT ARE NOT GUARANTEED AS TO THEIR ACCURACY OR THE ENCOUNTERING OF OTHER OBSTACLES DURING THE COURSE OF THE WORK. THE CONTRACTOR SHALL BE RESPONSIBLE AND PAY FOR ALL DAMAGES TO EXISTING UTILITIES. THE CONTRACTOR SHALL NOT ASSUME THAT WHERE NO UTILITIES ARE SHOWN, THAT NONE EXIST.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL WATERLINES DURING CONSTRUCTION. THE CONTRACTOR SHALL BE ESPECIALLY CAREFUL WHEN EXCAVATING BEHIND WATERLINES, TEES, AND BENDS WHEREVER THERE IS A POSSIBILITY OF WATERLINE MOVEMENT DUE TO THE REMOVAL OF THE SUPPORTING EARTH BEYOND THE EXISTING REACTION BLOCKS. THE CONTRACTOR SHALL TAKE WHATEVER MEASURES NECESSARY TO PROTECT THE WATERLINES, SUCH AS CONSTRUCTING SPECIAL REACTION BLOCKS (WITH BOARD OF WATER SUPPLY APPROVAL) AND/OR MODIFYING HIS CONSTRUCTION METHOD.
5. THE CONTRACTOR SHALL NOTIFY BOARD OF WATER SUPPLY CAPITAL PROJECTS DIVISION, CONSTRUCTION SECTION IN WRITING OR CALL (808) 748-5730, AND SUBMIT SIX (6) SETS OF "24x36" APPROVED CONSTRUCTION DRAWINGS, ONE WEEK PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES.
6. RE-APPROVAL SHALL BE REQUIRED IF THIS PROJECT IS NOT UNDER CONSTRUCTION WITHIN A PERIOD OF TWO (2) YEARS.
7. PRIOR TO ANY EXCAVATION, THE CONTRACTOR SHALL VERIFY IN THE FIELD, THE LOCATION OF EXISTING WATERLINES AND APPURTENANCES.
8. ANY ADJUSTMENTS TO THE EXISTING WATER SYSTEM REQUIRED DURING CONSTRUCTION, TO MEET THE REQUIREMENTS OF THE BOARD OF WATER SUPPLY STANDARDS, WHETHER SHOWN ON THE PLANS OR NOT, SHALL BE DONE BY THE CONTRACTOR AT NO COST TO THE BOARD OF WATER SUPPLY.
9. WHEN A UTILITY (GAS, SEWER, ELECTRICAL DUCT LINE, FIBER OPTIC, DRAINAGE, ETC.) CROSSES BELOW A BOARD OF WATER SUPPLY WATER MAIN, THE DESIGNER OF RECORD AND THEIR CONSTRUCTION ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING THE ADEQUATE WATER MAIN STRUCTURAL SUPPORT AND SUBMIT THE CONSTRUCTION METHOD AND SHOP DRAWING, STAMPED BY A LICENSED ENGINEER AND REVIEWED AND ACCEPTED BY THE DESIGNER OF RECORD, TO THE BOARD OF WATER SUPPLY FOR REVIEW AND APPROVAL. ALL WORK SHALL BE AT NO COST TO THE BOARD OF WATER SUPPLY.
10. ALL PLANS APPROVED BY THE BOARD OF WATER SUPPLY ARE BASED SOLELY ON THE ADEQUACY OF THE WATER SUPPLY.
11. ALL WATER MAINS AND APPURTENANCES SHALL BE SUBJECT TO HYDROSTATIC TEST PRESSURE OF 150 PSI SHALL BE VERIFIED BY THE CONTRACTOR IN ACCORDANCE WITH DIVISION 300 – CONSTRUCTION, SECTION 302.28, PIPE PRESSURE TEST OF THE "WATER SYSTEM STANDARDS", DATED 2002. DURING THE 30-MINUTE PRESSURE TEST, THE PRESSURE SHALL NOT DROP MORE THAN 10 PSI.
12. AFTER INSTALLATION OF TAPPING SLEEVE AND TAPPING VALVE AND PRIOR TO TAPPING THE EXISTING WATER MAIN, THE ASSEMBLY SHALL BE PRESSURE TESTED AT 150 PSI ON BOTH SIDES OF THE VALVE AND IN ACCORDANCE WITH THE WATER SYSTEM STANDARDS, DATED 2002.
13. REQUESTS FOR WATER OUTAGES SHALL BE SUBMITTED TO THE BOARD OF WATER SUPPLY CONSTRUCTION INSPECTOR NOT LESS THAN FOURTEEN (14) CALENDAR DAYS IN ADVANCE. THE REQUEST SHALL INDICATE THE SPECIFIC AREA, DATE, TIME, AND THE ANTICIPATED DURATION OF THE PROPOSED OUTAGE. OUTAGES SHALL BE APPROVED AT THE CONVENIENCE OF THE BOARD OF WATER SUPPLY. THE CONTRACTOR SHALL PLAN ALL WORK TO MINIMIZE THE NUMBER AND DURATION OF OUTAGES. THE CONTRACTOR SHALL NOTIFY THE AFFECTED CONSUMERS (RESIDENTS AND MERCHANTS).
14. THE CONTRACTOR SHALL CHLORINATE THE ENTIRE INSIDE SURFACE OF EACH PIPE AND FITTING WITH DISINFECTION SOLUTION OF 5 OUNCES OF SODIUM HYPOCHLORITE MIXED WITH 10 GALLONS OF WATER. (FOR CONNECTION ONLY)
15. PRIOR TO INSTALLATION, THE CONTRACTOR SHALL SUBMIT FOR APPROVAL BY BOARD OF WATER SUPPLY, THE MANUFACTURER'S CERTIFICATION THAT ALL CAST IRON (GRAY OR DUCTILE) FITTINGS FOR THE PROJECT CONFORM IN ALL RESPECTS TO THE WATER SYSTEM STANDARDS, DATED 2002 AND ADDENDUMS.
16. POLYGON SHAPE FOR MECHANICAL JOINT GLANDS AS DESCRIBED IN AWWA STANDARD C111 SHALL BE "STRAIGHT-SIDED" OR AN APPROVED EQUAL ON A JOB-TO-JOB BASIS.
17. CONTRACTOR SHALL CUT AND PLUG AND REMOVE ALL EXISTING UNUSED LATERALS AT THE MAIN WHETHER OR NOT SHOWN ON THE PLANS. THE DAMAGED AREA SHALL BE REPAIRED TO AN EQUAL OR BETTER CONDITION THAN THE IMMEDIATE AREA. ALL WORK SHALL BE DONE AT THE EXPENSE OF THE CONTRACTOR.
18. PIPE CUSHION SHALL BE OF HIGH RESISTIVITY MATERIAL. THE CONTRACTOR SHALL SUBMIT A SOIL CERTIFICATION THAT HIGH RESISTANT CUSHION MATERIAL HAS A RESISTIVITY GREATER THAN 5,000 OHM-CM. REMAINDER OF THE BACKFILL MATERIAL SHALL BE AS SPECIFIED IN THE BOARD OF WATER SUPPLY WATER SYSTEM STANDARDS. PIPE CUSHION AND BACKFILL MATERIAL SHALL CONTAIN NO HAZARDOUS SUBSTANCES ABOVE REGULATORY ACTION LEVELS INCLUDING BUT NOT LIMITED TO LEAD, ASBESTOS, MERCURY, CHROMIUM, CADMIUM, ZINC, STRONTIUM, AND POLYCHLORINATED BIPHENYLS (PCB).
19. ALL DUCTILE IRON FITTINGS AND METALLIC VALVES SHALL HAVE A FACTORY APPLIED COATING AND WRAPPED WITH PETROLATUM WAX TAPE.
20. ALL DUCTILE IRON PIPE, INCLUDING SECTIONS REQUIRING REINFORCED CONCRETE JACKETING, SHALL BE DUCTILE IRON CLASS 53 WITH A BONDED DIELECTRIC COATING AS PER THE BOARD OF WATER SUPPLY WATER SYSTEM STANDARDS AS AMENDED.
21. CLEANING SHALL BE BY THE USE OF "PIGS" INTRODUCED INTO THE PIPELINE AND RUN COMPLETELY THROUGH ALL INSTALLED PIPELINES AND ALL BRANCH LINES FOR FIRE HYDRANTS. "PIGGING" OF SERVICE LATERALS IS NOT REQUIRED. BARE FOAM "PIGS" SHALL BE USED TO SWAB PIPING CLEAN AS EACH LENGTH OF THE PIPELINE IS INSTALLED. THE TYPE, DENSITY, SIZE, DIAMETER AND LENGTH OF THE PIG SHALL BE SUBMITTED FOR REVIEW AND APPROVAL BY THE MANAGER PRIOR TO PIGGING WORK. "PIG" SHALL BE USED PER MANUFACTURER'S SPECIFICATIONS. PRIOR TO USE, THE "PIG" SHALL BE SUBMERGED IN A CHLORINE SOLUTION OF 1 OZ. OF 5% CHLORINE BLEACH IN 5 GALLONS OF WATER. "PIGGING" OF THE PIPELINE SHALL BE CONSIDERED INCIDENTAL TO THE INSTALLATION OF THE NEW PIPELINE. MANUAL SWEEPING, HAND CLEANING OR SWABBING MAY BE ALLOWED IN LIEU OF "PIGGING" AS APPROVED BY THE BOARD OF WATER SUPPLY MANAGER.
22. ALL FIRE HYDRANTS TO BE ADJUSTED AND/OR RELOCATED SHALL BE REPLACED WITH NEW FIRE HYDRANTS, UNLESS OTHERWISE DIRECTED BY THE BOARD OF WATER SUPPLY.
23. TWO-WAY BLUE REFLECTIVE HYDRANT MARKERS TYPE DB SHALL BE INSTALLED AT ALL NEW FIRE HYDRANT INSTALLATIONS. CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS OF HYDRANT MARKERS WITH THE NEAREST HONOLULU FIRE DEPARTMENT BATTALION CHIEF.
24. INSTALL 4 MIL THICK, NON-METALLIC, BLUE COLORED, 6 INCHES WIDE WARNING TAPE OVER CENTERLINE OF THE PIPE AND BELOW THE BASE COURSE ALONG THE ENTIRE LENGTH OF TRENCH. TAPE SHOULD BE MARKED WITH "CAUTION WATER LINE BURIED BELOW".

WATER NOTES (CONT'D)

25. THE CONTRACTOR SHALL INSTALL ELECTRONIC MARKERS TO ALL MAINS AND TEST THE ELECTRONIC MARKERS PRIOR TO INSTALLATIONS TO VERIFY PROPER OPERATION. BOARD OF WATER SUPPLY PERSONNEL SHALL VERIFY THE NUMBER AND LOCATIONS OF PLACED ELECTRONIC MARKERS BEFORE FINAL PAVING OF THE PROJECT.
26. SOIL RESISTIVITY FOR THE SITE HAS A CORROSION RATING OF CATEGORY B AS REPORTED BY BILLS ENGINEERING INC. AS THE DEFAULT OPTION. ALL REQUIRED ELECTRICAL ISOLATION PROCEDURES AND CORROSION CONTROL REQUIREMENTS SHALL APPLY.
27. THE CONTRACTOR SHALL FURNISH AND INSTALL AN INSULATING CORPORATION STOP AND PETROLATUM WAX TAPE AT ALL TAPS (FOR DI PIPE AND COPPER LATERAL COMBINATION ONLY).
28. AT THE ELECTRICAL/CABLE/SIGNAL DUCTLINE WATER CROSSINGS, ADJUST ALL ELECTRICAL/CABLE/SIGNAL DUCTLINE ELEVATIONS TO MAINTAIN THE REQUIRED VERTICAL CLEAR SEPARATION FROM ALL WATER MAINS. CONFORMANCE TO THE BOARD OF WATER SUPPLY 2002 WATER SYSTEM STANDARDS AS AMENDED SHALL BE AT NO COST AND ADHERED TO.
29. MAINTAIN THE REQUIRED MINIMUM HORIZONTAL CLEAR SEPARATION BETWEEN ALL WATER MAINS, AND THE NEAREST ELECTRICAL/CABLE/SIGNAL DUCTLINES PARALLELING THE WATER SYSTEM. CONFORMANCE TO THE BOARD OF WATER SUPPLY 2002 WATER SYSTEM STANDARDS AS AMENDED SHALL BE AT NO COST AND ADHERED TO.
30. MAINTAIN THE REQUIRED MINIMUM HORIZONTAL CLEAR SEPARATION BETWEEN ELECTRICAL/CABLE/SIGNAL APPURTENANCES, (INCLUDING ANY MODULAR UNITS) AND THE NEAREST WATER MAINS OR WATER APPURTENANCE. CONTRACTOR SHALL FIELD VERIFY FOR ANY CONFLICTS AT EACH ELECTRICAL/CABLE/SIGNAL APPURTENANCE LOCATION. WHERE CONFLICTS OCCUR, THE CONTRACTOR SHALL COORDINATE WITH THE PROJECT ENGINEER TO REVISE THE ELECTRICAL/CABLE/SIGNAL APPURTENANCE TO PROVIDE THE REQUIRED CLEARANCES. CONFORMANCE TO THE BOARD OF WATER SUPPLY 2002 WATER SYSTEM STANDARDS AS AMENDED SHALL BE AT NO COST AND ADHERED TO.

WATER NOTES (CHLORINATION)

- A. THE FOLLOWING CHLORINATION AND WATER SAMPLE COLLECTION PROCEDURE SHALL APPLY TO ALL WATER PIPELINE PROJECTS (ALL WORK TO BE COORDINATED THROUGH BOARD OF WATER SUPPLY INSPECTOR):
1. CHLORINATION OF WATER SYSTEMS
- A. THE CONTRACTOR SHALL PROVIDE A 4-WEEK ADVANCE NOTICE, IN WRITING, TO THE OFFICER-IN-CHARGE FOR PROPOSED FLUSHING, FILLING AND BACTERIAL TESTING OF THE NEW PIPELINE.
- B. THE CONTRACTOR SHALL HIRE A STATE OF HAWAII – DEPARTMENT OF HEALTH CERTIFIED LABORATORY TO PROVIDE WATER SAMPLING SERVICES AND TO DELIVER WATER SAMPLES TO THE MICRO LAB FOR ANALYSIS. WATER SAMPLES FOR BACTERIAL TESTING SHALL BE DELIVERED NO LATER THAN 2:30 P.M. ON THE DAY THE SAMPLES ARE TAKEN TO THE BOARD OF WATER SUPPLY MICROLAB LOCATED AT 630 S. BERTANIA ST., HONOLULU, HI 96843. THE MICRO LAB SHALL PERFORM ANALYSIS AND PROVIDE THEIR RESULTS TO THE OFFICER-IN-CHARGE BY 4:30 P.M. ON THE FOLLOWING DAY (IN SOME CASES, FINAL RESULTS NOTIFICATION MAY TAKE UP TO 48 HOURS).
- C. WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH THE BOARD OF WATER SUPPLY WATER SYSTEM STANDARDS (2002), AS AMENDED, SECTION 302.29.

STEP 1 – PRELIMINARY FLUSHING (PRIOR TO CHLORINATION): THE MAINS SHALL BE FLUSHED WITH MAXIMUM AVAILABLE PRESSURE AND VELOCITY. ADEQUACY OF TURNOVERS SHALL BE DETERMINED BY THE ABSENCE OF PARTICLES. TURBIDITY SHALL BE LESS THAN 1.0 NTU BEFORE CHLORINATION. DURING ALL FLUSHING OPERATIONS, THE MANAGER OR THE MANAGER'S AUTHORIZED REPRESENTATIVE SHALL DETERMINE THE RATE OF WATER USE.

STEP 2 – CHLORINATION: THE CONTRACTOR SHALL SUBMIT TO THE MANAGER, FOR APPROVAL, A SKETCH SHOWING LOCATIONS OF SAMPLING POINTS AND A PLAN OR SCHEDULE DELINEATING THE METHOD OR STEPS THE CONTRACTOR PROPOSES TO USE TO ACCOMPLISH THE WORK. THE FOLLOWING METHODS FOR CHLORINATION SHALL BE USED:

- A. THE FOLLOWING CHLORINATION AND WATER SAMPLE COLLECTION PROCEDURE SHALL APPLY TO ALL WATER PIPELINE PROJECTS:
- I. STEP 1: CHLORINATE MAIN BY FILLING WITH WATER AND INTRODUCING CHLORINE IN SUFFICIENT QUANTITY TO OBTAIN A MINIMUM CHLORINE CONCENTRATION OF 50 PARTS PER MILLION. LEAVE CHLORINATED WATER IN MAIN OVERNIGHT.
- II. STEP 2: FLUSH MAIN WITH FRESH WATER UNTIL ALL CHLORINE HAS BEEN FLUSHED OUT AS EVIDENCED BY THE N,N-DIETHYL-P-PHENYLENEDIAMINE (DPD) TEST, THEN COLLECT A WATER SAMPLE WHILE CONTINUING TO FLUSH THE MAIN.
- III. STEP 3: REPEAT STEPS 1 AND 2. AFTER COLLECTING THE SECOND WATER SAMPLE, STOP FLUSHING AND ALLOW THE WATER TO STAND IN THE MAIN OVERNIGHT.
- IV. STEP 4: THOROUGHLY FLUSH THE MAIN WITH FRESH WATER UNTIL ALL WATER THAT HAD BEEN STANDING IN THE MAIN OVERNIGHT HAS BEEN FLUSHED OUT. STOP FLUSHING AND LET THE WATER STAND IN THE MAIN FOR ONE HOUR. COLLECT A WATER SAMPLE.
- B. THE MAIN IS DEEMED ACCEPTABLE AND CERTIFIED WHEN (I) THE THREE CONSECUTIVE WATER SAMPLES, COLLECTED ON DIFFERENT DAYS AS REASONABLY CLOSE TO 24 HOURS APART AS PRACTICAL OPERATING CONDITIONS ALLOW UNDER STEPS 1 AND 2, SHOW NO TC (TOTAL COLIFORM BACTERIA), NO E. COLI, LESS THAN 200 CFU/ML (COLONY FORMING UNITS PER ML) OF HPC (HETEROTROPHIC PLATE COUNT BACTERIA) OR LESS THAN 202 HPC USING THE MPN (MOST PROBABLE NUMBER) METHOD AND TURBIDITY <1.0 NTU AND (II) THE SAMPLE OF WATER HELD IN THE MAIN FOR ONE HOUR, COLLECTED UNDER STEP 4, ALSO SHOWS NO TC, NO E. COLI, LESS THAN 200 CFU/ML OF HPC OR LESS THAN 202 HPC USING THE MPN METHOD AND TURBIDITY <1.0 NTU.
- C. CHLORINATION, FLUSHING, SAMPLING AND TESTING WILL BE EXTENDED SHOULD UNSATISFACTORY RESULTS BE ENCOUNTERED. ANY SAMPLE THAT SHOWS POSITIVE TC, E. COLI, HPC >200 CFU/ML, HPC >202 MPN OR TURBIDITY> 1.0 NTU IS UNSATISFACTORY.
- D. STEPS 1 AND 2 MAY BE REPEATED BEFORE COLLECTING THE ONE HOUR HOLD SAMPLE SPECIFIED IN STEP 4. REPEATING STEPS 1 AND 2 IS RECOMMENDED IN THE EVENT SAMPLES SHOW THE PRESENCE OF TC AND/OR E. COLI AND/OR INCREASING TOTAL BACTERIAL RESULTS FROM ONE SAMPLE TO THE NEXT.
- E. WATER SAMPLES THAT SHOW THE PRESENCE OF ATYPICAL RESULTS, DEBRIS, HIGH TURBIDITY OR RESULTS INCONSISTENT WITH EXISTING WATER ARE SUBJECT TO RECONFIRMATION. THE MANAGER RESERVES THE RIGHT TO REQUEST AND TEST ADDITIONAL WATER SAMPLES IN THE INTEREST OF SAFEGUARDING PUBLIC HEALTH AND SAFETY AT NO ADDITIONAL COST TO THE DEPARTMENT.

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

T003

WATER NOTES (CHLORINATION) (CONT'D)

- F. LIQUID CHLORINE, CHLORINE BASED LIQUID DISINFECTANTS OR CALCIUM HYPOCHLORITE THAT HAS BEEN TESTED AND CERTIFIED AS MEETING THE SPECIFICATIONS OF ANSI/NSF STANDARD 60, DRINKING WATER TREATMENT CHEMICALS –HEALTH EFFECTS, SHALL BE USED FOR THE CHLORINATION OF THE WATER MAINS.
- G. PRIOR TO CHLORINATION, THE WATER MAINS SHALL BE THOROUGHLY FLUSHED.
- H. THE INTERIOR SURFACES OF THE WATER MAINS SHALL BE EXPOSED TO THE CHLORINATING SOLUTION BY COMPLETELY FILLING THE MAIN REMOVE AIR POCKETS, FOR A MINIMUM OF 24-HOURS AND THE FREE CHLORINE RESIDUAL SHALL NOT BE LESS THAN 10 PPM AFTER SUCH TIME.
- I. SHOULD THE CALCIUM HYPOCHLORITE BE USED, NO SOLID AND/OR UNDISSOLVED PORTION OF THE COMPOUND SHALL BE INTRODUCED INTO ANY SECTION OF THE WATER MAINS TO BE CHLORINATED.
- J. AT THE END OF THE 24-HOUR DISINFECTION PERIOD, REPRESENTATIVE SAMPLES SHALL BE TAKEN AND ANALYZED TO ASSURE A FREE CHLORINE RESIDUAL OF A LEAST 10 PPM.
- K. SHOULD THE FREE CHLORINE RESIDUAL RESULTS INDICATE ADEQUATE CHLORINATION, THE WATER MAINS SHALL BE THOROUGHLY FLUSHED AND FILLED WITH WATER FROM THE EXISTING SYSTEM AND AGAIN TESTED FOR FREE CHORINE RESIDUAL. THE FLUSHING SHALL BE CONSIDERED ADEQUATE IF THE FREE CHLORINE RESIDUAL TEST RESULTS INDICATE THAT THE WATER IN THE WATER MAINS HAS A COMPARABLE CHLORINE RESIDUAL AS THE WATER IN THE EXISTING SYSTEM.
- L. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER DISPOSAL OF CHLORINATED WATER TO SAFEGUARD PUBLIC HEALTH AND THE ENVIRONMENT IN ACCORDANCE WITH APPLICABLE STATE OF HAWAII DEPARTMENT OF HEALTH REQUIREMENTS. A NEUTRALIZING CHEMICAL SHALL BE APPLIED TO THE WATER TO BE DISPOSED TO THOROUGHLY NEUTRALIZE THE CHLORINE RESIDUAL REMAINING IN THE WATER IN ACCORDANCE WITH BOARD OF WATER SUPPLY WATER SYSTEM STANDARDS (2002), AS AMENDED.
- M. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH PRIOR TO THE START OF CONSTRUCTION, FOR THE DISPOSAL OF WATER USED FOR HYDRO TESTING AND CHLORINATION, AS REQUIRED BY THE CONTRACT DOCUMENTS.
- N. FOLLOWING THE ACCEPTABLE FLUSHING OF THE WATER MAINS, THREE (3) CONSECUTIVE DAYS OF ACCEPTABLE SAMPLES, TAKEN AT LEAST 24-HOURS APART, FROM REPRESENTATIVE POINTS SHALL BE TAKEN AND SUBJECTED TO MICROBIOLOGICAL TESTS. FOR WATER LINES, AT LEAST ONE SET OF SAMPLES SHALL BE COLLECTED FROM EVERY 1,200 FEET OF THE NEW WATER MAIN, PLUS ONE FROM THE END OF THE LINE AND AT LEAST ONE SET FROM EACH BRANCH. POSITIVE OR INVALID TEST RESULTS WILL NOT BE ACCEPTABLE, AND THE PROCESS WILL BE REPEATED.
- O. ALL MEASUREMENTS FOR CHLORINE RESIDUAL SHALL BE ANALYZED USING E.P.A. APPROVED METHODS FOR DRINKING WATER.
- P. ALL MICROBIOLOGICAL TESTS SHALL BE PERFORMED BY A LABORATORY APPROVED BY THE DEPARTMENT OF HEALTH, STATE OF HAWAII AND THE WATER QUALITY DIVISION OF THE BOARD OF WATER SUPPLY.
- Q. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ALL OF THE FOREGOING.
- R. CLEANING AND SWABBING PROCEDURES SHALL BE IN ACCORDANCE WITH BOARD OF WATER SUPPLY WATER SYSTEM STANDARDS (2002), AS AMENDED.
- S. ALL MATERIALS IN DIRECT CONTACT WITH THE POTABLE WATER SHALL HAVE NATIONAL SANITATION FOUNDATIONS (NSF) APPROVALS. THE CONTRACTOR SHALL SUBMIT THESE APPROVALS TO THE BOARD OF WATER SUPPLY FOR INFORMATION ONLY PRIOR TO ITS APPLICATION.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

Signature

SIGNATURE

Exp: 4/30/24

DAVID B. BILLS

LICENSED PROFESSIONAL ENGINEER

No. 4516-C

HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

GENERAL NOTES – 2

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FILE	POCKET	FOLDER	NO.

Tue, 12 Sep 2023 - 11:05am
NA\Projects\641-00 MAKAHA & WAIANALAO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 T003 GEN NOTES - 2.dwg

JOB NO. 641-00

SUGGESTED SEQUENCE OF WORK

THE MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS HAS FIVE (5) MAIN PHASES. EACH PHASE HAS A BMP INSTALLATION PLAN TO ALLOW THE WORK TO BE COMPLETED IN THAT PROJECT PHASE FOLLOWED BY A DESCRIPTION OF WORK TO BE PERFORMED DURING THAT PHASE.

PHASE 1 CLEARING AND GRUBBING AND CUT SECTION FOR "TR1"

BMP'S PHASE 1 (SHT C008)

1. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND STAGING AREA. (SEE SHT C008)
2. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AT THE TOP AND BOTTOM OF CUT SECTION FOR "TR1". (SEE SHT C008)
3. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND THE MODULAR TRUSS BRIDGE LAUNCH SITE. (SEE SHT C008)
4. INSTALL BMP'S CONSISTING OF 12-INCH FILTER-SOCK AROUND TEMPORARY DIVERSION DITCH (SEE SHT C008)
5. SET 3' X 3' SUPER SACKS AT HEAD END OF DIVERSION DITCH (STA 0 + 00) TO ROUTE ANY STREAM FLOW FROM ENTERING DIVERSION DITCH

CONSTRUCTION ACTIVITIES PHASE 1

1. ALL CLEARING AND GRUBBING FOR TREES OVER 15-FOOT TALL SHALL NOT OCCUR BETWEEN JUNE 1 AND SEPTEMBER 15 WHICH IS THE HOARY BAT PUPPING SEASON. (SP 39 NATURAL RESOURCES ASSESSMENT-PAGE 22).
2. CLEAR AND GRUBB AND SET-UP STAGING AREA (SEE SHT C008)
3. CLEAR AND GRUBB MODULAR TRUSS BRIDGE LAUNCH SITE. EXCAVATION OF THE BRIDGE LAUNCH SITE CAN COMMENCE. EXCAVATED MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. (SEE SHT C008)
4. CLEAR AND GRUBB CUT BANK SITE FOR ("TR1"). EXCAVATION FOR "TR1" CAN COMMENCE (250 CU. YD). EXCAVATED MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. THE CUT WILL RECEIVE SOIL NAILS AND A SHOTCRETE FACING. (SEE SHT C008 AND C012)
5. CLEAR AND GRUB AREA FOR TEMPORARY DIVERSION DITCH (50 CU YD+/-). EXCAVATION FOR DIVERSION DITCH CAN COMMENCE WITH INSTALLATION OF TRENCH BOTTOM AND TRENCH SHIELDS. EXCAVATED MATERIAL CAN BE STOCKPILED IN THE VICINITY OF THE DIVERSION DITCH WITH FILTER-SOCK PROTECTION AND TARP TYPE COVER AND USED FOR DIVERSION DITCH RESTORATION. (SEE SHT C008, C013 AND C0014)
6. ALL CLEARED AND GRUBBED MATERIAL SHALL BE PLACED IN TRUCKS WITH TREES CUT TO TRANSPORTABLE SIZE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS
7. EXCAVATION FOR LAUNCH AREA (500 CU. YD.+/-) CAN COMMENCE. SEED LAUNCH SITE AFTER GRADING. (SEE SHT C008)

PHASE 2 BEGIN DIVERSION DITCH FLOW AND INSTALL TEMPORARY ACCESS ROAD WITH TEMPORARY 16-INCH WATER DI CL53 WATER LINE.

BMP'S PHASE 2 SHT (C009)

1. ALL PHASE 1 BMP'S TO BE KEPT IN PLACE.
2. PLACE 3' X 3' SUPERSACKS ACROSS STREAM TO DIRECT MAKAHA STREAM WATER INTO THE TEMPORARY DIVERSION DITCH FOR DURATION OF PROJECT. DIVERSION DITCH IS DESIGNED FOR 500 CFS FLOW. THE 2-YEAR 24-HOUR MAKAHA STREAM FLOW IS 270 CFS. THE PLANS CALL FOR 2-NO. 8 REBARS ON THE DOWN STREAM SIDE OF THE 3 X 3 SUPERSACKS FOR ANCHORAGE. (SEE SHT C009, C013 AND C014)
3. EXTEND 12-INCH FILTER-SOCK FROM BOTTOM OF "TR1" CUT ALONG THE DOWNSTREAM SIDE OF THE TEMPORARY ACCESS ROAD. (SEE SHT C009)

CONSTRUCTION ACTIVITIES PHASE 2

1. DRY UP THE DOWNSTREAM SIDE OF THE SUPERSACKS DIVERTING STREAM FLOW AND UPSTREAM EDGE OF EXISTING ACCESS ROAD. DISPOSE OF WATER AS DUST CONTROL WATER WITH NO DISCHARGE BACK INTO MAKAHA STREAM.
2. EXCAVATE AND INSTALL 16-INCH DI PIPE CL 53 WITH CUSHION PER BWS WSS BETWEEN TEMPORARY POINTS OF CONNECTION (STA 42+77.25 EXISTING ACCESS ROAD AND 44 +63.02 EXISTING ACCESS ROAD. (SEE SHT C005, C005 AND C015)
3. GRADE FOR TEMPORARY ACCESS ROAD (10 CU. YD.) (SEE SHTS C009, C015 AND C020)
4. PLACE GABIONS IN LOW AREA OF TEMPORARY ACCESS ROAD (SEE SHT C019)
5. PLACE GEOTERRA GTO CONSTRUCTION ROAD SYSTEM, OR EQUAL, AS THE TEMPORARY ACCESS ROAD SURFACE. INSTALL GEOTERRA GTO UNITS WITH ALL BOLT CONNECTORS AND AUGER ANCHORS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. FABRICATE TEMPORARY WATER LINE CONNECTIONS INCLUDING STRUCTURAL STRUTS WITH SUFFICIENT CURING TIME TO ALLOW BOTH CONNECTIONS IN A MAXIMUM WATER OUTAGE TIME OF ___ HOURS. (SEE SHT C005)
7. DEMOLISH ELECTRICAL AND COMMUNICATIONS AS SHOWN ON SHTS E101 AND E102
8. SET-UP TEMPORARY ELECTRIC AND COMMUNICATIONS. (SEE SHTS E103 & E104).

PHASE 3 MAJORITY OF STREAM EXCAVATION TO PLACE GROUTED RUBBLE PAVEMENT. BUILD BRIDGE ABUTMENTS AND SET MODULAR PANEL TRUSS BRIDGE.

BMP'S PHASE 3 SHT (C010)

1. KEEP ALL PHASE 1 AND PHASE 2 BMP'S IN PLACE
2. PLACE A ROW OF 3' X 3' SUPERSACKS DOWNSTREAM OF THE LIMITS OF GRADING. (SEE SHT C010)

CONSTRUCTION ACTIVITIES PHASE 3

1. EXCAVATE PER PHASE 3 GRADING (500 CU. YD) WITH ALL EXCAVATED MATERIAL PLACED IN LOCATION FOR TRANSFER TO TRUCK FOR DISPOSAL OFF-SITE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. ALTERNATE IS TO PLACE EXCAVATED MATERIAL DIRECTLY INTO TRANSFER TRUCK. (SEE SHT C007, C010 AND C017)
2. INSTALL BRIDGE ABUTMENTS. (SEE SHT C007, C010, S101 AND S201)
3. PLACE GROUTED RUBBLE PAVEMENT (SEE SHT C009, C007 AND C017)
4. TRANSFER PRE-CONSTRUCTED MODULAR PANEL TRUSS BRIDGE TO LAUNCH SITE. (NOTE: USE SUPPLIER'S ON-SITE ASSIST TIME TO THE MAXIMUM EXTENT POSSIBLE (4 DAYS) FROM TIME OF ABUTMENT COMPLETION AND GROUTED RUBBLE PAVEMENT IS COMPLETE AND ITEMS 5 AND 6 ARE COMPLETED (SEE SHT C010)
5. LAUNCH BRIDGE ONTO ABUTMENTS (SEE 010)
6. COMPLETE ASSEMBLY OF MODULAR PANEL TRUSS BRIDGE TO THE SATISFACTION OF BRIDGE SUPPLIER INCLUDING FOOT WALKER PANELS. MODULAR TRUSS PANEL BRIDGE SUPPLIER TO ISSUE LETTER THAT BRIDGE HAS BEEN ERECTED AND INSTALLED IN ACCORDANCE WITH SUPPLIERS' APPROVAL. SEE SHT C010 AND C501 THROUGH C506)
7. PLACE NEW 16-INCH WATER LINE ON BRIDGE AND THROUGH ABUTMENTS ON EACH SIDE OF BRIDGE UP TO THE VICINITY OF THE WATER LINE RECONNECTIONS ON THE LOW SIDE OF THE BRIDGE (STA 42 + 85.23) TO THE EXISTING 16-INCH WATER LINE ON THE UPPER SIDE OF BRIDGE (STA 44 +71.58) (SEE SHTS C006 AND C007)
8. FABRICATE TEMPORARY WATER LINE CONNECTIONS INCLUDING STRUCTURAL STRUTS WITH SUFFICIENT CURING TIME TO ALLOW BOTH CONNECTIONS TO BE MADE IN A MAXIMUM WATER OUTAGE TIME OF ___ HOURS. (SEE C006, C007 AND S203)
9. PLACE PERMANENT ELECTRIC AND COMMUNICATIONS ON BRIDGE WITH CONNECTIONS TO EXISTING ELECTRIC AND COMMUNICATIONS ON BOTH SIDES OF BRIDGE (SEE SHTS E105 AND E106)
10. AFTER NEW ELECTRICAL AND COMMUNICATIONS IS OPERABLE DISMANTLE TEMPORARY ELECTRICAL AND COMMUNICATION OVERHEAD LINES.
11. AFTER COMPLETION OF PHASE 3 CONSTRUCTION THE PERMANENT MODULAR TRUSS BRIDGE SHOULD BE FULLY OPERATIONAL.

PHASE 4 REMAINDER OF STREAM EXCAVATION AND PROJECT REMEDIAL WORK

BMP'S PHASE 4 (SHT C011)

1. REMOVE FILTER-SOCK FROM MODULAR PANEL BRIDGE LAUNCH SITE AFTER SEED HAS TAKEN HOLD. (SEE SHT C008)
2. REMOVE FILTER-SOCK FROM TOP OF "TR1" CUT AND DOWN THE EXISTING LEFT SIDE OF BWS ACCESS ROAD. (SEE SHT C009)
3. DIVERSION DITCH TO REMAIN IN PLACE
4. THE ROW OF 3' X 3' SUPER SACKS BELOW PHASE 3 STREAM EXCAVATION TO REMAIN IN PLACE. (SEE SHT C010)

CONSTRUCTION ACTIVITIES PHASE 4 (C011)

1. EXCAVATE PER PHASE 4 GRADING (275 CU. YD.) WITH ALL EXCAVATED MATERIAL PLACED IN LOCATION FOR TRANSFER TO TRUCK FOR DISPOSAL OFF-SITE. MATERIAL SHALL BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE RULES AND REGULATIONS FOR EXPORT OF FILL FROM A CONSTRUCTION SITE. ALTERNATE IS TO PLACE EXCAVATED MATERIAL DIRECTLY INTO TRANSFER TRUCK. (SEE SHT C011)
2. AFTER PHASE 4 GRADING IS COMPLETE INSTALL A 12-INCH LAYER OF GROUTED RUBBLE PAVEMENT BETWEEN UPSTREAM SIDE OF GROUTED RUBBLE PAVEMENT PROVIDING BRIDGE ABUTMENT PROTECTION AND THE TOE OF THE 2H:1V BANK OF PHASE 4 GRADING. (SEE SHT C017)

PHASE 5 MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS RESTORATION

CONSTRUCTION ACTIVITIES


1. AFTER CONCRETE RUBBLE MASONRY OF ITEM 2-CONSTRUCTION ACTIVITIES PHASE 4 ABOVE HAS SET SIMULTANEOUSLY, RE-ADJUST 3' X 3' SUPERSACKS TO BLOCK ANY FLOW INTO THE DIVERSION DITCH AND EXCAVATE A 8-FOOT WIDE AND 4-FOOT-DEEP CUT (45 CU. YD) FROM THE TOP OF THE 2H:1V PHASE 4 BANK TO AN UPSTREAM ELEVATION OF APPROXIMATELY 860.0 FEET. THIS CUT WILL LET MAKAHA STREAM GRADUALLY RETURN TO ITS TYPICAL STREAM FLOW BEFORE THE BWS CULVERT WAS CONSTRUCTED. (SEE SHT C012)
2. DISASSEMBLE DIVERSION DITCH BY REMOVING ALL TRENCH SHIELDS AND WOOD BOTTOM. CLSM BOTTOM CAN BE ABANDONED IN PLACE. USE STOCKPILED DIVERSION DITCH EXCAVATION FOR DIVERSION DITCH BACKFILL. PLACE IN LIFTS OF NO MORE THAN 12-INCHES AND COMPACT TO 85 PERCENT COMPACTION. (SEE SHT C008)
3. PLACE GRASS SEED AND MULCH AT THE TOP DIVERSION DITCH TRENCH BACKFILL AND GRADED BRIDGE LAUNCH SITE.
4. DISASSEMBLE STAGING AREA AND LEAVE IN A NATURAL STATE LESS THE CLEARING AND GRUBBING THAT OCCURRED PRIOR.

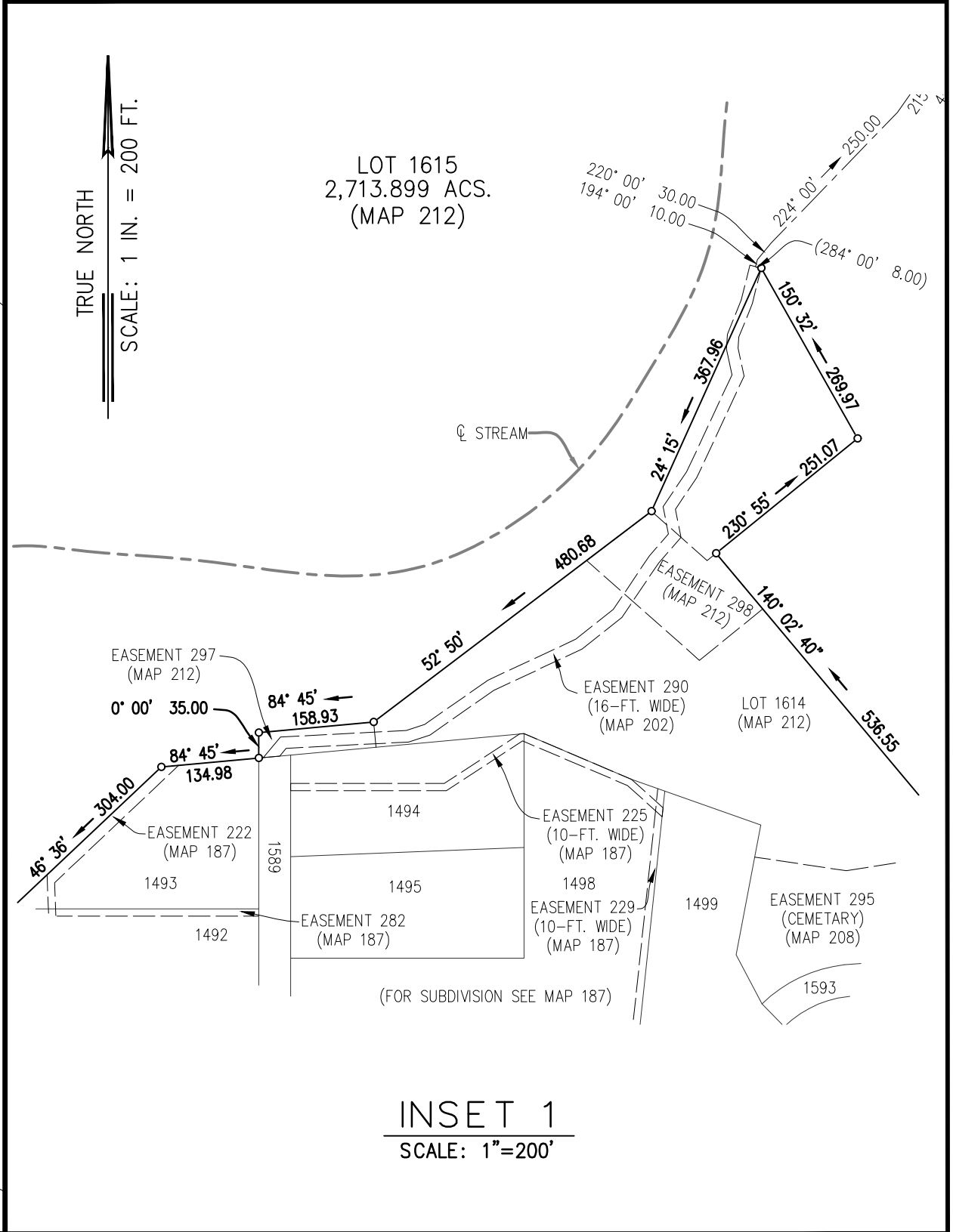
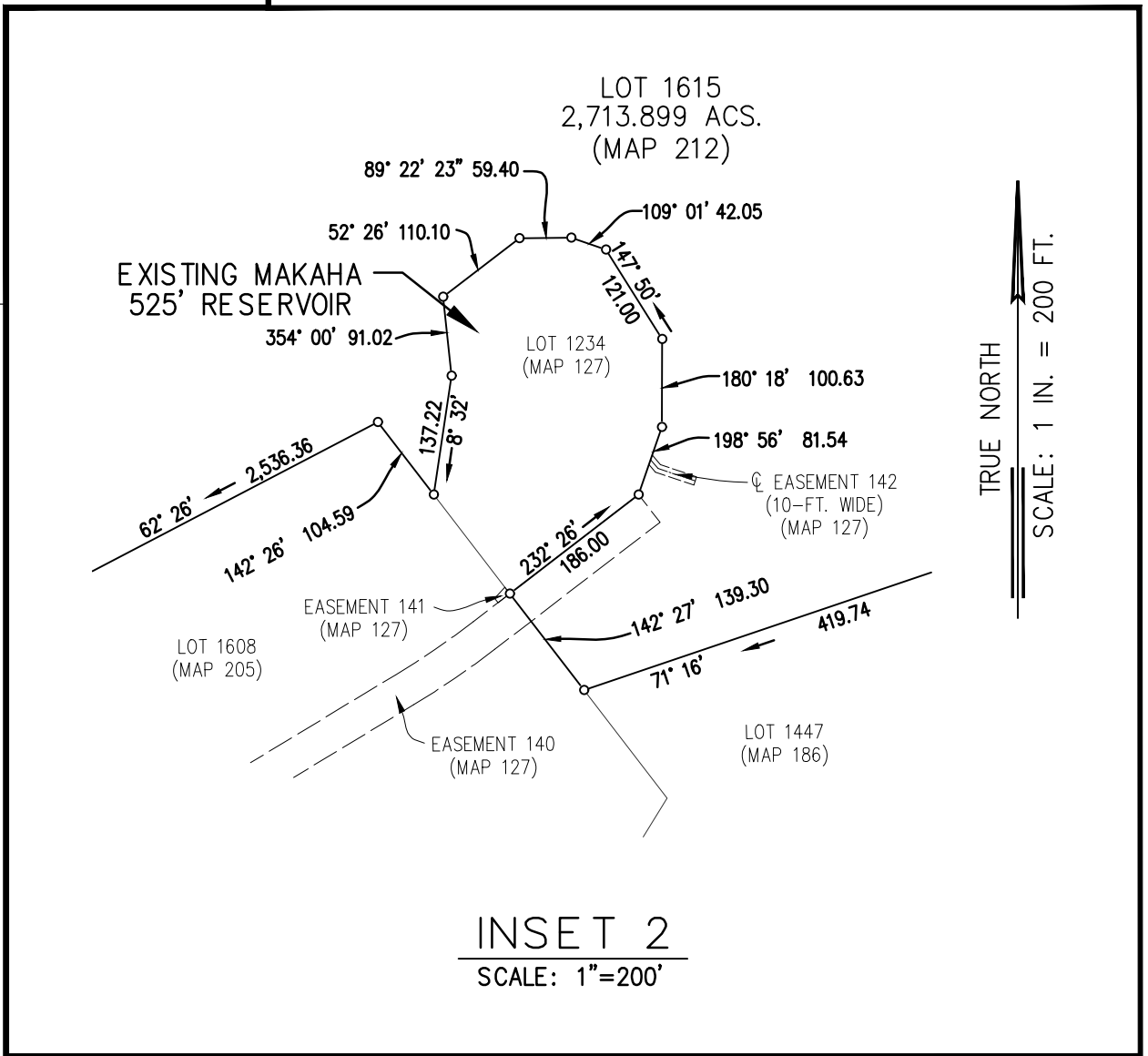
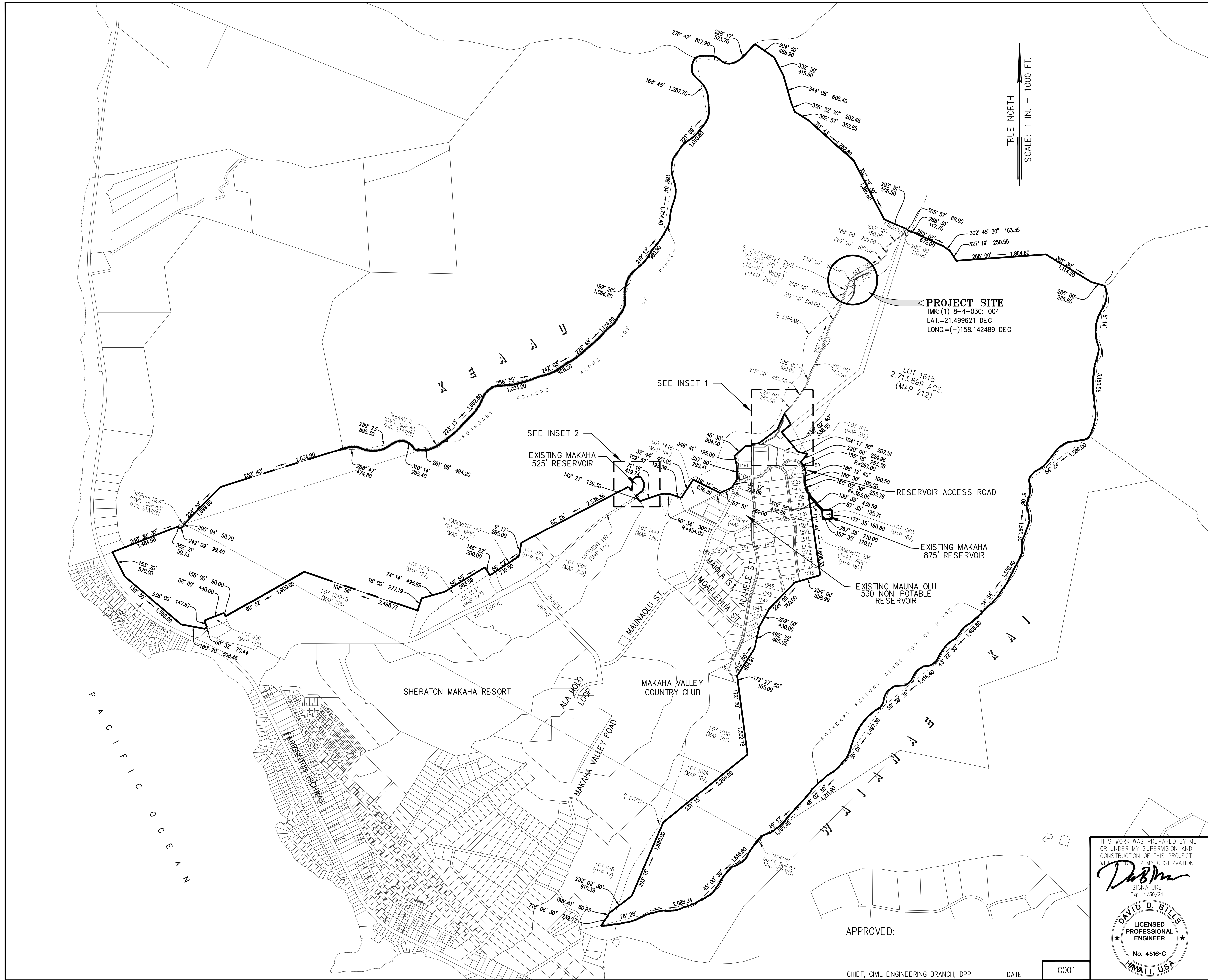
APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

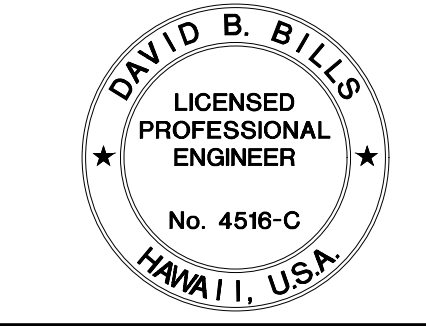
T004

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	JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
	GENERAL NOTES — 3			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: _____
	DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 4 OF 50 SHEETS		
FILE	POCKET	FOLDER	NO.	



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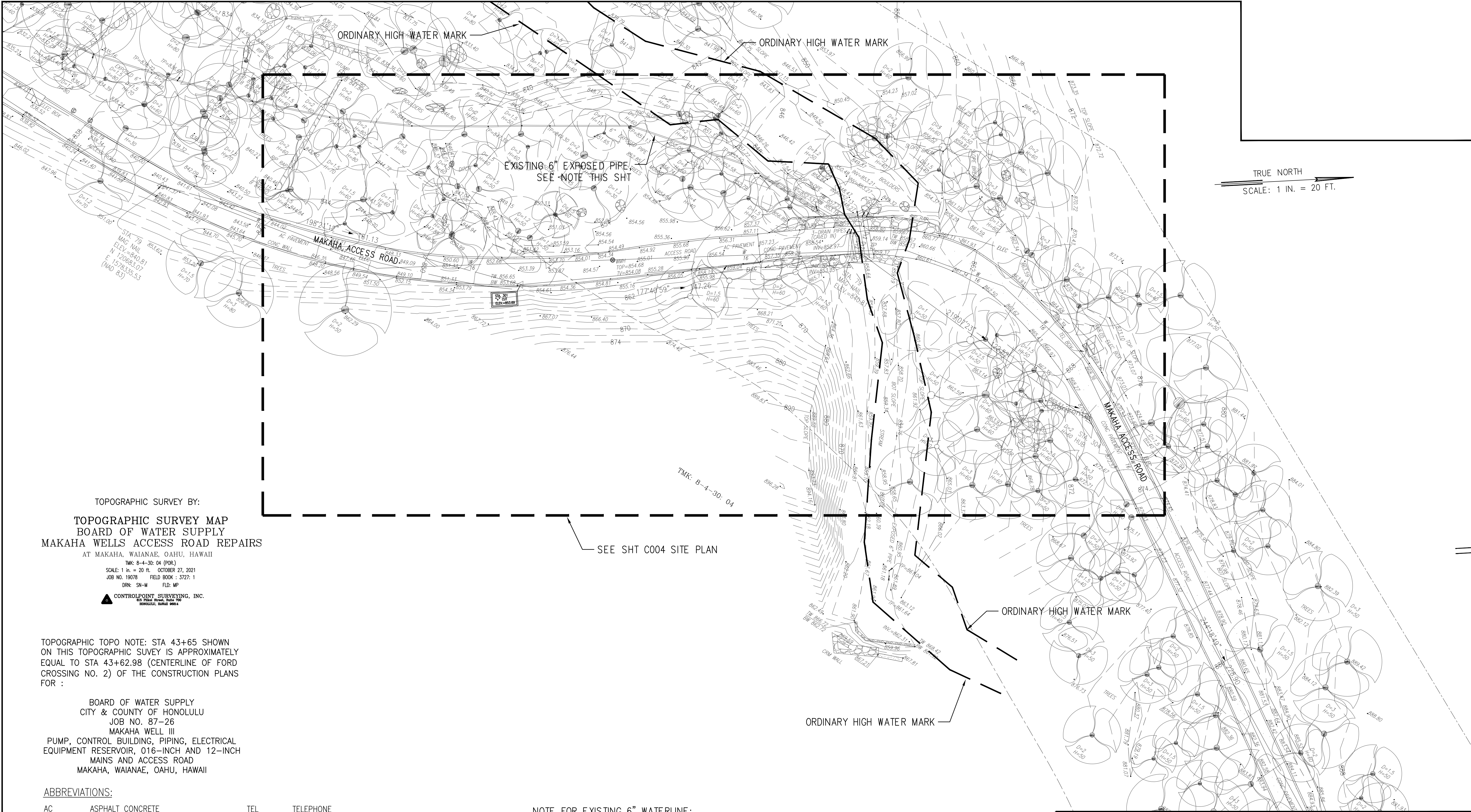
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

BUILDING PERMIT SITE PLAN

APPROVED BY: _____				DATE: _____	
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FIELD BOOK NO: _____		SCALE: AS INDICATED		SHEET 5 OF 50 SHEETS	

FILE	POCKET	FOLDER	NO.



TOPOGRAPHIC SURVEY BY:
TOPOGRAPHIC SURVEY MAP
BOARD OF WATER SUPPLY
MAKAHA WELLS ACCESS ROAD REPAIRS
AT MAKAHA, WAIANAE, OAHU, HAWAII
TMK: 8-4-30: 04 (POR)
SCALE: 1 in. = 20 ft. OCTOBER 27, 2021
JOB NO. 19078 FIELD BOOK : 3727: 1
DRN: SN-M FLD: MP
 CONTROLPOINT SURVEYING, INC.
815 Pihai Street, Suite 700
Honolulu, Hawaii 96814

TOPOGRAPHIC TOPO NOTE: STA 43+65 SHOWN
ON THIS TOPOGRAPHIC SURVEY IS APPROXIMATELY
EQUAL TO STA 43+62.98 (CENTERLINE OF FORD
CROSSING NO. 2) OF THE CONSTRUCTION PLANS
FOR :

BOARD OF WATER SUPPLY
CITY & COUNTY OF HONOLULU
JOB NO. 87-26
MAKAHA WELL III
PUMP, CONTROL BUILDING, PIPING, ELECTRICAL
EQUIPMENT RESERVOIR, 016-INCH AND 12-INCH
MAINS AND ACCESS ROAD
MAKAHA, WAIANAE, OAHU, HAWAII

ABBREVIATIONS:

AC	ASPHALT CONCRETE	TEL	TELEPHONE
BW	BOTTOM WALL	TP	TOP PIPE
CONC	CONCRETE	TS	TOP STEM
CRM	CONCRETE RUBBLE MASONRY (ROCK) WALL	TV	TOP VALVE
D	DIAMETER OR DRAIN	TW	TOP WALL
ELEC	ELECTRIC	W	WATER
H	HEIGHT	WMH	WATER MANHOLE
INV	INVERT	WV	WATER VALVE

NOTE FOR EXISTING 6" WATERLINE:
ASSUME 6" WATERLINE IS ABANDONED. REMOVE PORTIONS
THAT CONFLICT WITH PROJECT SCOPE. USE CAUTION TO VERIFY
IF ABANDONED.

EXISTING CONDITIONS PLAN
SCALE: 1" = 20'-0"

APPROVED:

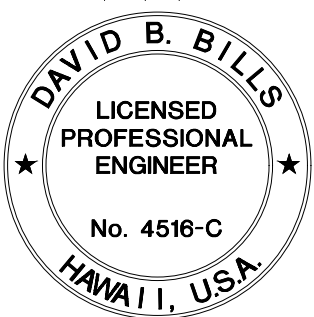
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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

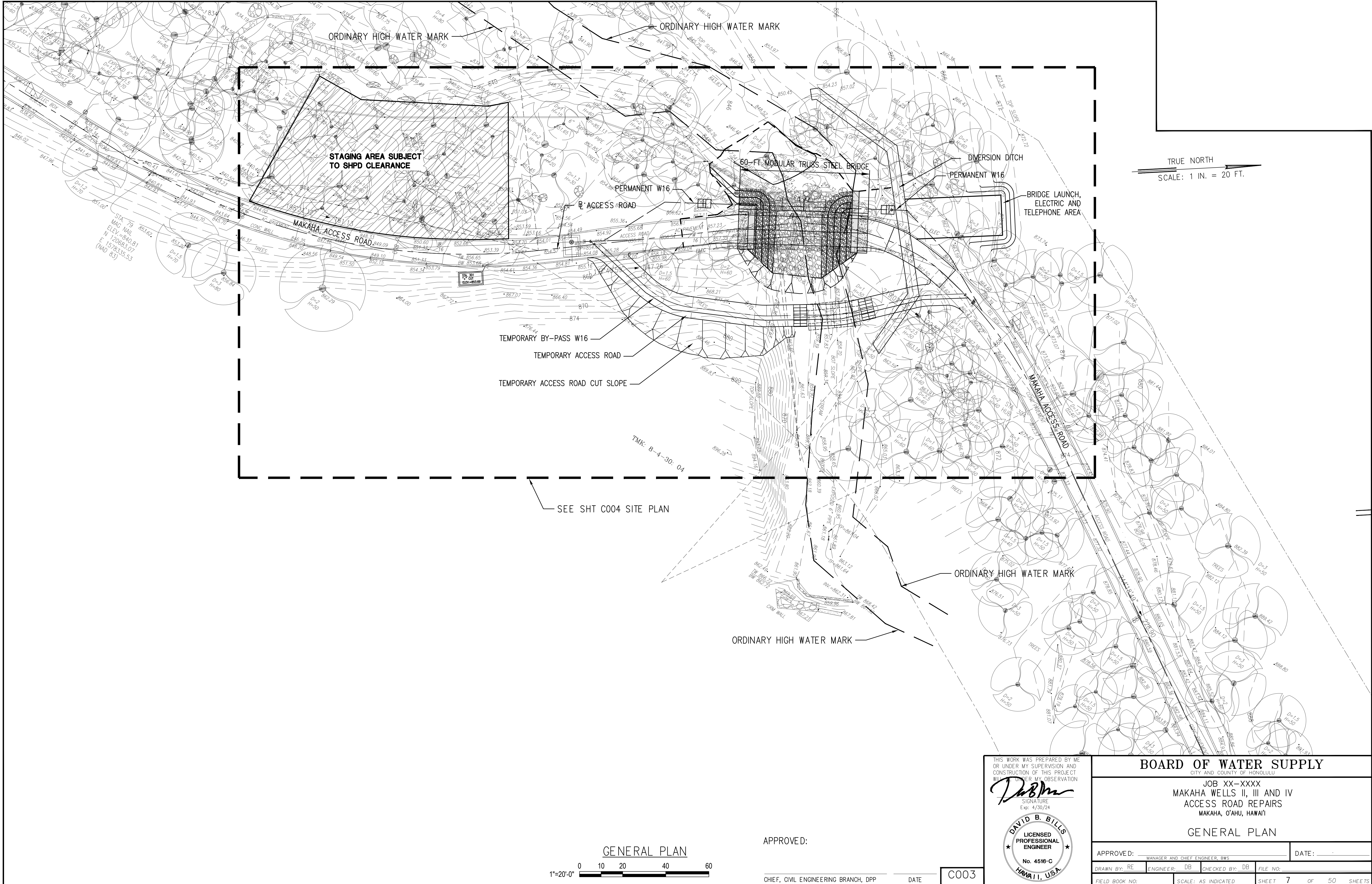
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, OAHU, HAWAII

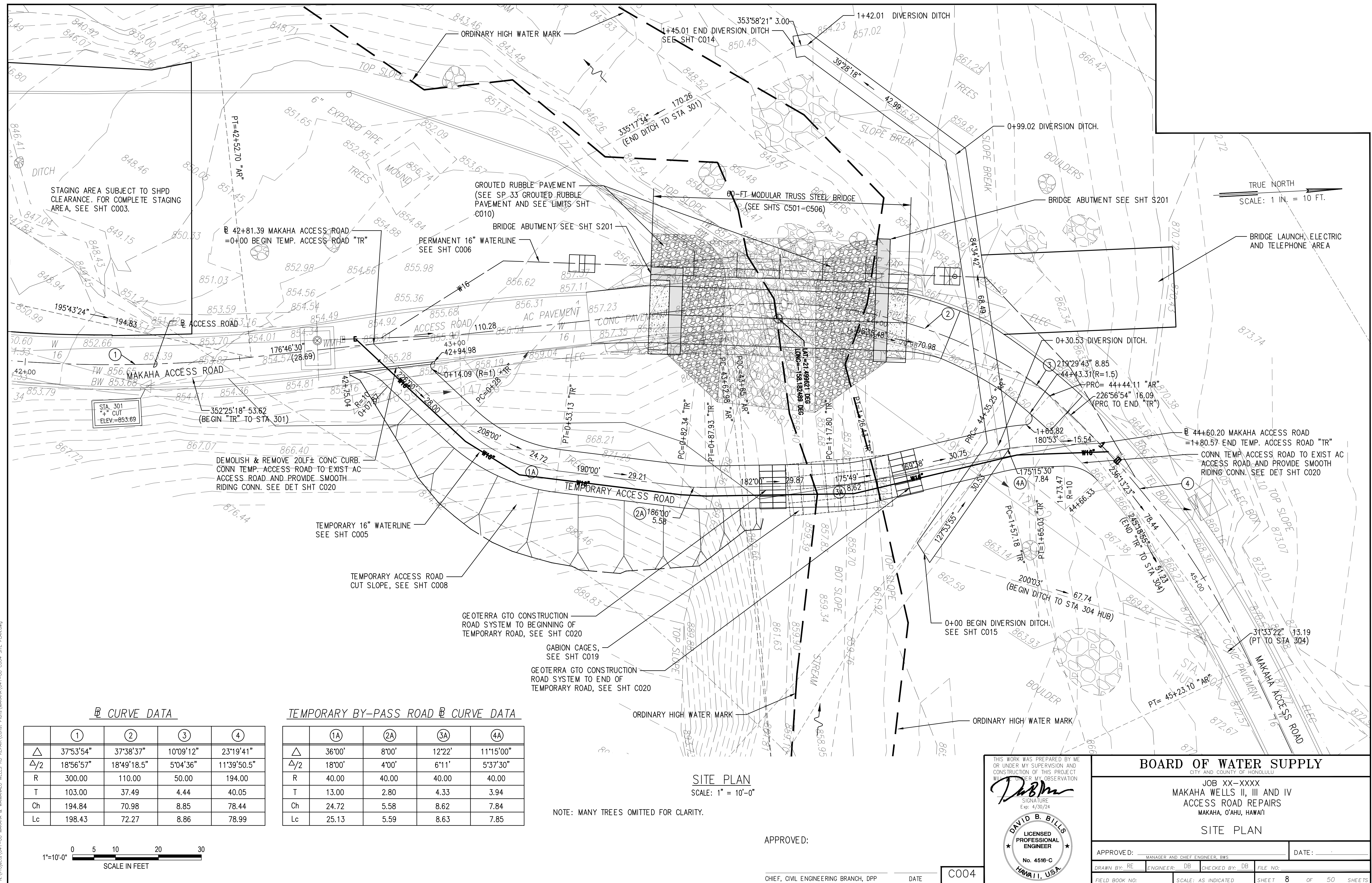
EXISTING CONDITIONS PLAN

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO:
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 6	OF 50 SHEETS

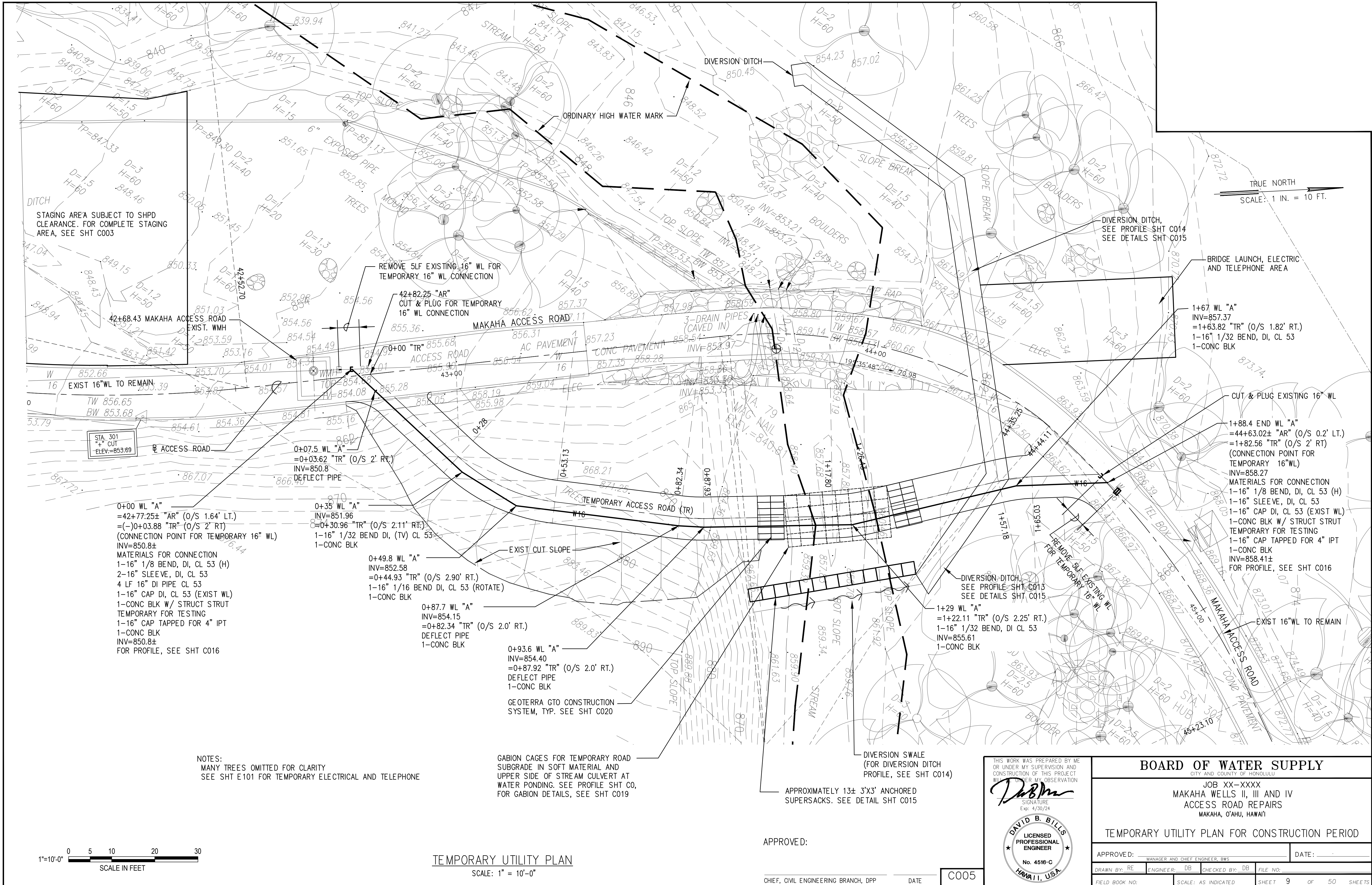
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Tue, 12 Sep 2023 - 11:17am
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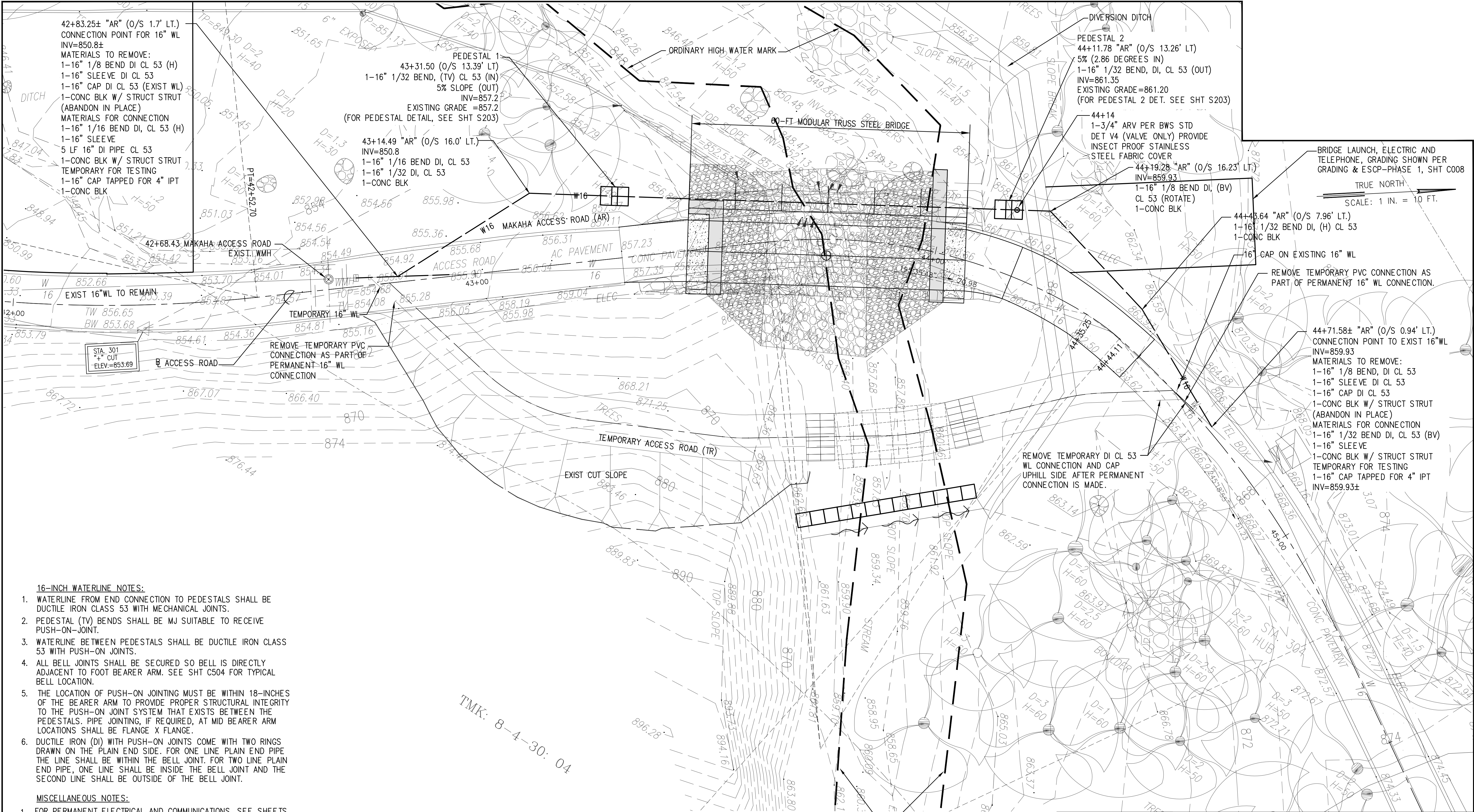




Wed, 13 Sep 2023 - 7:52pm
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Wed, 13 Sep 2023 - 7:56pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C006 PERMANENT 16-INCH WL PLAN.dwg



16-INCH WATERLINE NOTES:

1. WATERLINE FROM END CONNECTION TO PEDESTALS SHALL BE DUCTILE IRON CLASS 53 WITH MECHANICAL JOINTS.
2. PEDESTAL (TV) BENDS SHALL BE MJ SUITABLE TO RECEIVE PUSH-ON-JOINT.
3. WATERLINE BETWEEN PEDESTALS SHALL BE DUCTILE IRON CLASS 53 WITH PUSH-ON JOINTS.
4. ALL BELL JOINTS SHALL BE SECURED SO BELL IS DIRECTLY ADJACENT TO FOOT BEARER ARM. SEE SHT C504 FOR TYPICAL BELL LOCATION.
5. THE LOCATION OF PUSH-ON JOINTING MUST BE WITHIN 18-INCHES OF THE BEARER ARM TO PROVIDE PROPER STRUCTURAL INTEGRITY TO THE PUSH-ON JOINT SYSTEM THAT EXISTS BETWEEN THE PEDESTALS. PIPE JOINTING, IF REQUIRED, AT MID BEARER ARM LOCATIONS SHALL BE FLANGE X FLANGE.
6. DUCTILE IRON (DI) WITH PUSH-ON JOINTS COME WITH TWO RINGS DRAWN ON THE PLAIN END SIDE. FOR ONE LINE PLAIN END PIPE THE LINE SHALL BE WITHIN THE BELL JOINT. FOR TWO LINE PLAIN END PIPE, ONE LINE SHALL BE INSIDE THE BELL JOINT AND THE SECOND LINE SHALL BE OUTSIDE OF THE BELL JOINT.

MISCELLANEOUS NOTES:

1. FOR PERMANENT ELECTRICAL AND COMMUNICATIONS, SEE SHEETS E003 AND E004.
2. TREES HAVE BEEN REMOVED FROM THIS SHEET PER GRADING & ESCP - PHASE 1, SHEET C008.

NOTES:
MANY TREES OMITTED FOR CLARITY
FOR PERMANENT ELECTRICAL AND
COMMUNICATIONS, SEE SHTS E003 AND E004

PERMANENT 16-INCH WATER LINE PLAN

SCALE: 1" = 10'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C006

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David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED
PROFESSIONAL
ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY

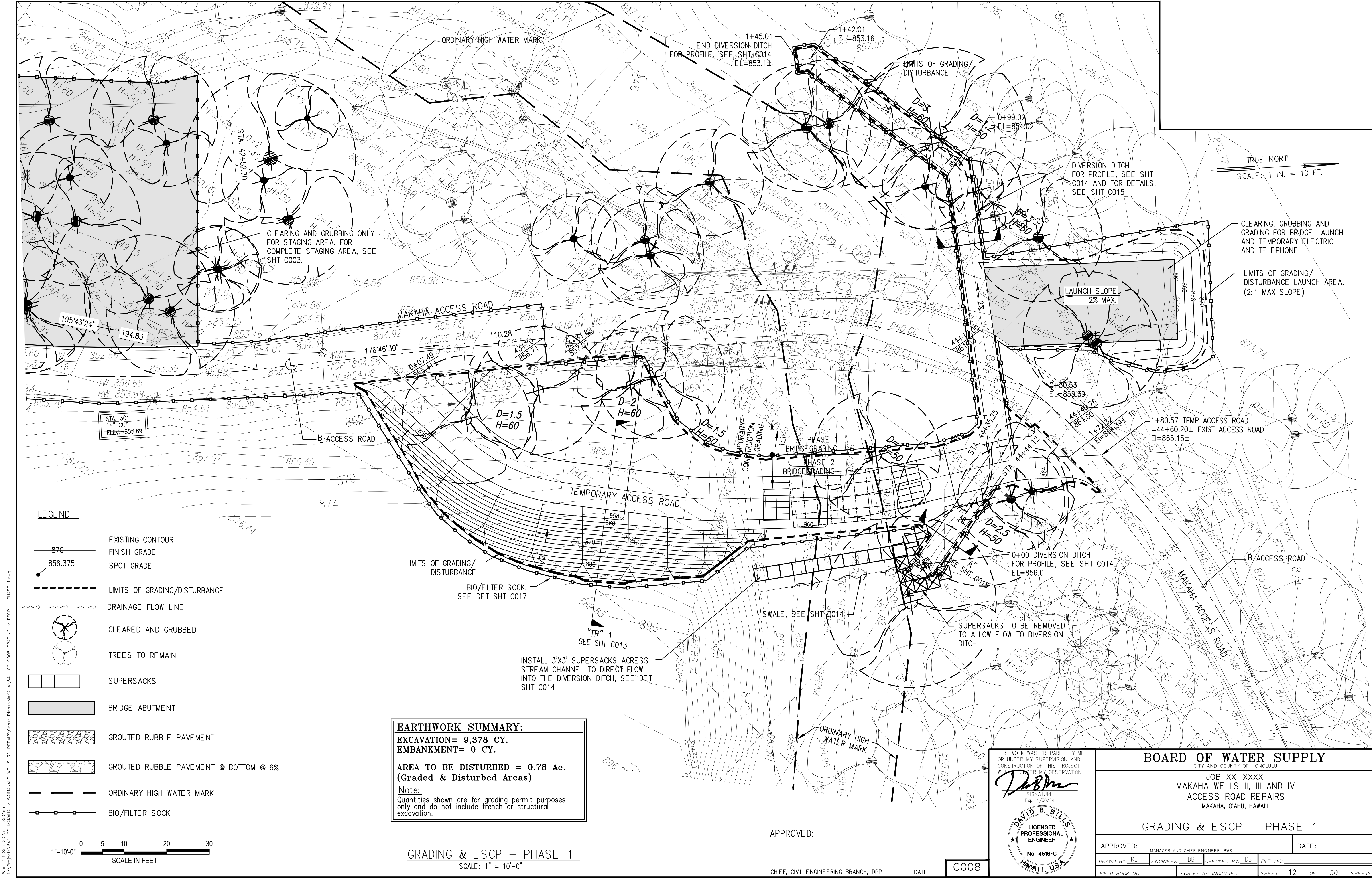
CITY AND COUNTY OF HONOLULU

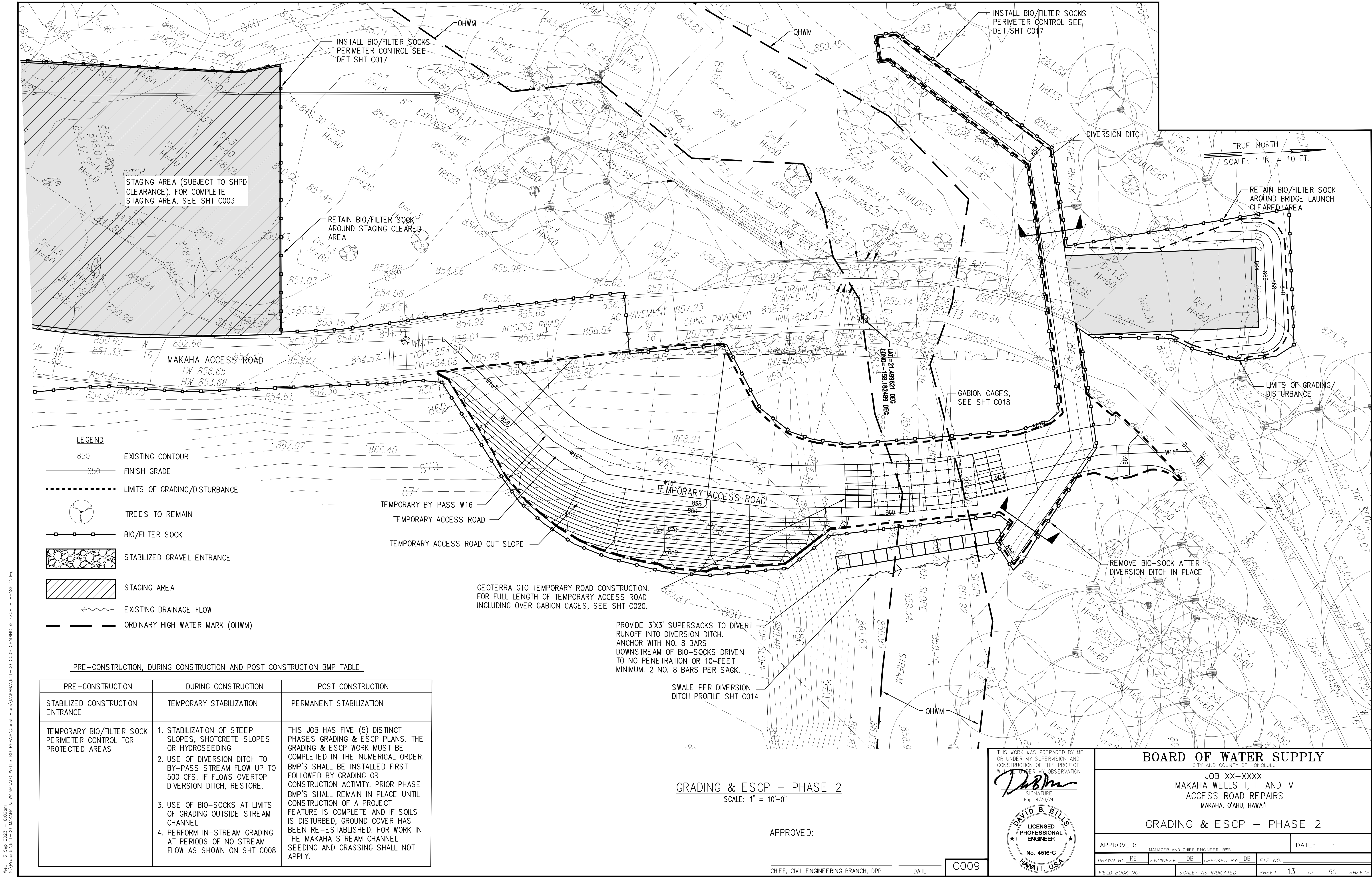
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

PERMANENT 16-INCH WATER LINE PLAN

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
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FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 10	OF 50 SHEETS

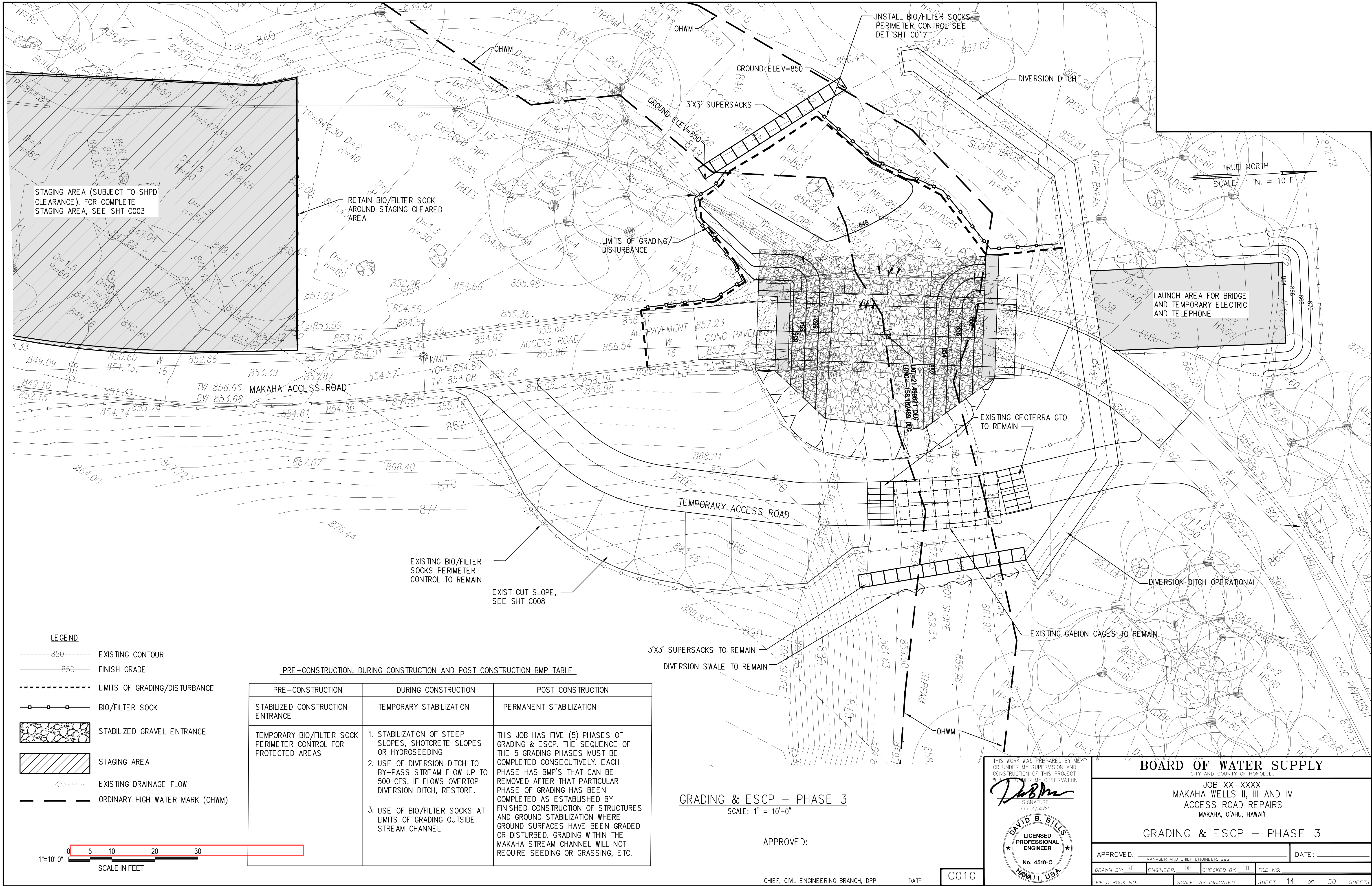
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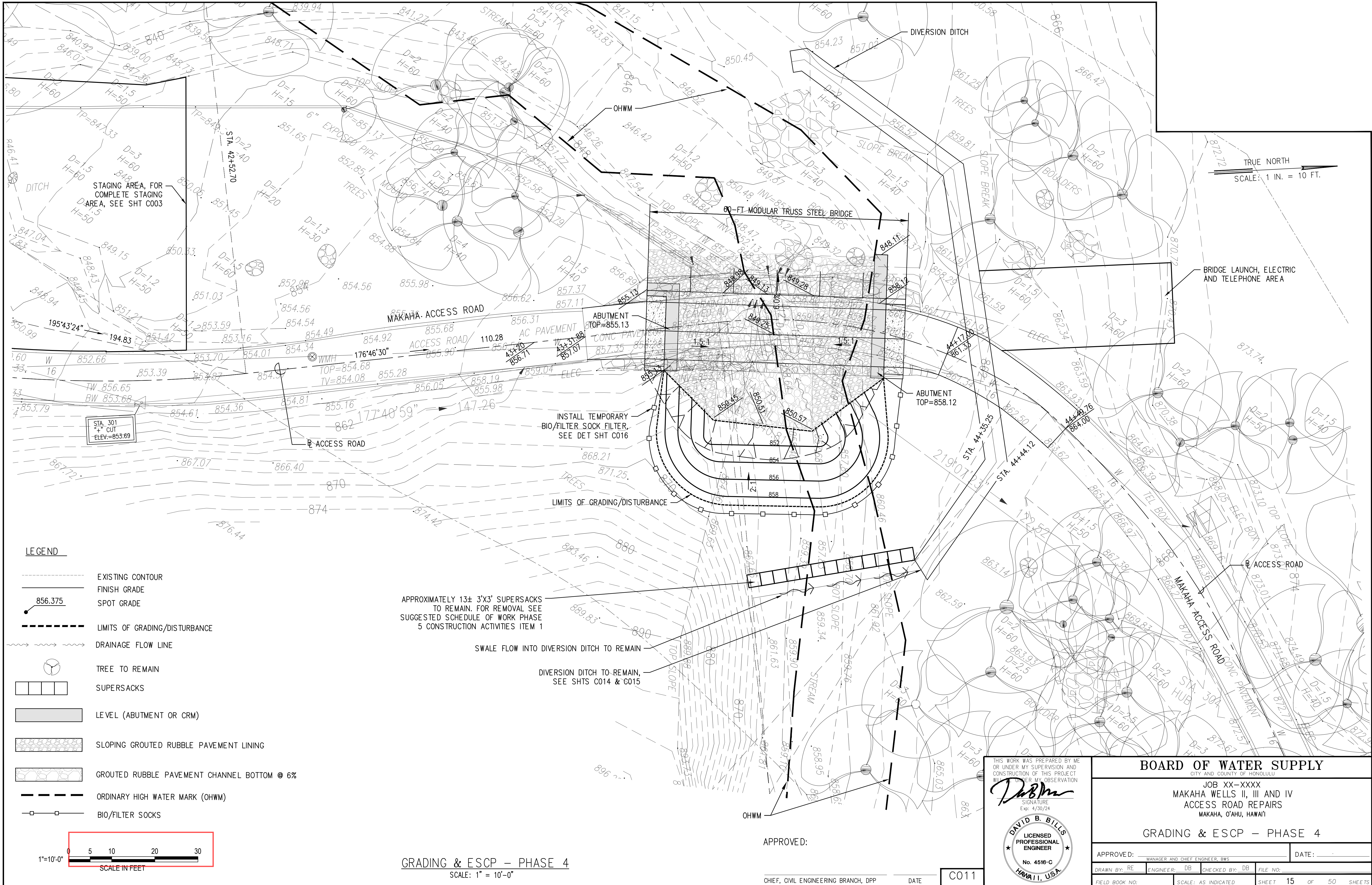


Wed, 13 Sep 2023 - 8:09am
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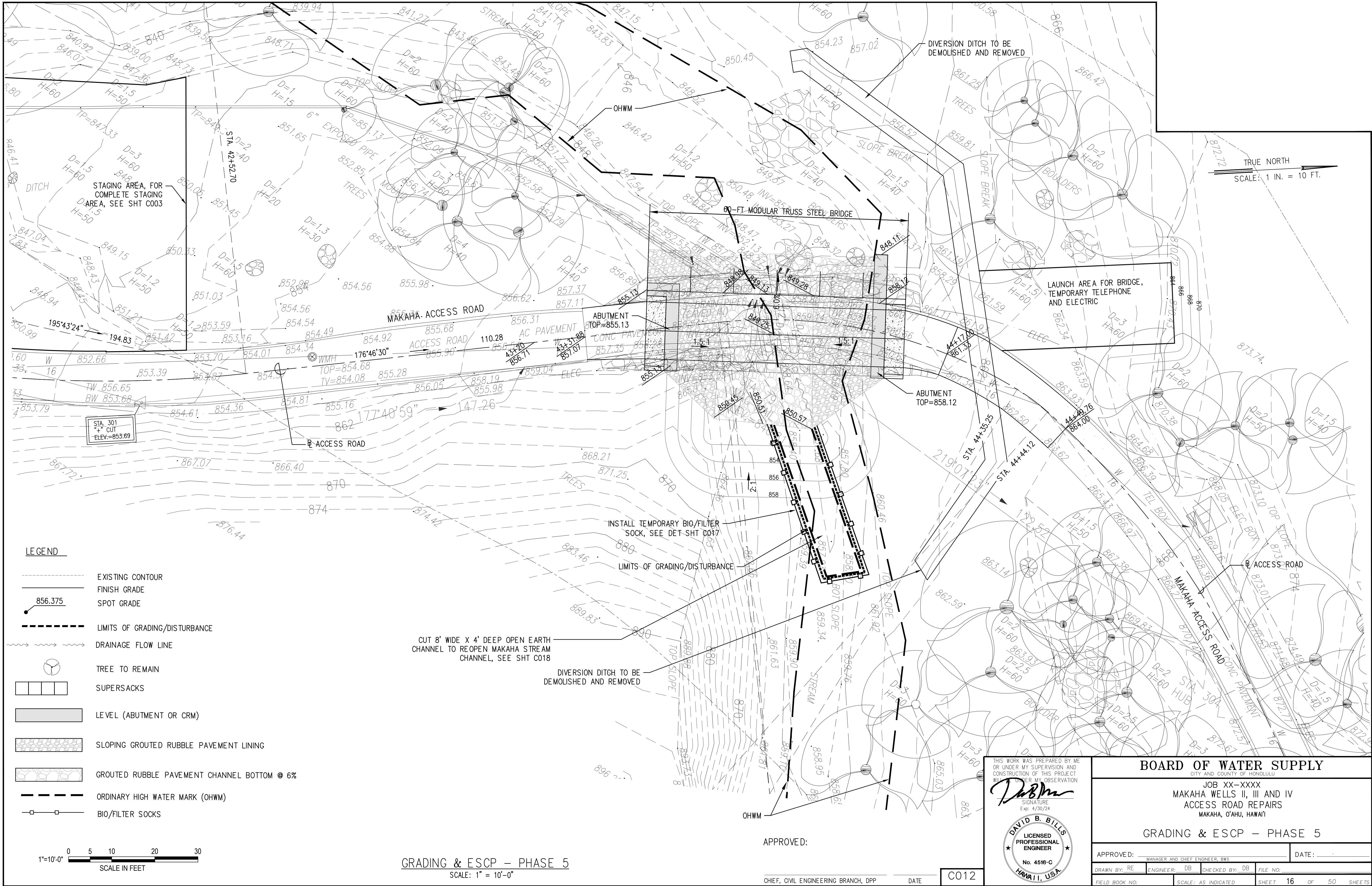
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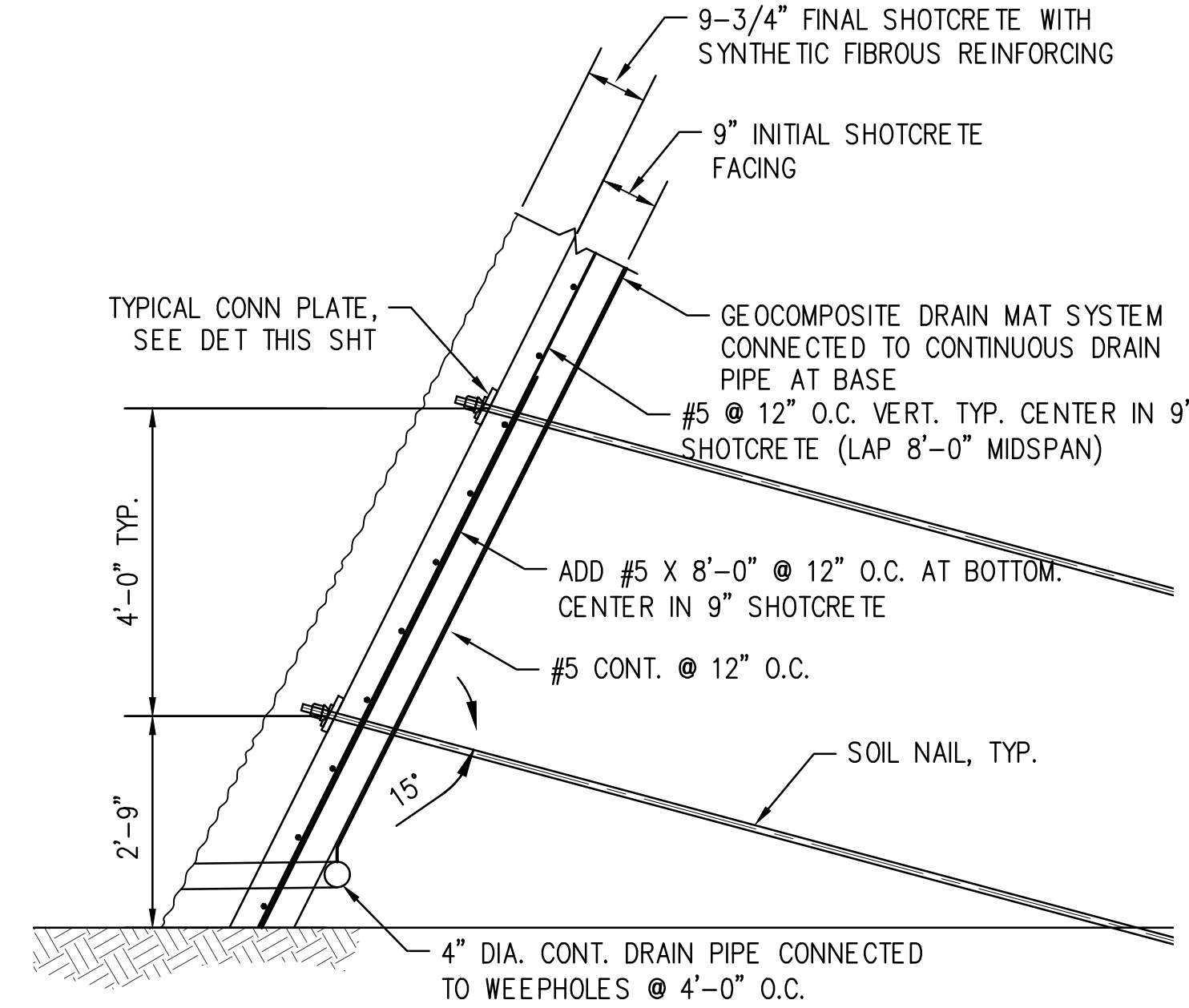
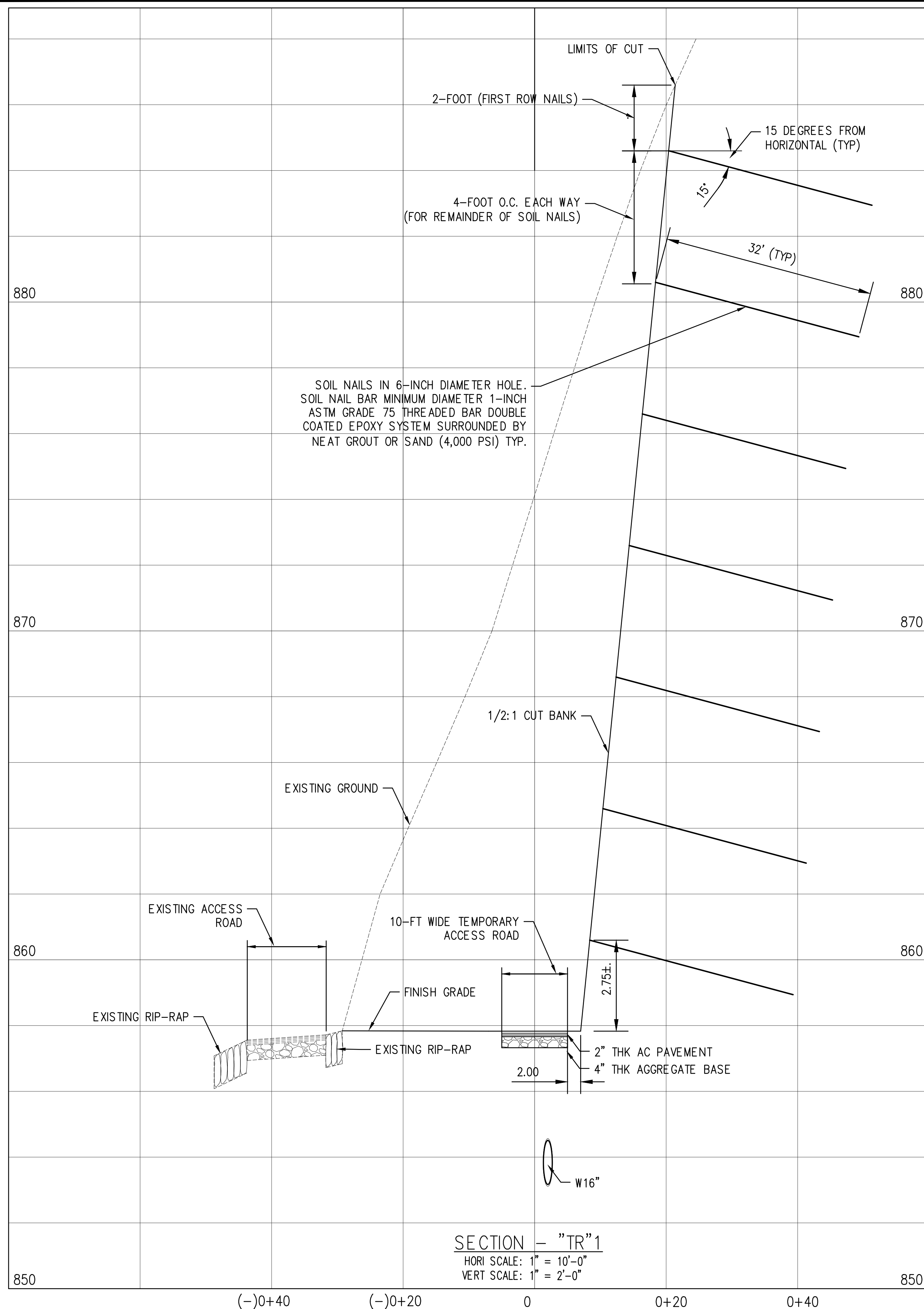


Wed, 13 Sep 2023 - 8:16am
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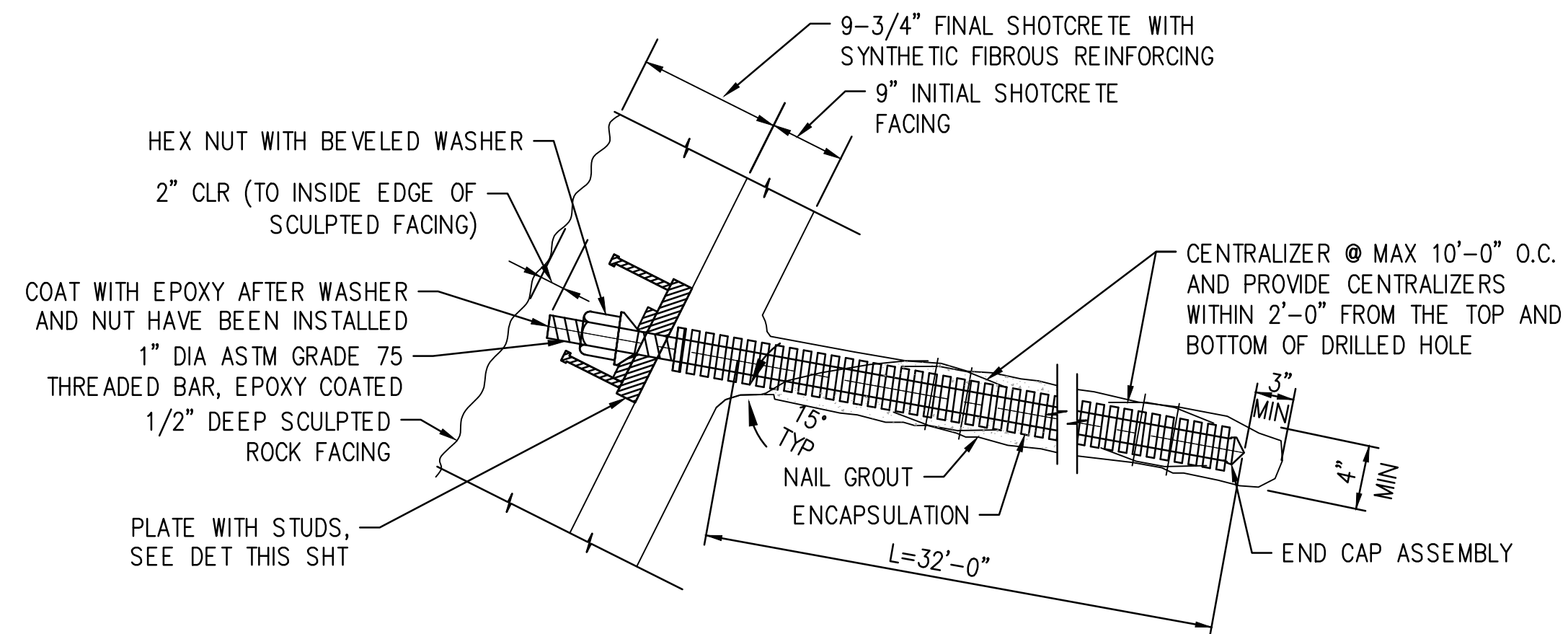
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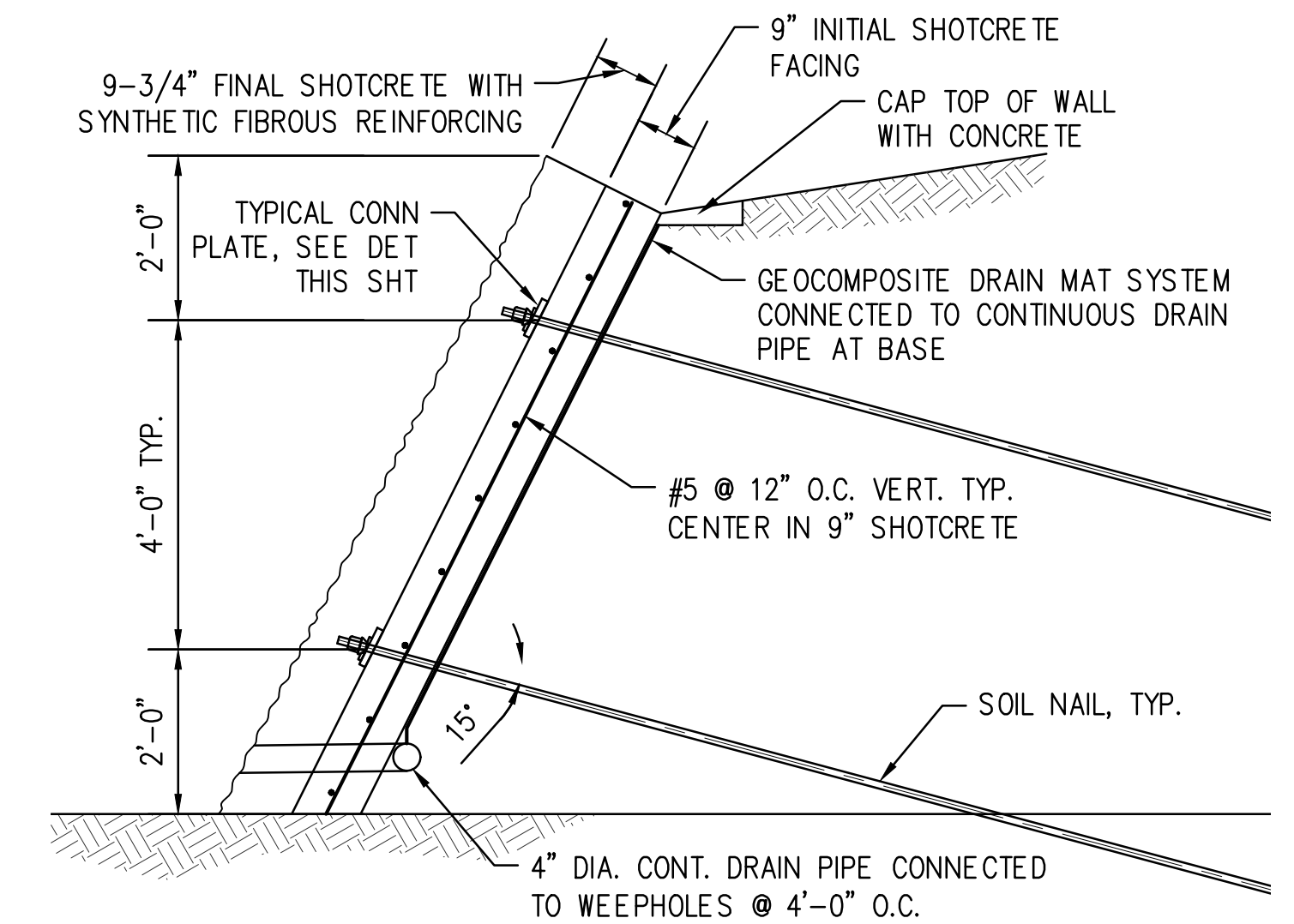
SECTION OF SHOTCRETE FACE DETAIL

SCALE: 1/2" = 1'-0"



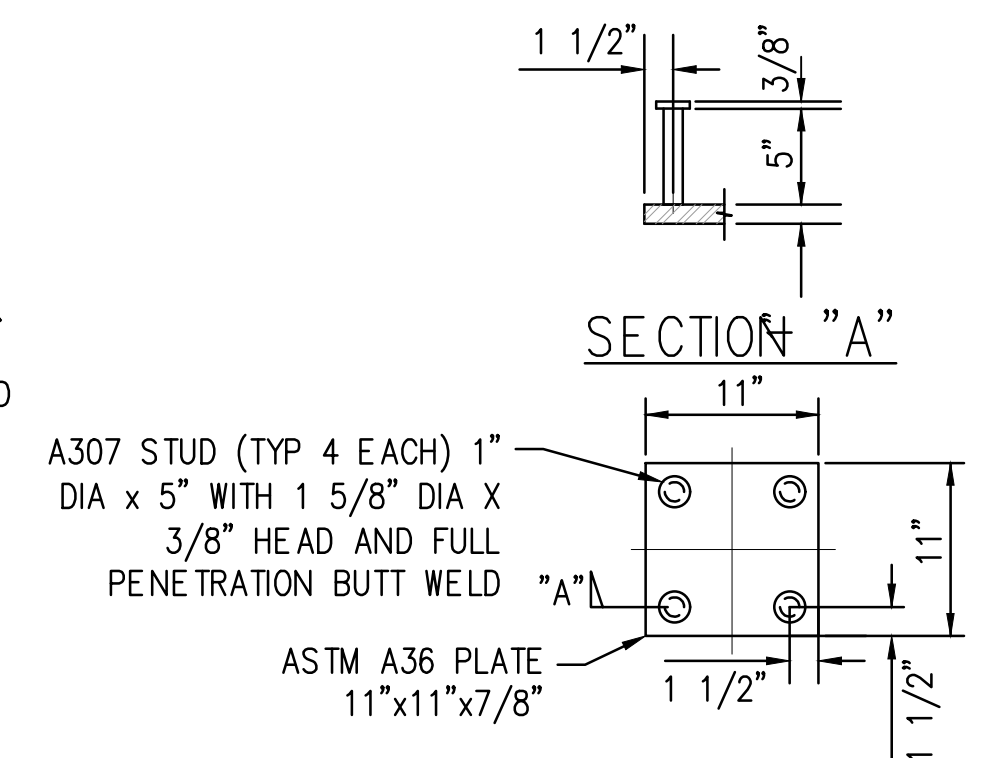
ENCAPSULATED PRODUCTION SOIL/ROCK ANCHOR DETAIL

NOT TO SCALE



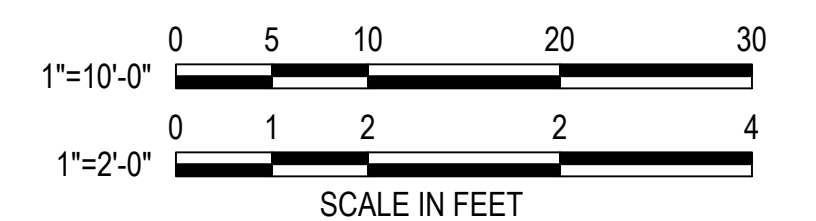
SECTION OF SHORT SHOTCRETE FACE DETAIL

SCALE: 1/2" = 1'-0"



CONNECTION PLATE WITH STUD DETAIL

SCALE: 1" = 1'-0"



- SOIL NAIL NOTES:

1. REFER TO GEOTECHNICAL REPORT ON SHEET SP150 GEOTECHNICAL REPORT, SECTION 1 SOIL NAILED RETAINING WALL SYSTEM AND THE COMPLETE GEOTECHNICAL REPORT.
2. CONTRACTOR SHALL PROVIDE SOIL NAIL PATTERN ON FACE OF SLOPE FOR GEOTECHNICAL REVIEW PRIOR TO COMMENCEMENT OF SOIL NAIL INSTALLATION.

APPROVED:


CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE _____

C013

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BOARD OF WATER SUPPLY

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

SECTION "TR" 1 AND DETAILS

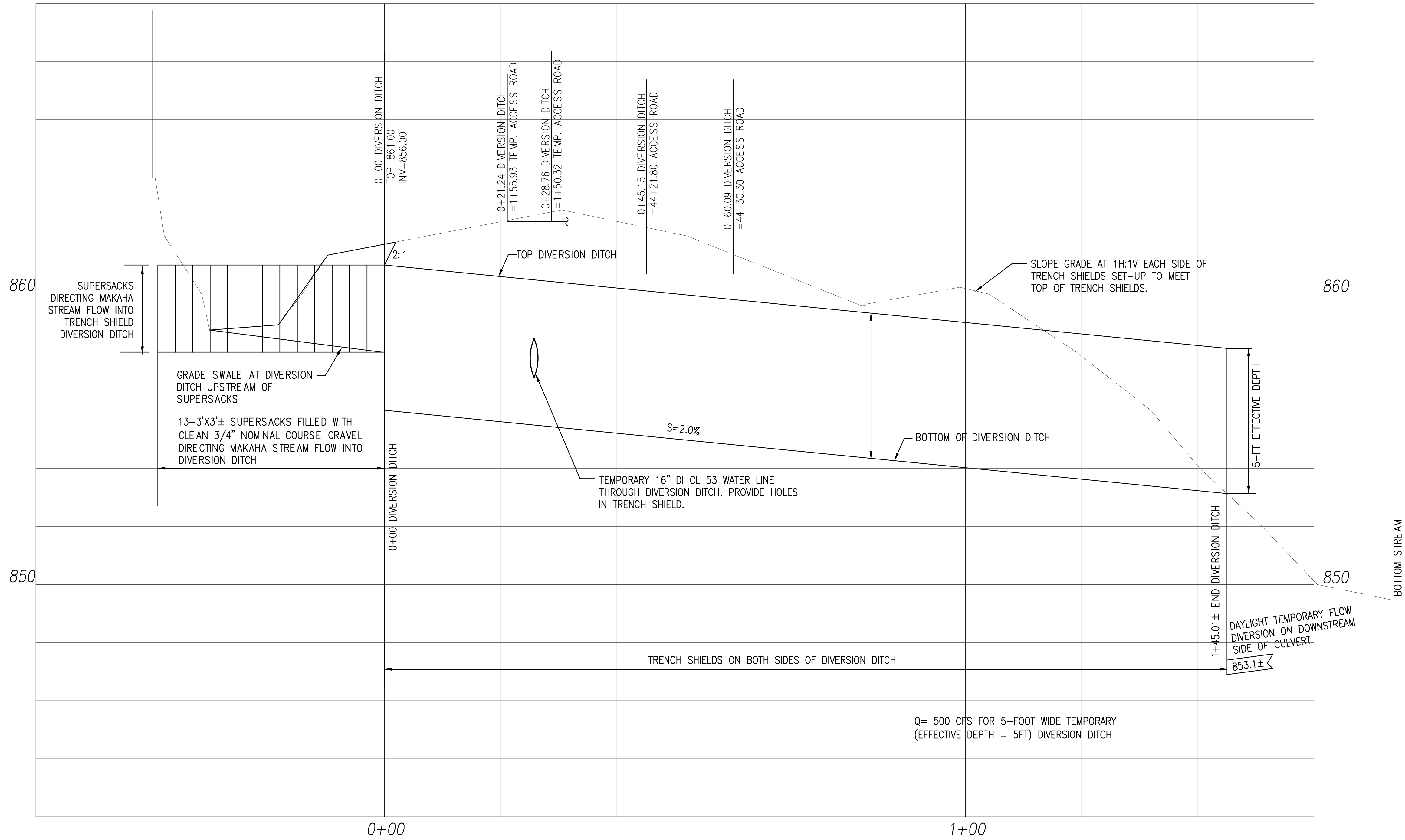
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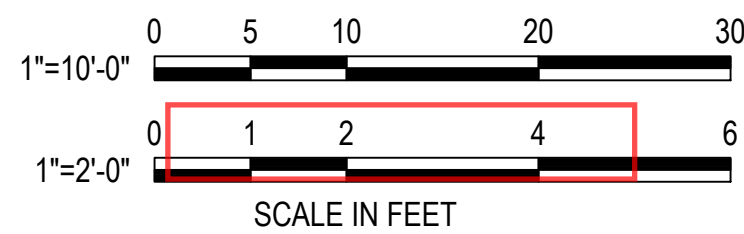
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FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 17 OF 50 SHEETS	

FILE	POCKET	FOLDER	NO.

Tue, 12 Sep 2023 - 1:31pm
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Corer Plans\MAKAHA\641-00 C014 DIVERSION DITCH PROFILE.dwg



NOTE:
FOR DIVERSION DITCH DETAILS, SEE SHT C015



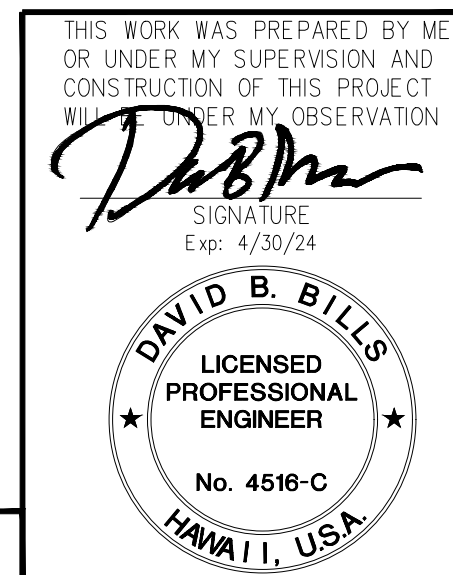
DIVERSION DITCH PROFILE
SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

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DATE

C014



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

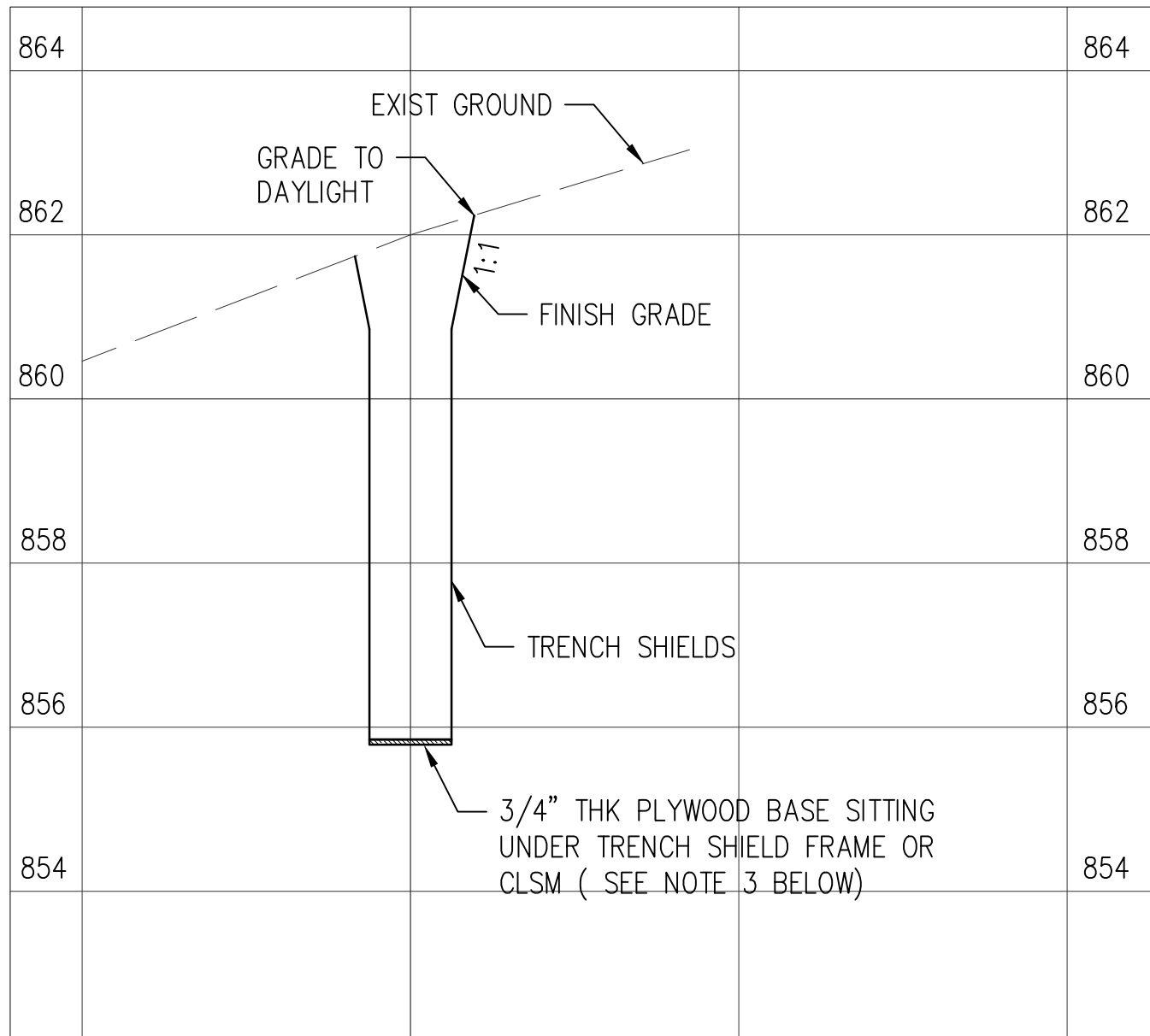
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

DIVERSION DITCH PROFILE

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
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FIELD BOOK NO:	SCALE: AS INDICATED	SHEET	18 OF 50 SHEETS

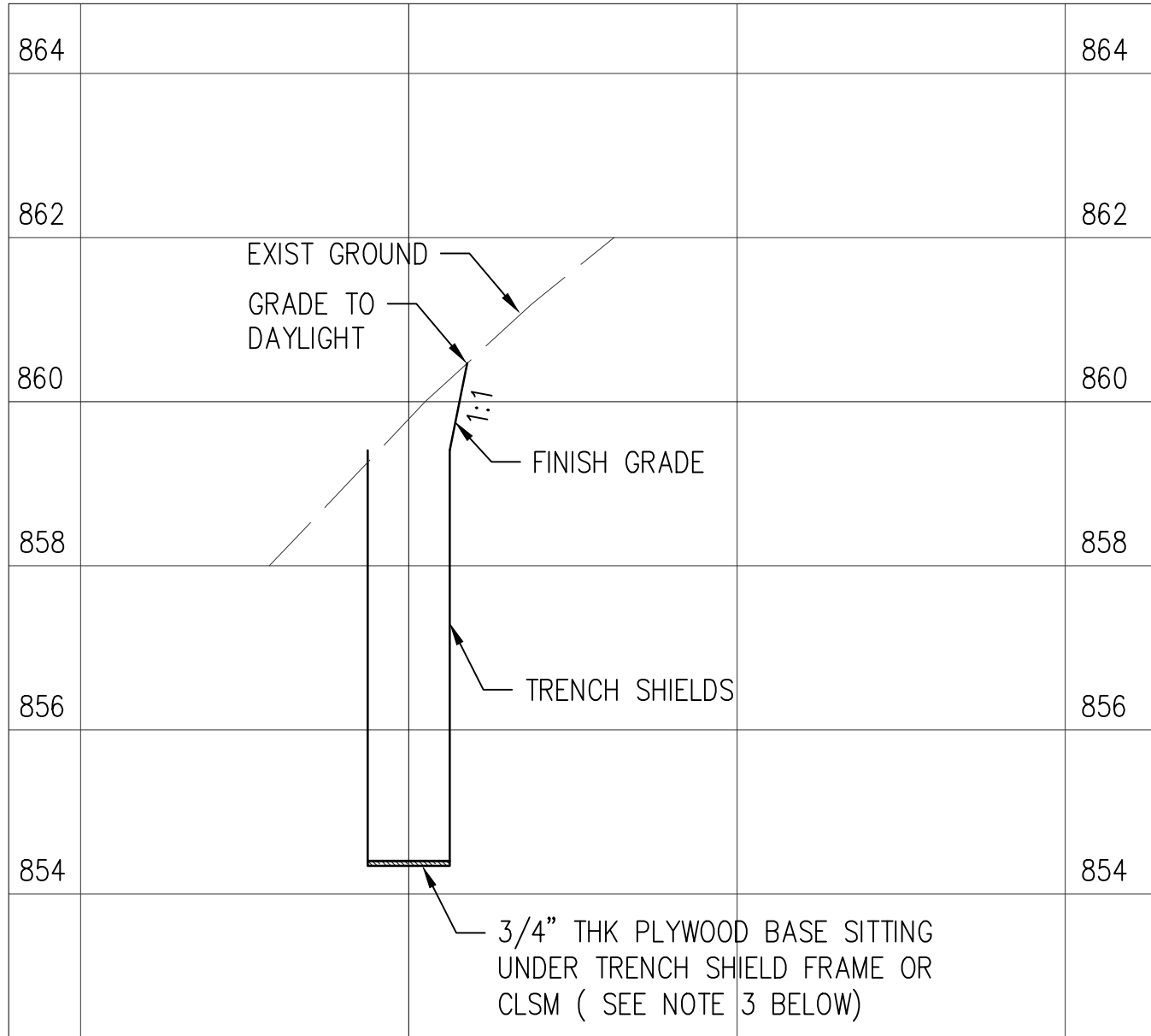
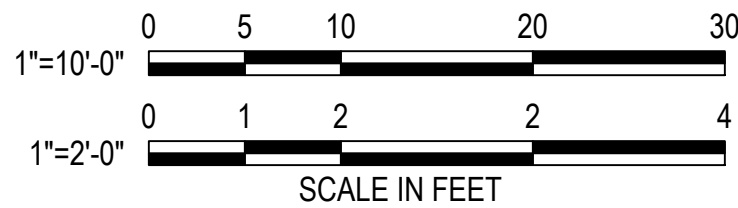
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Wed, 13 Sep 2023 - 8:28am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Corset Plans\MAKAHA\641-00 C015 SECTIONS & DIVERSION DITCH DETAILS.dwg



SECTION A
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)

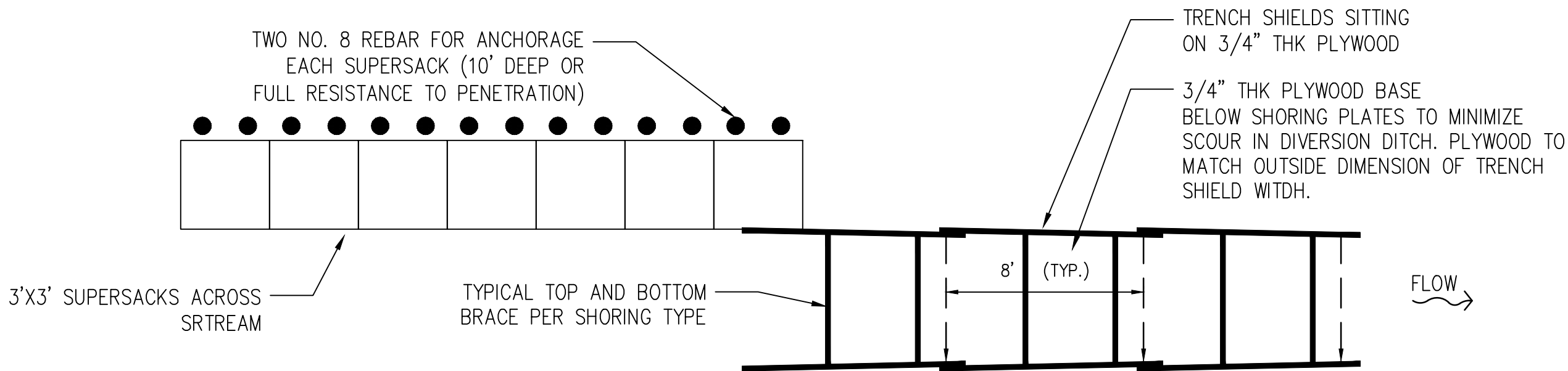
- NOTES:
- THE DIVERSION DITCH SHALL BE EXCAVATED AND THE EXCAVATED MATERIAL SHALL BE STOCKPILED AND PROTECTED WITH TEMPORARY COVER AND FILTER SOCK AROUND THE BASE OF THE COVER. THIS STOCKPILE FILL WILL BE USED TO RESTORE DIVERSION DITCH EXCAVATION TO ITS ORIGINAL CONDITION OR BETTER.
 - INSTALL DIVERSION DITCH PER DETAILS THIS SHEET AND SHT CO.
 - AN ALTERNATIVE TO PLYWOOD IS PLACING A 6-INCH LAYER OF 1500 PSI CLSM AT CHANNEL FLOOR. USE BOND BREAKER BETWEEN CLSM AND SHIELD TO ALLOW SALVAGE OF SHIELDS.
 - JOINT BETWEEN SHIELDS SHALL BE WATERPROOFED TO PREVENT WATER OUT MIGRATION FROM DIVERSION DITCH OR OVERLAPPED AS SHOWN IN PLAN VIEW OF DIVERSION DITCH DETAIL THIS SHEET.
 - AFTER DIVERSION DITCH IS NO LONGER NEEDED THE TRENCH SHIELDS SHALL BE REMOVED AND PLYWOOD FLOOR (CLSM CAN BE ABANDONED IN PLACE).
 - STOCKPILED DIVERSION DITCH EXCAVATION SHALL BE USED FOR DIVERSION TRENCH BACKFILL. PLACE LIFTS NO MORE THAN 12-INCHES AND COMPACT TO 85% (ASTM D1557).



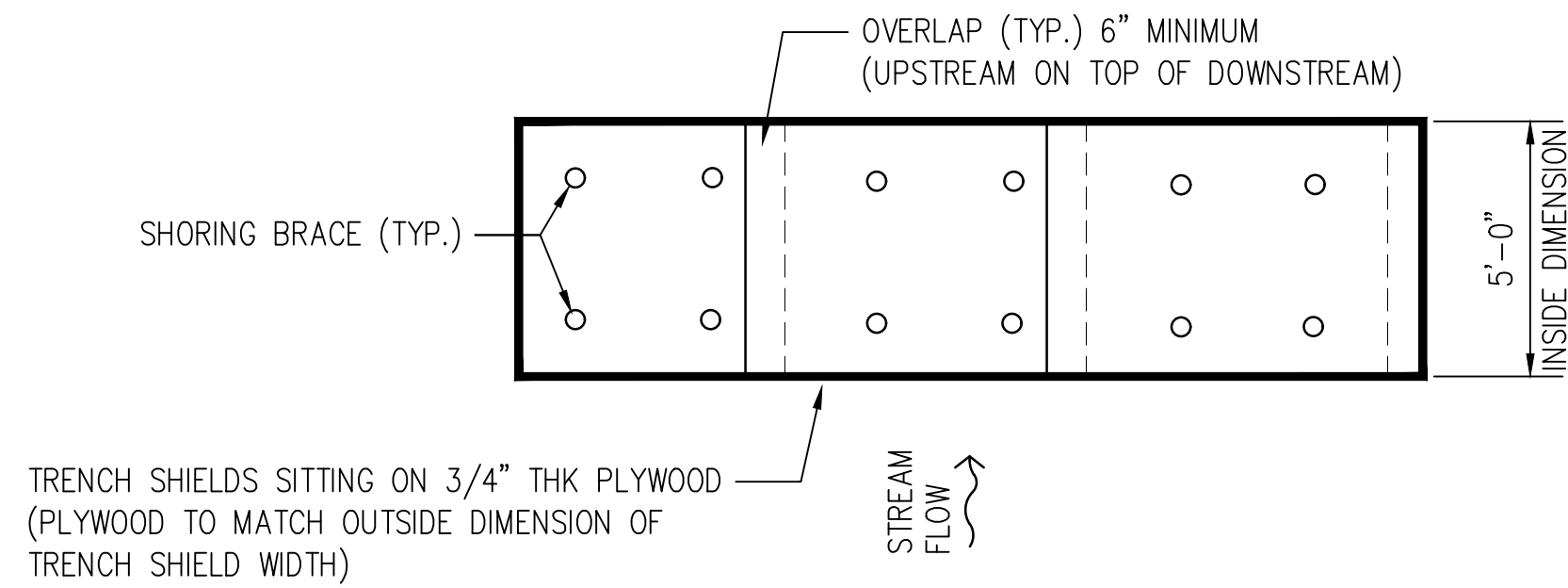
SECTION B
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)



TYPICAL TRENCH SHIELDS
NOT TO SCALE



PLAN
SCALE: 1/4"=1'-0"



SECTION
SCALE: 1"=1'-0"

NOTE:

TOTAL LENGTH OF DIVERSION TRENCH IS 145± LINEAR FEET

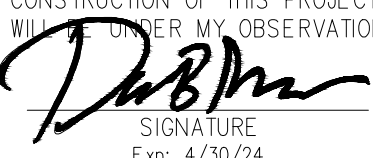
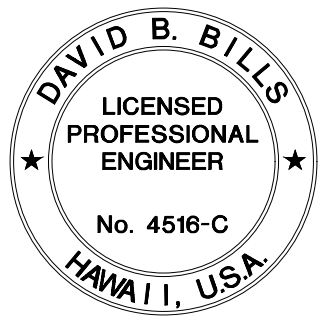
DIVERSION DITCH USING SHORING PLATES
SCALE: AS SHOWN

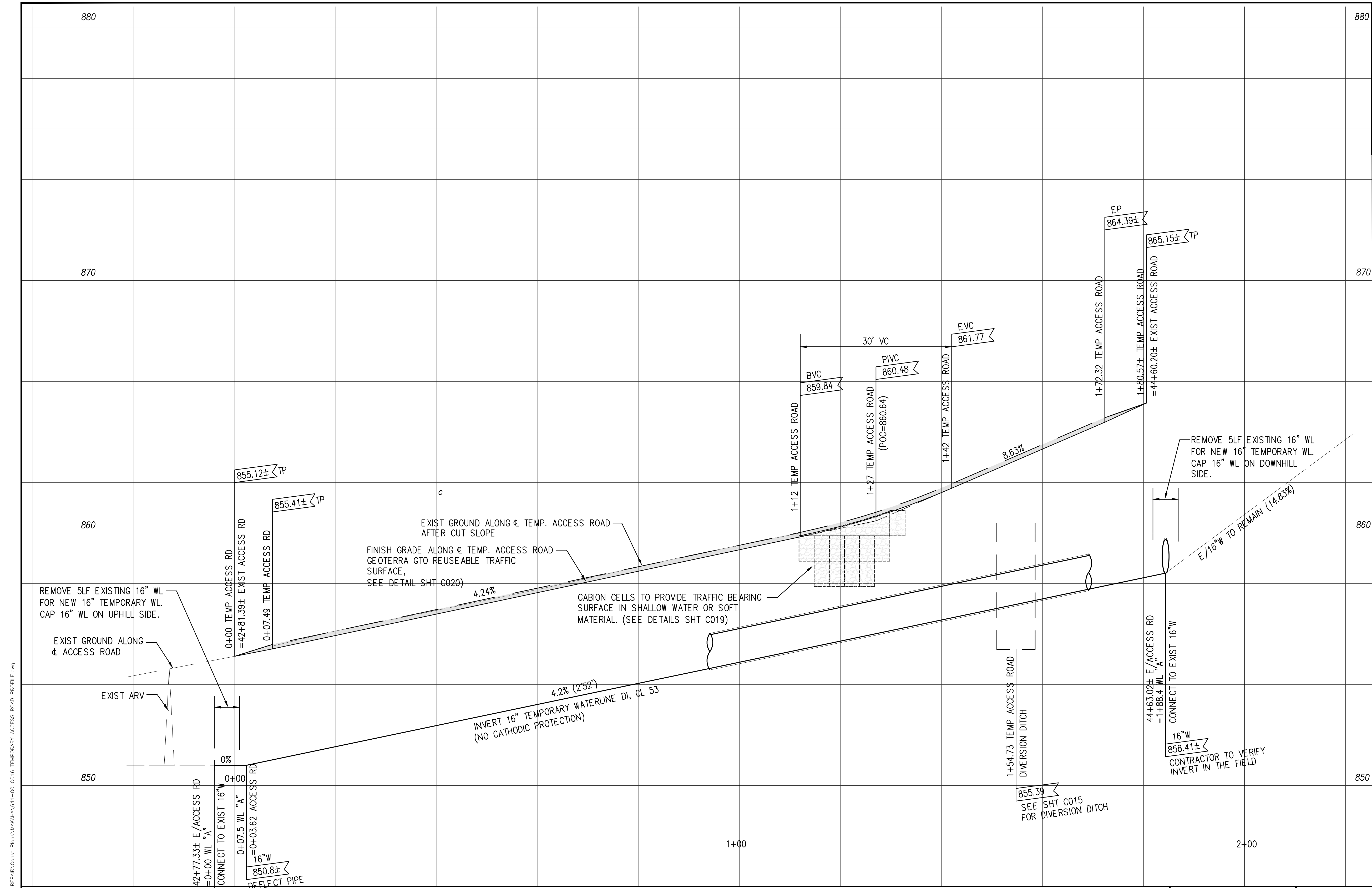
APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

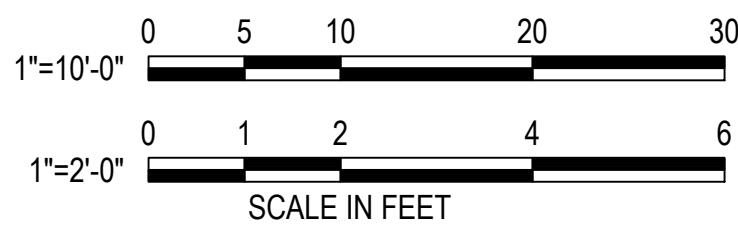
DATE

C015

<div>THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION</div> <div> SIGNATURE Exp: 4/30/24</div> <div></div>	BOARD OF WATER SUPPLY <small>CITY AND COUNTY OF HONOLULU</small>			
	JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
	SECTIONS & DIVERSION DITCH DETAILS			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>		DATE: _____	
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FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 19 OF 50 SHEETS	
FILE	POCKET	FOLDER	NO.	



Wed, 13 Sep 2023 - 8:30am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Corr. Plans\MAKAHA\641-00 C016 TEMPORARY ACCESS ROAD PROFILE.dwg



16"W
850.8±
CONTRACTOR TO VERIFY
INVERT IN THE FIELD

TEMPORARY ACCESS ROAD PROFILE

SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

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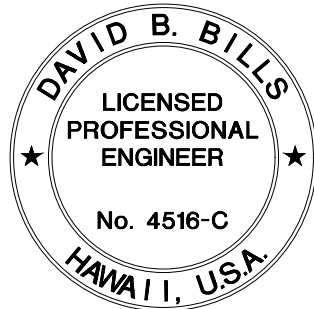
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C016

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David B. Bills
SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

TEMPORARY ACCESS ROAD AND
TEMPORARY 16" WL PROFILE

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
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SHEETS			

FILE	POCKET	FOLDER	NO.

Tue, 12 Sep 2023 - 1:41pm
NA\Projects\641-00 MAKAHA & WANAMALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C017 ESCP NOTES AND DETAILS.dwg

EROSION AND SEDIMENT CONTROL PLAN NOTES:

PROJECT SEQUENCE:

1. INSTALL STABILIZED CONSTRUCTION INGRESS/EGRESS, SEDIMENT FILTER FOR CATCH BASINS, & PERIMETER CONTROL FOR PROTECTED AREAS.
2. PROCEED WITH CLEARING AND GRUBBING OF AREAS WHERE SHOTCRETE IS TO BE APPLIED.
3. PROCEED WITH THE INSTALLATION OF SHOTCRETE SLOPE STABILIZATION.
4. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
5. INSPECTIONS SHALL BE PERFORMED WEEKLY.

RAIN RESPONSE PLAN NOTES:

1. THE FOLLOWING SHALL BE PERFORMED WHEN HEAVY RAIN, TROPICAL STORM OR HURRICANE IS IMMINENT, OR IS FORECASTED IN THE NEXT 48 HOURS.
2. TEMPORARILY SUSPEND ACTIVE GRADING.
3. INSPECT ALL PERIMETER CONTROLS AND INLET PROTECTION DEVICES AND MAINTAIN AS NEEDED. IF A SEVERE STORM IS EXPECTED, REMOVE INLET PROTECTION DEVICES TO PREVENT FLOODING ON SURROUNDING STREETS.
4. COVER OR RELOCATE MATERIAL STOCKPILES AND LIQUID MATERIAL CONTAINERS TO AVOID CONTACT WITH RAINWATER.
5. PLACE SPILL PANS OR OIL-ONLY SPILL PADS UNDER CONSTRUCTION VEHICLES TO PREVENT RUNOFF FROM CONTACTING ANY SPILLED PETROLEUM PRODUCTS. PROPERLY DISPOSE OF ANY ACCUMULATED OILY WATER AFTER THE RAIN EVENT.
6. RE-INSPECT AFTER THE APPROACHING HEAVY RAINS, TROPICAL STORM OR HURRICANE, AND REPLACE OR MAINTAIN BMPS AS NEEDED.

GOOD HOUSEKEEPING BMPS NOTES:

1. STREET SWEEPING, VACUUMING. ALL POLLUTANTS DISCHARGED FROM CONSTRUCTION SITE TO OFFSITE AREAS MUST BE SWEEPED OR VACUUMED EACH DAY BEFORE LEAVING THE JOB SITE.
2. MATERIALS DELIVERY, STORAGE AND USE MANAGEMENT. PREVENT, REDUCE OR ELIMINATE THE DISCHARGE OF POLLUTANTS FROM MATERIAL DELIVERY, STORAGE AND USE TO THE STORM WATER SYSTEM OR WATERCOURSES BY MINIMIZING THE STORAGE OF HAZARDOUS MATERIALS ONSITE, STORING MATERIALS IN A DESIGNATED AREA, INSTALLING SECONDARY CONTAINMENT. CONSTRUCTION MATERIALS, WASTE, TOXIC AND HAZARDOUS SUBSTANCES, STOCKPILES AND OTHER SOURCES OF POLLUTANT SHALL NOT BE STORED IN BUFFER AREAS, NEAR AREAS OF CONCENTRATED FLOW, OR AREAS ABUTTING THE MS4, RECEIVING WATERS, OR DRAINAGE IMPROVEMENTS THAT DISCHARGE OFFSITE. PRIMARY AND SECONDARY CONTAINMENT CONTROLS AND COVERS SHALL BE IMPLEMENTED TO THE MEP.
3. SPILL PREVENTION AND CONTROL. CREATE AND IMPLEMENT SPILL PREVENTION AND RESPONSE PLAN TO ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO THE MS4 AND RECEIVING WATERS FROM LEAKS AND SPILLS BY REDUCING THE CHANCE FOR SPILLS, ABSORBING, CONTAINING, AND CLEANING UP SPILLS AND PROPERLY DISPOSING OF SPILL MATERIALS. AT A MINIMUM, ALL PROJECTS SHALL CLEANUP ALL LEAKS AND SPILLS IMMEDIATELY.
4. HAZARDOUS MATERIALS. PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM HAZARDOUS WASTE THROUGH PROPER MATERIAL USE AND WASTE DISPOSAL. IN THE EVENT THAT HAZARDOUS MATERIALS ARE DISCHARGED TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL IMMEDIATELY NOTIFY THE DEPARTMENT OF FACILITIES MAINTENANCE, HONOLULU FIRE DEPARTMENT, AND HONOLULU POLICE DEPARTMENT OF THE DISCHARGE BY TELEPHONE. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE, AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.
5. NONHAZARDOUS MATERIALS. IN THE EVENT THAT NONHAZARDOUS MATERIALS ARE DISCHARGE TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL NOTIFY THE CITY DEPARTMENT OF FACILITIES MAINTENANCE BY TELEPHONE NO LATER THAN THE NEXT BUSINESS DAY. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.
6. VEHICLE AND EQUIPMENT CLEANING. ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT CLEANING OPERATIONS BY USING OFFSITE FACILITIES WHEN FEASIBLE, WASHING IN DESIGNATED, CONTAINED AREAS ONLY, AND ELIMINATING DISCHARGES TO THE STORM DRAIN SYSTEM BY EVAPORATING AND/OR TREATING WASH WATER, AS APPROPRIATE OR INFILTRATING WASH WATER FOR EXTERIOR CLEANING ACTIVITIES THAT USE WATER ONLY.
7. VEHICLE AND EQUIPMENT FUELING. PREVENT FUEL SPILLS AND LEAKS BY USING OFFSITE FACILITIES, FUELING ONLY IN DESIGNATED AREAS, ENCLOSING OR COVERING STORED FUEL, AND IMPLEMENTING SPILL CONTROLS SUCH AS SECONDARY CONTAINMENT AND ACTIVE MEASURES USING SPILL RESPONSE KITS.
8. VEHICLE AND EQUIPMENT MAINTENANCE. ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT MAINTENANCE OPERATIONS BY USING OFFSITE FACILITIES WHEN FEASIBLE, PERFORMING WORK IN DESIGNATED AREAS ONLY, USING SPILL PADS UNDER VEHICLES AND EQUIPMENT, CHECKING FOR LEAKS AND SPILLS, AND CONTAINING AND CLEANING UP SPILLS IMMEDIATELY.
9. SOLID WASTE MANAGEMENT. PREVENT OR REDUCE DISCHARGE OF POLLUTANTS TO THE LAND, GROUNDWATER, IN STORM WATER, FROM SOLID WASTE OR CONSTRUCTION AND DEMOLITION WASTE, BY PROVIDING DESIGNATED WASTE COLLECTION AREAS. COLLECT SITE TRASH DAILY, AND ENSURE THAT CONSTRUCTION WASTE IS COLLECTED, REMOVED, AND DISPOSED OF, ONLY AT AUTHORIZED DISPOSAL AREAS.
10. SANITARY/SEPTIC WASTE MANAGEMENT. TEMPORARY AND PORTABLE SANITARY AND SEPTIC WASTE SYSTEMS SHALL BE MOUNTED OR STAKED IN, WELL-MAINTAINED, AND SCHEDULED FOR REGULAR WASTE DISPOSAL AND SERVICING. SOURCES OF SANITARY AND/OR SEPTIC WASTE SHALL NOT BE STORED NEAR THE MS4 OR RECEIVING WATERS.
11. STOCKPILE MANAGEMENT. STOCKPILES SHALL NOT BE LOCATED IN DRAINAGE WAYS, WITHIN 50- FEET FROM AREAS OF CONCENTRATED FLOWS, AND ARE NOT ALLOWED IN THE CITY RIGHT-OF-WAY. SEDIMENT BARRIERS OR SILT FENCES SHALL BE USED AROUND THE BASE OF ALL STOCKPILES. STOCKPILES SHALL NOT EXCEED 15 FEET IN HEIGHT. STOCKPILES GREATER THAN 15 FEET IN HEIGHT SHALL REQUIRE 8 FOOT WIDE BENCHING IN ACCORDANCE WITH ROH CHAPTER 14, ARTICLE 15. STOCKPILES MUST BE COVERED WITH PLASTIC SHEETING OR A COMPARABLE MATERIAL IF THEY WILL NOT BE ACTIVELY USED WITHIN 7 DAYS.
12. LIQUID WASTE MANAGEMENT. LIQUID WASTE SHALL BE CONTAINED IN A CONTROLLED AREA SUCH AS A HOLDING PIT, SEDIMENT BASIN, ROLL-OFF BIN, OR PORTABLE TANK, OF SUFFICIENT VOLUME AND TO CONTAIN THE LIQUID WASTES GENERATED. CONTAINMENT AREAS OR DEVICES MUST BE IMPERMEABLE AND LEAK FREE AND SHOULD NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNEL OR STORM DRAINS.
13. CONCRETE WASTE MANAGEMENT. PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM CONCRETE WASTE BY CONDUCTING WASHOUT OFFSITE OR PERFORMING ONSITE WASHOUT, IN A DESIGNATED AREA CONSTRUCTED AND MAINTAINED IN SUFFICIENT QUANTITY AND SIZE TO CONTAIN ALL LIQUID AND CONCRETE WASTE GENERATED BY WASHOUT OPERATIONS. PLASTIC LINING MATERIAL SHALL BE A MINIMUM OF 10 MILLIMETER POLYETHYLENE SHEETING AND SHALL BE FREE OF HOLES, TEARS, OR OTHER DEFECTS THAT COMPROMISE THE IMPERMEABILITY OF THE MATERIAL. CONTAINMENT AREAS AND DEVICES SHALL NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNELS, OR STORM DRAINS. WASHOUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASHOUT IS 75 PERCENT FULL. ONCE CONCRETE WASTES ARE WASHED INTO DESIGNATED AREA AND ALLOWED TO HARDEN, THE CONCRETE SHALL BE BROKEN UP, REMOVED, AND DISPOSED OF AS SOLID WASTES.
14. CONTAMINATED SOIL MANAGEMENT. AT A MINIMUM, CONTAIN CONTAMINATED MATERIAL SOIL BY SURROUNDING WITH IMPERMEABLE LINED BERMS OR COVER EXPOSED CONTAMINATED MATERIAL WITH PLASTIC SHEETING. CONTAMINATED SOIL SHALL BE DISPOSED OF PROPERLY IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS.
15. BMP & SITE MAINTENANCE. RELOCATE, RECONSTRUCT AND MAINTAIN BMPS AS NEEDED TO KEEP THEM EFFECTIVE AT ALL TIMES. PROCEED WITH CONSTRUCTION WITH LEAST POSSIBLE DISTURBANCE OF VEGETATIVE AREAS AND STRUCTURES. REMOVE OR DISMANTLE TEMPORARY EROSION CONTROL STRUCTURES AFTER CONSTRUCTION OF LINING ARE COMPLETE. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION. INSPECTIONS SHALL BE PERFORMED WEEKLY.
16. DUST CONTROL. THE CONTRACTOR, AT HIS/HER OWN EXPENSE, SHALL KEEP THE PROJECT AND ITS SURROUNDING AREAS FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH.

EROSION PREVENTION/SEDIMENT CONTROL NOTES:

1. THE CONTRACTOR SHALL FOLLOW THE GUIDELINES IN THE CITY & COUNTY OF HONOLULU'S "RULES RELATING TO WATER QUALITY".
2. MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTHWORK IS INITIATED.
3. TEMPORARY STABILIZATION IS REQUIRED ON DISTURBED AREAS WHICH ARE AT FINAL GRADE OR WHEN THE DISTURBED AREA WILL NOT BE WORKED FOR 7 CONSECUTIVE DAYS OR MORE.
4. PERMANENT STABILIZATION. ALL DISTURBED AREAS SHALL BE PERMANENTLY STABILIZED USING VEGETATIVE COVERING, PAVEMENT, OR EQUIVALENT, PRIOR TO REMOVING EROSION AND SEDIMENT MEASURES. TRAPPED SEDIMENT AND AREAS OF DISTURBED SOIL WHICH RESULT FROM THE REMOVAL OF THE TEMPORARY MEASURES SHALL BE IMMEDIATELY AND PERMANENTLY STABILIZED.
5. PRESERVE EXISTING VEGETATION. CLEARLY MARK THE AREAS TO BE PRESERVED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING SHALL BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.
6. MINIMIZE SOIL COMPACTION AREAS. WHERE FINAL STABILIZATION OR INFILTRATION PRACTICES ARE TO BE INSTALLED, AREA SHALL BE PROTECTED FROM EXCESSIVE COMPACTION DURING CONSTRUCTION. VEHICLE AND EQUIPMENT USE SHALL BE RESTRICTED OR TECHNIQUES TO CONDITION THE SOILS TO SUPPORT VEGETATION SHALL BE IMPLEMENTED IN THE AREAS THAT HAVE BEEN COMPACTED AND ARE DESIGNATED TO REMAIN VEGETATIVE OR POST-CONSTRUCTION INFILTRATION AREAS. CLEARLY MARK THE AREAS TO BE AVOIDED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING SHALL BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.
7. PERIMETER CONTROLS ARE REQUIRED DOWN SLOPE OF ALL DISTURBED AREAS.
8. INLET PROTECTION (SEDIMENT FILTER)
 - A) ALL STORM DRAIN INLETS ONSITE AND THOSE OFFSITE WHICH MAY RECEIVE RUNOFF FROM THE SITE SHALL USE AN INLET PROTECTION DEVICE UNLESS THEY ARE DIRECTED TO A SEDIMENT BASIN.
 - B) SEDIMENT LEVELS MAY NOT EXCEED ONE THIRD OF THE HEIGHT OF A SEDIMENT BARRIER OR INLET PROTECTION DEVICE AT ANY POINT ALONG THE LENGTH OF THE SEDIMENT BARRIER OR THE INLET PROTECTION DEVICE.
 - C) SEDIMENT BARRIERS AND INLET PROTECTION DEVICES SHALL BE UNCLOGGED AND CLEANED WHEN PERFORMANCE IS COMPROMISED.
 - D) TORN, WEATHERED, OR SAGGING, SEDIMENT BARRIERS OR INLET PROTECTION DEVICES SHALL BE REPAIRED OR REPLACED IMMEDIATELY.
9. TRACKING CONTROL
 - A) MINIMIZE SEDIMENT TRACK-OUT ONTO OFFSITE STREETS, OTHER PAVED AREAS, AND SIDEWALKS FROM VEHICLES EXITING THE CONSTRUCTION SITE BY RESTRICTING VEHICLE TRAFFIC TO PROPERLY DESIGNATED AREAS AND USING ADDITIONAL CONTROLS TO REMOVE SEDIMENT FROM VEHICLE TIRES PRIOR TO EXITING THE SITE.
 - B) VEHICULAR PARKING AND MOVEMENTS ON PROJECT SITE SHALL BE CONFINED TO PAVED SURFACES OF PREDEFINED PARKING AREAS AND VEHICLE PATHS, WHICH SHALL BE MARKED WITH FLAGS OR BOUNDARY FENCING.
 - C) ALL POLLUTANTS AND MATERIALS THAT ARE DROPPED, WASHED, TRACKED, SPILLED OR OTHERWISE DISCHARGED FROM A PROJECT TO OFFSITE STREETS, OTHER PAVED AREAS, SIDEWALKS OR THE MS4 SHALL BE CLEANED USING DRY METHODS SUCH AS SWEEPING OR VACUUMING.
 - D) WASHING POLLUTANTS AND MATERIALS THAT ARE DISCHARGED FROM THE PROJECT SITE TO THE MS4 INTO DRAIN INLETS OR CATCH BASINS IS PROHIBITED UNLESS THE MATERIAL IS SEDIMENT AND THE INLETS ARE DIRECTED TO A SEDIMENT BASIN OR SEDIMENT TRAP.
10. SLOPE PROTECTION IS REQUIRED ON AREAS WITH SLOPES GREATER THAN 15% AND ON AREAS OF MODERATE SLOPE THAT ARE PRONE TO EROSION UNLESS THEY ARE BEING ACTIVELY WORKED. USE DIVERSION UPSTREAM OF SLOPE (DIKES, SWALES, SLOPE DRAINS) TO DIVERT WATER AROUND THE SLOPE. PROVIDE A 10-FT BUFFER ZONE AT THE TOE OF SLOPE. ONLY 5 ACRES MAY BE DISTURBED AT ANYTIME ON SLOPES GREATER THAN 15%.
11. BEST MANAGEMENT PRACTICES (BMPS) SHALL NOT BE REMOVED UNTIL FINAL STABILIZATION IS COMPLETE FOR THAT PHASE.
12. REFER TO CITY & COUNTY OF HONOLULU BEST MANAGEMENT PRACTICES MANUAL – CONSTRUCTION, FOR MORE INFORMATION ON BMPS.
13. A PERSON RESPONSIBLE FOR IMPLEMENTING THE ESCP AT THE PROJECT SITE ("ESCP COORDINATOR") MUST BE DESIGNATED PRIOR TO PERMIT ISSUANCE USING THE FORM PROVIDED IN APPENDIX A TO THE RULES RELATING TO WATER QUALITY.
14. A BRIEF EXPLANATION OF WHY THE OMITTED BMP IS UNNECESSARY AND IMPRACTICABLE FOR THE PROJECT HAS BEEN PROVIDED UNDER SEPARATE DOCUMENTATION TO DPP. AS CONSTRUCTION PROGRESSES, REVISIONS MAY BE NECESSARY AND SHALL BE PROVIDED TO DPP INSPECTORS BY THE CONTRACTOR.
 - A) SEDIMENT BARRIERS
15. CONTRACTOR SHALL COMPLY WITH THE PROJECT SCHEDULE REQUIREMENTS OF THE CITY'S RULES RELATING TO WATER QUALITY AND IS TO SUBMIT THE SCHEDULED START DATE TWO WEEKS PRIOR.

LIST OF BMPS:

PRE CONSTRUCTION:

1. STABILIZED CONSTRUCTION INGRESS/EGRESS
2. FILTER SOCK PERIMETER CONTROL

DURING CONSTRUCTION:

1. RELOCATE, RECONSTRUCT AND MAINTAIN BMPS AS NEEDED TO KEEP THEM EFFECTIVE AT ALL TIMES.
2. PROCEED WITH CONSTRUCTION WITH LEAST POSSIBLE DISTURBANCE OF VEGETATIVE AREAS AND STRUCTURES.
3. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
4. INSPECTIONS SHALL BE PERFORMED WEEKLY.
5. RECONSTRUCT WALL(S) AND REINSTALL LANDSCAPING AS REQUIRED TO MATCH EXISTING CONDITIONS OR BETTER.
6. TEMPORARY STABILIZATION.

POST-CONSTRUCTION

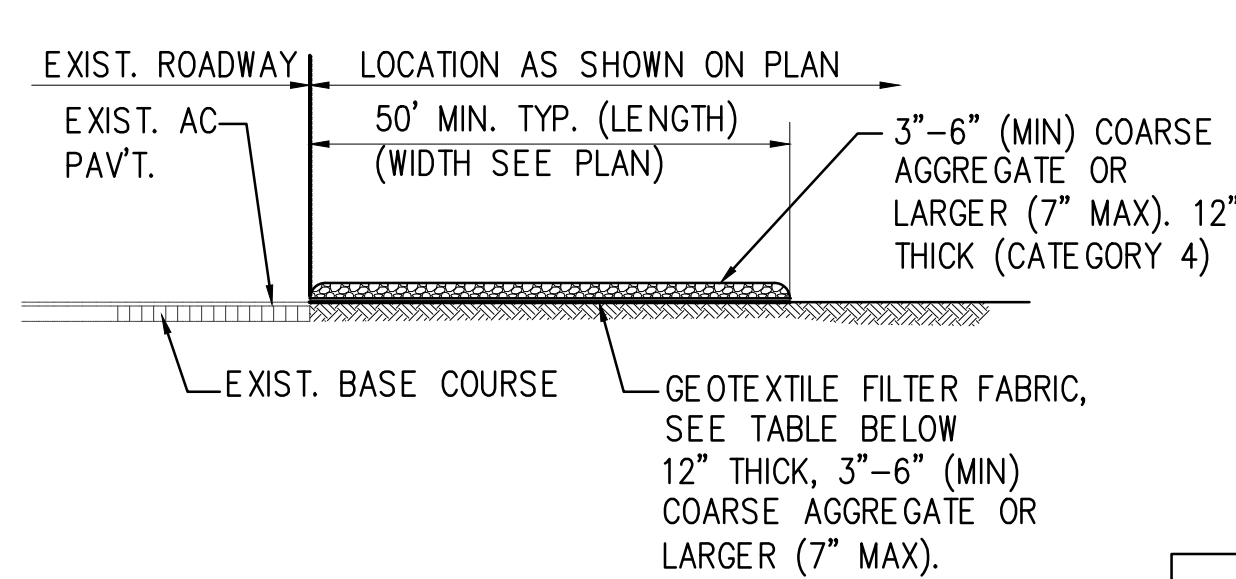
1. PERMANENT STABILIZATION

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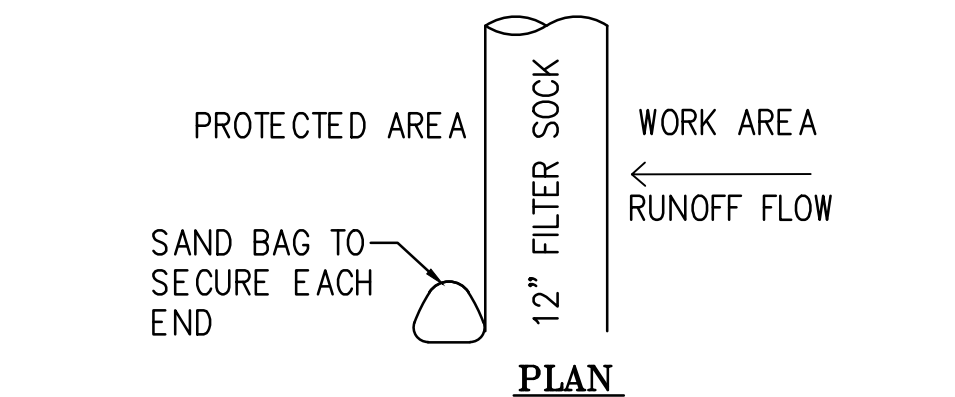
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

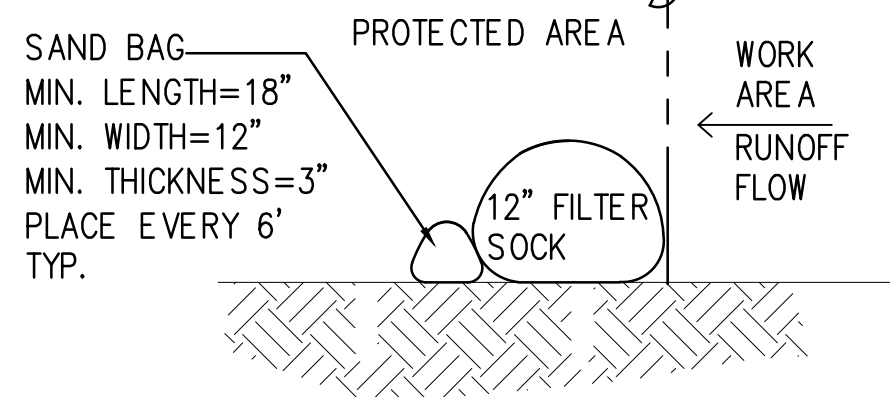
C017



SECTION



PLAN



SECTION

BIO/FILTER SOCK DETAILS

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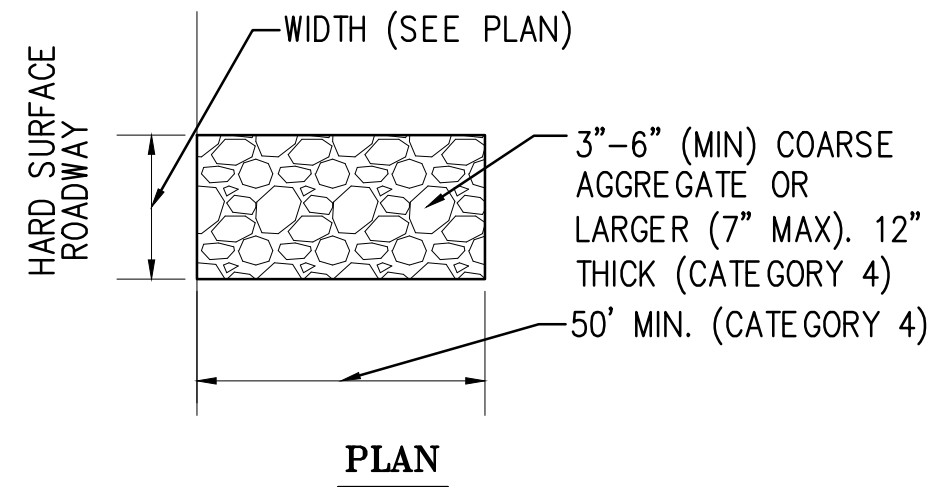
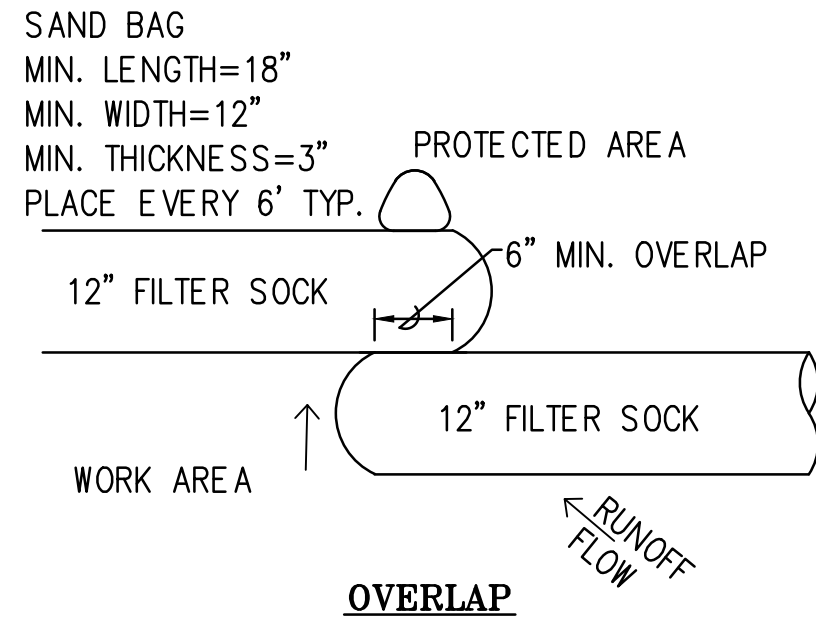


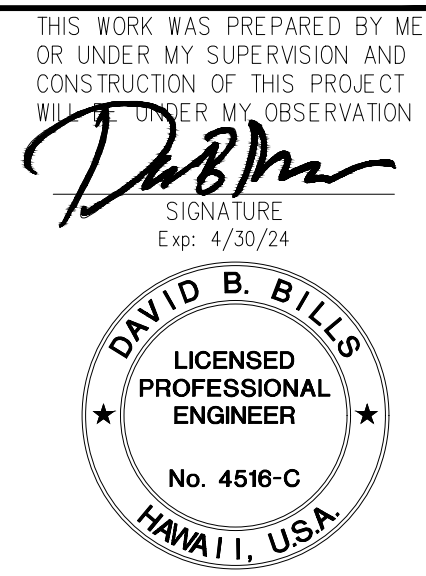
TABLE A GEOTEXTILE REQUIREMENTS	
PHYSICAL PROPERTY	REQUIREMENTS
GRAB TENSILE STRENGTH	220 LB (ASTM D1682)
ELONGATION FAILURE	60% (ASTM D1682)
MULLEN BURST STRENGTH	430 LB (ASTM D3768)
PUNCTURE STRENGTH	125 LB (ASTM D751, MODIFIED)
EQUIVALENT OPENING	SIZE 40-80 (U.S. STD SIEVE, CW-02215)

CONSTRUCTION INGRESS/EGRESS DETAILS

NOT TO SCALE



OVERLAP



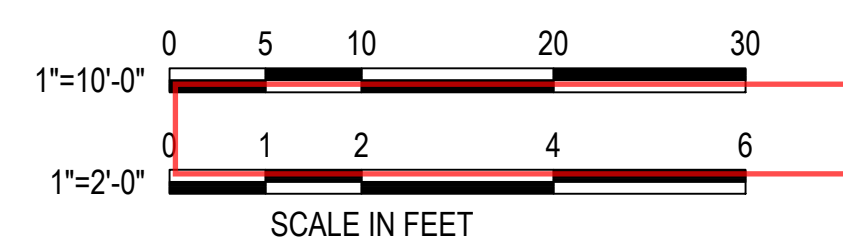
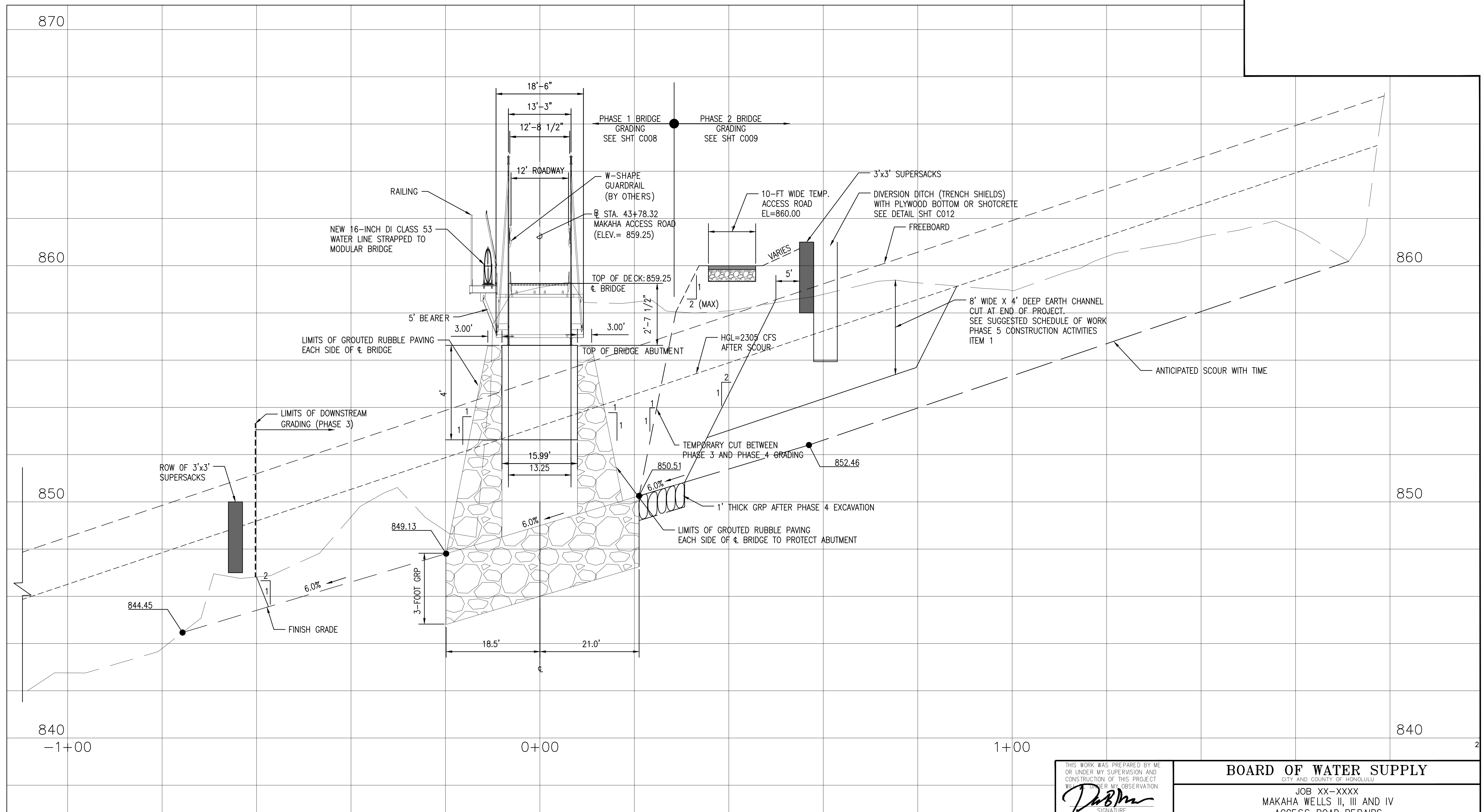
BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

EROSION SEDIMENT CONTROL PLAN
NOTES AND DETAILS

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FIELD BOOK NO: _____		SCALE: AS INDICATED		SHEET 21 OF 50 SHEETS	
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EXTENDED STREAM SECTION
SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE _____

C018

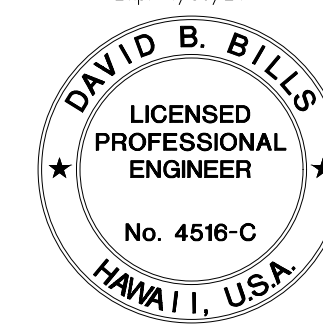
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OR UNDER MY SUPERVISION AND
CONSTRUCTION OF THIS PROJECT
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[Signature]

SIGNATURE

Exp: 4/30/24



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

EXTENDED STREAM SECTION AT CENTERLINE
OF STREAM WITH ACROW BRIDGE

APPROVED: _____			DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS				
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CONSTRUCTION NOTES FOR GABION STRUCTURES

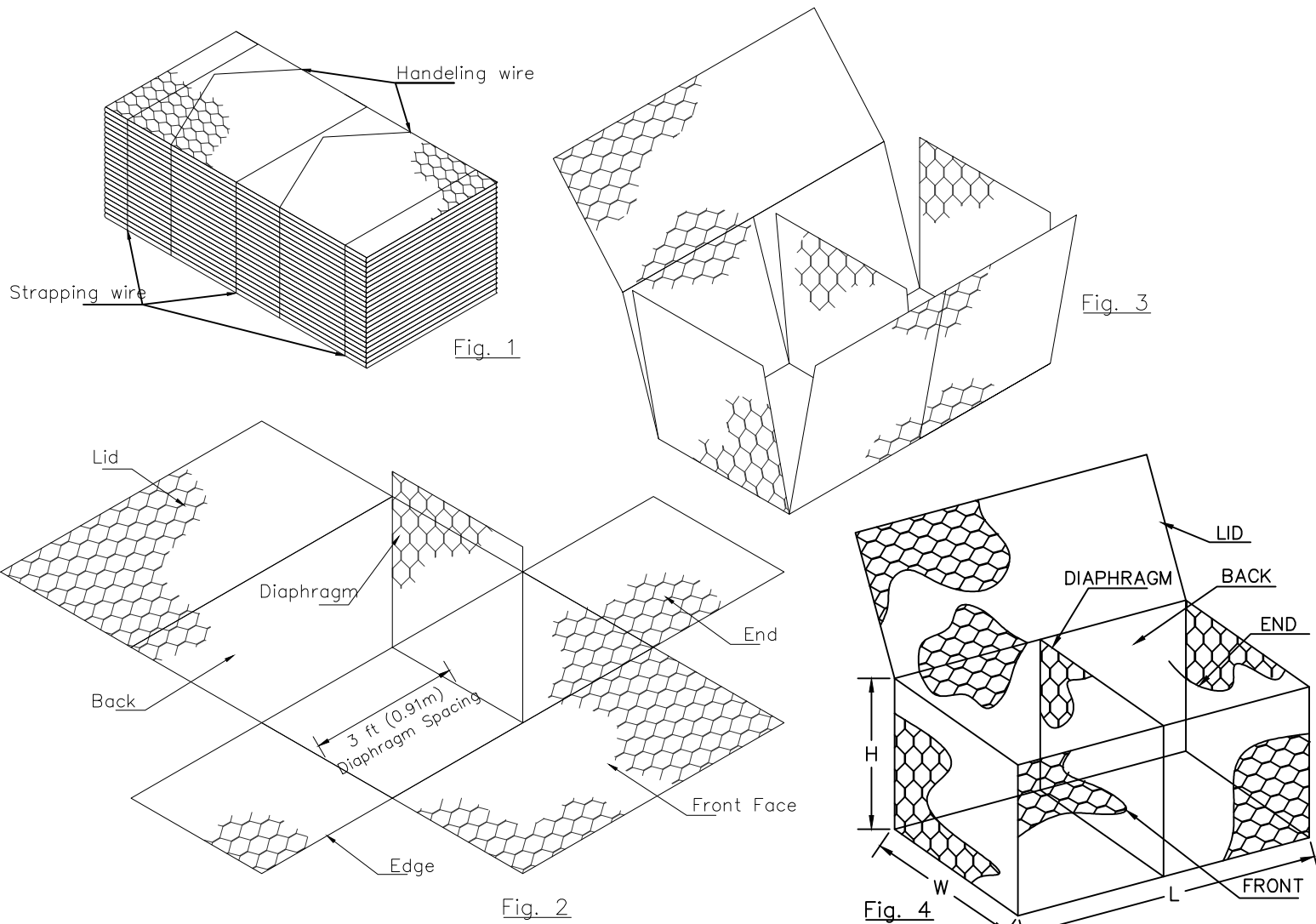
1. Product description
- 1.1. Gabions are baskets manufactured from 1 layer of 8x10 double twisted hexagonal woven steel wire mesh, as per ASTM A975-97 (Figs. 1 – 4). An additional layer of mesh shall be fastened onto the exposed face(s) of each gabion, gabions are filled with stones at the project site to form flexible, permeable, monolithic structures such as retaining walls, channel linings, and weirs for erosion control projects. Galvanized steel wire is used in the manufacture of the gabion. The standard specifications for mesh-wire are shown in Table 2. The gabion is divided into cells by diaphragms positioned at approximately 3 ft (0.9 m) centers (Fig. 2). To reinforce the structure, all mesh panel edges are selvaged with a wire having a greater diameter (Table 3). Dimensions and sizes of Polymer coated gabions are shown in Table 1. Gabions shall be manufactured and shipped with all components mechanically connected at the production facility.
2. Materials
- 2.1. Backfill material specified below shall be free draining and shall meet the physical properties requirements defined in Section 7.1, and shall be clean, free draining crushed stone.
- 2.2. Cobbles material shall be a clean crushed stone or granular fill meeting the following gradation per ASTM D 422:

Table 0 Rock Sizing for Gabions	
Sieve Size	Percent Passing
8"	100%
4"	0 to 5%

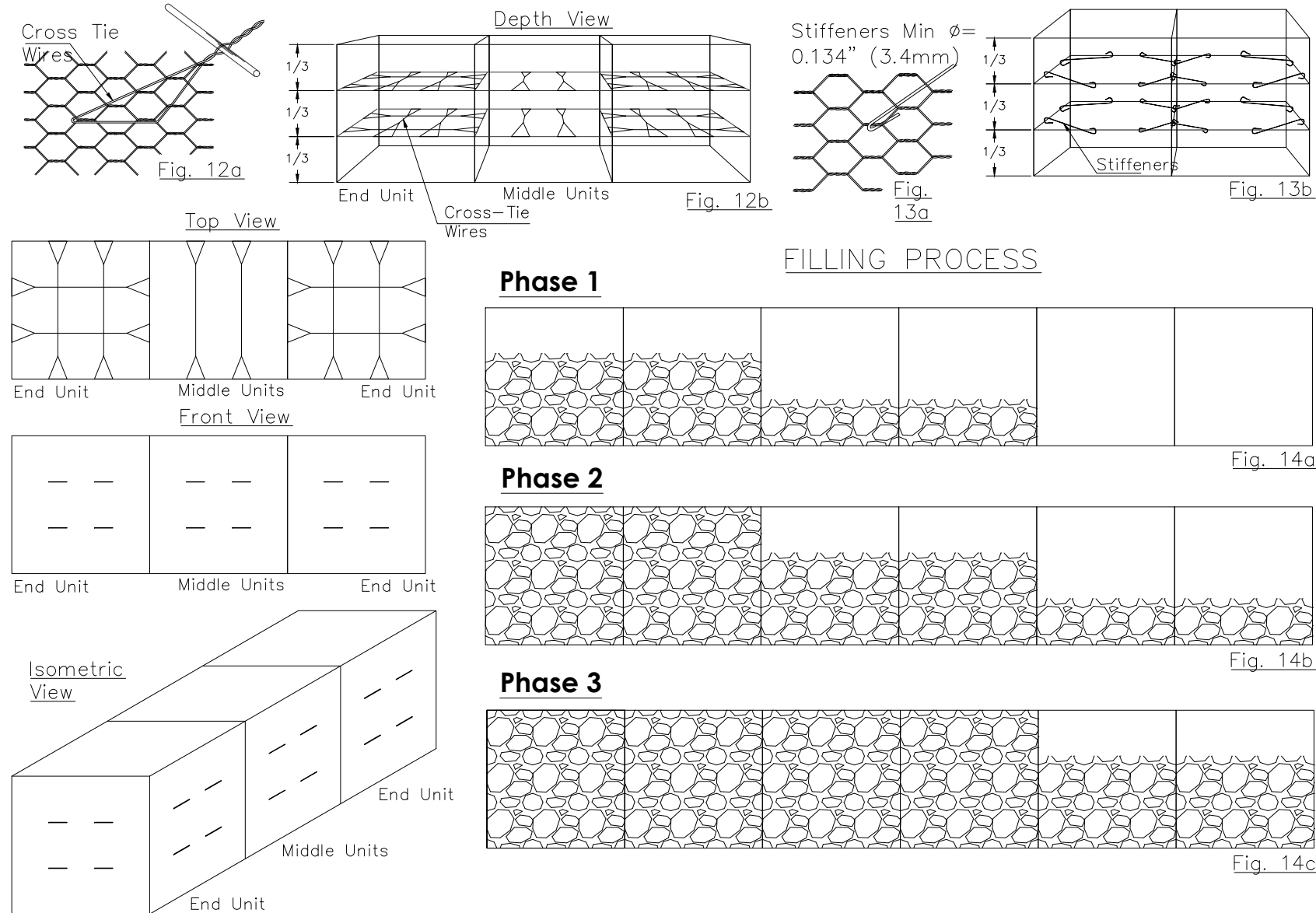
UNPACKING & ASSEMBLY PROCESS

Gabions are delivered to the job site in bundles. They are compressed and strapped in the factory for easier shipping and handling.

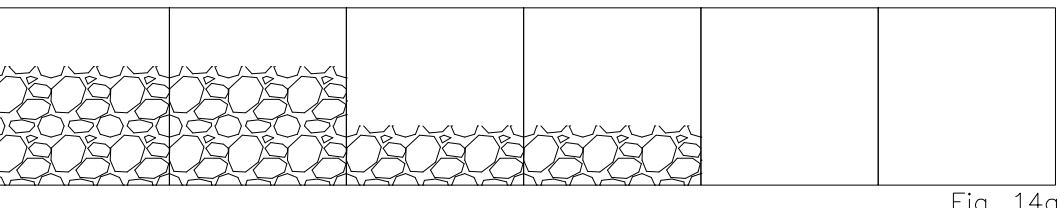
- Open and unfold the gabions one by one on a flat, hard surface. Eliminate all folds due to the packaging.
- Pull up the sides and the diaphragms to form an open box. Be sure the top of the face and the side are at the same level.
- Fold by hand the end of the reinforcing wire of the main unit and the diaphragms allowing the gabion to stand by itself.



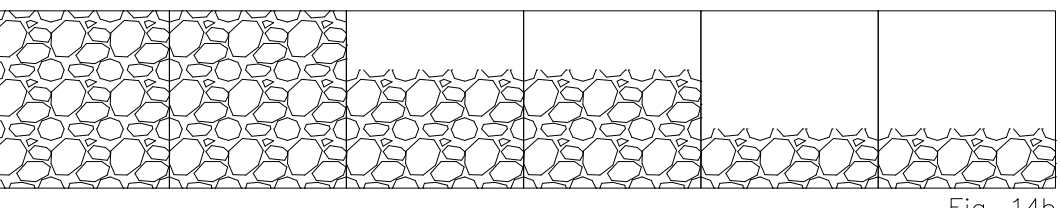
REINFORCING DETAIL



Phase 1



Phase 2



Phase 3

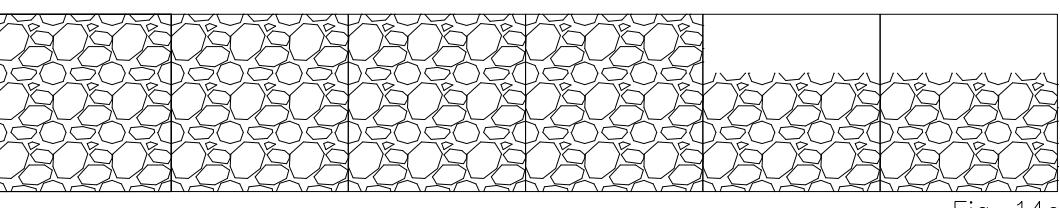
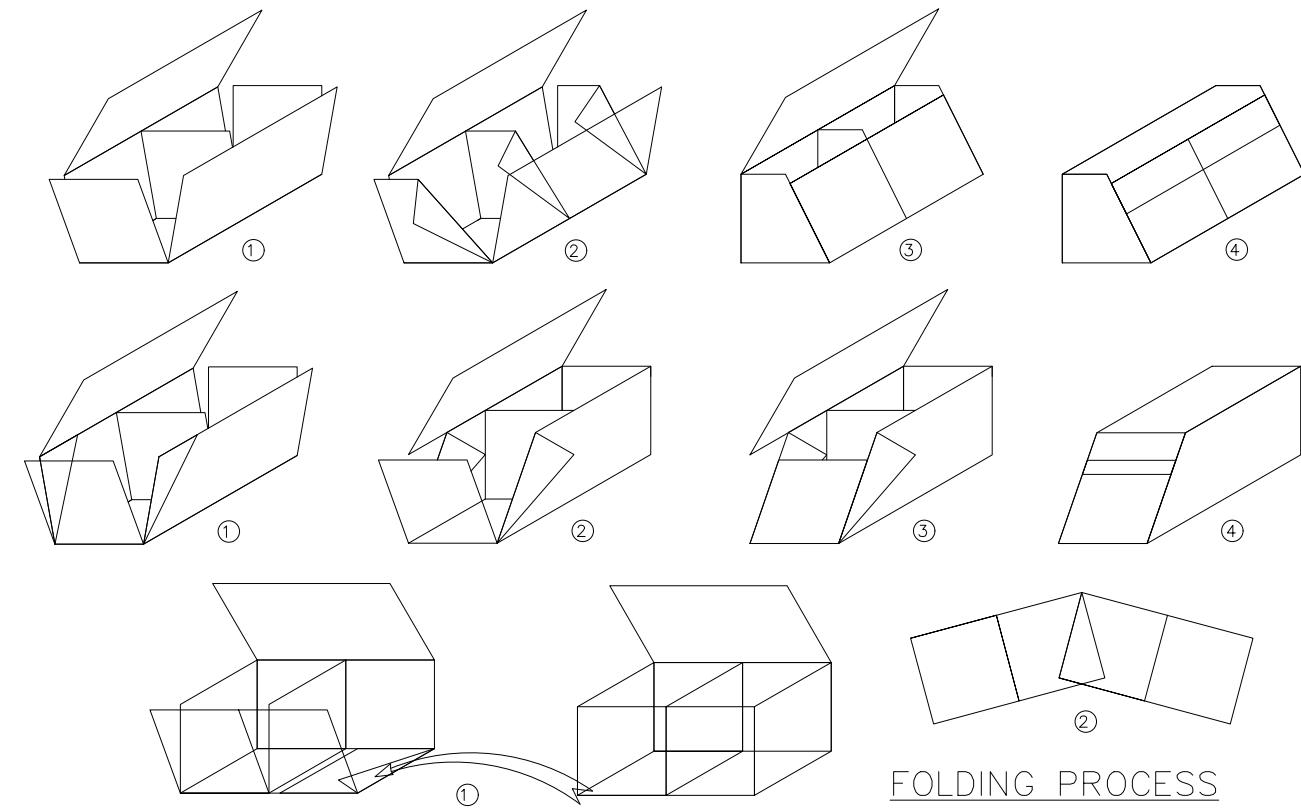


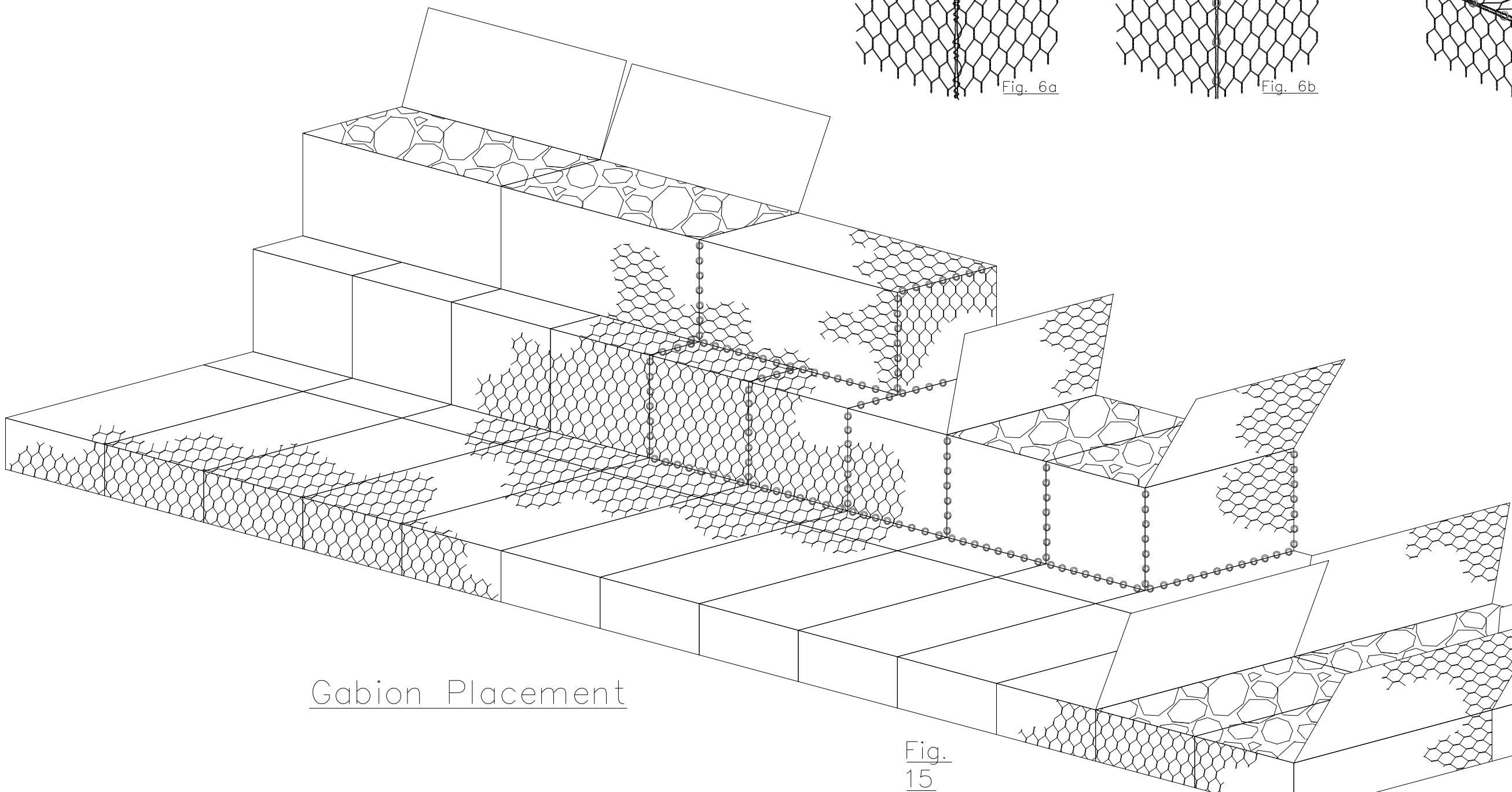
Table 1 Sizes for Gabions			
L=Length ft (m)	W=Width ft (m)	H=Height ft (m)	# of Cells
6 (1.8)	3 (0.9)	3 (0.9)	2
9 (2.7)	3 (0.9)	3 (0.9)	3
12 (3.6)	3 (0.9)	3 (0.9)	4
6 (1.8)	3 (0.9)	1.5 (0.45)	2
9 (2.7)	3 (0.9)	1.5 (0.45)	3
12 (3.6)	3 (0.9)	1.5 (0.45)	4
6 (1.8)	3 (0.9)	1 (0.3)	2
9 (2.7)	3 (0.9)	1 (0.3)	3
12 (3.6)	3 (0.9)	1 (0.3)	4
4.5 (1.4)	3 (0.9)	3 (0.9)	1

Table 2 Standard Mesh Wire			
Type	"D" in (mm)	Tolerance	Wire Dia. in (mm)
8x10/Polymer Coated Galvanized steel	3.25 (83)	±10%	0.106 (2.70)

Table 3 Standard Wire Diameters			
	Lacing Wire	Mesh Wire	Selvage Wire / Preformed Stiffeners
Wire Diameter Int. Ø in (mm)	0.087 (2.20)	0.106 (2.70)	0.134 (3.4)
Wire Tolerance (±) ø in (mm)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)

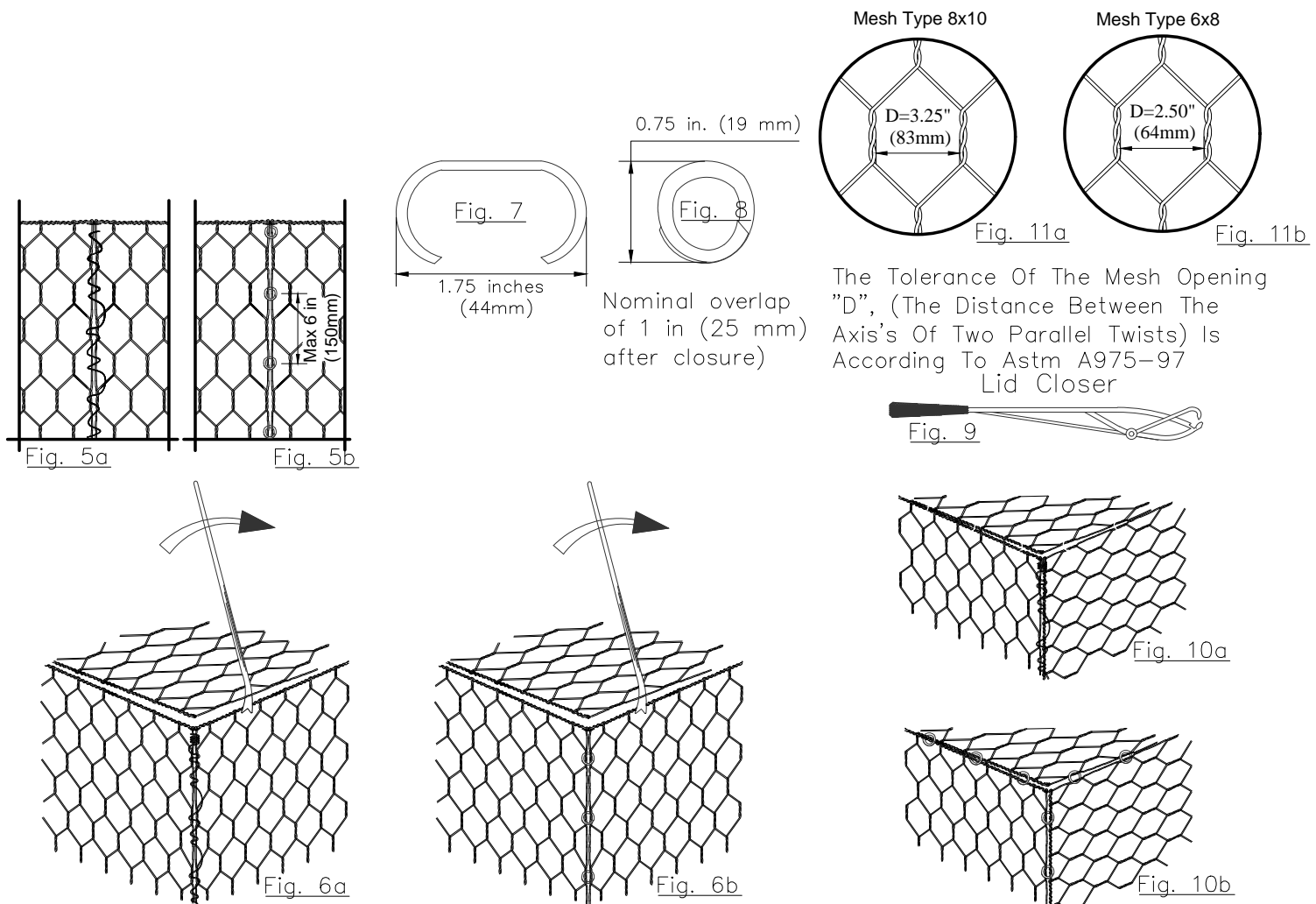


FOLDING PROCESS

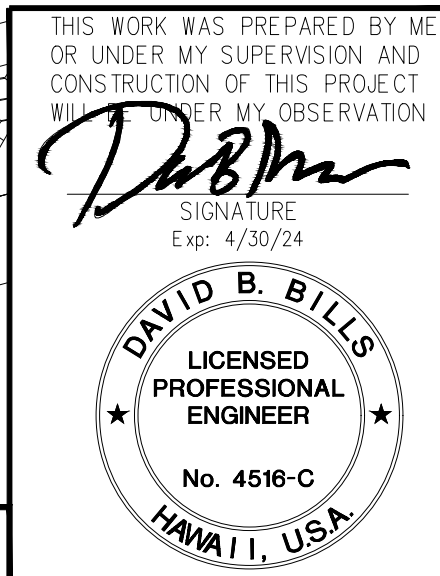


Gabion Placement

- 2.3. Wire -- All tests on wire must be performed prior to manufacturing the mesh. All wire shall comply with ASTM A580/580M. Type 304CU or 316L, condition A annealed. Wire used for the manufacture of gabions and the lacing wire, shall have a minimum tensile strength of 70,000 psi (480 mpa) as per ASTM A580/A580M, Table 2.
- 2.4. Woven wire mesh Type 8x10 -- The mesh and wire characteristics shall be in accordance with ASTM A975-97 Table 1. mesh type 8x10. The nominal mesh opening d = 3.25 in. (83 mm) (Fig. 11a & 11b) . The minimum mesh properties for strength and flexibility shall be in accordance with the following:
Mesh tensile strength shall be 4800 lb/ft (70 KN/m) minimum when tested in accordance with ASTM A975-97.
Connection to selvages shall be 2740 lb/ft (40 kn/m) when tested in accordance with ASTM A975-97.
3. FOUNDATION PREPARATION
- 3.1. The foundation on which the gabions are to be placed shall be level, and graded to the elevations as shown on the project construction drawings. The foundation for gabions shall be level, smooth, and free of surface irregularities, loose material, and vegetation, in accordance with the project specifications. Appropriate measures shall be taken for filtering and drainage of the foundation, as per the project specifications (filter cloth, drain works, etc.). Geotextiles required to be installed behind gabion structures shall comply with the requirements for subsurface drainage applications.
4. Closing process
Edges are joined together, using the appropriate lacing techniques.
Manual: Continuous wire looped tightly around every other mesh opening, alternating single and double loops (Fig. 5a).
Mechanical: Using a pneumatic or hand power tool, employing stainless steel "C" shaped fasteners. For continuity and strength, the recommended spacing is 6-inches, max 150mm (Fig 5b).



5. CONSTRUCTION
- 5.1. Assembly -- Open and unfold each gabion on a flat, hard surface and remove any shipping folds if necessary. This can be done by placing the fold over a 2" x 4" board and walking along the sides. Lift up the sides, ends and diaphragms into a vertical position to form an open box shape (Fig. 3). Gabion units are assembled and connected to one another using lacing wire specified in Table 3 and described in Fig. 5. Preformed stiffeners or lacing wire can be used as internal connecting wires when a structure requires more than one layer of gabions to be stacked on top of each other. Internal connecting wires with lacing wire shall connect the exposed face of a cell to the opposite side of the cell. Internal connecting preformed stiffeners shall connect the exposed face of a cell to the adjacent side of the cell. Preformed stiffeners are installed at 45' to the face/side of the unit, extending an equal distance along each side to be braced (approximately 1 ft. (300 mm)). An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed. Stainless steel ring fasteners can be used instead of, or to complement, the lacing wire (Fig. 7 & 8).
- 5.2. Fastening procedure -- When using lacing wire, cut off a piece of wire approximately 1.5 times the length of the edge to be tied. Longer edges shall be joined by several lengths of wire. Tie wires shall be secured around the selvage wire or heavier edge wire, where present, by looping and twisting the lacing wire around itself. Proceed tying with alternate double and single loops. Double loops shall be made at intervals not greater than 6 in. (150 mm). Pull baskets tightly together during the tying operation. The other end of the tie wire shall be secured by again looping and twisting the wire around itself. When steel ring fasteners are used, the use of either a mechanical or a pneumatic fastening tool is required. Spacing of the rings shall be in accordance with ASTM A975-97, Table 2 minimum strength requirements of mesh and connections. In any case, ring fasteners spacing shall not exceed 6 in. (150 mm). Rings shall be installed at the end and center diaphragms and along all edges. Care shall be taken to ensure the steel ring fastener is completely closed after installation.
- 5.3. Installation and filling -- Gabions shall be connected together and aligned before filling the baskets with rock. Rocks for gabions may be produced by any suitable quarrying method, and by the use of any device that yields the required sizes within the gradation limits chosen. Rocks shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. Gabion rocks shall range between 4-8 in. (100-200 mm) & have a D50 of 6-in. The range in sizes may allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the gabion's exposed surface. In all cases, the oversize rock shall not be larger than 10 in. (250 mm), and the undersize rock shall not be smaller than 2 in. (50 mm). During the filling operation some manual stone placement is required to minimize voids. The exposed faces of vertical structures may be carefully hand placed to give a neat, flat, and compact appearance. The cells shall be filled in stages so that local deformation may be avoided. That is, at no time, shall any cell be filled to a depth exceeding 1 ft (300 mm) higher than the adjoining cell (Fig. 14a - 14c). Stiffeners or cross ties shall be installed as indicated Figs. 12a & 12b, 13a & 13b, fixed at 1/3 and 2/3 of the height for 3 ft or 1m gabions as the cell is filled. In 1.5 ft (500 mm) high units stiffeners may be fixed at the half height level, if required. Preformed corner stiffeners are installed at 45' to the face/side of the unit, extending an equal distance along each side being braced (approximately 1 ft [300 mm]). When more than one layer of gabions is required, in order for the individual units to become incorporated into one continuous structure, the next layer of gabions must be connected to the layer underneath after this layer has been securely closed (Fig. 15).
- 5.4. Closing -- To allow for settlement, level off the fill 1-1.5 in. (25-40 mm) above the top of the mesh. Fold the lid down and pull the edges of the panels to be connected using an appropriate tool such as a lid closer (Fig. 9). The lids shall be tightly laced along all edges, ends and diaphragms in the same manner as described for assembling units (Figs. 6a & 6b, 10a & 10b). Adjacent lids may be securely attached simultaneously. All end wires shall then be turned in to avoid protrusions.
- 5.5. Testing methods -- Testing methods and frequency, and verification of material specifications and compaction shall be the responsibility of the City's Geotechnical engineer, under the direction of the Officer-in-Charge. The shear strength testing of reinforced backfill shall be required for every 1000 cubic yards placed or if the nature of backfill soil visually changes.
6. TECHNICAL REQUIREMENTS
- 6.1. The contractor shall have an approved set of construction drawings and contract specifications on-site at all times during construction of the gabion wall structure.
- 6.2. Gabion shall be placed at the locations and elevations shown on the project drawing sheets.
- 6.3. Tracked construction equipment shall not be operated directly on the gabion wall. A minimum fill thickness of 6 in. (150mm) is required for operation of tracked vehicles over the gabion wall. Turning of tracked vehicles shall be kept to a minimum to prevent displacing the fill and / or the gabion wall.
7. Drainage
- 7.1. The backfill surface shall be graded away from the wall face a minimum of 2 percent slope and a temporary soil berm shall be constructed near the wall crest to prevent surface and water runoff from overtopping the wall. Grading shall be performed at the end of each work day.
- 7.2. At the end of each work day, backfill surface shall be compacted with a smooth wheel roller to minimize ponding of water and saturation of the backfill.



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

GABION DETAILS

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO:
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 23	OF 50 SHEETS
FILE	POCKET	FOLDER	NO.

TYPICAL GABION DETAILS

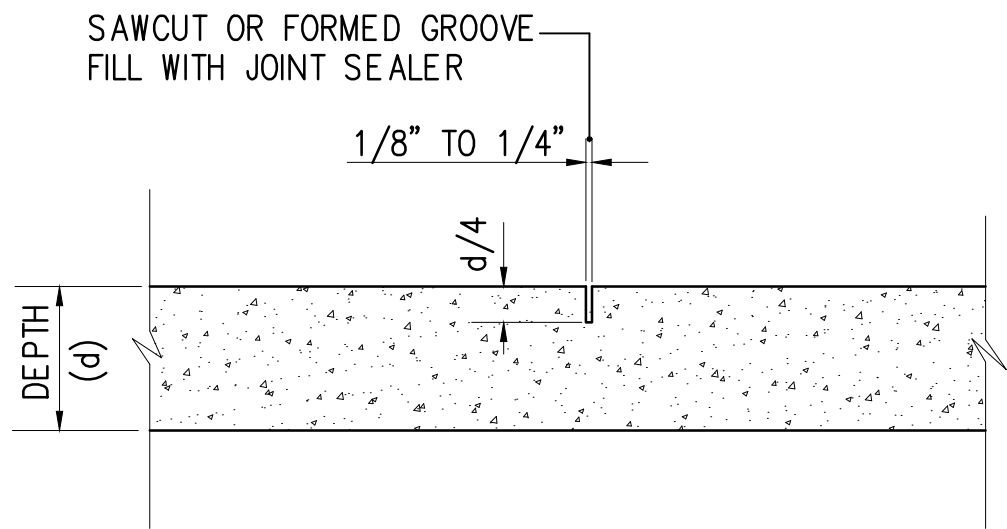
NOT TO SCALE

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C019

Thu, 14 Sep 2023 - 10:39am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C020 SIGN POST, TYP PAVT AND GEOTERRA DETAILS.dwg



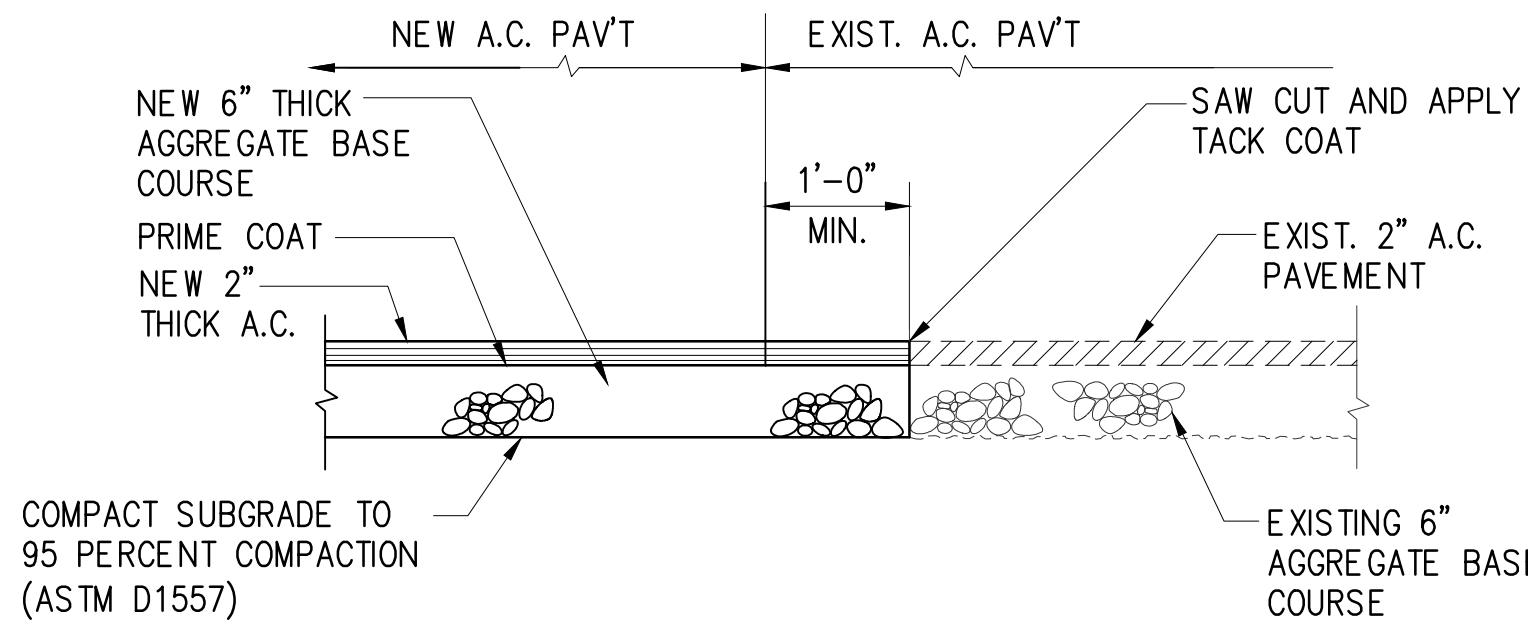
TRANSVERSE CONTRACTION JOINT
SCALE : 1 1/2" = 1'-0"

CONCRETE PAVEMENT AND JOINT NOTES:

1. ALL CONCRETE SHALL BE DWS 2500
2. CONTRACTION JOINTS SHALL BE PROVIDED AT 12-FOOT INTERVAL
3. COLD JOINTS BETWEEN CONCRETE POURS SHALL BE USED FOR POURS THAT ARE NOT CONTINUOUS. REBAR SHALL BE PAINTED AND GREASED

CONCRETE PAVEMENT JOINT DETAILS

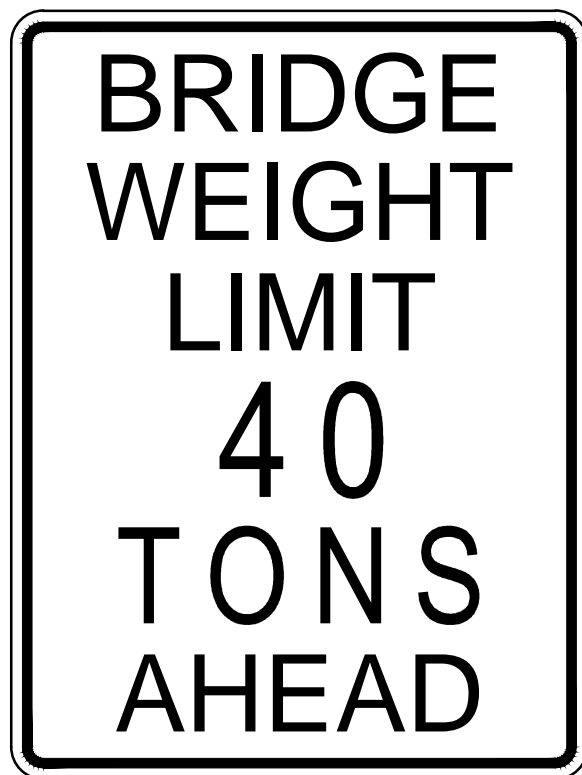
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AC PAVEMENT CONNECTION DETAIL

SCALE: 3/4"=1'-0"

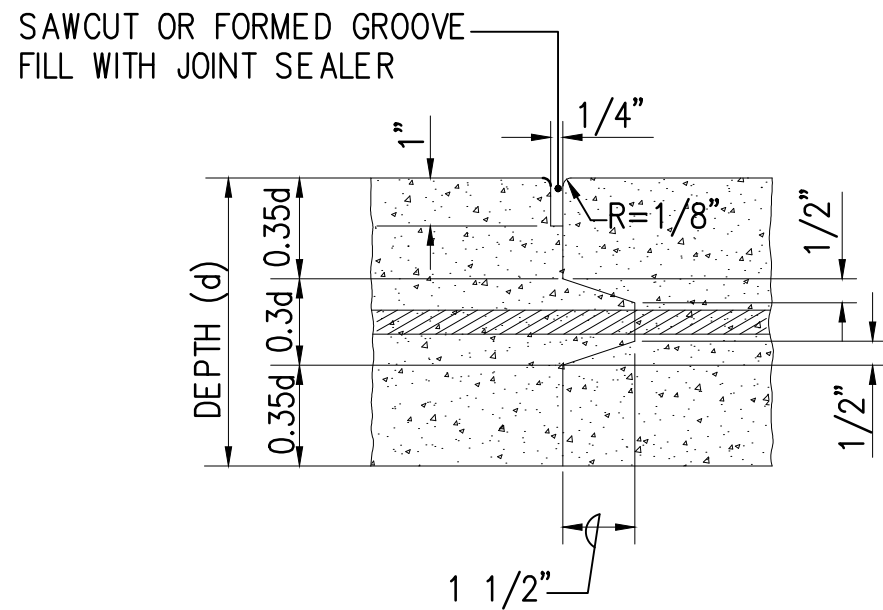
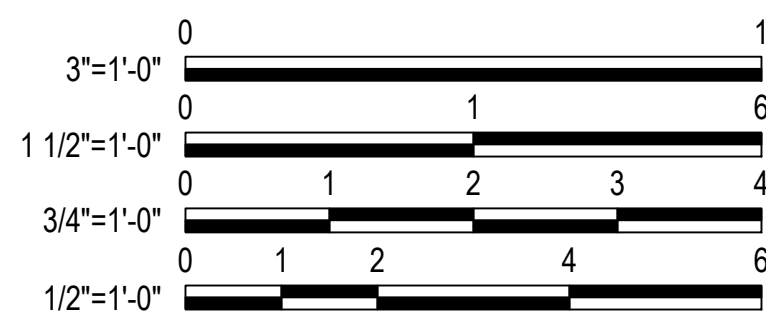
(FOR CONCRETE PAVEMENT REPAIR SEE SHT E106 NOTE 5)



R12-V6 SIGN INSTALLED ON SIGN POST

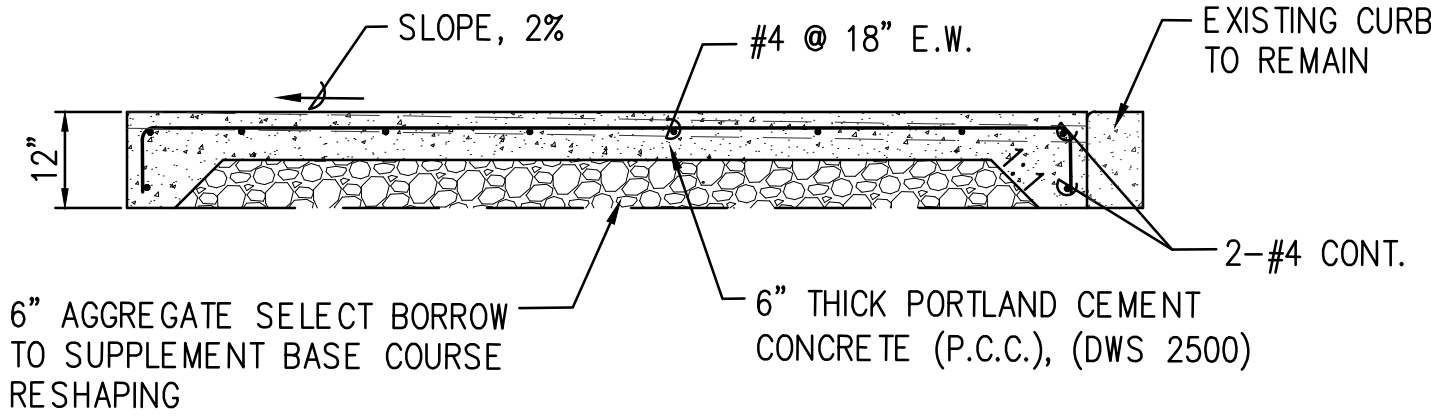
NOT TO SCALE

NOTE: PLACE VEHICLE WEIGHT SIGN AT SECOND ACCESS GATE AT BEGINNING OF BWS ACCESS ROAD (SEE SHT T001 LOCATION MAP)



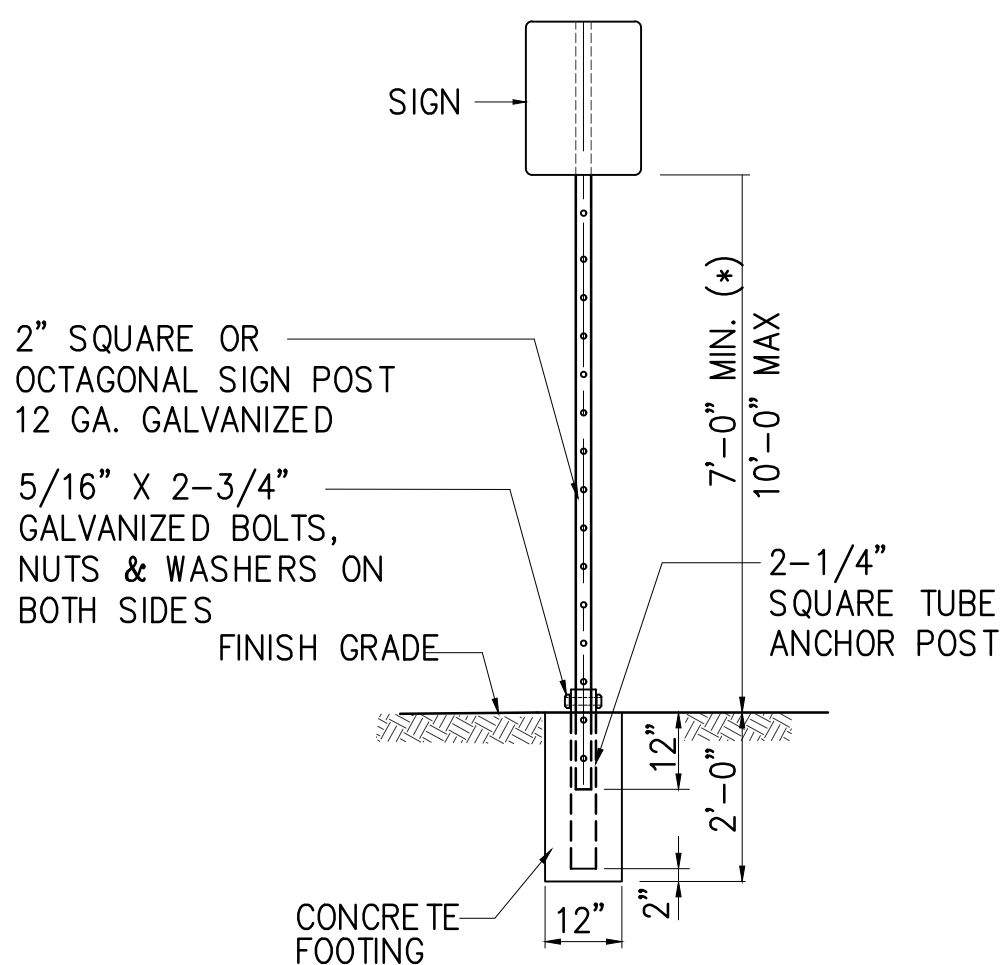
COLD JOINT BETWEEN CONCRETE PADS

SCALE: 3" = 1'-0"



CONCRETE REPAIR DETAIL

SCALE: 1/2" = 1'-0"



ANCHOR POSTS NOTES:

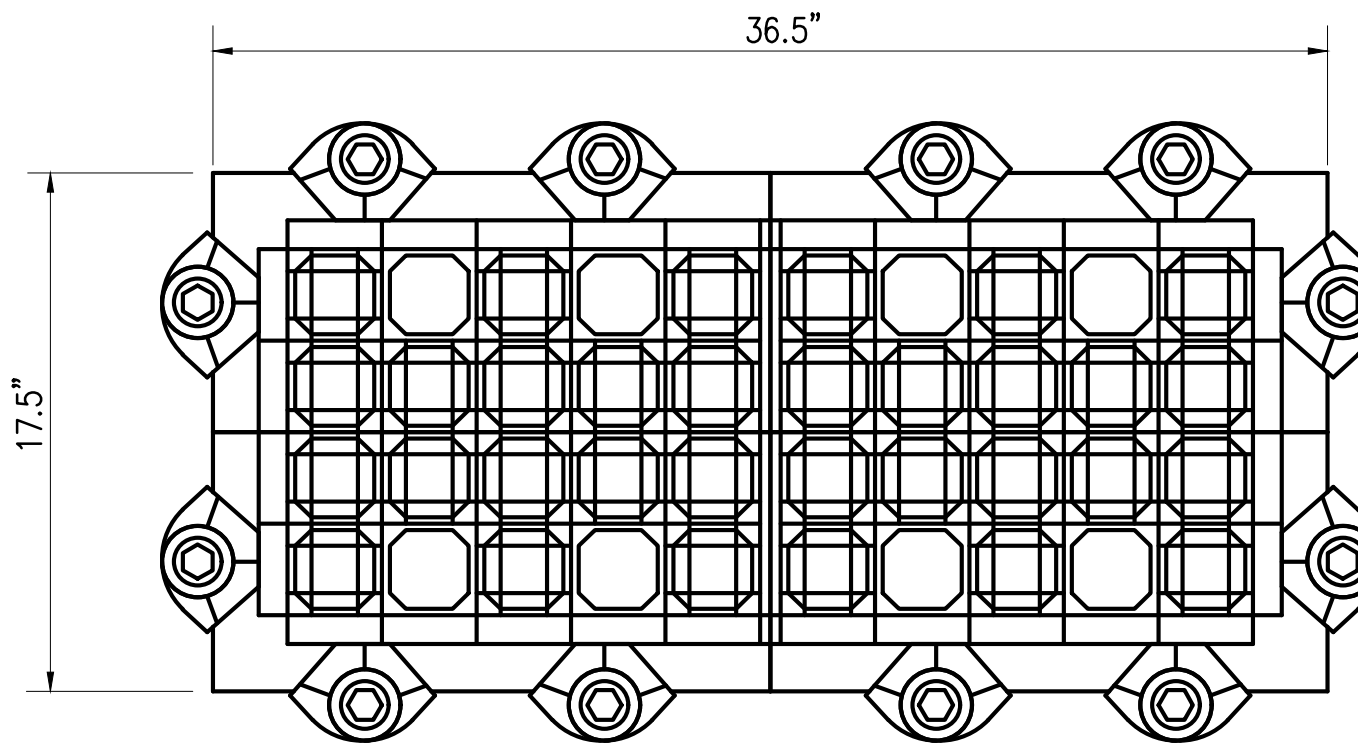
1. KEEP INSIDE OF 2-1/4" ANCHOR POST FREE FROM IMPEDIMENTS THAT MAY PREVENT PROPER SEATING OF 2" SIGN POST.
2. SQUARE TUBING SIGN POST SHALL BE TELESCOPING TYPE WITH 7/16" DIA. HOLES AT 1" O.C. ON FOUR SIDES.
3. OCTAGON SIGN POST SHALL BE TELESCOPING TYPE WITH 7/16" DIA. HOLES AT 1" O.C. ON TWO SIDES.
4. USE 5/16" X 2-3/4" BOLTS TO SECURE THE OCTAGONAL AND SQUARE TUBING POST ONTO THE 2-1/4" SQUARE TUBE ANCHOR POST.

INSTALLATION OF NEW
SIGN POST W/ CONCRETE FOOTING

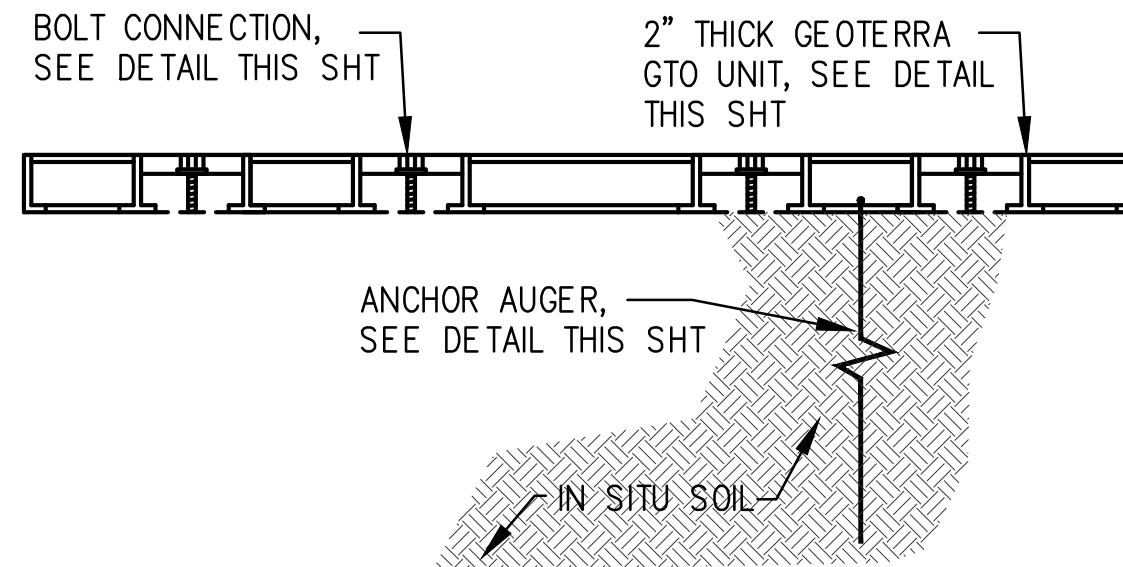
SCALE: 1/2"=1'-0"

GEOTERRA GTO INSTALLATION INSTRUCTIONS:

1. POLYMER BOLTS CONNECT AND SECURE INDIVIDUAL ADJOINING GEOTERRA GTO UNITS TO FORM THE GEOTERRA GTO MAT SYSTEM. BOLT CONNECTOR AND BOLT AND TAB CONNECTION DETAILS SHOWN ON THIS SHEET.
2. A TOTAL OF TWELVE CONNECTION UNITS ARE PROVIDED ON EACH GEOTERRA GTO UNIT. FOUR TABS EXIST ON THE LONG SIDE OF THE GEOTERRA GTO UNIT AND TWO TABS ON THE SHORT SIDE.
3. EACH GEOTERRA GTO UNIT CONTAINS INTEGRAL NUTS FOR SECURING CONNECTOR BOLTS. BOLTS SHOULD BE PLACED AND SECURED IN ALL LOCATIONS.
4. BOLTS CAN BE INSTALLED WITH MANUAL TORSIONS TOOL OR WITH A POWER DRILL DRIVER TOOL.
5. BOLTS CAN BE EASILY REMOVED AND THE GEOTERRA GTO MAT SYSTEM CAN BE DISASSEMBLED FOR REMOVAL, STORAGE AND REUSE.
6. PROVIDE A HIGH STRENGTH WOVEN GEOTEXTILE WITH A MINIMUM WIDE-TENSILE STRENGTH OF 4800 LBS/FT (70 kN x 70 kN/m) ULTIMATE ELONGATION (ASTM D 4596), AND A MAXIMUM APPARENT OPENING OF 30 US SIEVE (ASTM D 4751). THE HIGH STRENGTH WOVEN TEXTILE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS INCLUDING OVERLAP.
7. AUGER ANCHORS FOR USE WITH HEAVY LOADING INSTALLATIONS TO CONTROL SURFACE DEFORMATIONS AND STABILIZE THE SURFACE SHALL BE USED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

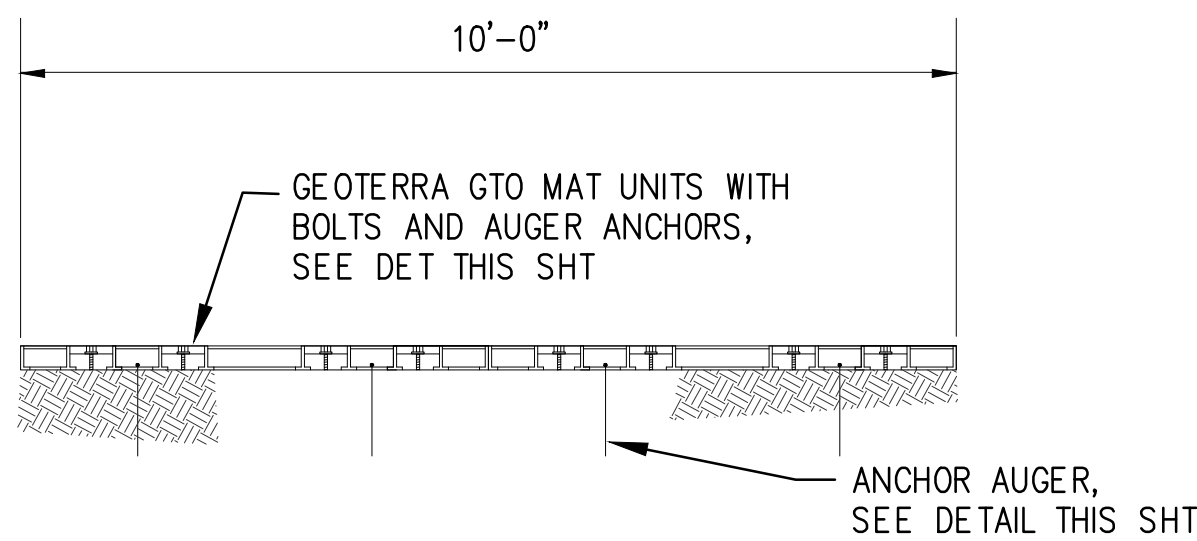


PLAN



SECTION

GEOTERRA® GTO DETAILS
NOT TO SCALE



GEOTERRA GTO TEMPORARY ACCESS ROAD

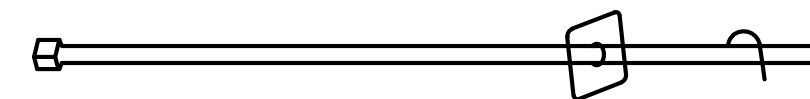
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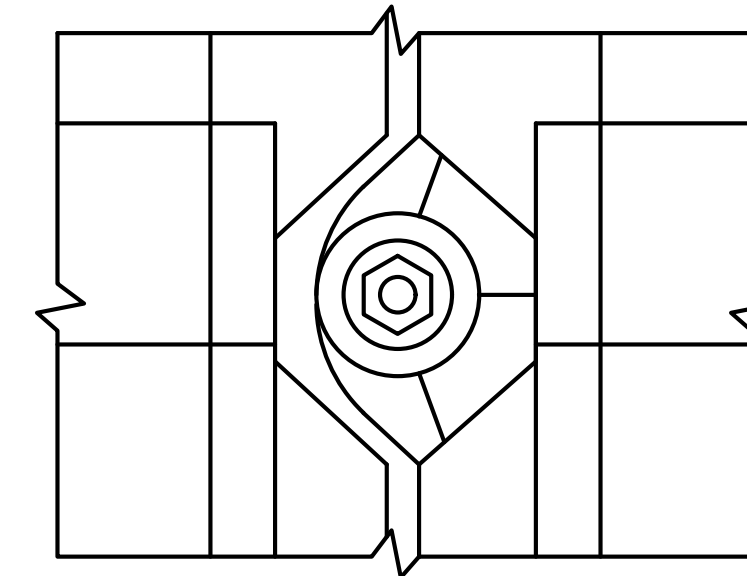
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

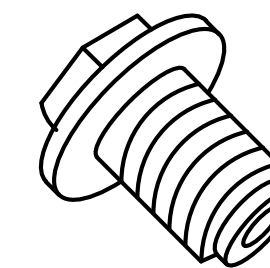
C020



AUGER ANCHOR



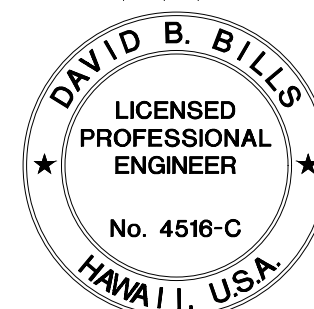
BOLT AND TAB CONNECTION



BOLT CONNECTOR

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SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY

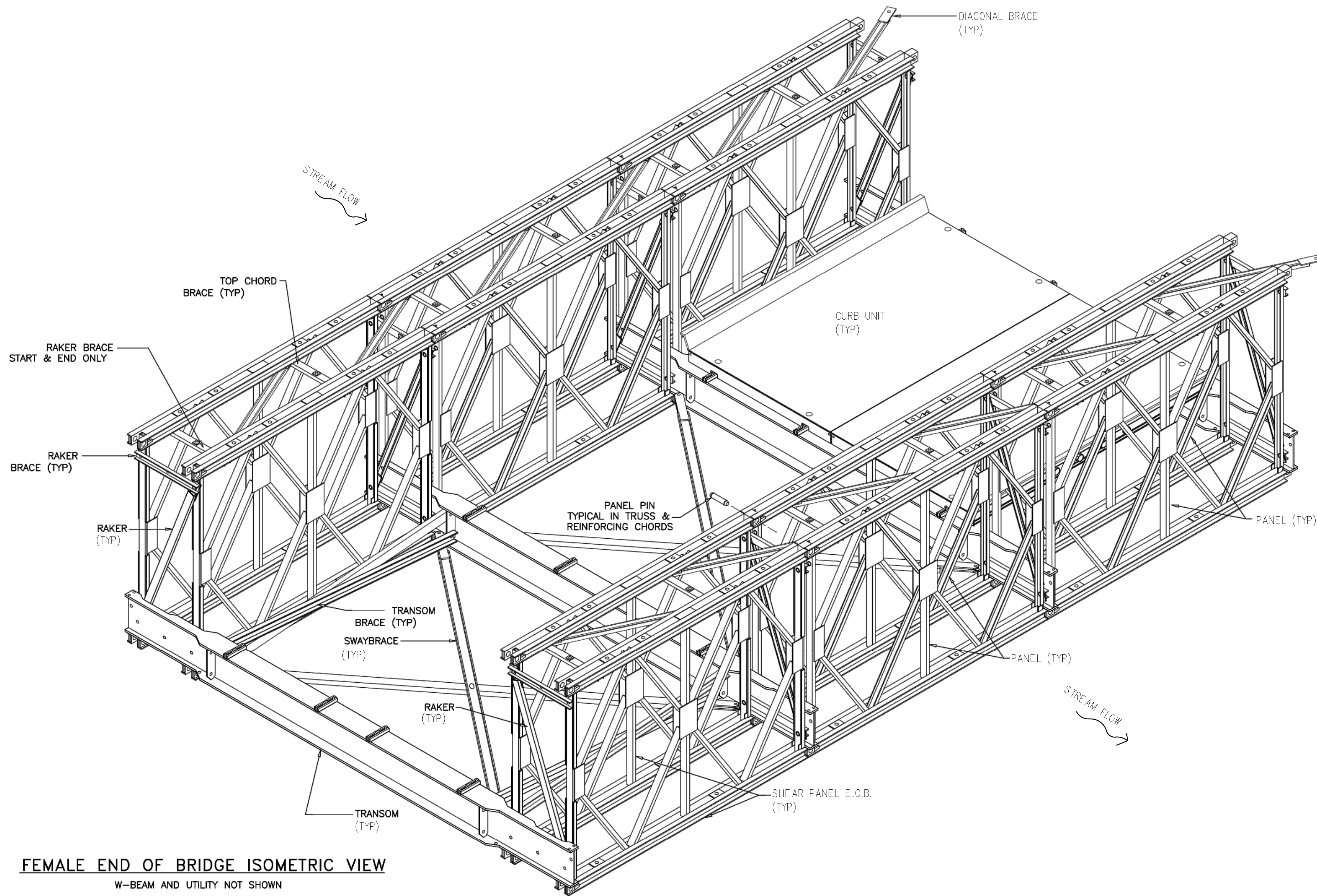
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

SIGN POST, TYPICAL PAVEMENT CONNECTION AND
GEOTERRA GTO UNIT DETAILS

APPROVED: _____			DATE: _____
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 24 OF 50 SHEETS	

FILE	POCKET	FOLDER	NO.



NOTE: WATER LINE AND DECKING OMITTED FROM THIS SHT. SEE SHT C503

BRIDGE ISOMETRIC VIEW

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C501

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David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

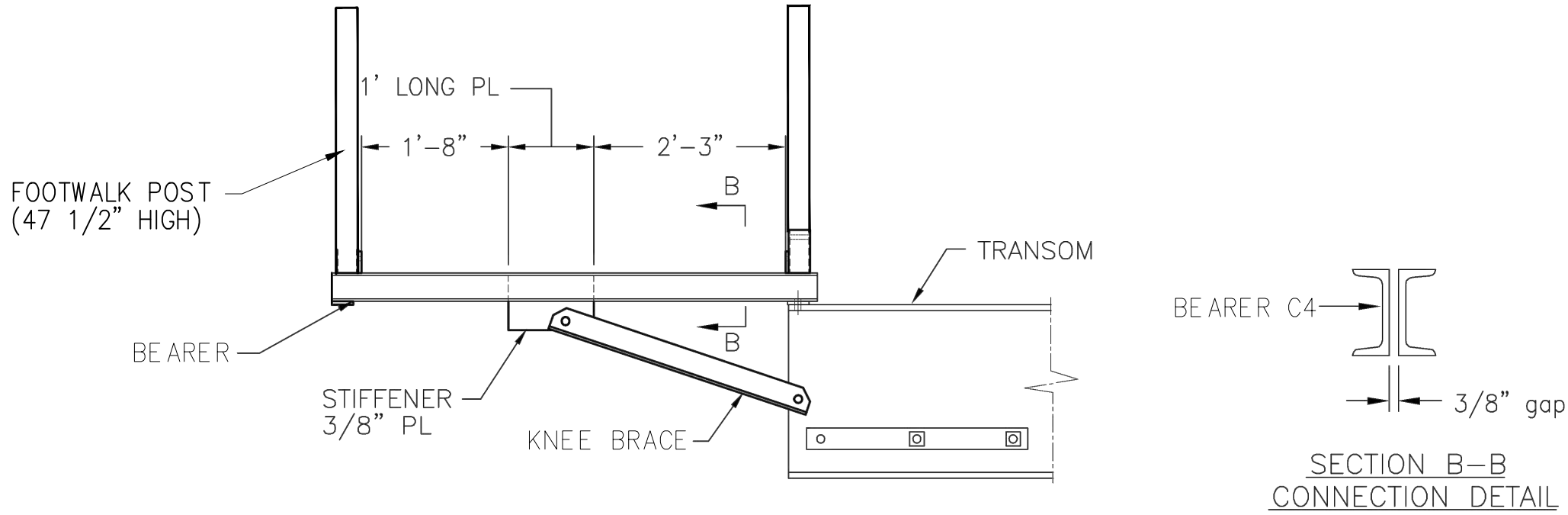
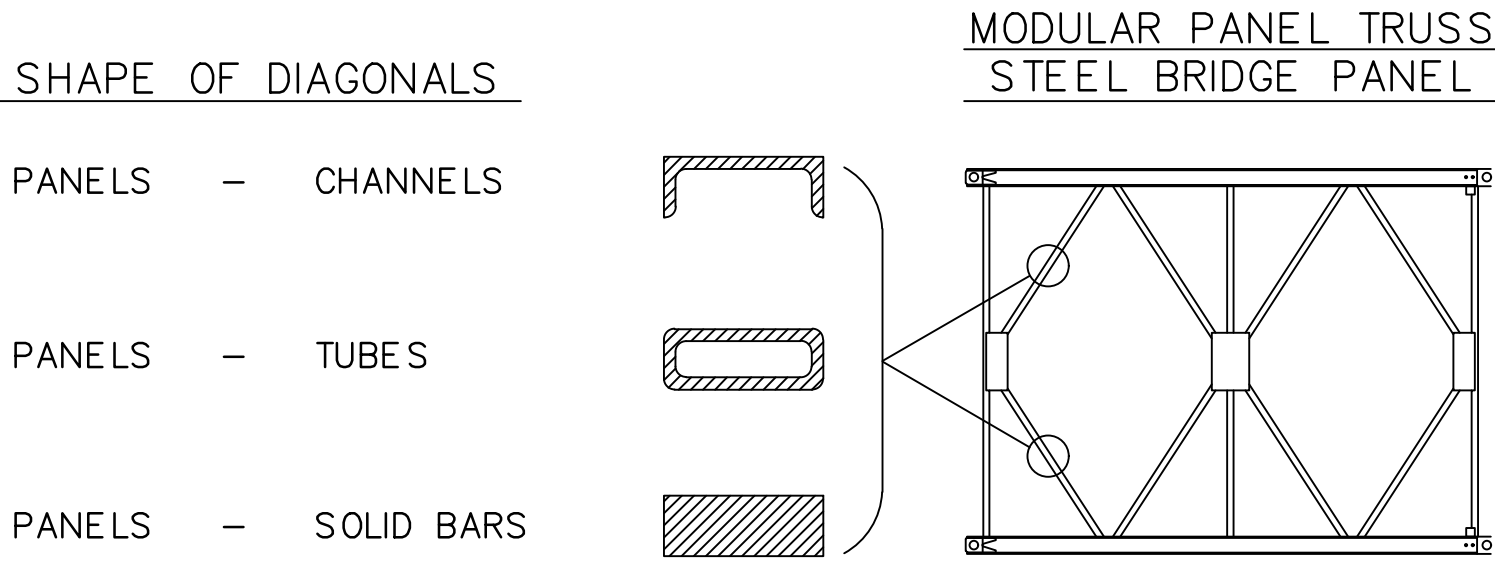
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII
MODULAR PANEL TRUSS STEEL BRIDGE
ISOMETRIC VIEW

APPROVED: _____		DATE: _____	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 25 OF 50 SHEETS

FILE	POCKET	FOLDER	NO.

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

TRUSS PANEL TYPES

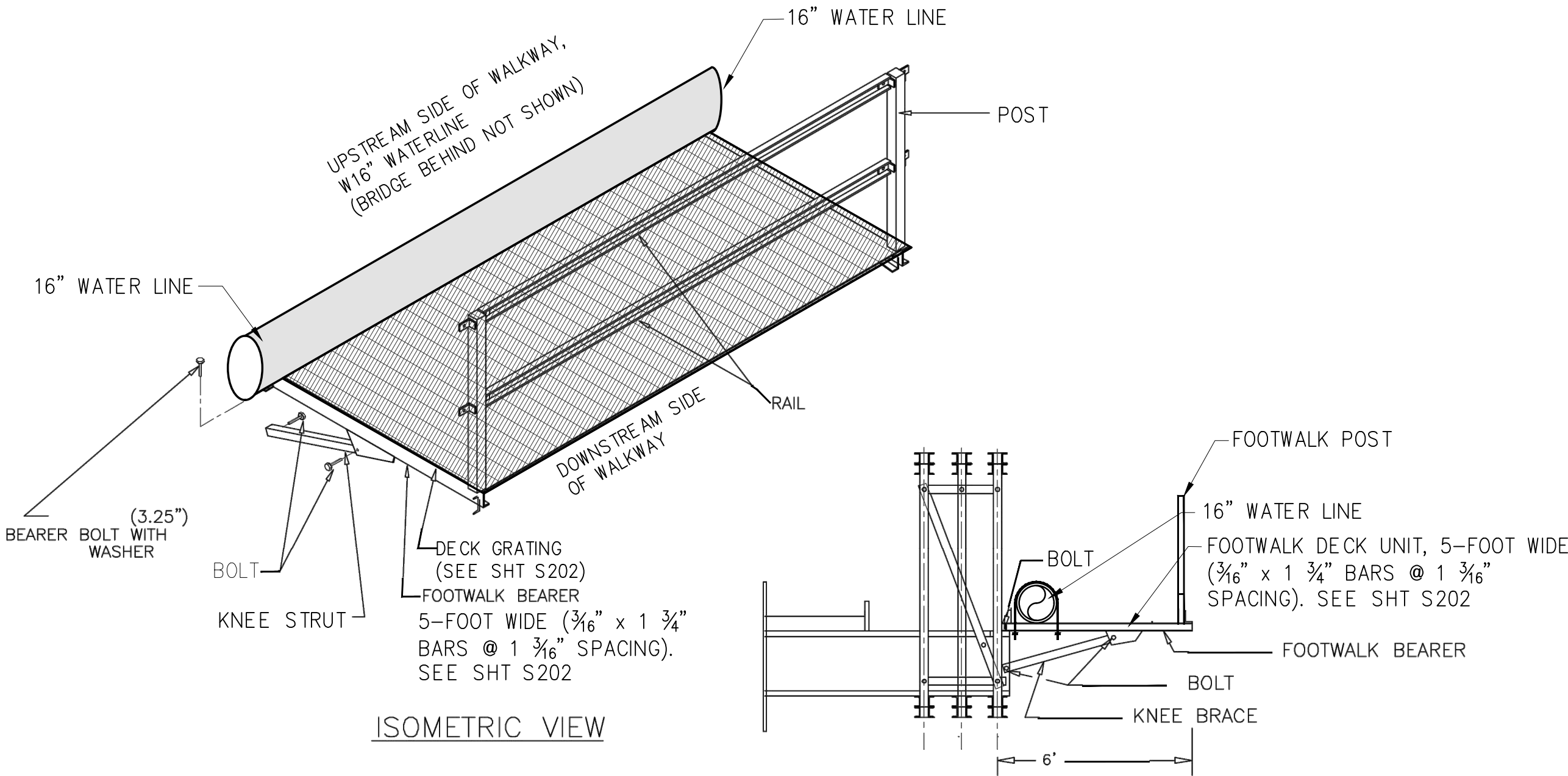


FOOTWALK BEARER CONNECTION

NOT TO SCALE

BRIDGE BOLT TORQUE VALUES

NAME	DIA ∅	UNDER HEAD LENGTH ±1/8"	TORQUE (FT/LBS)
SHORT BRACE BOLT	1"	2 3/4"	450
LONG RAKER BOLT	1"	4"	450
TRANSOM SHEAR BOLT	1"	5 1/2"	450
TRANSOM BOLT	1"	4 1/4"	450
DECK T BOLT	3/4"	N/A	110
BRACE BOLT	1"	3 1/2"	450
CHORD BOLT	1 1/4"	3 1/2"	650



ISOMETRIC VIEW

SIDEWALK CONNECTION DETAIL

NOT TO SCALE

GENERAL NOTES AND SPECIFICATIONS

DESIGN SPECIFICATION
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7th EDITION, 2014 WITH 2015 AND 2016 INTERIM REVISIONS

LIVE LOAD
1 LANES OF HL-93 (0.64 KIP/FOOT)

DEAD LOAD
ANTI-SKID EPOXY COATED DECK
TRUSS MOUNTED GUARDRAIL (W-SHAPE)

- BRIDGE SPECIFICATIONS
- (a) PANEL CHORDS, DIAGONALS & VERTICALS, PANEL REINFORCING CHORDS AND RAKERS
AASHTO M223 Gd. 65
 - (b) DECKING, RAKER BRACE, TRANSOM, DIAGONAL BRACE, CHORD BRACE, SWAYBRACE, TRANSOM BRACE
AASHTO M223 Gd. 50
 - (c) PANEL PINS
ASTM A193 Gd. B7
 - (d) BOLTS
AASHTO M164M-A325

FINISH
ALL MAJOR COMPONENTS GALVANIZED TO AASHTO M111-ASTM A123. ALL BOLTS ARE HOT DIPPED GALVANIZED. PINS ARE ELECTRO GALVANIZED.

SHOP DRAWINGS
MANUFACTURER TO PROVIDE SHOP DRAWINGS AFTER ALL CITY AND COUNTY PLAN APPROVALS

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

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Exp: 4/30/24

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

MODULAR PANEL TRUSS STEEL BRIDGE
GENERAL NOTES AND SPECIFICATIONS

APPROVED: _____

MANAGER AND CHIEF ENGINEER, BWS

DATE: _____

DRAWN BY: RE

ENGINEER: DB

CHECKED BY: DB

FILE NO: _____

FIELD BOOK NO: _____

SCALE: AS INDICATED

SHEET 26 OF 50 SHEETS

FILE

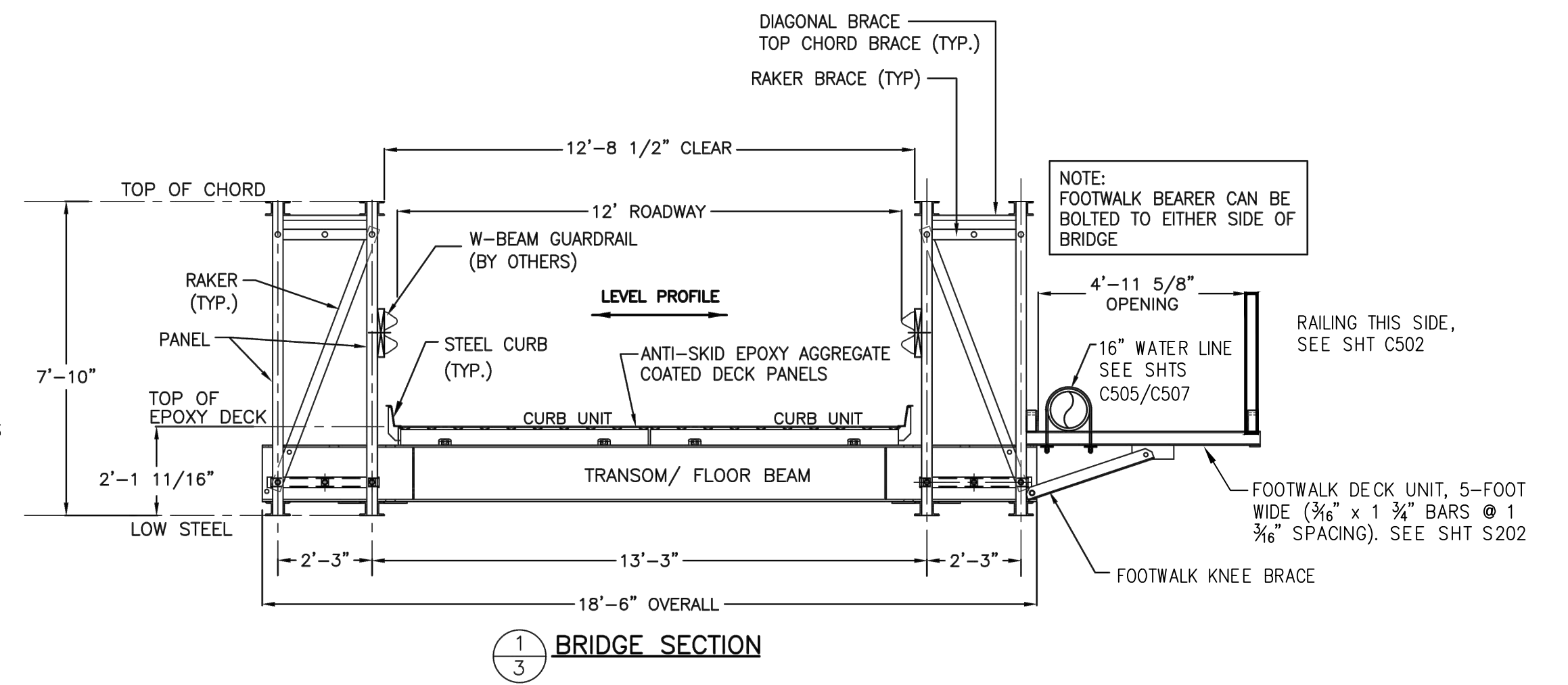
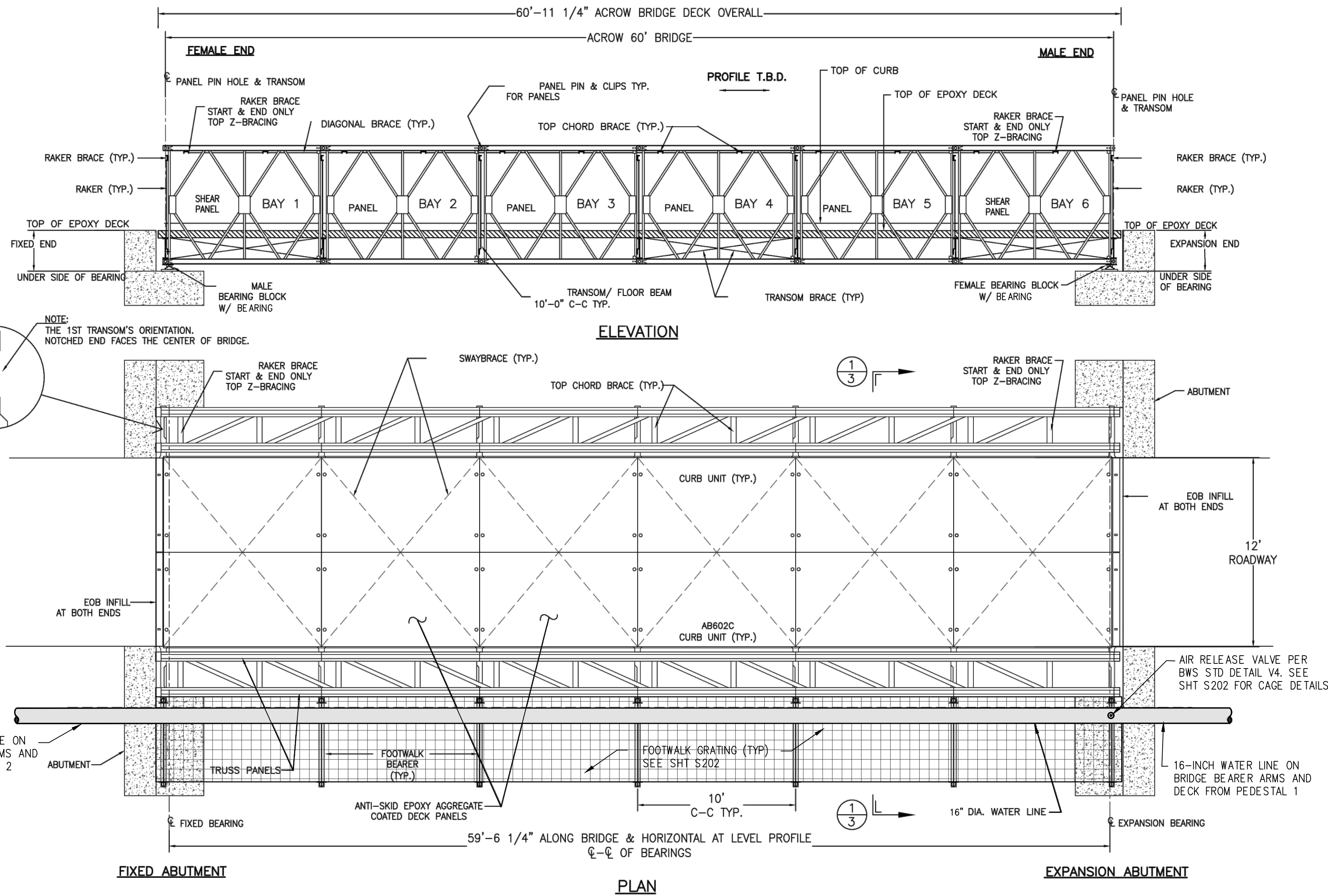
POCKET

FOLDER

NO.

Wed, 13 Sep 2023 - 9:46pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C503.MPTS BRIDGE-03.dwg

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments



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OR UNDER MY SUPERVISION AND
CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION

David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
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ENGINEER
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HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

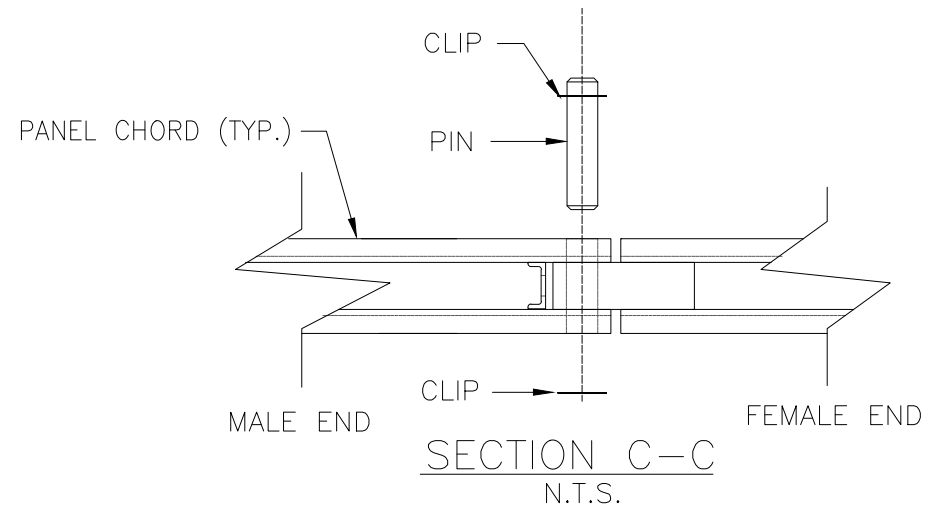
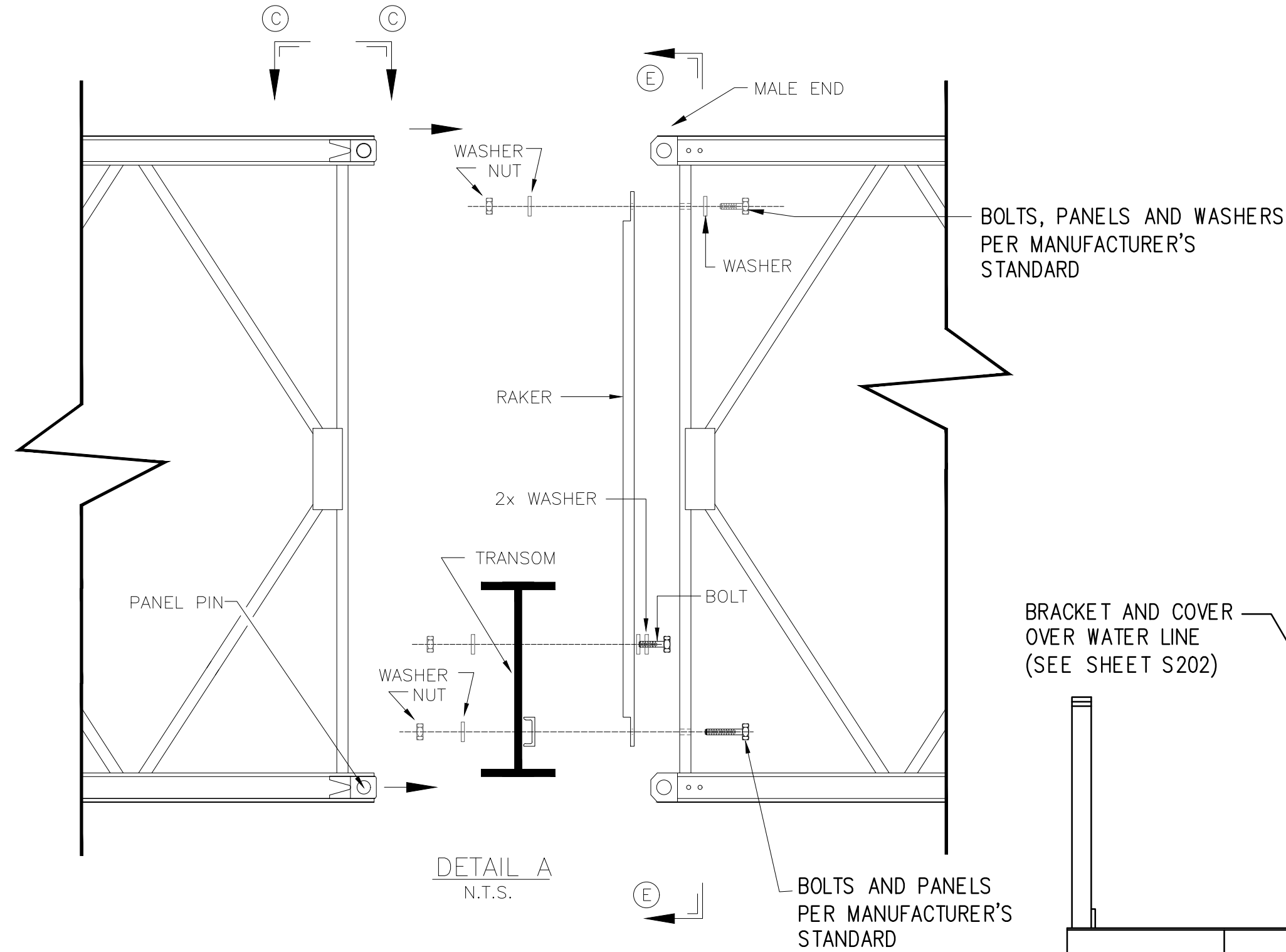
MODULAR PANEL TRUSS STEEL BRIDGE GENERAL PLAN ELEVATION AND SECTION

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET	27 OF 50 SHEETS

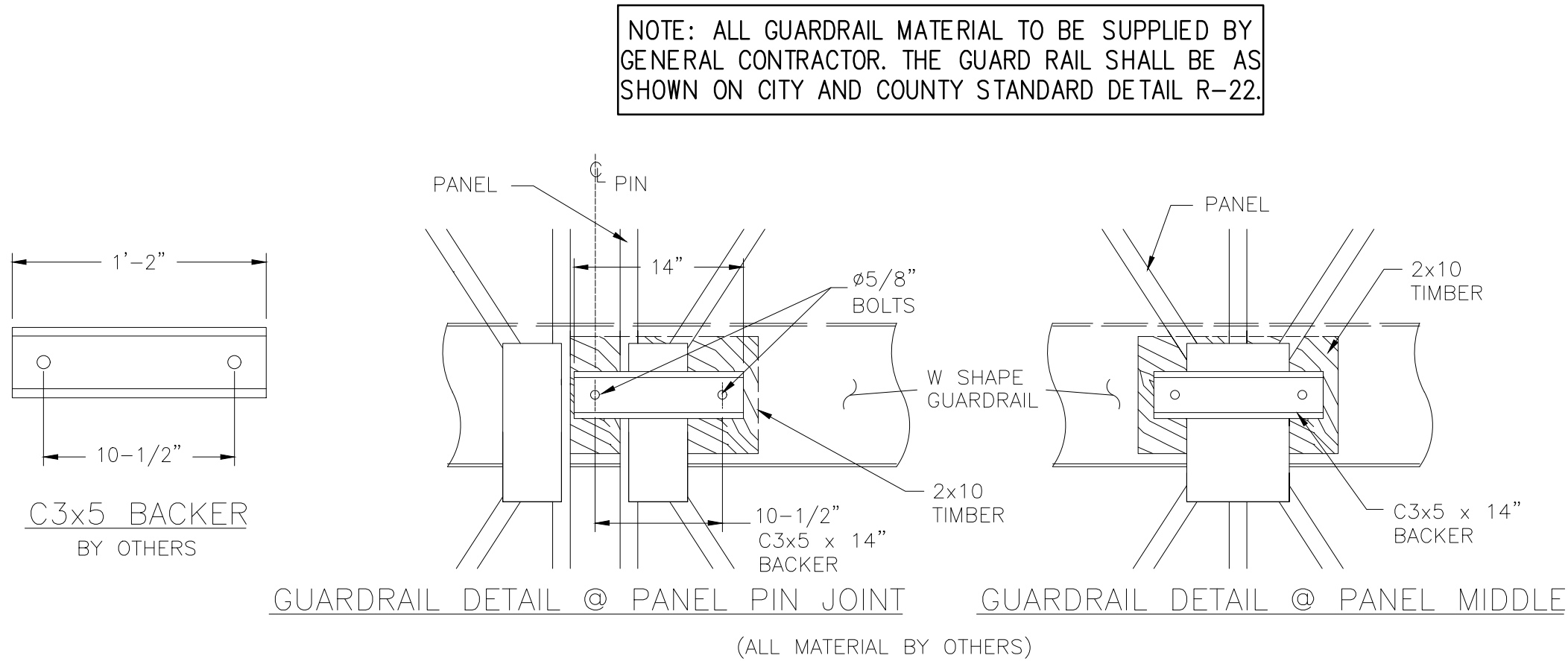
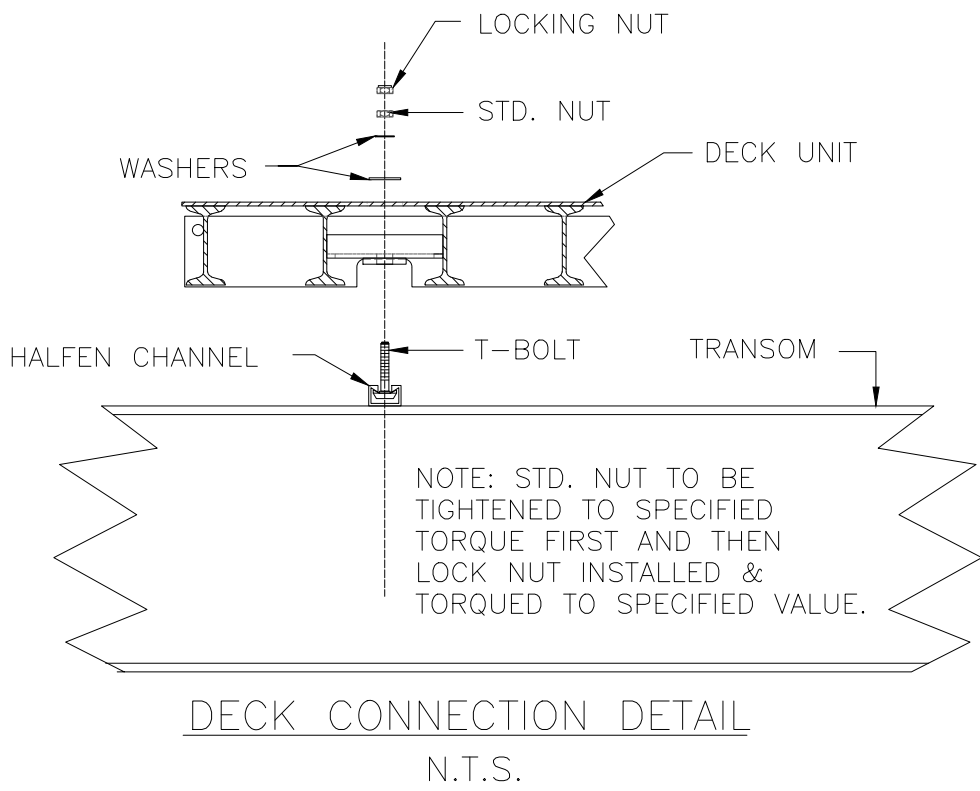
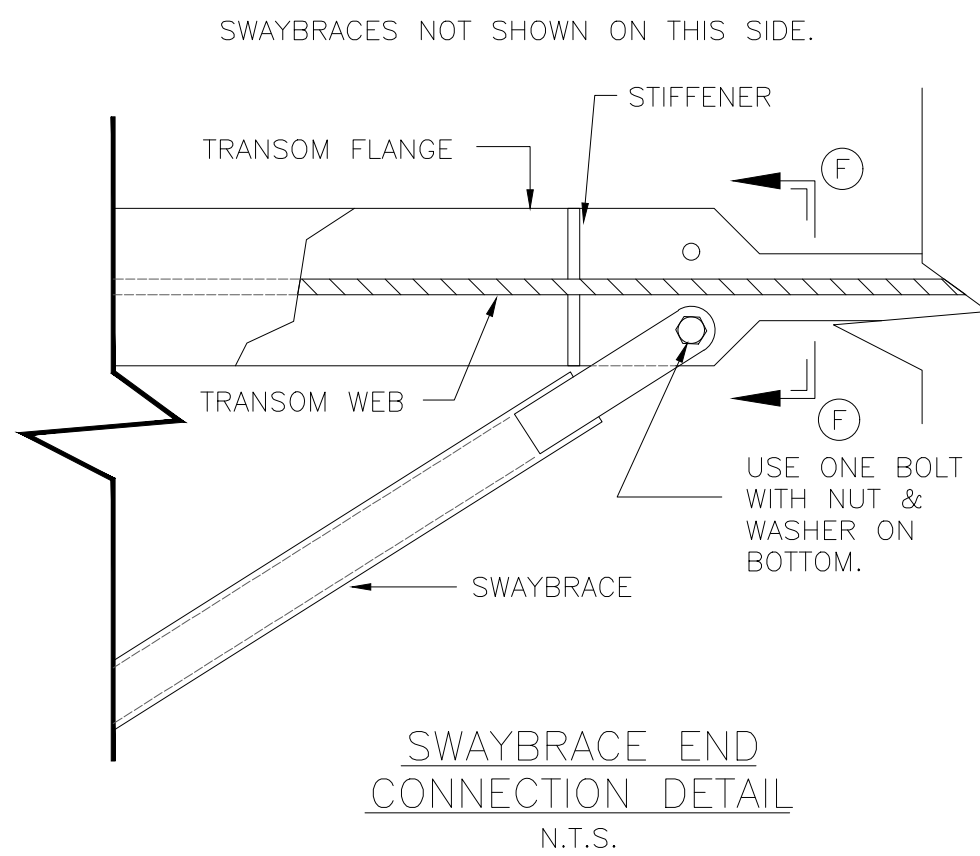
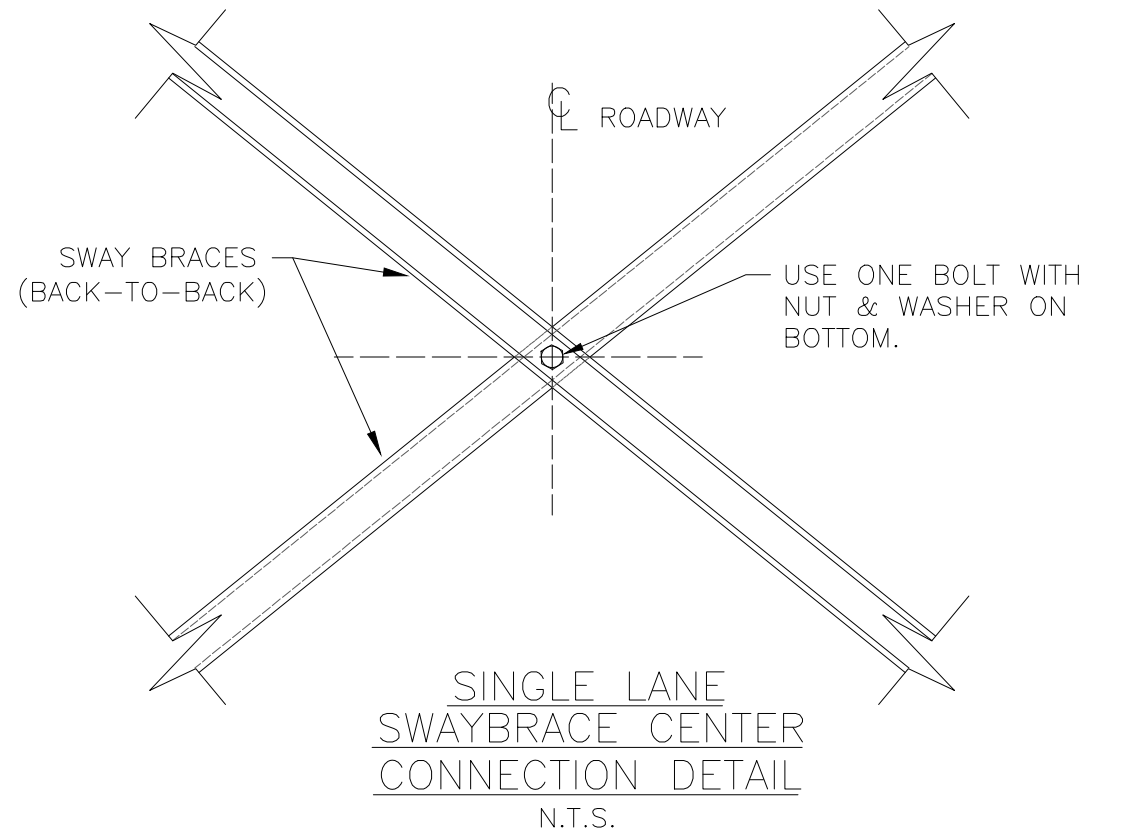
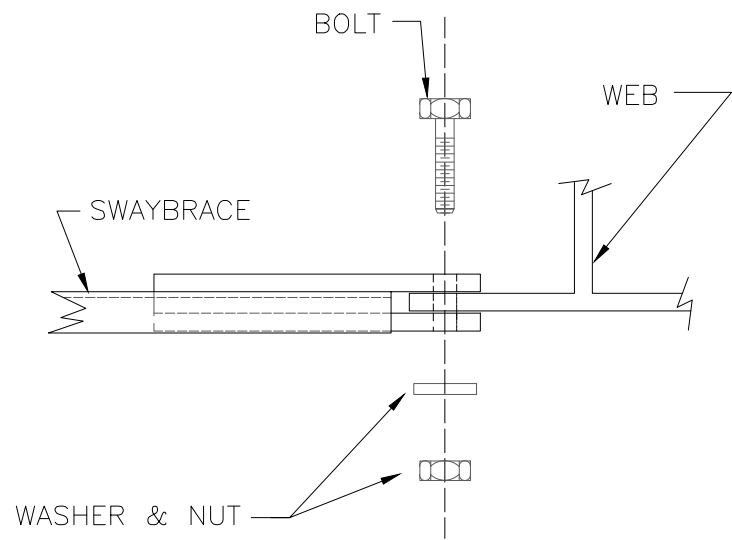
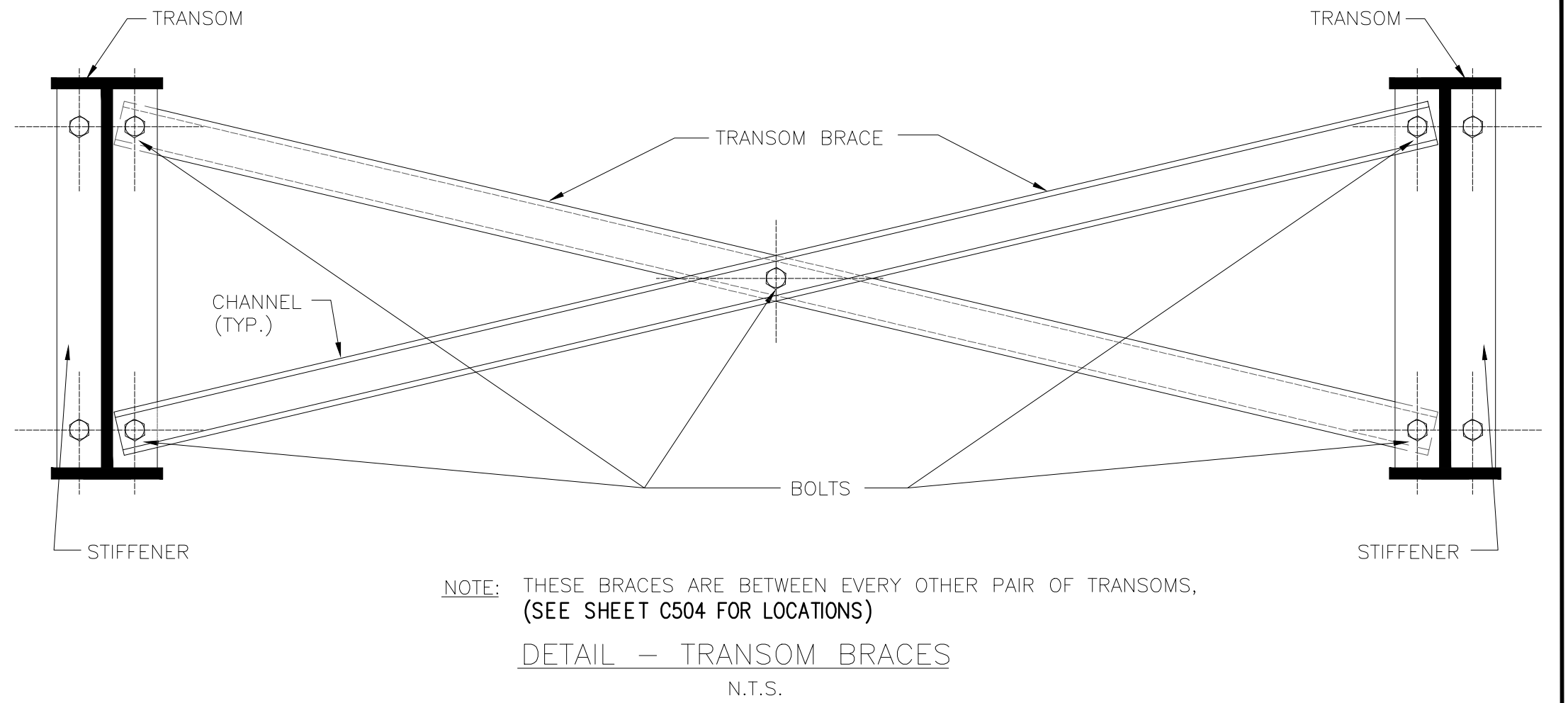
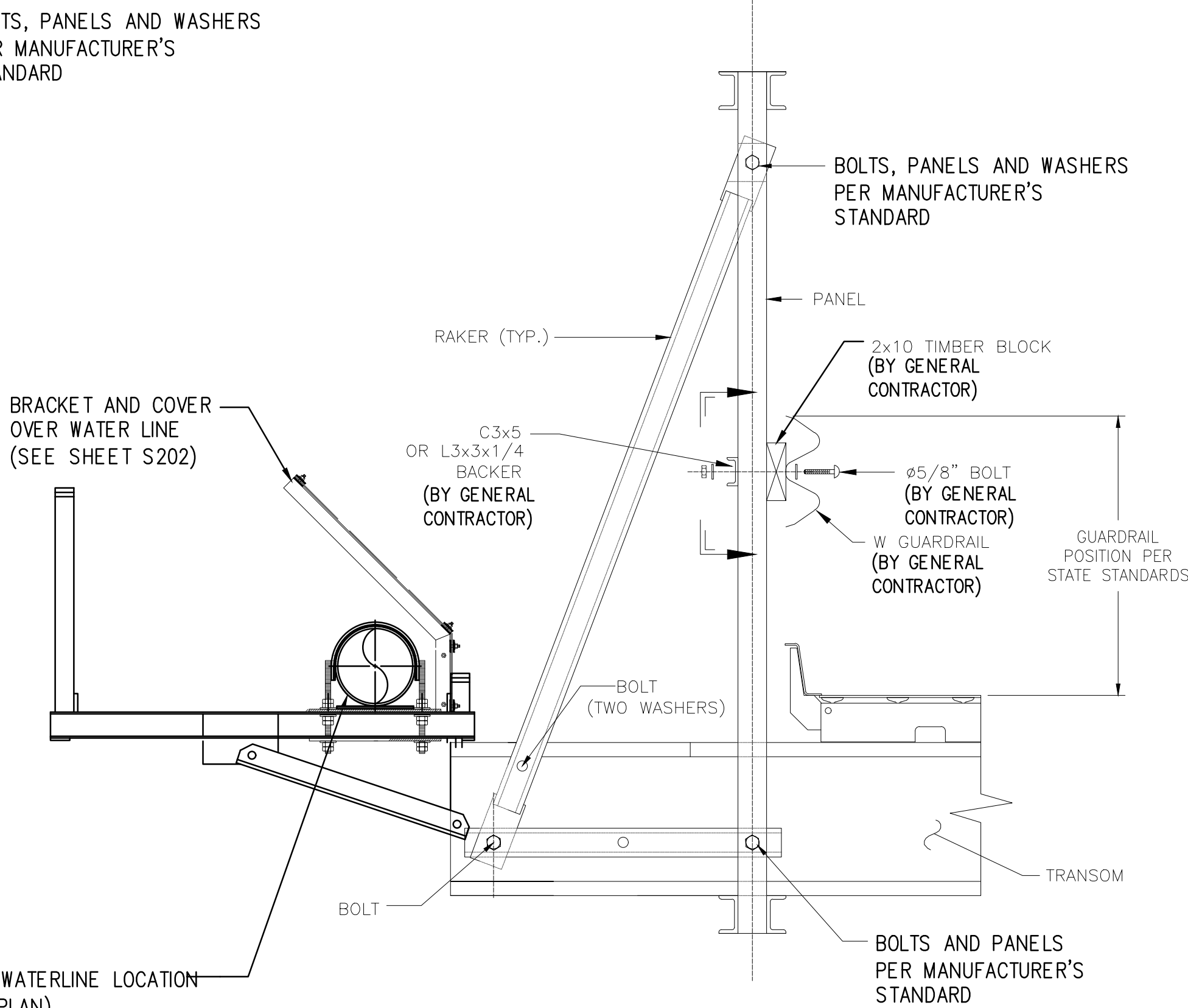
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C503

Tue, 12 Sep 2023 - 2:00pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C504MPTS BRIDGE-04 .dwg



NEW 16" D.I. CL 53 WATERLINE LOCATION
(INV.=VARIES (SEE PLAN))
SEE DETAIL C507 FOR TYPICAL STAINLESS
STEEL U-BOLT AND NEOPRENE GASKET
BETWEEN PIPE AND BRIDGE STRUCTURE.
THE CLASS 53 DUCTILE IRON PIPE WITH
PUSH-ON JOINTS, OR APPROVED EQUAL
THROUGH THE ENTIRE LENGTH OF BRIDGE.



NOTE:
GUARDRAIL TO BE ATTACHED AT EACH PANEL MIDDLE & PANEL PIN JOINT.

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

C504

THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION AND
CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION

David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED
PROFESSIONAL
ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

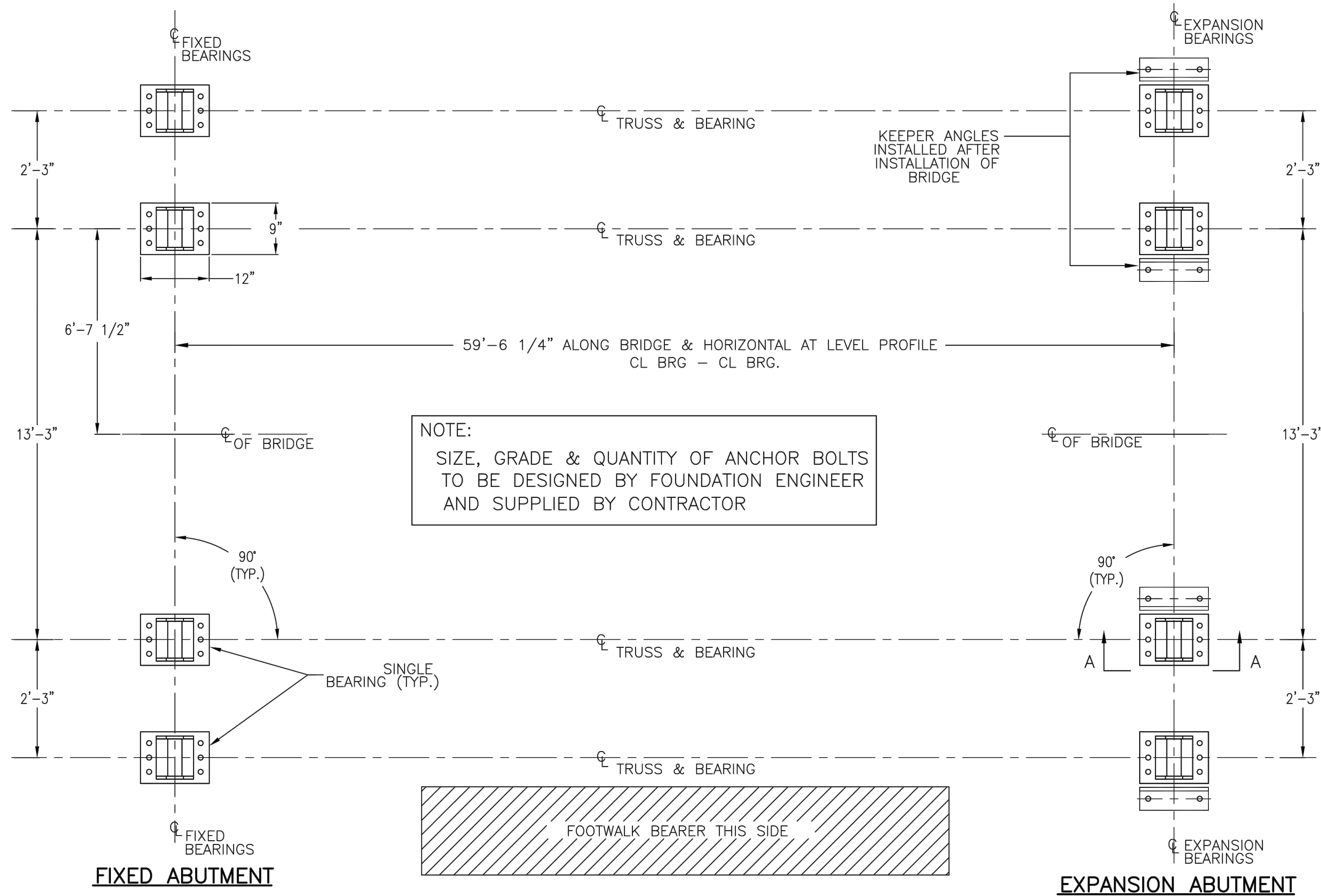
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

MODULAR PANEL TRUSS STEEL BRIDGE
TYPICAL CONNECTION DETAILS

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 28 OF 50 SHEETS	

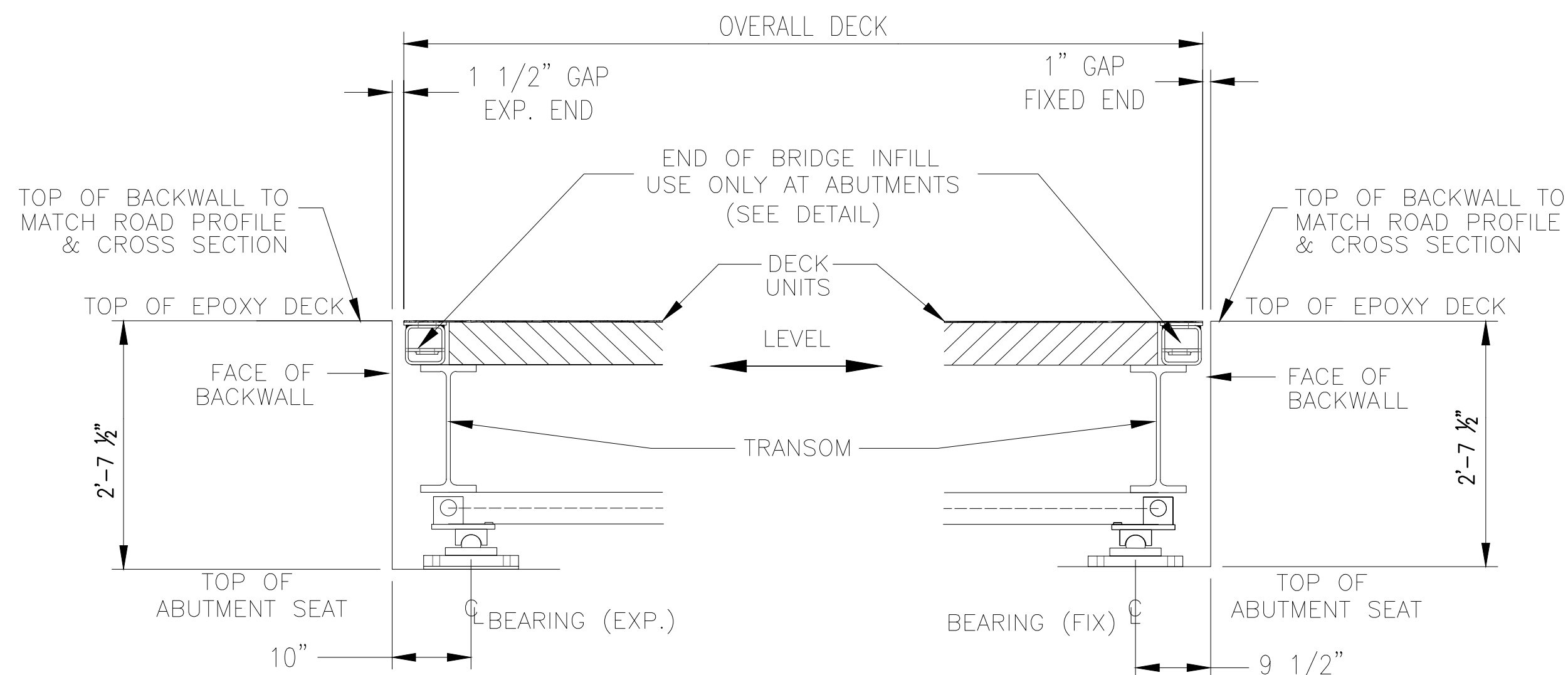
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Wed, 13 Sep 2023 - 8:41pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C505.MPTS BRIDGE-05.dwg



BEARING LAYOUT

(ALL DIMENSIONS AT 70°F)



EXPANSION END
SOUTH ABUTMENT

FIXED END
NORTH ABUTMENT

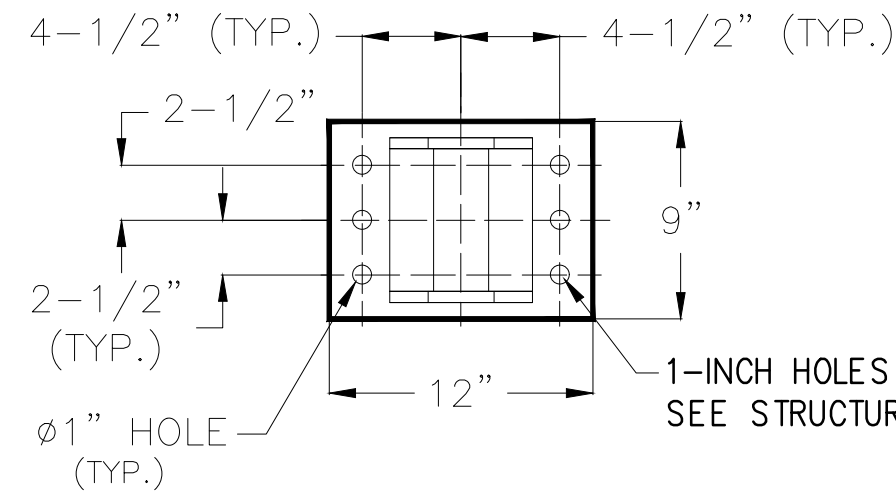
* HOLE AND BOLT SIZE TO BE
VERIFIED WHEN SHOP
DRAWINGS AND
MANUFACTURER'S STRUCTURAL
CALCULATIONS ARE PROVIDED

1-INCH HOLES AND 7/8-INCH BOLTS (TYP).
SEE STRUCTURAL DRAWING S201.

MIN. 3x3x3/8"
KEEPER ANGLE

DO NOT INSTALL ANCHOR
BOLTS IN EXPANSION
BEARING PLATE

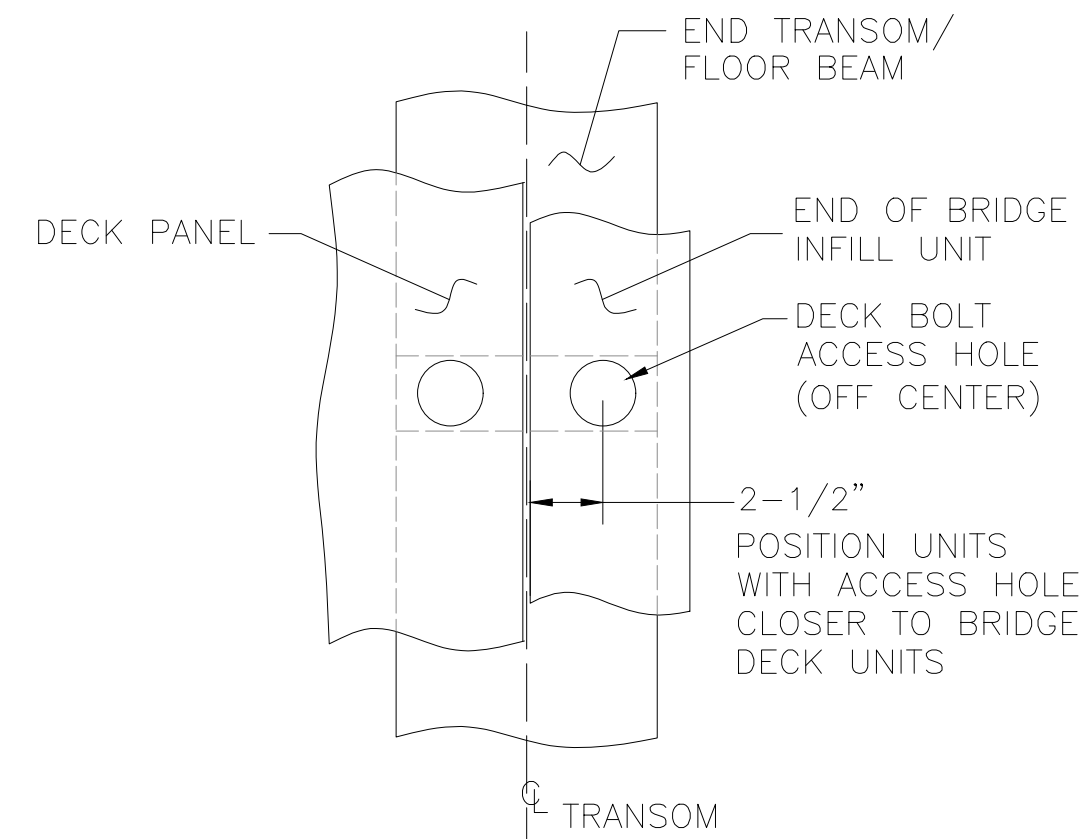
1-INCH HOLES AND 7/8-INCH BOLTS (TYP).
SEE STRUCTURAL DRAWING S201.



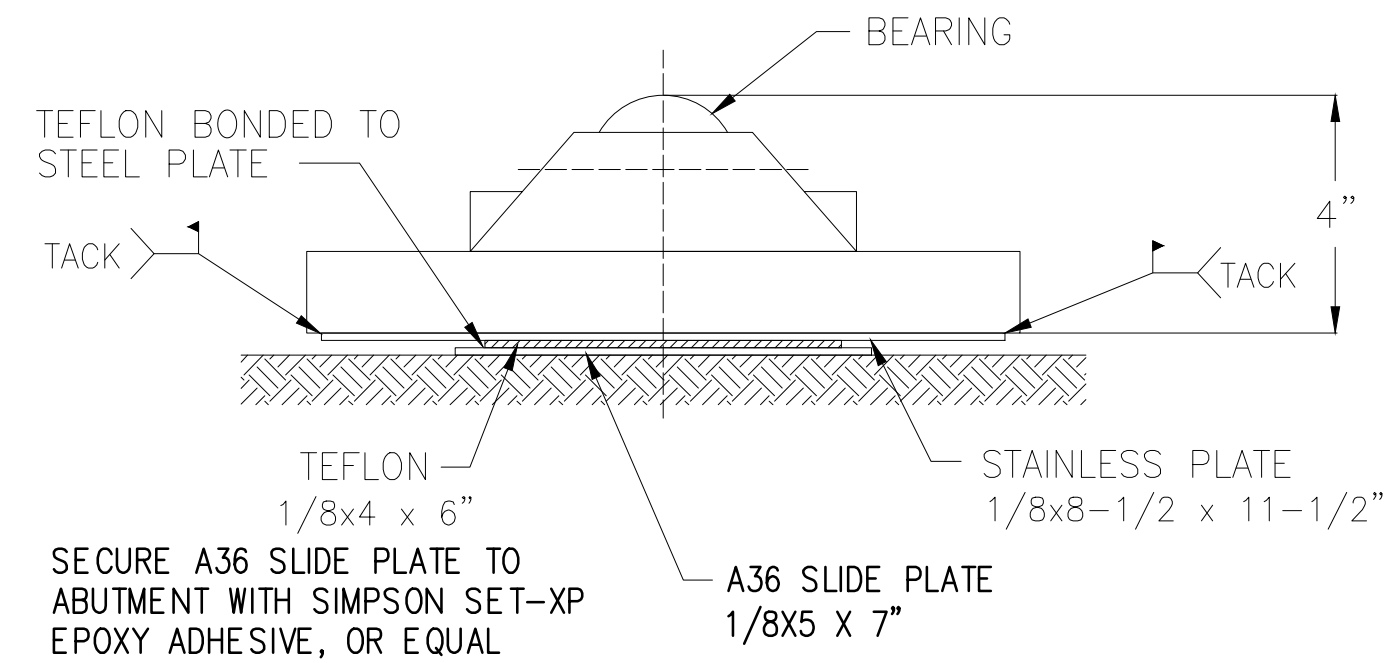
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1-3/8" THICK PLATE

EXPANSION END - BEARING DETAIL



END OF DECK UNIT DETAIL



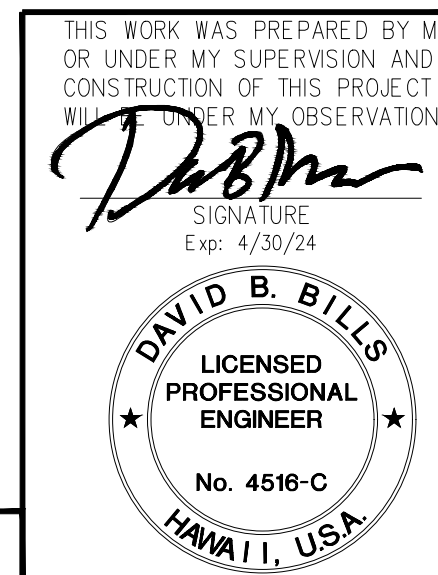
EXPANSION BEARING

SECTION A-A

ANGLE NOT SHOWN
FOR CLARITY

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

C505



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

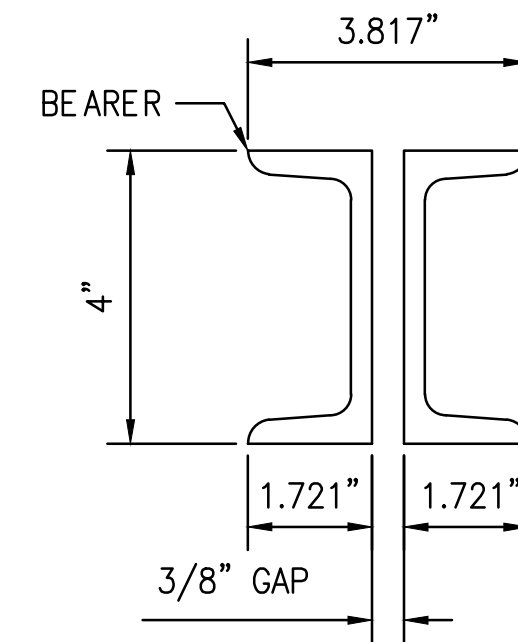
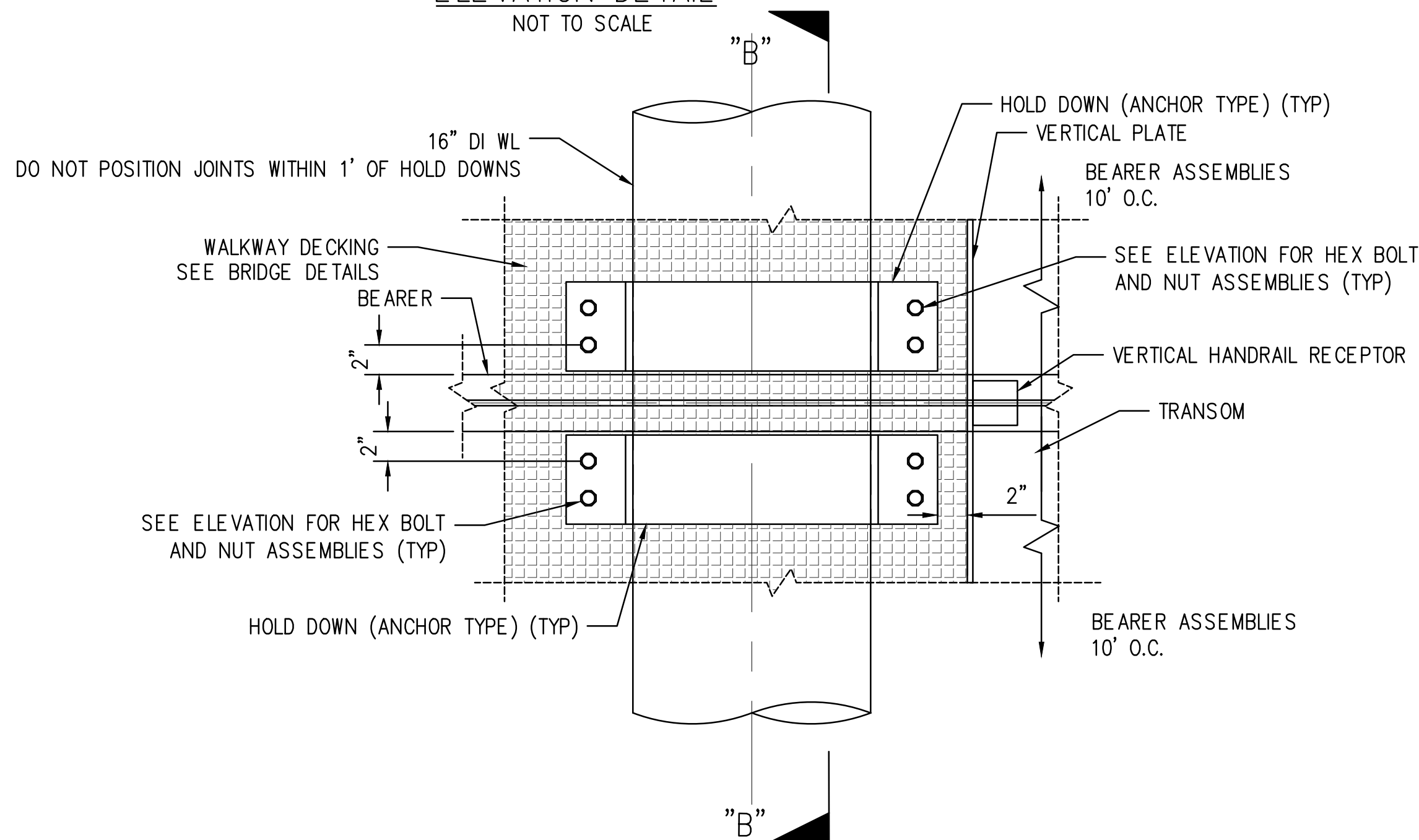
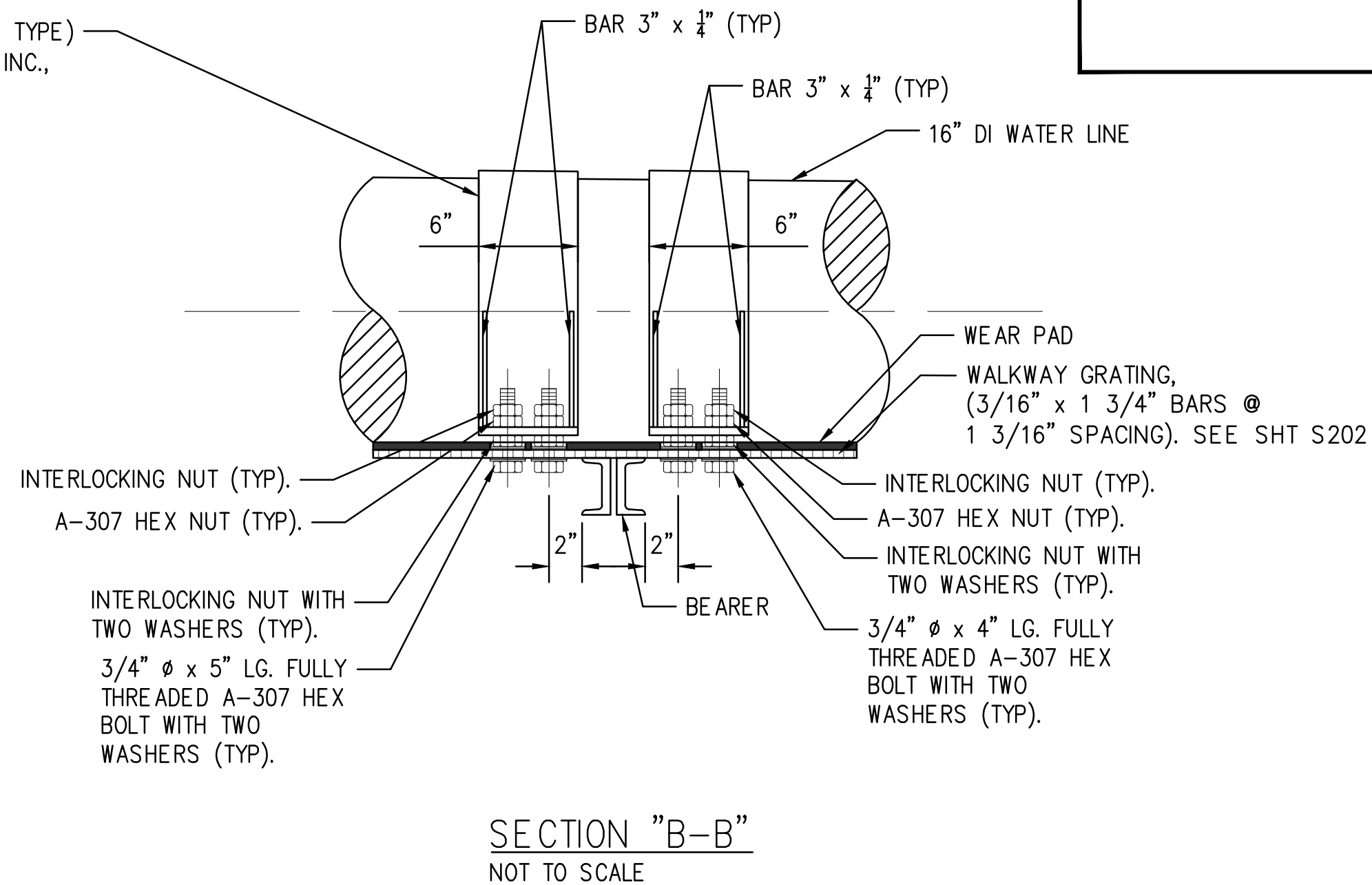
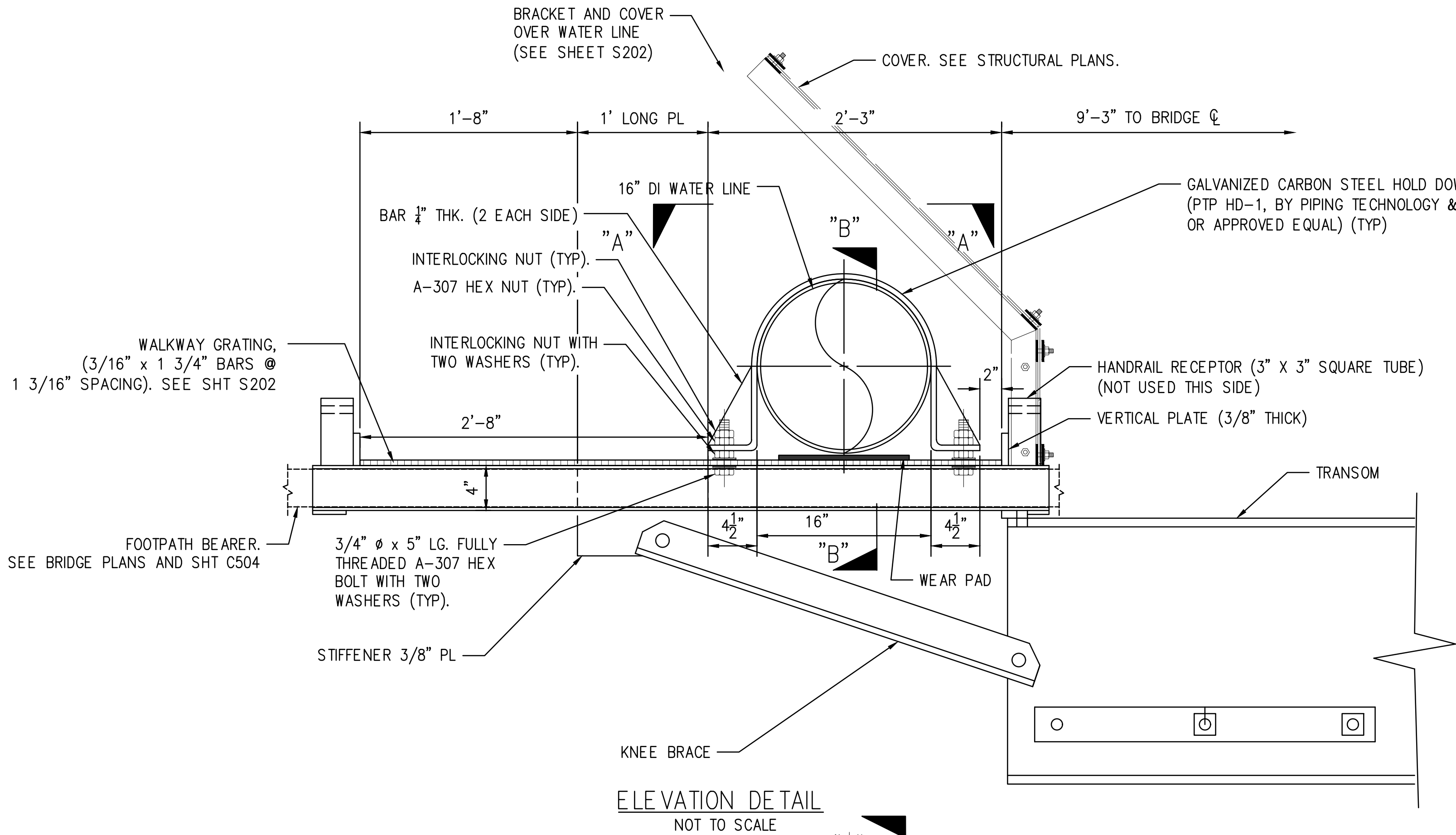
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

MODULAR PANEL TRUSS STEEL BRIDGE
BEARING LAYOUT AND DETAILS

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:		SCALE:	AS INDICATED
SHEET	29	OF	50
SHEETS			

FILE	POCKET	FOLDER	NO.

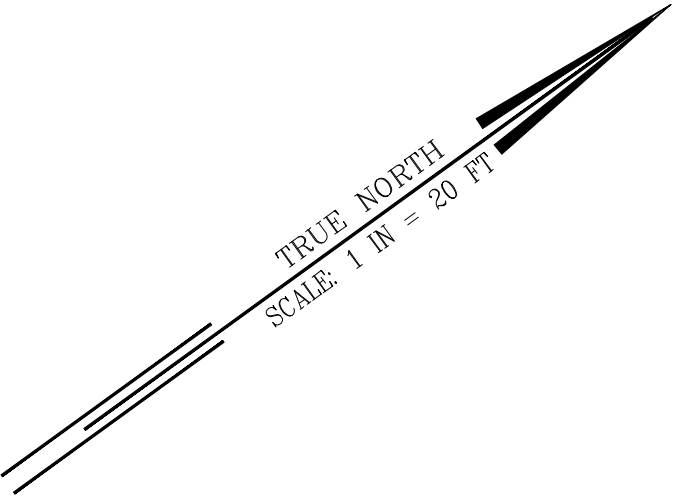
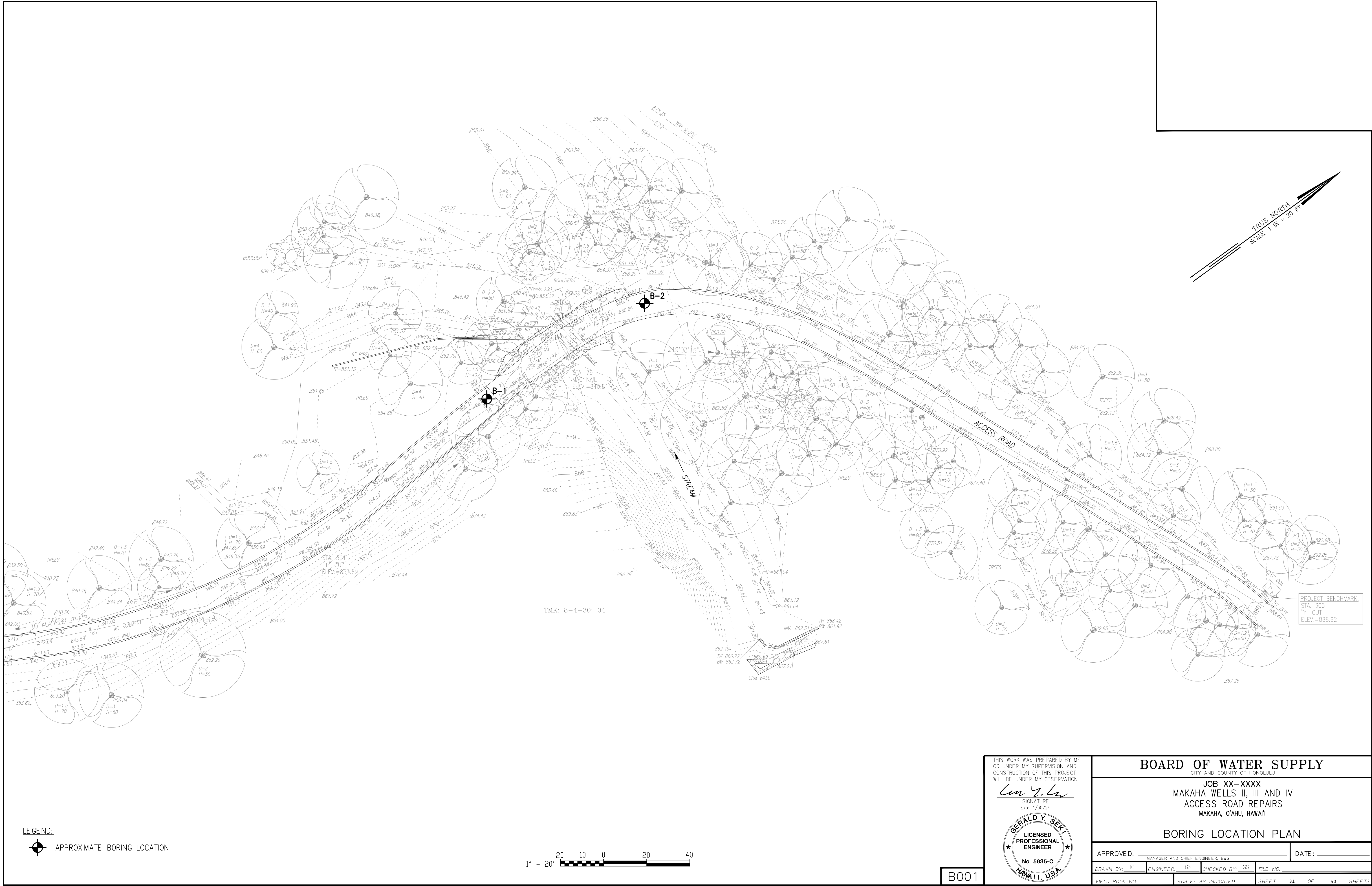
Wed, 13 Sep 2023 — 10:11am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C506-HG_MPTS BRIDGE-06.dwg



Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

C506

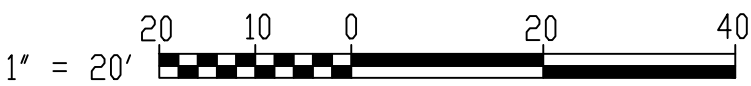
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION		BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU	
SIGNATURE <i>David B. Bills</i> Exp: 4/30/24		JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII	
DAVID B. BILLS LICENSED PROFESSIONAL ENGINEER No. 4516-C HAWAII, USA		WATER LINE TIE-DOWN STRAP DETAILS	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: _____	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 30 OF 50 SHEETS
FILE	POCKET	FOLDER	NO.



PROJECT BENCHMARK:
STA. 305
"M" CUT
ELEV.=888.92

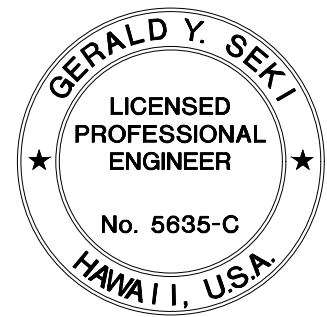
TMK: 8-4-30: 04

LEGEND:
 APPROXIMATE BORING LOCATION



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OR UNDER MY SUPERVISION AND
CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION

Gerald Y. Seki
SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU


JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

BORING LOCATION PLAN

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	HC	ENGINEER:	GS
CHECKED BY:	GS	FILE NO:	
FIELD BOOK NO:		SCALE:	AS INDICATED
SHEET	31	OF	50
SHEETS			

FILE	POCKET	FOLDER	NO.


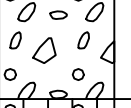

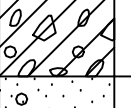
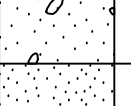
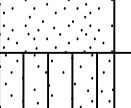

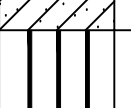
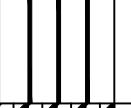
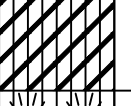

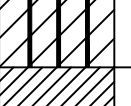
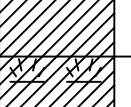
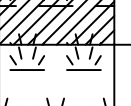
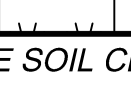
B001



GEOLABS, INC.
Geotechnical Engineering


Soil Log Legend


UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)


MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	GRAVELS	CLEAN GRAVELS LESS THAN 5% FINES	 GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES MORE THAN 12% FINES	 GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			 GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			 GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS	CLEAN SANDS LESS THAN 5% FINES	 SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES MORE THAN 12% FINES	 SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			 SM	SILTY SANDS, SAND-SILT MIXTURES
			 SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS 50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	 ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			 CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			 OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE	 MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			 CH	INORGANIC CLAYS OF HIGH PLASTICITY
			 OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			 PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
HIGHLY ORGANIC SOILS				


NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS


LEGEND


 (2-INCH) O.D. STANDARD PENETRATION TEST


 (3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE


 SHELBY TUBE SAMPLE

 GRAB SAMPLE

 CORE SAMPLE

 WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING

 WATER LEVEL OBSERVED IN BORING AFTER DRILLING

 WATER LEVEL OBSERVED IN BORING OVERNIGHT

LL

LIQUID LIMIT (NP=NON-PLASTIC)

PI

PLASTICITY INDEX (NP=NON-PLASTIC)

TV

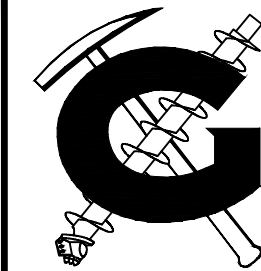
TORVANE SHEAR (tsf)

UC

UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH

TXUU

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)



GEOLABS, INC.
Geotechnical Engineering

Soil Classification Log Key
(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)	COHESIVE SOIL (- #200 ≥ 50%)
<ul style="list-style-type: none">PRIMARY constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., GRAVEL, SAND)SECONDARY constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (SILTY or CLAYEY); otherwise, a granular constituent is used (GRAVELLY or SANDY) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY GRAVEL, CLAYEY SAND) and precede the primary constituent.accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY GRAVEL with a little sand)	<ul style="list-style-type: none">PRIMARY constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., CLAY, SILT)SECONDARY constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY CLAY, SILTY CLAY, CLAYEY SILT) and precede the primary constituent.accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY CLAY with some sand)
EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: SILTY GRAVEL with some sand	

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

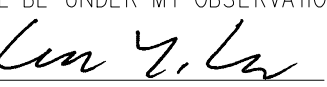
PP: Pocket Penetrometer

*Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).

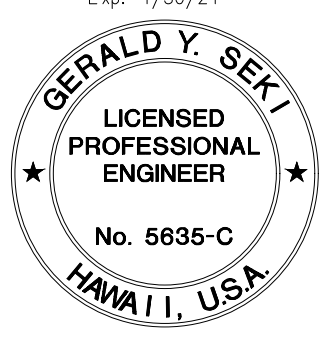
SOIL CLASS LOG KEY 7956-00.GPJ GEOLABS.GDT 11/23/21

LOG LEGEND FOR SOIL 7956-00.GPJ GEOLABS.GDT 11/23/23

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Exp: 4/30/24



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

BORING LOG LEGENDS

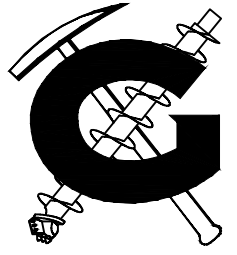
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MANAGER AND CHIEF ENGINEER, BWS

DATE: _____

DRAWN BY: HC ENGINEER: GS CHECKED BY: GS FILE NO: _____

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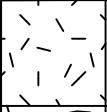

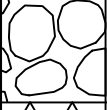
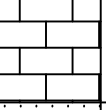
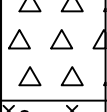
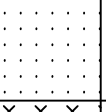
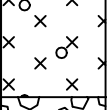
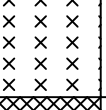

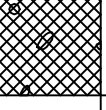
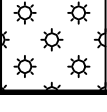



GEOLABS, INC.

Geotechnical Engineering

Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		CONGLOMERATE
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive:

Greater than 24 inches apart

Slightly Fractured:

12 to 24 inches apart

Moderately Fractured:

6 to 12 inches apart

Closely Fractured:

3 to 6 inches apart

Severely Fractured:

Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered:

Rock shows no sign of discoloration or loss of strength.

Slightly Weathered:

Slight discoloration inwards from open fractures.

Moderately Weathered:

Discoloration throughout and noticeably weakened though not able to break by hand.

Highly Weathered:

Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.

Extremely Weathered:

Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard:

Specimen breaks with difficulty after several "pinging" hammer blows.

Example: Dense, fine grain volcanic rock

Hard:

Specimen breaks with some difficulty after several hammer blows.

Example: Vesicular, vugular, coarse-grained rock

Medium Hard:

Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce.

Example: Porous rock such as clinker, cinder, and coral reef

Soft:

Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot.

Example: Weathered rock, chalk-like coral reef

Very Soft:

Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure.

Example: Saprolite


GEOTECHNICAL NOTES:

- A geotechnical engineering report entitled "Geotechnical Engineering Exploration, Makaha Wells II, III and IV Access Road Repairs, Makaha, Oahu, Hawaii" dated November 19, 2021 has been prepared by Geolabs, Inc. A copy of the report is on file at the office of the Engineer for review by the Contractor.
- For boring locations, see Drawing No. B001.
- The information presented in the logs of borings depict the subsurface conditions encountered at that specified location and at the time of the field exploration only. Variations of subsoil conditions from those depicted in the logs of borings may occur between and beyond the borings.
- The penetration resistance shown on the logs of borings indicate the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.
- The data given is for general information only. Bidders shall examine the site and the boring data and draw their own conclusions therefrom as to the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or conditions other than at the boring locations shown and at the time the borings were taken.


JOB NO.

B003

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Exp: 4/30/24



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

ROCK LOG LEGEND & NOTES

APPROVED: _____

MANAGER AND CHIEF ENGINEER, BWS

DATE: _____

DRAWN BY: HC

ENGINEER: GS

CHECKED BY: GS

FILE NO: _____

FIELD BOOK NO: _____

SCALE: AS INDICATED


SHEET 33 OF 50 SHEETS


FILE

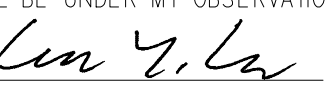
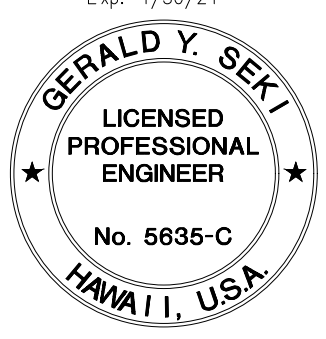
POCKET

FOLDER

NO.

		GEOLABS, INC.		MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, OAHU, HAWAII										Log of Boring 1	
Other Tests		Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 857 *			
												Description			
UC=9.0 ksf	11 37	121		70 25		45 41		5				GW	2-inch ASPHALTIC CONCRETE		
												CH	Brownish gray SANDY GRAVEL (BASALTIC), moist (base course)		
LL=58 PI=29	20 37					12 19		10				MH	Brown with some gray SILTY CLAY with some sand and a little gravel (basaltic), very stiff, moist (older alluvium)		
												CH	Reddish brown with some gray CLAYEY SILT with some sand and a little gravel (basaltic), stiff to very stiff, moist (older alluvium)		
													Brownish gray COBBLES AND BOULDERS (BASALTIC) with a little clay, dense, moist (colluvium)		
													Brown with some gray SILTY CLAY with some gravel and a little cobbles (basaltic), stiff to very stiff, moist (older alluvium)		
								15					Boring terminated at 15 feet		
								20						* Elevations estimated from Topographic Survey Map dated September 19, 2019 prepared by Controlpoint Surveying, Inc.	
								25							
Date Started: December 31, 2019												Water Level: ▼ Not Encountered			
Date Completed: December 31, 2019															
Logged By: S. Latronic												Drill Rig: CME-75DR			
Total Depth: 15 feet												Drilling Method: 4" Solid-Stem Auger & PQ Coring			
Work Order: 7956-00												Driving Energy: 140 lb. wt., 30 in. drop			

		GEOLABS, INC.		MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, OAHU, HAWAII										Log of Boring 2	
Other Tests		Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 861 *			
												Description			
LL=42 PI=17 UC=2.6 ksf	17 8	106		83		65 56		5				ML	5-inch CONCRETE		
												CL	Grayish brown CLAYEY SILT with some sand, damp (fill)		
UC=14120 psi				68				10					Brown with some gray SANDY CLAY with some gravel (basaltic) and a little sand, hard, moist (older alluvium) grades more gravelly		
													Gray with traces of brown COBBLES AND BOULDERS (BASALTIC) with a little silt, very dense, moist (river channel deposit) grades with sandy gravel pockets locally		
								15					Boring terminated at 15 feet		
								20							
								25							
Date Started: December 31, 2019												Water Level: ▼ Not Encountered			
Date Completed: December 31, 2019															
Logged By: S. Latronic												Drill Rig: CME-75DR			
Total Depth: 15 feet												Drilling Method: 4" Solid-Stem Auger & PQ Coring			
Work Order: 7956-00												Driving Energy: 140 lb. wt., 30 in. drop			

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	JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII			
	BORING LOGS			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: _____
	DRAWN BY: HC	ENGINEER: GS	CHECKED BY: GS	FILE NO: _____
	FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 34 OF 50	SHEET 15
	FILE	POCKET	FOLDER	NO.

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GENERAL NOTES:

1. DIMENSIONS SHOWN ARE NOMINAL AND ARE BASED ON RECORD DRAWING AND MANUFACTURER'S INFORMATION. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO COMMENCING WORK.
2. ACTUAL FIELD DIMENSIONS OF EXISTING FITTINGS MAY VARY AND MUST BE VERIFIED BY CONTRACTOR PRIOR TO COMMENCING WORK.
3. PIPE DISTANCES GIVEN ARE FROM CENTERLINE OF FITTING TO CENTERLINE OF FITTING (OR CUT IN EXISTING PIPE).
4. CONTRACTOR SHALL SECURE AND BRACE ALL TEMPORARY PLUGS PRIOR TO HYDRO-TESTING. ALL TEMPORARY BRACING SHALL BE REMOVED PRIOR TO CONNECTING TO EXISTING LINES.
5. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, DECEMBER 2020, AND STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1984, AS AMENDED, OF THE DEPARTMENTS OF PUBLIC WORKS, AND CITY AND COUNTY OF HONOLULU.
6. VERIFY AND CHECK ALL DIMENSIONS AND DETAILS SHOWN ON THE DRAWINGS PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCY SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.
7. THE CONTRACTOR SHALL OBSERVE AND COMPLY WITH ALL FEDERAL, STATE AND LOCAL LAWS REQUIRED FOR THE PROTECTION OF PUBLIC HEALTH, SAFETY AND ENVIRONMENTAL QUALITY AND FOR WORKER PROTECTION.
8. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE TO MEET, AT ALL TIMES ON THE PROJECT SITE, THE REQUIREMENTS OF THE STATE OF HAWAII, DEPARTMENT OF HEALTH ADMINISTRATIVE RULES TITLE 11, CHAPTER 54 – WATER QUALITY STANDARDS.
9. THE CONTRACTOR SHALL, AT HIS OR HER OWN EXPENSE, KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCES. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS AND REGULATIONS OF THE STATE OF HAWAII DEPARTMENT OF HEALTH (DOH), THE STATE OF HAWAII OCCUPATIONAL SAFETY ADMINISTRATION (HIOSH), THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE U.S. OCCUPATIONAL AND HEALTH ADMINISTRATION (OSHA).
10. THE CONTRACTOR SHALL REMOVE ALL SILT AND DEBRIS RESULTING FROM HIS WORK AND DEPOSITED IN DRAINAGE FACILITIES, ROADWAYS AND OTHER AREAS. THE COSTS INCURRED FOR ANY NECESSARY REMEDIAL ACTION BY THE ENGINEER SHALL BE PAYABLE BY THE CONTRACTOR.
11. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES AND STRUCTURES AS SHOWN IN THE PLANS ARE FROM THE LATEST AVAILABLE RECORD DATA. THERE ARE NO GUARANTEES AS TO THE ACCURACY OF UTILITIES AND STRUCTURES SHOWN OR THAT OTHER OBSTACLES WILL NOT BE ENCOUNTERED DURING THE COURSE OF THE WORK. THE CONTRACTOR SHALL NOT ASSUME THAT WHERE NO UNDERGROUND UTILITIES, LINES, CONDUITS OR STRUCTURES ARE SHOWN, NONE EXIST. RATHER IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PAY FOR ALL DAMAGES TO EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY THE LOCATION AND DEPTH OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTION TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO THE EXCAVATION FOR THE NEW LINES.
12. PRIOR TO THE START OF EXCAVATION, THE CONTRACTOR SHALL NOTIFY ALL OWNERS OF UNDERGROUND IMPROVEMENTS, INCLUDING PUBLIC AND PRIVATE UTILITIES, OF IMPENDING WORK IN THE AREA AND SHALL REQUEST LINE LOCATIONS FOR ALL UNDERGROUND IMPROVEMENTS ON THE PROJECT SITE INCLUDING, BUT NOT LIMITED TO, ELECTRIC (PUBLIC AND PRIVATE), TELEPHONE, SCADA SIGNAL LINES, CATV, GAS, POL, WATER, SEWER AND STORM DRAINAGE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND PROTECTION OF ALL UNDERGROUND IMPROVEMENTS REGARDLESS OF OWNERSHIP OF SUCH IMPROVEMENTS AND SHALL PAY ALL COSTS OF REPAIR AND DAMAGES FOR ANY HARM TO EXISTING UTILITIES RESULTING FROM CONTRACTOR'S ACTIONS OR THE ACTIONS OF CONTRACTOR'S AGENTS, EMPLOYEES, SUB-CONTRACTORS, SUPPLIERS, AND SERVICE PROVIDERS. PERSONAL INJURIES RESULTING FROM CONTACT WITH EXISTING UTILITIES IN ANY LOCATION SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
13. ALL EXISTING UTILITIES, SERVICE LINES, SUPPLY LINES, SIGNAL LINES AND COMMUNICATIONS LINES SHALL REMAIN IN PLACE AND IN SERVICE THROUGHOUT THE TERM OF THE PROJECT. IF RELOCATION OF EXISTING IMPROVEMENTS IS REQUIRED FOR THE CONTRACTOR'S CONVENIENCE, INTERRUPTION OF SERVICE SHALL BE KEPT TO A MINIMUM AND SHALL BE DONE AT THE CONTRACTOR'S EXPENSE AND ONLY WITH THE APPROVAL OF THE ENGINEER.
14. WHEN TRENCH EXCAVATION IS ADJACENT TO OR UNDER EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY SHEETING AND BRACING THE EXCAVATION AND STABILIZING THE EXISTING GROUND TO RENDER IT SAFE AND SECURE FROM POSSIBLE SLIDES, CAVE-INS AND SETTLEMENT AND FOR PROPERLY SUPPORTING EXITING STRUCTURES AND FACILITIES WITH BEAMS, STRUTS OR UNDERPINNING TO FULLY PROTECT THEM FROM DAMAGE.

GENERAL NOTES (CONTINUED):

15. BACKFILL UNDER EXISTING STRUCTURES OR FACILITIES SHALL BE SANDY OR GRANULAR MATERIAL COMPLETELY PLACED AS SOON AS THE PIPE IS LAID AND TESTED. THE BACKFILL MATERIAL SHALL BE RAMMED WITH PROPER TOOLS UNTIL COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DENSITY.
16. THE CONTRACTOR SHALL PROVIDE ACCESS TO AND FROM ALL DRIVEWAYS AND STREETS AT ALL TIMES.
17. THE CONTRACTOR SHALL RESTORE TO THEIR ORIGINAL CONDITION ALL IMPROVEMENTS DAMAGED AS A RESULT OF THE CONSTRUCTION, INCLUDING PAVEMENTS, EMBANKMENTS, CURBS, SIGNS, LANDSCAPING, STRUCTURES, UTILITIES, WALLS, FENCES, ETC. UNLESS PROVIDED FOR SPECIFICALLY IN THE PROPOSAL, DEMOLITION AND RESTORATION OF EXISTING ITEMS, INCLUDING GROUND COVER, WEED BARRIERS AND SURFACING MATERIALS SHALL BE INCIDENTAL TO THE WORK AND WILL NOT BE PAID FOR SEPARATELY BUT COMPENSATION SHALL BE INCLUDED IN THE APPROPRIATE LUMP SUM PRICE OR APPROPRIATE UNIT PRICE FOR EXCAVATION OR BACKFILL.
18. THE CONTRACTOR SHALL SECURE ALL NECESSARY LICENSES, PERMITS, APPROVALS AND CLEARANCES AND SHALL PAY ALL APPLICATION, LICENSE, PERMIT AND INSPECTION FEES REQUIRED FOR THE WORK AND SHALL GIVE ALL NOTICES NECESSARY FOR AND INCIDENTAL TO THE PROPER AND LAWFUL EXECUTION OF THE WORK.
19. THE CONTRACTOR SHALL MAINTAIN VEHICULAR ACCESS TO SITE DURING WORKING & NON-WORKING HOURS.
20. THE CONTRACTOR SHALL PROVIDE TEMPORARY SECURITY COVER(S) OVER ANY AND ALL OPENINGS CREATED AS A CONSEQUENCE OF THE PROJECT WORK. THE COVERINGS SHALL BE ADEQUATE TO PROTECT THE INTERIOR AND ALL NECESSARY EQUIPMENT FROM WEATHER AND TO MAINTAIN BUILDING SECURITY. SECURITY COVERS SHALL BE PROVIDED WHENEVER THE CONTRACTOR IS AWAY FROM THE PROJECT SITE AND/OR AT THE DIRECTION OF THE ENGINEER.
21. BUILDING SHALL BE SECURED AT THE END OF EACH DAY'S WORK.
22. THE CONTRACTOR SHALL BE HELD TO HAVE EXAMINED THE PREMISES AND VERIFICATION OF EXISTING CONDITIONS PRIOR TO SUBMITTAL OF THEIR BID. NO COMPENSATION SHALL BE MADE BECAUSE OF ANY MISUNDERSTANDING OR ERROR REGARDING CONDITIONS OR AMOUNT OF WORK TO BE DONE.
23. CONTRACTOR SHALL SUBMIT A CONSTRUCTION SCHEDULE, IDENTIFYING START AND FINISH OF EACH MAJOR TASK, INCLUDING OUTAGES. THE WORK SHALL BE SEQUENCED TO MINIMIZE INTERRUPTION TO THE PUMP STATION SERVICE. SUBMIT SCHEDULE PRIOR TO START OF WORK. OUTAGES SHALL BE APPROVED BY THE BWS.
24. CONTRACTOR SHALL SUBMIT AS-BUILT DRAWINGS IN ACCORDANCE WITH SPECIAL PROVISIONS.

GENERAL CONSTRUCTION NOTES:

1. CONTRACTOR SHALL COORDINATE ALL WORK WITH THE HAWAIIAN ELECTRIC COMPANY AND HAWAIIAN TELCOM.
2. PROVIDE POLYOLEFIN 200LB TEST PULLCORD IN ALL EMPTY CONDUITS, UNLESS OTHERWISE NOTED.
3. ALL ELECTRICAL EQUIPMENT ENCLOSURES AND EQUIPMENT MOUNTING HARDWARE AND FASTENERS FOR OUTDOOR INSTALLATION SHALL BE TYPE 316 STAINLESS STEEL, UNLESS OTHERWISE NOTED.

ELECTRICAL SYMBOLS

EXIST SYMBOL	NEW SYMBOL	DESCRIPTION
		LARGE JUNCTION BOX, SIZE AS NOTED, WALL MTD
		ELECTRICAL UTILITY LINE
		TELECOMMUNICATIONS UTILITY LINE
		JOINT UTILITY POLE
		HTCO 2' X 6' PULLBOX. PROVIDE 2X6 PRECAST CONCRETE PULLBOX PER HTCO STD DWG NO. 34078. INSCRIBE COVER WITH "HTCO"
		HECO 4' X 6' HANDHOLE. PROVIDE 4X6 PRECAST CONCRETE PULLBOX PER HECO STD DWG NO. 101024. INSCRIBE COVER W/ "HECO"
		GUY WIRE AND ANCHOR
		CONDUIT CONCEALED IN SLAB OR BELOW GRADE
		EXPOSED CONDUIT
		FLEXIBLE METALLIC CONDUIT
		OVERHEAD UTILITY LINE, "E" DENOTES ELECTRICAL, "T" DENOTES TELECOMMUNICATIONS
		ELECTRICAL/TELECOM DUCTLINE WITH DUCTLINE & DESIGNATORS; ITEM IN CIRCLE INDICATES DUCT SECTION TYPE; DUCT SECTION CUT LINES INDICATES VIEW OF DUCT SECTION; SHOWN WITH DUCT SECTION COMPLEMENTS TYPE "A" DUCT SECTION WITH 2-5"E & 1-2"T DUCTS (E=ELECTRIC, T=TELECOM)
		NOTE SYMBOL, SEE PLAN FOR NOTES

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SIGNATURE
Exp: 4/30/24

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

ELECTRICAL SYMBOLS, GENERAL NOTES, DUCT SECTIONS

APPROVED: _____ DATE: _____
MANAGER AND CHIEF ENGINEER, BWS

DRAWN BY: CAD ENGINEER: RY CHECKED BY: BJO FILE NO: _____

FIELD BOOK NO: SCALE: AS INDICATED SHEET 35 OF 50 SHEETS

FILE	POCKET	FOLDER	NO.

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HAWAIIAN ELECTRIC COMPANY (HECO) NOTES:

1. LOCATION OF HAWAIIAN ELECTRIC FACILITIES

THE LOCATION OF HAWAIIAN ELECTRIC'S OVERHEAD AND UNDERGROUND FACILITIES SHOWN ON THE PLANS ARE FROM EXISTING RECORDS WITH VARYING DEGREES OF ACCURACY AND ARE NOT GUARANTEED AS SHOWN. THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATIONS OF THE FACILITIES AND SHALL EXERCISE PROPER CARE IN EXCAVATING AND WORKING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES AND UTILITY CROSSINGS ARE SHOWN, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS AND CROSSINGS TO VERIFY THE DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES WHETHER SHOWN OR NOT SHOWN ON THE PLANS.

2. COMPLIANCE WITH HAWAII OCCUPATIONAL SAFETY AND HEALTH LAWS

THE CONTRACTOR SHALL COMPLY WITH THE STATE OF HAWAII'S OCCUPATIONAL SAFETY AND HEALTH LAWS AND REGULATIONS, INCLUDING WITHOUT LIMITATION, THOSE RELATED TO WORKING ON OR NEAR EXPOSED OR ENERGIZED ELECTRICAL LINES AND EQUIPMENT.

3. EXCAVATION CLEARANCE

THE CONTRACTOR SHALL OBTAIN AN EXCAVATION CLEARANCE FROM HAWAIIAN ELECTRIC'S PLANNING AND DESIGN SECTION OF THE TRANSMISSION & DISTRIBUTION ENGINEERING DEPARTMENT (543-5654) LOCATED AT 820 WARD AVENUE, 4TH FLOOR, A MINIMUM OF TEN (10) WORKING DAYS PRIOR TO STARTING CONSTRUCTION.

4. CAUTION!!! ELECTRICAL HAZARD!!!

EXISTING HAWAIIAN ELECTRIC OVERHEAD AND UNDERGROUND LINES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION UNLESS PRIOR SPECIAL ARRANGEMENTS HAVE BEEN MADE WITH HAWAIIAN ELECTRIC. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO HANDLE THESE ENERGIZED LINES AND ERECT TEMPORARY GUARDS TO PROTECT THESE LINES FROM DAMAGE. THE CONTRACTOR SHALL WORK CAUTIOUSLY AT ALL TIMES TO AVOID ACCIDENTS AND DAMAGE TO EXISTING HAWAIIAN ELECTRIC FACILITIES, WHICH CAN RESULT IN ELECTROCUTION.

5. OVERHEAD LINES

STATE LAW (OSHA) REQUIRES THAT A WORKER AND THE LONGEST OBJECT HE OR SHE MAY CONTACT CANNOT COME CLOSER THAN A SPECIFIED MINIMUM RADIAL CLEARANCE WHEN WORKING CLOSE TO OR UNDER ANY OVERHEAD LINES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE INFORMED OF AND COMPLY WITH THE LAW.

AT ANY TIME SHOULD THE CONTRACTOR ANTICIPATE THAT HIS WORK WILL RESULT IN THE NEED TO ENCROACH WITHIN THE MINIMUM REQUIRED CLEARANCE AS STATED IN THE LAW, THE CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC AT LEAST THREE (3) MONTHS PRIOR TO THE PLANNED ENCROACHMENT SO THAT, IF FEASIBLE, THE NECESSARY PROTECTIONS (E.G. RELOCATE OR DE-ENERGIZE HAWAIIAN ELECTRIC LINES) CAN BE INVESTIGATED. HAWAIIAN ELECTRIC MAY ALSO BE ABLE TO BLANKET ITS DISTRIBUTION (12KV AND BELOW) LINES TO PROVIDE A VISUAL AID IN PREVENTING ACCIDENTAL CONTACT. HAWAIIAN ELECTRIC'S COST OF SAFEGUARDING OR IDENTIFYING ITS LINES WILL BE CHARGED TO THE CONTRACTOR.

CONTACT HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 FOR ASSISTANCE IN IDENTIFYING AND SAFEGUARDING OVERHEAD POWER LINES.

6. POLE BRACING

- A. CONTRACTOR SHALL NOT EXCAVATE WITHIN 10 FEET OF HAWAIIAN ELECTRIC'S UTILITY POLES OR ANY ANCHOR SYSTEM SUPPORTING THE UTILITY POLE. IF CONTRACTOR MUST EXCAVATE AN AREA MORE THAN 12 INCHES DEEP BY 12 INCHES WIDE, AND CLOSER THAN 10 FEET FROM A UTILITY POLE OR ITS ANCHOR SYSTEM, CONTRACTOR WILL BE RESPONSIBLE FOR PROTECTING, SUPPORTING, SECURING AND TAKING ALL PRECAUTIONS TO PREVENT DAMAGE TO OR LEANING OF EXISTING POLES. BEFORE COMMENCING SUCH EXCAVATION, CONTRACTOR MUST NOTIFY HAWAIIAN ELECTRIC WHICH MAY LEAD TO IMPLEMENTING POLE BRACING REQUIREMENTS. HAWAIIAN ELECTRIC REQUIRES A MINIMUM OF TEN (10) WORKING DAYS TO CONDUCT THE REVIEW OF CONTRACTOR'S SUBMITTAL. CONTRACTOR SHALL SUBMIT ITS BRACING CALCULATIONS AND DRAWINGS, PREPARED AND STAMPED BY A LICENSED STRUCTURAL ENGINEER, TO HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS (543-7070) FOR REVIEW. CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND REMOVAL OF THE TEMPORARY POLE BRACING SYSTEM, AS WELL AS ALL COSTS INCURRED BY HAWAIIAN ELECTRIC TO REVIEW CONTRACTOR'S DRAWINGS AND TO REPAIR OR STRAIGHTEN POLES IMPACTED BY CONTRACTOR'S ACTIVITIES, INCLUDING RESPONSE AND RESTORATION COSTS INCURRED BY HAWAIIAN ELECTRIC ARISING OUT OF OR RELATED TO OUTAGES CAUSED BY CONTRACTOR'S FAILURE TO MEET THE FOREGOING REQUIREMENTS. HAWAIIAN ELECTRIC'S RECEIPT OF POLE BRACING CALCULATION OR DRAWING SUBMITTALS OF ANY CONTRACTOR, INCLUDING WORK PROCEDURE, SHALL NOT RELIEVE CONTRACTOR FROM ANY LIABILITY RESULTING FROM CONTRACTOR'S EXCAVATION NEAR OR AROUND HAWAIIAN ELECTRIC'S UTILITY POLES.
- B. HAWAIIAN ELECTRIC MAY PROVIDE TO THE CUSTOMER INFORMATION RELATED TO POLE BRACING, INCLUDING CALCULATIONS AND OTHER BASIC ENGINEERING. HOWEVER, HAWAIIAN ELECTRIC PROVIDES THIS INFORMATION FOR INFORMATIONAL PURPOSES ONLY AND DOES NOT WARRANT ANY OF THE INFORMATION PROVIDED TO CUSTOMER. HAWAIIAN ELECTRIC HEREBY DISCLAIMS ANY LIABILITY ASSOCIATED WITH THE CUSTOMER'S USE OF INFORMATION PROVIDED TO THE CUSTOMER FROM HAWAIIAN ELECTRIC. IT IS THE CUSTOMER'S DUTY TO OBTAIN ENGINEERING FROM ITS OWN ENGINEER OR CONTRACTOR IN ORDER TO BRACE POLES AND THE USE OF HAWAIIAN ELECTRIC'S INFORMATION DOES NOT EXCUSE THE CUSTOMER FROM PERFORMING ITS OWN EVALUATION OF THE BRACING NEEDS. SHOULD THE CUSTOMER INSTALL BRACING AT ANY POLE LOCATION, CUSTOMER SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS HAWAIIAN ELECTRIC FROM ANY THIRD PARTY CLAIMS ASSOCIATED WITH THE CUSTOMER'S BRACING OF A POLE. SHOULD THE WORK CUSTOMER PERFORM AT OR NEAR THE POLE LOCATION COMPROMISE THE POLE OR ITS SURROUNDINGS IN ANY WAY, CUSTOMER SHALL RESTORE OR REPLACE THE POLE SO THAT IT IS NO LONGER COMPROMISED.

7. UNDERGROUND LINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF UNDERGROUND LINES. HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL CABLES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO BREAK INTO EXISTING HAWAIIAN ELECTRIC FACILITIES, HANDLE THESE CABLES, AND ERECT TEMPORARY GUARDS TO PROTECT THESE CABLES FROM DAMAGE. THE COST OF HAWAIIAN ELECTRIC'S ASSISTANCE IN PROVIDING PROPER SUPPORT AND PROTECTION OF ITS UNDERGROUND LINES WILL BE CHARGED TO THE CONTRACTOR. FOR ASSISTANCE/COORDINATION IN PROVIDING PROPER SUPPORT AND PROTECTION OF THESE LINES, THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 A MINIMUM OF TEN (10) WORKING DAYS IN ADVANCE.

SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S 138KV OR 46KV UNDERGROUND LINES (SEE HAWAIIAN ELECTRIC INSTRUCTIONS TO CONSULTANTS/CONTRACTORS ON "EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND 138KV AND/OR 46KV LINES" FOR DETAILED REQUIREMENTS).

FOR VERIFICATION OF UNDERGROUND LINES, THE CONTRACTOR SHALL CALL THE HAWAII ONE CALL CENTER AT 866-423-7287 MINIMUM OF FIVE (5) WORKING DAYS IN ADVANCE.

8. UNDERGROUND FUEL PIPELINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES. SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES (SEE HAWAIIAN ELECTRIC'S SPECIFIC FUEL PIPELINE "GUIDELINES" TO CONSULTANTS/CONTRACTORS ON EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL PIPELINES FOR DETAILED REQUIREMENTS).

9. EXCAVATIONS

WHEN TRENCH EXCAVATION IS ADJACENT TO OR BENEATH HAWAIIAN ELECTRIC'S EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR IS RESPONSIBLE FOR:

- A) ARRANGING FOR HAWAIIAN ELECTRIC STANDBY PERSONNEL TO OBSERVE WORK AT CONTRACTOR'S COST.
- B) SHEETING, BRACING, OR OTHERWISE SUPPORTING THE EXCAVATION AND STABILIZING THE EXISTING GROUND TO RENDER IT SAFE AND SECURE AND TO PREVENT POSSIBLE SLIDES, CAVE-INS, AND SETTLEMENTS.
- C) PROPERLY SUPPORTING EXISTING STRUCTURES OR FACILITIES WITH BEAMS, STRUTS, UNDER-PINNINGS, OR OTHER NECESSARY METHODS TO FULLY PROTECT IT FROM DAMAGE.
- D) BACKFILLING WITH PROPER BACKFILL MATERIAL INCLUDING SPECIAL THERMAL BACKFILL WHERE EXISTING (REFER TO ENGINEERING DIVISION FOR THERMAL BACKFILL SPECIFICATIONS).

10. RELOCATION OF HAWAIIAN ELECTRIC FACILITIES

ANY WORK REQUIRED TO RELOCATE OR MODIFY HAWAIIAN ELECTRIC FACILITIES SHALL BE DONE BY HAWAIIAN ELECTRIC, OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION, AND SHALL PROVIDE NECESSARY SUPPORT FOR HAWAIIAN ELECTRIC'S WORK, WHICH MAY INCLUDE, BUT NOT BE LIMITED TO, STAKING OF POLE/ANCHOR LOCATIONS, IDENTIFYING RIGHT OF WAY AND PROPERTY LINES, EXCAVATION AND BACKFILL, PERMITS AND TRAFFIC CONTROL, BARRICADING, AND RESTORATION OF PAVEMENT, SIDEWALKS, AND OTHER FACILITIES.

ALL COSTS ASSOCIATED WITH ANY RELOCATION OR MODIFICATION (EITHER TEMPORARY OR PERMANENT) FOR THE CONVENIENCE OF THE CONTRACTOR, OR TO ENABLE THE CONTRACTOR TO PERFORM HIS WORK IN A SAFE AND EXPEDITIOUS MANNER IN FULFILLING HIS CONTRACT OBLIGATIONS SHALL BE BORNE BY THE CONTRACTOR.

11. CONFLICTS

ANY REDESIGN OR RELOCATION OF HAWAIIAN ELECTRIC'S FACILITIES NOT SHOWN ON THE PLANS MAY BE CAUSE FOR LENGTHY DELAYS. THE CONTRACTOR ACKNOWLEDGES THAT HAWAIIAN ELECTRIC IS NOT RESPONSIBLE FOR ANY DELAY OR DAMAGE THAT MAY ARISE AS A RESULT OF ANY CONFLICTS DISCOVERED OR IDENTIFIED WITH RESPECT TO THE LOCATION OR CONSTRUCTION OF HAWAIIAN ELECTRIC'S ELECTRICAL FACILITIES IN THE FIELD, REGARDLESS OF WHETHER THE CONTRACTOR HAS MET THE REQUESTED MINIMUM ADVANCE NOTICES. IN ORDER TO MINIMIZE ANY DELAY OR IMPACT ARISING FROM SUCH CONFLICTS, HAWAIIAN ELECTRIC SHOULD BE NOTIFIED IMMEDIATELY UPON DISCOVERY OR IDENTIFICATION OF SUCH CONFLICT.

12. DAMAGE TO HAWAIIAN ELECTRIC FACILITIES

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL HAWAIIAN ELECTRIC SURFACE AND SUBSURFACE UTILITIES AND SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES AS A RESULT OF HIS OPERATIONS. THE CONTRACTOR SHALL IMMEDIATELY REPORT SUCH DAMAGES OR ANY HAZARDOUS CONDITIONS RELATED TO HAWAIIAN ELECTRIC'S LINES TO HAWAIIAN ELECTRIC'S TROUBLE DISPATCHER AT 548-7961. REPAIR WORK SHALL BE DONE BY HAWAIIAN ELECTRIC OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. COSTS FOR DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES SHALL BE BORNE BY THE CONTRACTOR.

IN CASE OF DAMAGE OR SUSPECTED DAMAGE TO HAWAIIAN ELECTRIC'S FUEL PIPELINE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY HAWAIIAN ELECTRIC'S SECURITY COMMAND CENTER AT 543-7685 (A 24-HOUR NUMBER) SO HAWAIIAN ELECTRIC PERSONNEL CAN SECURE THE DAMAGED SECTION AND REPORT ANY OIL SPILLS TO THE PROPER AUTHORITIES. ALL COSTS ASSOCIATED WITH THE DAMAGE, REPAIR, AND OIL SPILL CLEANUP SHALL BE BORNE BY THE CONTRACTOR.

13. HAWAIIAN ELECTRIC STAND-BY PERSONNEL

THE CONTRACTOR MAY REQUEST HAWAIIAN ELECTRIC TO PROVIDE AN INSPECTOR TO STAND-BY DURING CONSTRUCTION NEAR HAWAIIAN ELECTRIC'S FACILITIES. THE COST OF SUCH INSPECTION

WILL BE CHARGED TO THE CONTRACTOR.

THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 A MINIMUM OF THREE (3) MONTHS IN ADVANCE TO ARRANGE FOR HAWAIIAN ELECTRIC STAND-BY PERSONNEL.

14. CLEARANCES

THE FOLLOWING CLEARANCES SHALL BE MAINTAINED BETWEEN HAWAIIAN ELECTRIC'S DUCTLINE AND ALL ADJACENT STRUCTURES (CHARTED AND UNCHARTED) IN THE TRENCH: (SEE TABLE)

THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER & HAWAIIAN ELECTRIC OF ANY HEAT SOURCES (POWER CABLE DUCT BANK, STEAMLINE, ETC.) ENCOUNTERED THAT ARE NOT PROPERLY IDENTIFIED ON THE DRAWING.

15. INDEMNITY

THE CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS HAWAIIAN ELECTRIC FROM AND AGAINST ALL LOSSES, DAMAGES, CLAIMS, AND ACTIONS, INCLUDING BUT NOT LIMITED TO REASONABLE ATTORNEY'S FEES AND COSTS BASED UPON OR ARISING OUT OF DAMAGE TO PROPERTY OR INJURIES TO PERSONS, OR OTHER TORTIOUS ACTS CAUSED OR CONTRIBUTED TO BY CONTRACTOR OR ANYONE ACTING UNDER ITS DIRECTION OR CONTROL OR ON ITS BEHALF; PROVIDED CONTRACTOR'S INDEMNITY SHALL NOT BE APPLICABLE TO ANY LIABILITY BASED UPON THE SOLE NEGLIGENCE OF HAWAIIAN ELECTRIC.

ADDITIONAL NOTES WHEN WORK INVOLVES CONSTRUCTION OF HAWAIIAN ELECTRIC FACILITIES

16. SCHEDULE

CONTRACTOR SHALL FURNISH HIS CONSTRUCTION SCHEDULE SIX (6) MONTHS PRIOR TO STARTING WORK ON HAWAIIAN ELECTRIC FACILITIES. CONTRACTOR SHALL GIVE HAWAIIAN ELECTRIC, IN WRITING, THREE (3) MONTHS NOTICE TO PROCEED WITH HAWAIIAN ELECTRIC'S PORTION OF WORK.

17. AUTHORITY

ALL CONSTRUCTION, RESTORATION WORK, AND INSPECTION SHALL BE SUBJECT TO WHICHEVER GOVERNMENTAL AGENCY HAS AUTHORITY OVER THE WORK.

18. SPECIFICATIONS

CONSTRUCTION OF HAWAIIAN ELECTRIC'S UNDERGROUND FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST REVISIONS OF HAWAIIAN ELECTRIC SPECIFICATIONS CS7001, CS7003, CS7202, CS9301, AND CS9401 AND APPLICABLE HAWAIIAN ELECTRIC STANDARDS.

19. CONSTRUCTION

CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES TO PROPERLY PERFORM AND FULLY COMPLETE ALL WORK SHOWN ON THE CONTRACT, DRAWINGS, AND SPECIFICATIONS. ALL MATERIALS SHALL BE NEW AND MANUFACTURED IN THE UNITED STATES OF AMERICA. ALL MANHOLE, HANDHOLE, AND DUCTLINE INSTALLATIONS SHALL BE INSPECTED AND APPROVED BY HAWAIIAN ELECTRIC PRIOR TO EXCAVATION AND PRIOR TO PLACING CONCRETE. CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST FIVE (5) WORKING DAYS PRIOR TO INSTALLING FACILITIES OR PLACING CONCRETE.

CONTRACTOR TO COORDINATE WORK TO BREAK INTO HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL FACILITIES WITH HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST TEN (10) WORKING DAYS IN ADVANCE.

20. STAKEOUT

THE CONTRACTOR SHALL ARRANGE FOR TONEOUTS OF ALL UNDERGROUND FACILITIES AND SHALL STAKEOUT ALL PROPOSED HAWAIIAN ELECTRIC FACILITIES WITHIN THE PROJECT AREA SO AS TO NOT CONFLICT WITH ANY UTILITY (EXISTING OR PROPOSED) AND ANY PROPOSED CONSTRUCTION OR IMPROVEMENT WORK FOR VERIFICATION BY HAWAIIAN ELECTRIC BEFORE PROCEEDING WITH HAWAIIAN ELECTRIC WORK.

21. DUCTLINES

ALL DUCTLINE INSTALLATIONS SHALL BE PVC SCHEDULE 40 ENCASED IN CONCRETE, UNLESS OTHERWISE NOTED. ALL COMPLETED DUCTLINES SHALL BE MANDREL TESTED BY THE CONTRACTOR IN THE PRESENCE OF HAWAIIAN ELECTRIC'S INSPECTOR USING HAWAIIAN ELECTRIC'S STANDARD PRACTICE. THE CONTRACTOR SHALL INSTALL 1800# TENSILE STRENGTH MULETAPE PULL LINE IN ALL COMPLETED DUCTLINES AFTER MANDREL TESTING IS COMPLETE.

22. JOINT POLE REMOVAL

THE LAST JOINT POLE OCCUPANT OF THE POLES SHALL REMOVE THE POLES.

23. AS-BUILT PLANS

THE CONTRACTOR SHALL PROVIDE HAWAIIAN ELECTRIC WITH A SET OF ELECTRONIC AND HARD COPY PLANS OF EACH SHEET SHOWING THE OFFSETS, STATIONING, AND VERTICAL ELEVATION OF THE DUCT LINE(S) CONSTRUCTED.

GUIDELINES FOR MINIMUM HORIZONTAL (PARALLEL) CLEARANCES BETWEEN HAWAIIAN ELECTRIC AND OTHER UNDERGROUND UTILITIES				
UNDERGROUND UTILITY	HAWAIIAN ELECTRIC DIRECT BURIED CABLE	HAWAIIAN ELECTRIC DIRECT BURIED IN CONDUIT (NO CONCRETE ENCASEMENT)	HAWAIIAN ELECTRIC 3' (MINIMUM) CONCRETE ENCASEMENT	APPLICABLE NOTES:
HAWAIIAN ELECTRIC DB CONDUITS	12"	3"	0"	
HAWAIIAN ELECTRIC 3" ENCASEMENT	0"	0"	0"	
TELEPHONE/CATV DB	12"	12"	6"	
TELEPHONE/CATV DB DUCTS	12"	12"	6"	
TELEPHONE/CATV 3" ENCASEMENT	0"	0"	0"	5
TRAFFIC SIGNAL	12"	12"	12"	
WATER DB (BWS OWNED)	36"	36"	36"	1, 4
CUSTOMER OWNED WATER SERVICE LATERALS	12"	12"	12"	
WATER (CONCRETE JACKETED) (BWS OWNED)	36"	36"	36"	1, 4
GAS DB	12"	12"	12"	1
GAS (CONCRETE JACKETED)	12"	12"	12"	1
SEWER DB	36"	36"	36"	1, 2
SEWER (CONCRETE JACKETED)	36"	36"	36"	1, 2
DRAIN	12"	12"	12"	1
FUEL PIPELINES				3
NOTES:				
1. WHERE SPACE IS AVAILABLE, PARALLEL CLEARANCE TO OTHER UTILITIES, OR FOREIGN STRUCTURES OTHER THAN COMMUNICATION OR TRAFFIC SIGNAL SHALL BE 36"				
2. IF 36" CLEARANCE CANNOT BE MET: - IF CLEARANCE IS LESS THAN 12", JACKET SEWER LINE WITH REINFORCED CONCRETE (PER HAWAIIAN ELECTRIC'S STD. 30-1030) FOR A DISTANCE OF 5' PLUS PIPE DIAMETER. - IF CLEARANCE IS BETWEEN 12" AND 36", JACKET SEWER LINE WITH PLAIN CONCRETE.				
3. ALL FUEL PIPELINE CROSSINGS SHALL BE REVIEWED AND APPROVED BY THE COMPANY THAT OWNS AND MAINTAINS IT.				
4. 5 FEET CLEAR TO WATER MAINS 16" OR LARGER.				
5. FOR SITUATIONS WITH 0" MINIMUM SEPARATION, A 6" SEPARATION IS RECOMMENDED.				
6. CLEARANCES MEASURED FROM OUTER EDGES OR DIAMETERS OF UTILITIES. WHENEVER CONCRETE JACKETS ARE INVOLVED, CLEARANCES SHALL BE TOTAL CLEAR DISTANCE BETWEEN THE CONCRETE JACKET AND UTILITY CONCERNED.				

DRAWING REVIEW

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Hawaiian Electric

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SIGNATURE
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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII
HECO NOTES

APPROVED: _____ DATE: _____

MANAGER AND CHIEF ENGINEER, BWS

DRAWN BY: CAD ENGINEER: RY CHECKED BY: BJO FILE NO: _____

FIELD BOOK NO: SCALE: AS INDICATED SHEET 36 OF 50 SHEETS

FILE	POCKET	FOLDER	NO.

HAWAIIAN ELECTRIC COMPANY (HECO) NOTES CONT.:

GUIDELINES FOR MINIMUM VERTICAL (CROSSING) CLEARANCES HAWAIIAN ELECTRIC AND OTHER UNDERGROUND UTILITIES				
UNDERGROUND UTILITY	HAWAIIAN ELECTRIC DIRECT BURIED CABLE	HAWAIIAN ELECTRIC DIRECT BURIED IN CONDUIT (NO CONCRETE ENCASEMENT)	HAWAIIAN ELECTRIC 3" (MINIMUM) CONCRETE ENCASEMENT	APPLICABLE NOTES:
HAWAIIAN ELECTRIC DB CONDUITS	6"	3"	0"	
HAWAIIAN ELECTRIC 3" ENCASEMENT	0"	0"	0"	
TELEPHONE/CATV DB	12"	12"	6"	
TELEPHONE/CATV DB DUCTS	12"	12"	6"	
TELEPHONE/CATV 3" ENCASEMENT	0"	0"	0"	3
TRAFFIC SIGNAL	12"	12"	6"	
WATER DB (BWS OWNED)	12"	12"	12"	5
CUSTOMER OWNED WATER SERVICE LATERALS	6"	6"	6"	
WATER (CONCRETE JACKETED) (BWS OWNED)	12"	12"	12"	5
GAS DB	12"	12"	12"	
GAS (CONCRETE JACKETED)	12"	12"	12"	
SEWER DB	24"	24"	24"	1
SEWER (CONCRETE JACKETED)	24"	24"	24"	1
DRAIN	12"	12"	6"	
FUEL PIPELINES				2
NOTES: <div><div>1. IF CLEARANCE CANNOT BE MET:<div><div>– IF CLEARANCE IS LESS THAN 12", JACKET SEWER LINE WITH REINFORCED CONCRETE (PER HAWAIIAN ELECTRIC'S STD. 30–1030) FOR A DISTANCE OF 5' PLUS PIPE DIAMETER.</div><div>– IF CLEARANCE IS BETWEEN 12" AND 24", JACKET SEWER LINE WITH PLAIN CONCRETE.</div></div></div><div>2. ALL FUEL PIPELINE CROSSINGS SHALL BE REVIEWED AND APPROVED BY THE COMPANY THAT OWNS AND MAINTAINS IT.</div><div>3. FOR SITUATIONS WITH 0" MINIMUM SEPARATION, A 6" SEPARATION IS RECOMMENDED.</div><div>4. CLEARANCES MEASURED FROM OUTER EDGES OR DIAMETERS OF UTILITIES. WHENEVER CONCRETE JACKETS ARE INVOLVED, CLEARANCES SHALL BE TOTAL CLEAR DISTANCE BETWEEN THE CONCRETE JACKET AND UTILITY CONCERNED.</div><div>5. 36" CLEARANCE IS REQUIRED FOR TRENCHLESS INSTALLATION WORK.</div></div>				

HAWAIIAN TELCOM (HTCO) NOTES:

1. THE CONTRACTOR SHALL PROCURE AND PAY FOR ALL LICENSES AND PERMITS AND SHALL GIVE ALL NOTICES NECESSARY AND INCIDENT TO THE DUE AND LAWFUL PROSECUTION OF THE WORK.

2. THE CONTRACTOR SHALL OBTAIN AN EXCAVATION PERMIT AND TONING REQUEST FROM HAWAIIAN TELCOM'S EXCAVATION PERMIT SECTION, LOCATED AT 1177 BISHOP STREET, TWO WEEKS PRIOR TO THE START OF CONSTRUCTION. HOURS OF BUSINESS ARE 8:00 A.M. TO 11:00 A.M. AND 12:00 P.M. TO 3:00 P.M. MONDAY THROUGH FRIDAY, EXCEPT HOLIDAYS.

3. PRIOR TO THE EXCAVATION OF THE DUCTLINE, THE CONTRACTOR SHALL REQUEST HAWAIIAN TELCOM TO LOCATE EXISTING DUCTLINE. WHEREVER REQUIRED. FOR UNDERGROUND CABLE LOCATING AND MARKING, FIVE (5) WORKING DAYS ADVANCE NOTICE IS REQUIRED. THREE (3) WORKING DAYS ADVANCE NOTICE IS REQUIRED FOR ANY INSPECTION BY A DESIGNATED REPRESENTATIVE.

4. THE LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION AND SHALL MAINTAIN PROPER CLEARANCES WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF HAWAIIAN TELCOM FACILITIES. THE CONTRACTOR SHALL VERIFY THEIR LOCATIONS AND SHALL BE LIABLE FOR ANY DAMAGES TO HAWAIIAN TELCOM FACILITIES. ANY DAMAGES SHALL BE REPORTED IMMEDIATELY TO HAWAIIAN TELCOM'S REPAIR SECTION AT #611 (24 HOURS) OR TO THE EXCAVATION PERMIT SECTION AT 546–7746 (NORMAL WORKING HOURS, MONDAY THROUGH FRIDAY, EXCEPT HOLIDAYS). AS A RESULT OF HIS OPERATIONS, ADJUSTMENTS TO THE NEW DUCTLINE ALIGNMENT, IF REQUIRED, SHALL BE MADE TO PROVIDE THE REQUIRED CLEARANCES.

5. THE CONTRACTOR SHALL TAKE NECESSARY PRECAUTION NOT TO DAMAGE EXISTING CABLES OR DUCTS. A HAWAIIAN TELCOM INSPECTOR OR DESIGNATED REPRESENTATIVE IS REQUIRED TO BE AT ANY JOB SITE. WHENEVER THERE WILL BE A BREAKAGE INTO OR ENTRY INTO ANY STRUCTURE THAT CONTAIN HAWAIIAN TELCOM FACILITIES. TEMPORARY CABLE AND DUCT SUPPORTS SHALL BE PROVIDED WHEREVER NECESSARY.

6. THE CONTRACTOR SHALL NOTIFY HAWAIIAN TELCOM'S INSPECTOR OR DESIGNATED REPRESENTATIVE A MINIMUM OF 72 HOURS PRIOR TO EXCAVATION, BRACING, OR BACKFILLING OF HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

7. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE "HAWAIIAN TELCOM STANDARD SPECIFICATIONS FOR PLACING TELEPHONE SYSTEMS" DATED JANUARY 2007. ALL SUBSEQUENT AMENDMENTS AND ADDITIONS, AND ALL OTHER PERTINENT STANDARDS FOR TELEPHONE CONSTRUCTION. CONTRACTOR SHALL FAMILIARIZE HIS PERSONNEL BY OBTAINING APPLICABLE SPECIFICATIONS.

8. WHEN EXCAVATION IS ADJACENT TO OR BENEATH HAWAIIAN TELCOM'S EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR SHALL:

a. SHEET AND/OR BRACE THE EXCAVATION TO PREVENT SLIDES, CAVE-INS, OR SETTLEMENTS TO ENSURE NO MOVEMENT TO HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

b. PROTECT EXISTING STRUCTURES AND/OR FACILITIES WITH BEAMS, STRUTS, OR UNDERPINNING WHILE EXCAVATING BENEATH THEM TO ENSURE NO MOVEMENT TO HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

9. THE CONTRACTOR SHALL BRACE ALL POLES OR LIGHT STANDARDS NEAR THE NEW DUCTLINE, MANHOLE, OR HANDHOLE DURING HIS OPERATIONS.

10. THE CONTRACTOR SHALL SAW–CUT AC. PAVEMENT AND CONCRETE GUTTER WHEREVER NEW MANHOLES, HANDHOLES, OR DUCTLINES ARE TO BE PLACED AND SHALL RESTORE TO EXISTING CONDITION OR BETTER.

11. THE CONTRACTOR SHALL COMPLY WITH THE POLICY ADOPTED BY THE DEPARTMENT OF PLANNING AND PERMITTING, CITY AND COUNTY OF HONOLULU, CONCERNING THE REPLACEMENT OF CONCRETE SIDEWALKS AFTER EXCAVATION WORK.
12. THE UNDERGROUND PIPES, CABLES, OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.

13. WHEREVER CONNECTIONS TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES PRIOR TO EXCAVATION OF THE MAIN TRENCHES TO VERIFY THEIR LOCATIONS AND DEPTHS.

14. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE COST FOR SUPPLEMENTARY MEASURES, WHICH WILL BE REQUIRED BY THE CITY AND COUNTY, SHALL BE BORNE BY THE CONTRACTOR.

15. THE CONTRACTOR SHALL PUMP ALL MANHOLES DRY DURING FINAL INSPECTION.

16. THE CONTRACTOR SHALL NOTIFY HAWAIIAN TELCOM INSPECTOR 24 HOURS PRIOR TO THE POURING OF CONCRETE OR BACKFILLING.

17. WHEN CONNECTING TO MANHOLE WALLS, ALL EXISTING REINFORCING BARS SHALL BE LEFT INTACT. DUCTS SHALL BE ADJUSTED IN THE FIELD IN ORDER TO CLEAR REINFORCING

18. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYING OUT ALL REQUIRED LINES AND GRADES AND SHALL PRESERVE ALL BENCH MARKS AND WORKING POINTS NECESSARY TO LAY OUT THE WORK CORRECTLY. THE NEW DUCTLINE SHALL BE ADJUSTED BY THE CONTRACTOR TO SUIT THE EXISTING CONDITIONS AND THE DETAILS AS DESCRIBED IN THE PLANS.

19. MINIMUM CONCRETE STRENGTH SHALL BE:

–FOR DUCTLINE 2500 PSI AT 28 DAYS

–FOR MANHOLE 3000 PSI AT 28 DAYS OR AS SPECIFIED IN DESIGN NOTES

20. BENDS IN THE DUCT ALIGNMENT, DUE TO CHANGES IN GRADE SHALL HAVE A MINIMUM RADIUS OF 25 FEET. ALL 90 DEGREE C–BENDS AT A POLE OR AT THE BUILDING FLOOR SLAB PENETRATION, SHALL HAVE A BEND RADIUS OF TEN TIMES THE DIAMETER OF THE DUCT OR GREATER.

21. AFTER DUCTLINE HAS BEEN COMPLETED, A MANDREL WITH A SQUARE FRONT NOT LESS THAN 12" LONG AND HAVING A DIAMETER OF 1/4" LESS THAN THE INSIDE DIAMETER OF THE DUCT, SHALL BE PULLED THROUGH EACH DUCT AFTER WHICH A BRUSH WITH STIFF BRISTLES SHALL BE PULLED THROUGH TO MAKE CERTAIN THAT NO PARTICLES OF EARTH, SAND, OR GRAVEL HAVE BEEN LEFT INSIDE. DUCTS SHALL BE COMPLETELY DRY AND CLEAN.

22. ALL DUCTS AND CONDUITS SHALL HAVE AN 1800# POLYESTER MULE–TAPE (NEPTCO, WP1800P, HAWAIIAN TELCOM MATERIAL CODE NO. 571154) INSTALLED THROUGHOUT ITS ENTIRE LENGTH. ALL DUCTS SHALL BE CAPPED TO PREVENT ENTRY OF FOREIGN MATERIAL DURING CONSTRUCTION AND AT THE COMPLETION OF INSTALLATION.

DRAWING REVIEW

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX–XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

HECO NOTES 2 + HTCO NOTES

APPROVED: _____			DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS				
DRAWN BY: CAD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 37 OF 50	SHEETS	

FILE	POCKET	FOLDER	NO.

DUCT SECTION BACKFILL NOTES:

- TYPE "A" BACKFILL – EARTH & GRAVEL.
ROCK SIZE TO BE 1" MAX. & THE
MIXTURE TO CONTAIN NOT MORE THAN
50% BY VOLUME OF ROCK PARTICLES.
95% COMPACTION.
- TYPE "B" BACKFILL – EARTH & GRAVEL.
MIXTURE MUST PASS A 1/2" MESH
SCREEN & CONTAIN NOT MORE THAN
20% BY VOLUME OF ROCK PARTICLES.
95% COMPACTION.
- NOTE – IF NORMAL MATERIAL AT
BOTTOM OF TRENCH IS NOT TYPE
"B", AN ADDITIONAL 3" SHALL BE
EXCAVATED & TYPE "B" BACKFILL
PROVIDED.
- CONCRETE – 3" ENCASEMENT,
3000 psi COMPRESSIVE STRENGTH
@ 28 DAYS.

1. FOR PAVEMENT RESTORATION DETAILS, SEE
CIVIL DRAWING C705.

DESIGNATION DESCRIPTIONS

ELEC = UTILITY CO. PRIMARY OR SECONDARY ELECTRIC
TEL = UTILITY CO. TELEPHONE

MINIMUM "X" DIMENSION
DUCT SEPARATION REQUIREMENTS

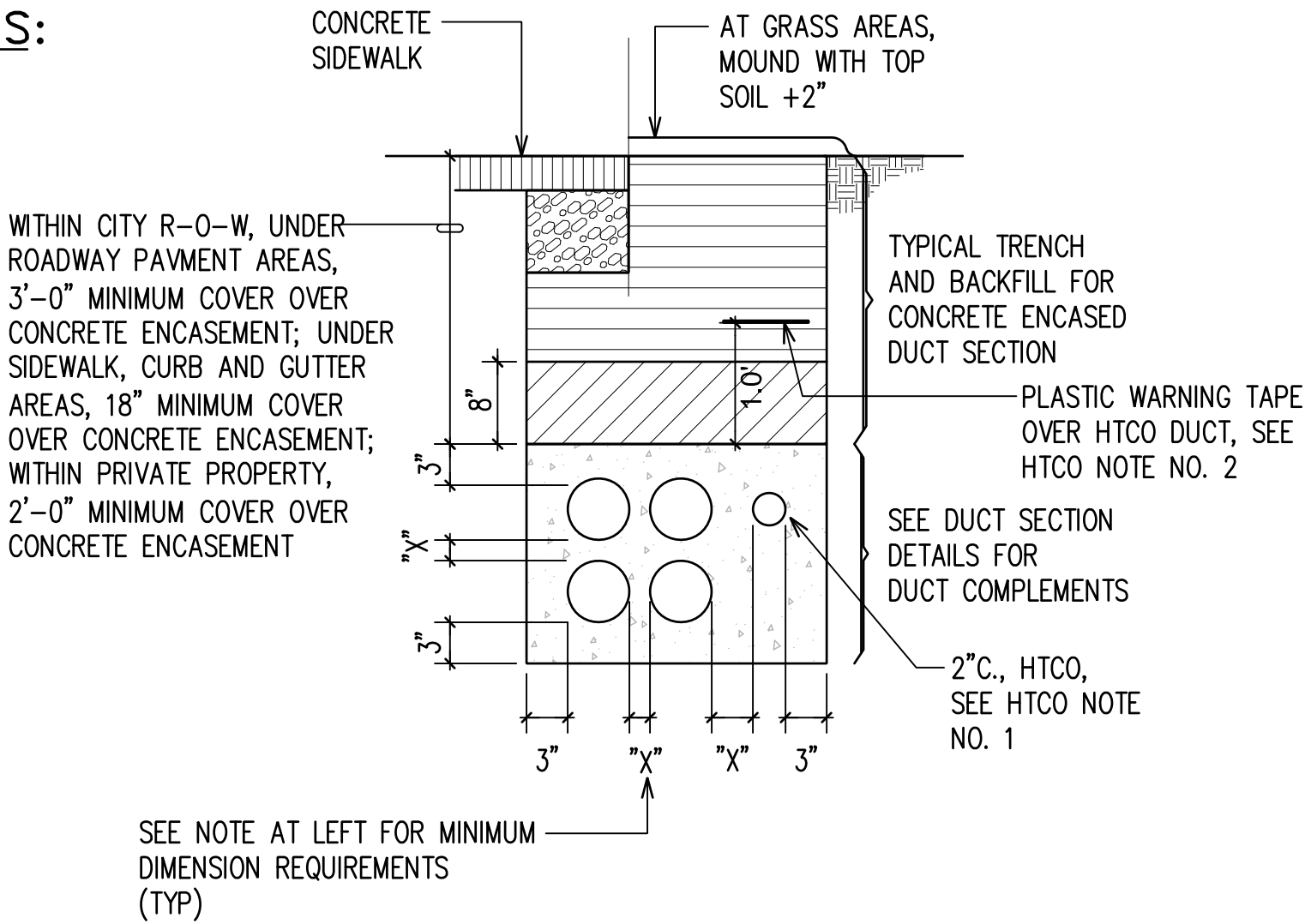
ELEC – ELEC = 1 1/2"

ELEC – TEL = 3"

MINIMUM OF 3" CONCRETE
ENCASEMENT AROUND
DUCTBANK

WHERE DUCTLINE CROSSES OVER
WATER LINE, PROVIDE THE FOLLOWING:

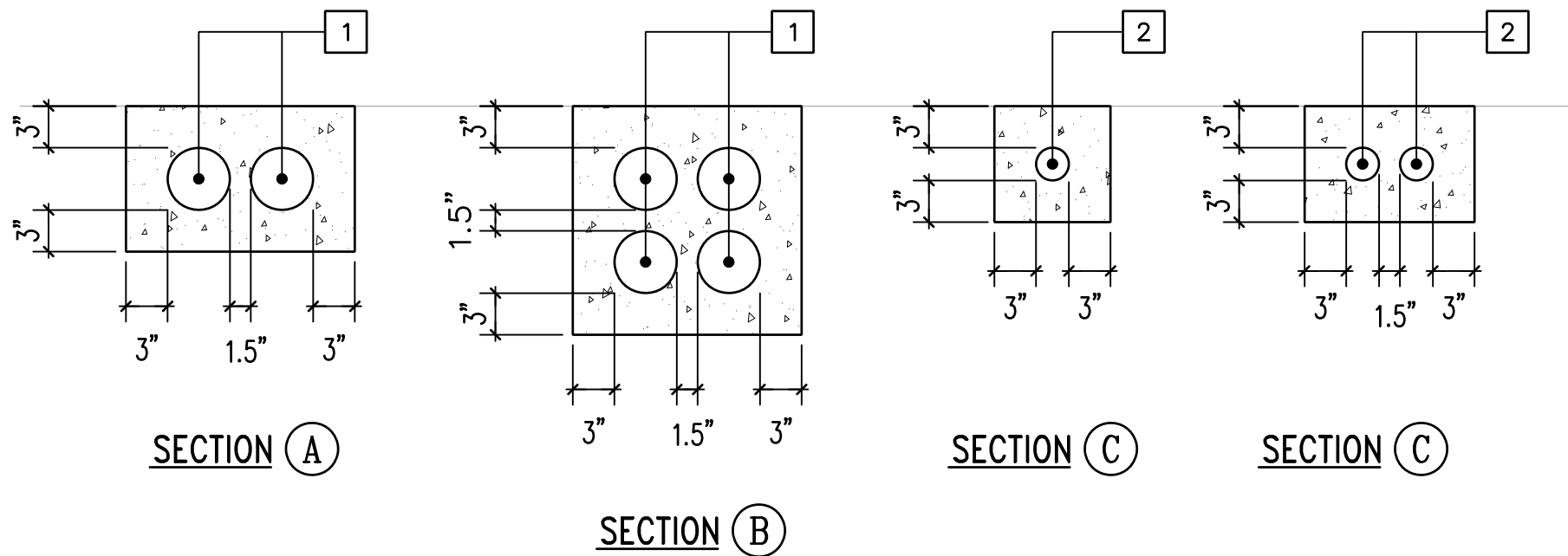
- 6" MINIMUM SEPARATION BETWEEN
DUCTLINES AND WATER LINE.
- PROVIDE CONCRETE JACKET
AROUND DUCTLINES.
- PROVIDE ONLY TYPE "B"
BACKFILL AROUND WATER
LINE.



TYPICAL DUCT SECTION

HAWAIIAN TELCOM (HTCO) DUCTLINE NOTES:

- CONTRACTOR SHALL PLACE NEPTCO WP 1800P
MULETAPE, OR APPROVED EQUAL, IN EACH
DUCT THROUGHOUT ITS ENTIRE LENGTH WITH PROTRUSIONS
OF 2 FEET IN MANHOLES AND HANDHOLES AT EACH END,
AND 1 FOOT IN PULLBOXES. MULETAPE IS RATED FOR
1800 LB PULL AND HAS FOOTAGE MARKINGS FOR
MEASURING DUCT LENGTHS.
- CONTRACTOR SHALL PLACE 8-MIL ORANGE COLORED PLASTIC
DETECTABLE WARNING TAPE, NOT LESS THAN 4" WIDE, ENTIRE
LENGTH OF TRENCH FOR ALL UNDERGROUND INSTALLATIONS.
TAPE SHOULD READ "WARNING-STOP DIGGING-CALL HTCO,
COMMUNICATIONS CABLE BURIED BELOW, FAILURE TO COMPLY
COULD RESULT IN LEGAL ACTION".



DUCT AND WIRE SCHEDULE

NO.	DUCT SIZE	WIRE SIZE	DESTINATION OR USE
1	4"	EMPTY CONDUIT W/ PULLWIRE	HECO PRIMARY FEEDER FROM JOINT POLE TO HECO HANDHOLE
2	2"	EMPTY CONDUIT W/ PULLWIRE	TELEPHONE SERVICE CONDUIT FROM JOINT POLE TO HTCO PULLBOX

NOTES:
1. ALL CONCRETE ENCASED DUCTS SHALL BE SCHEDULE 40 PVC.

APPROVED BY _____ DATE _____
HAWAIIAN TELCOM

E004

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

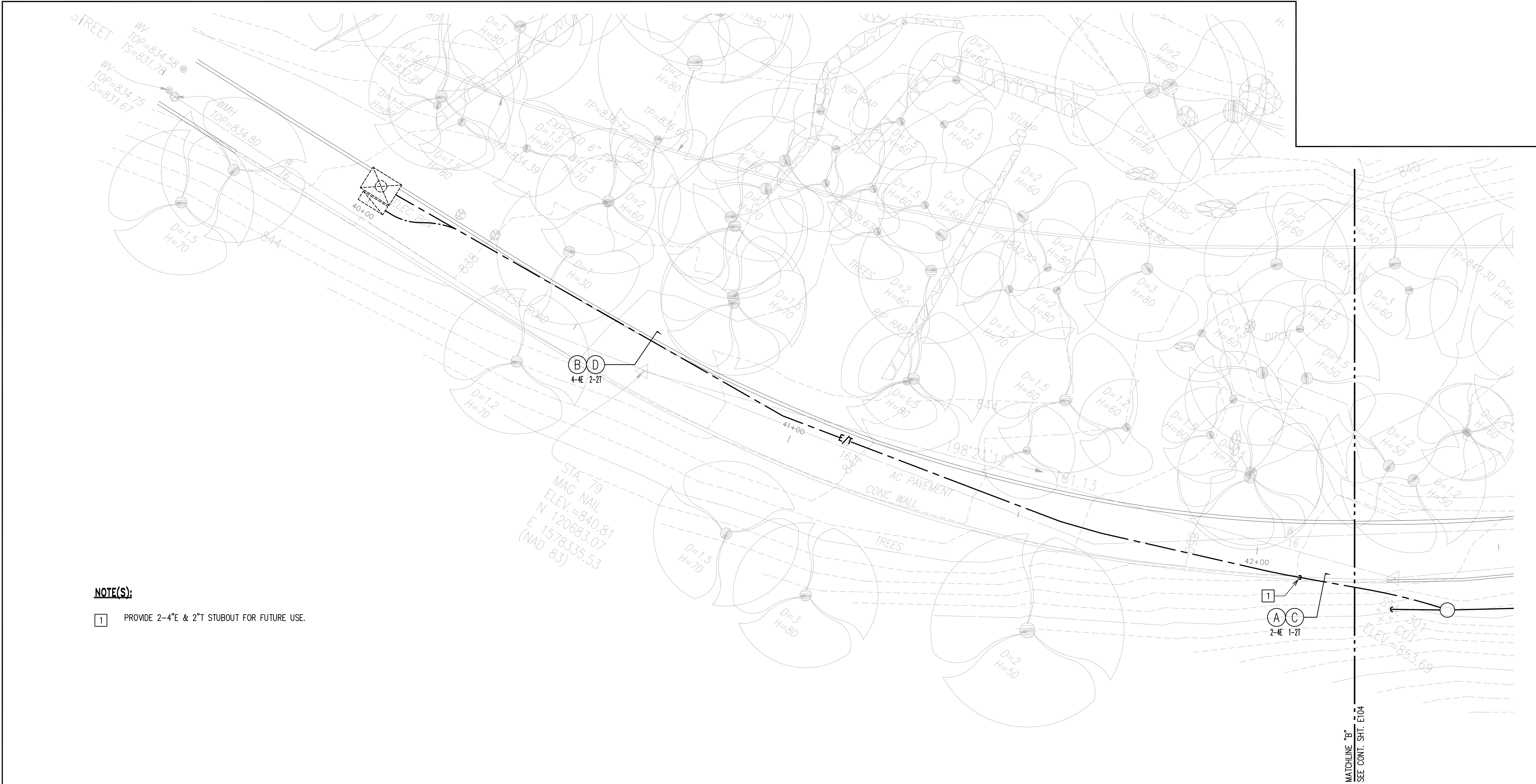
DUCT SECTION DETAILS

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DRAWN BY: CAD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 38 OF 50	SHEETS

FILE	POCKET	FOLDER	NO.

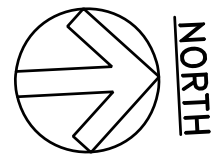


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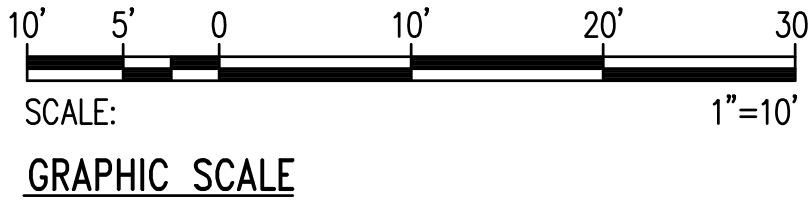


NOTE(S):

- 1 PROVIDE 2-4"E & 2"T STUBOUT FOR FUTURE USE.



1 TEMPORARY ELECTRICAL SITE PLAN 1
E103 SCALE: 1"=10'



E103

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Exp: 4/30/24

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

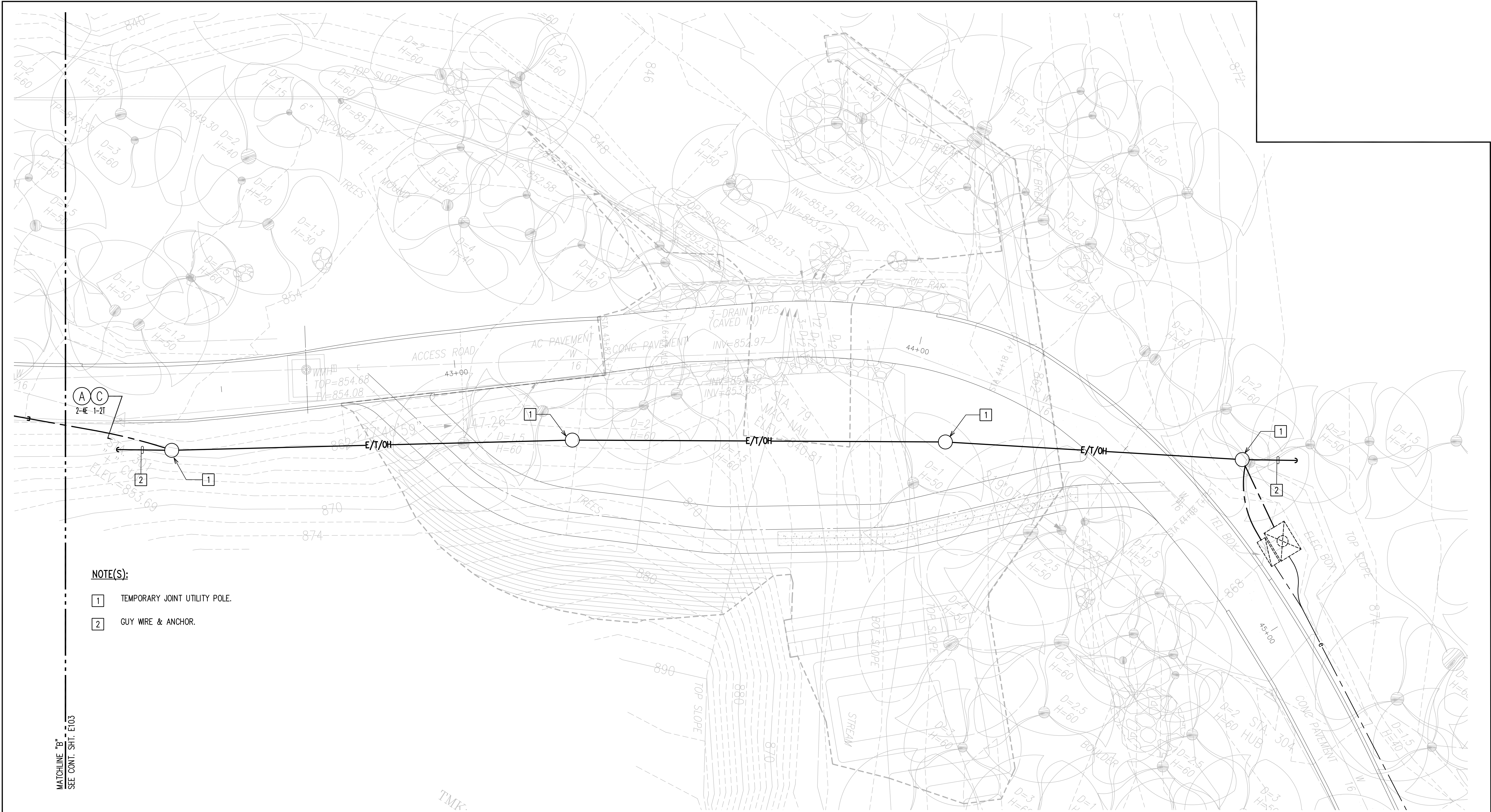
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

TEMPORARY ELECTRICAL SITE PLAN 1

APPROVED: _____				DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS					
DRAWN BY: CAD		ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____	
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 41	OF 50	SHEETS

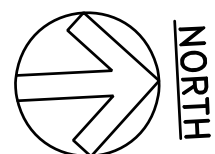
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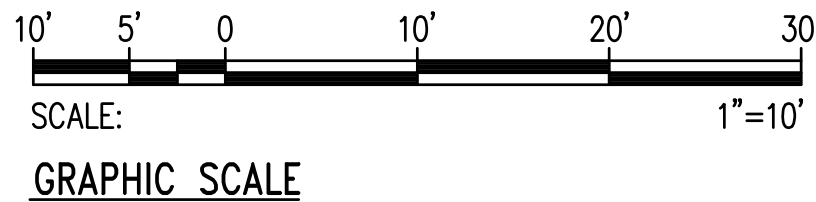


NOTE(S):

- 1 TEMPORARY JOINT UTILITY POLE.
- 2 GUY WIRE & ANCHOR.



1 TEMPORARY ELECTRICAL SITE PLAN
E104 SCALE: 1"=10'



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CITY AND COUNTY OF HONOLULU

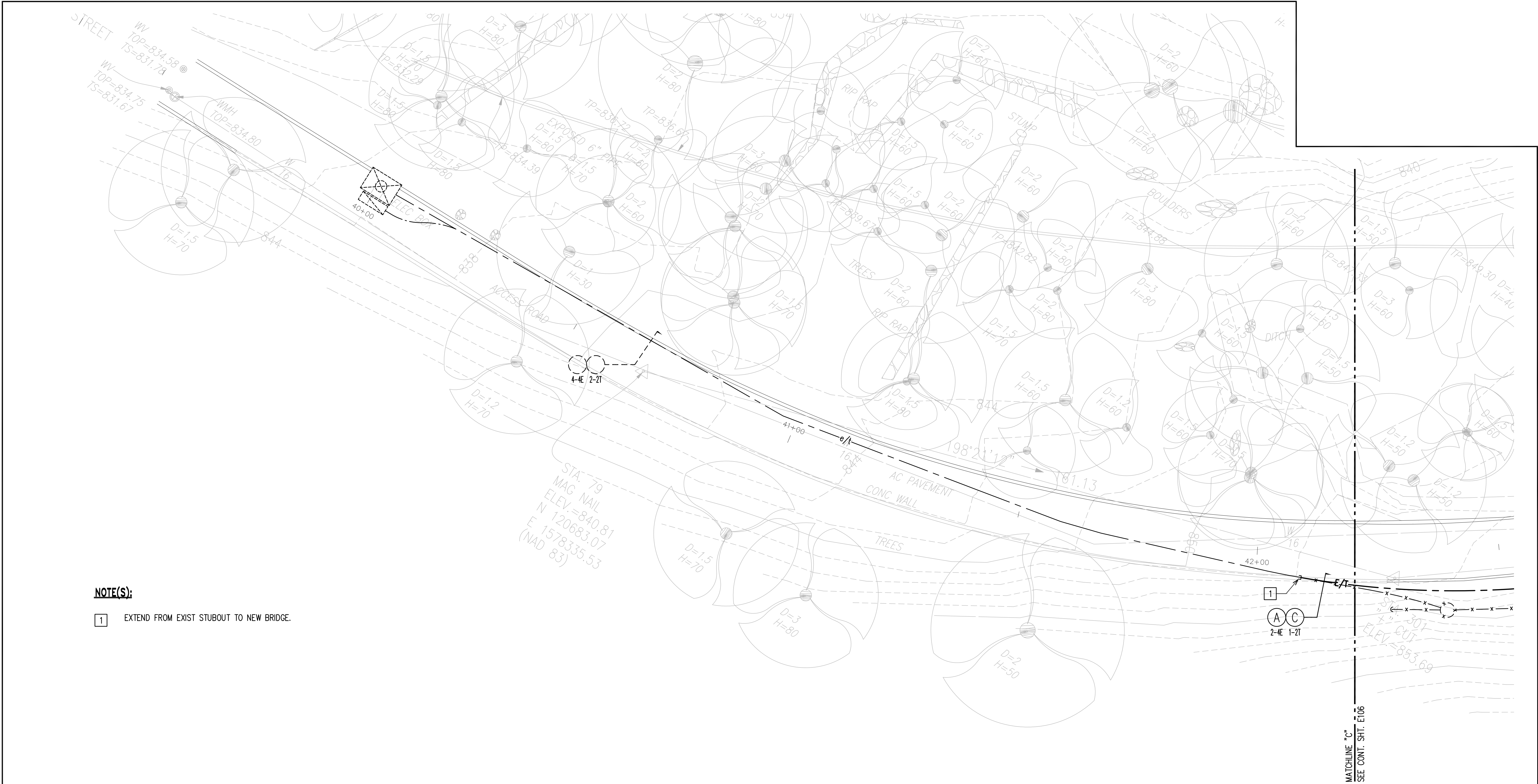
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

TEMPORARY ELECTRICAL SITE PLAN 2

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MANAGER AND CHIEF ENGINEER, BWS				
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FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 42 OF 50	SHEETS

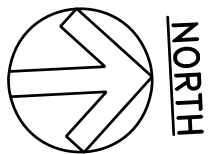
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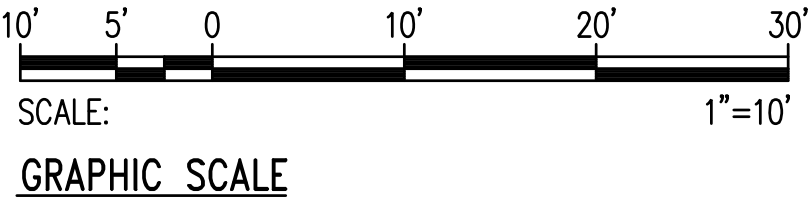


NOTE(S):

- 1 EXTEND FROM EXIST STUBOUT TO NEW BRIDGE.



1 ELECTRICAL SITE PLAN 1
E105 SCALE: 1"=10'



E105

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Exp: 4/30/24

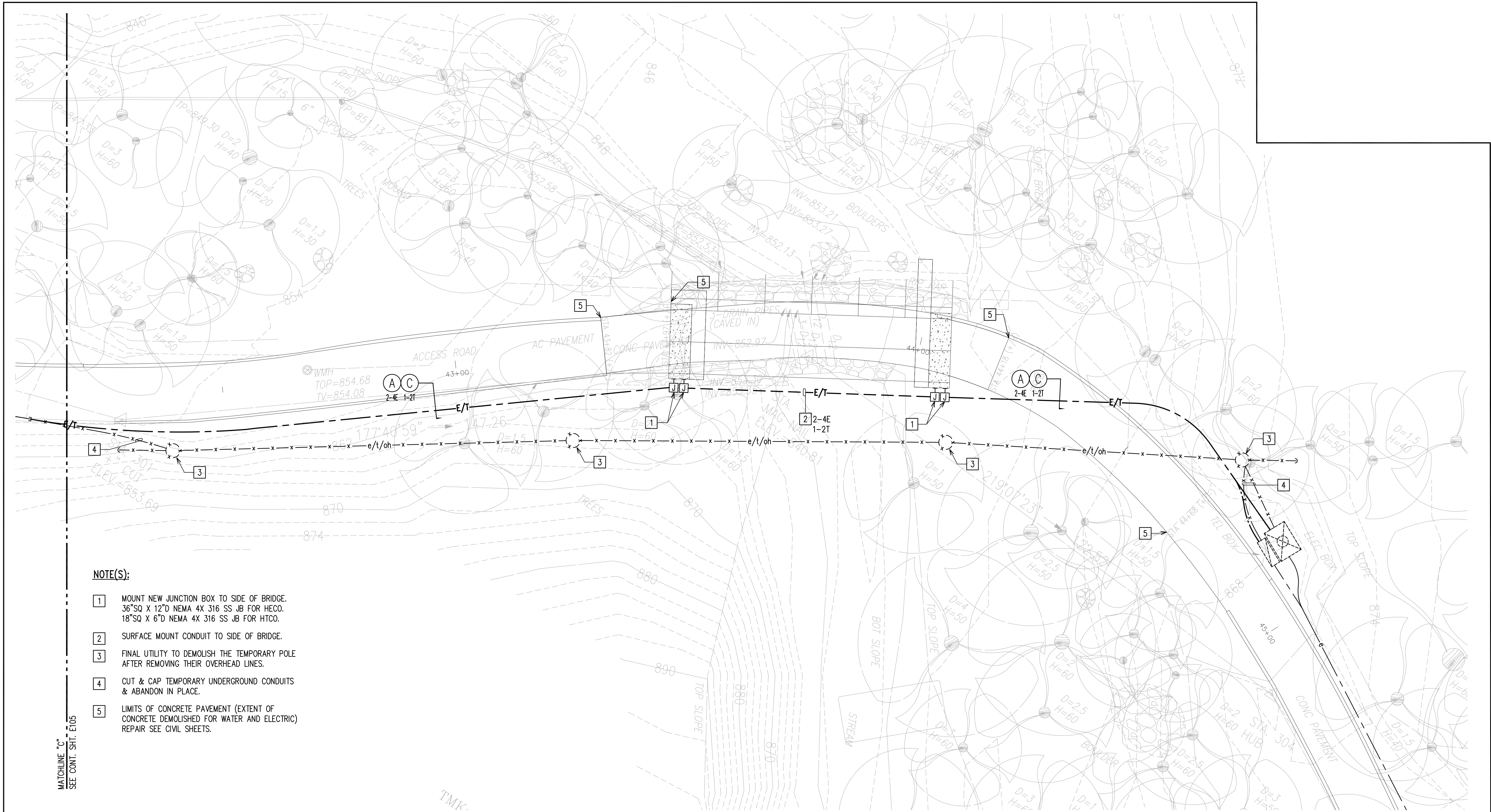
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII
ELECTRICAL SITE PLAN 1

APPROVED: _____				DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS					
DRAWN BY: CAD		ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____	
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 43	OF 50	SHEETS

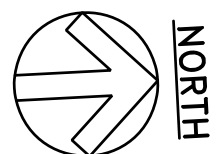
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NOTE(S):

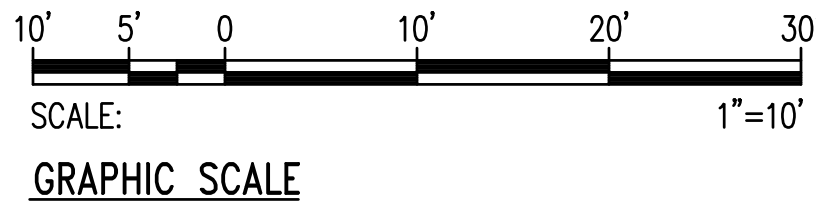
- 1 MOUNT NEW JUNCTION BOX TO SIDE OF BRIDGE.
36"SQ X 12"D NEMA 4X 316 SS JB FOR HECO.
18"SQ X 6"D NEMA 4X 316 SS JB FOR HTCO.
- 2 SURFACE MOUNT CONDUIT TO SIDE OF BRIDGE.
- 3 FINAL UTILITY TO DEMOLISH THE TEMPORARY POLE
AFTER REMOVING THEIR OVERHEAD LINES.
- 4 CUT & CAP TEMPORARY UNDERGROUND CONDUITS
& ABANDON IN PLACE.
- 5 LIMITS OF CONCRETE PAVEMENT (EXTENT OF
CONCRETE DEMOLISHED FOR WATER AND ELECTRIC)
REPAIR SEE CIVIL SHEETS.



1
E106

ELECTRICAL SITE PLAN 2

SCALE: 1"=10'



E106

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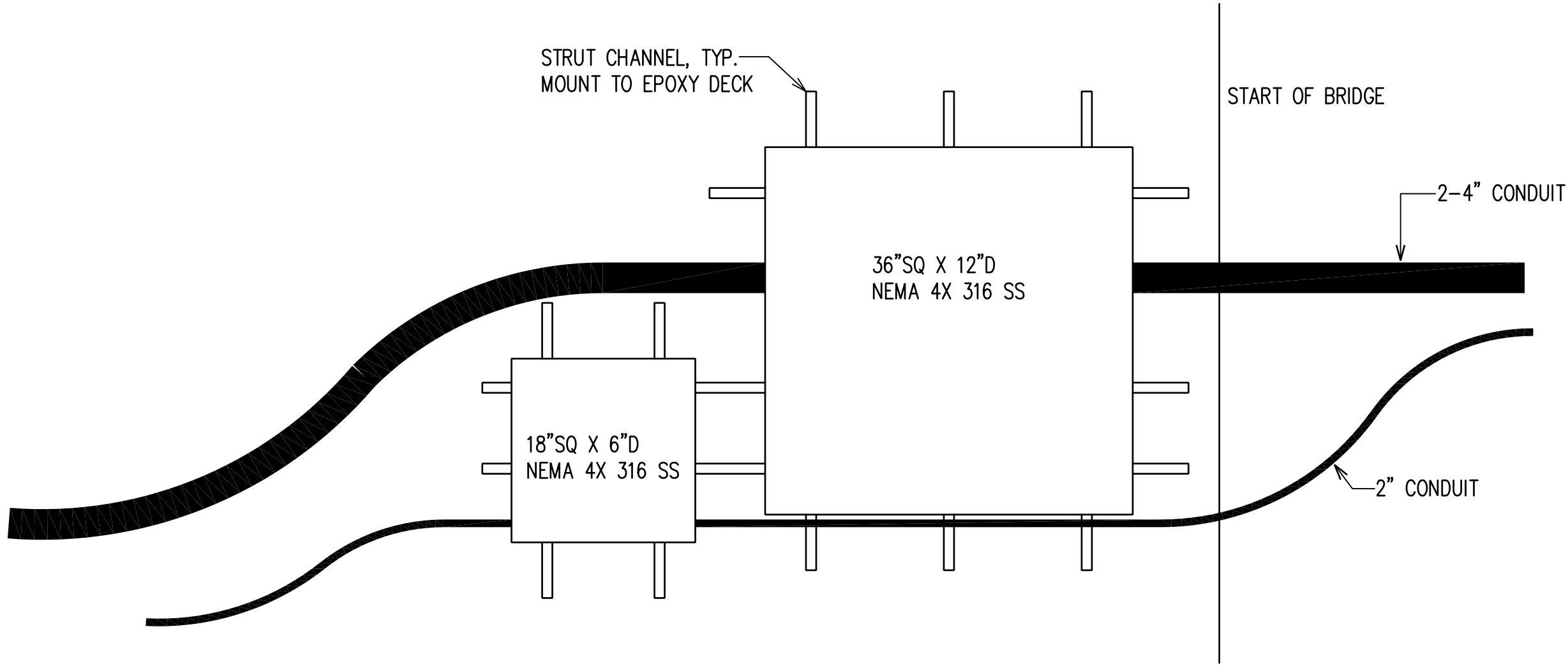
SIGNATURE
Exp: 4/30/24

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

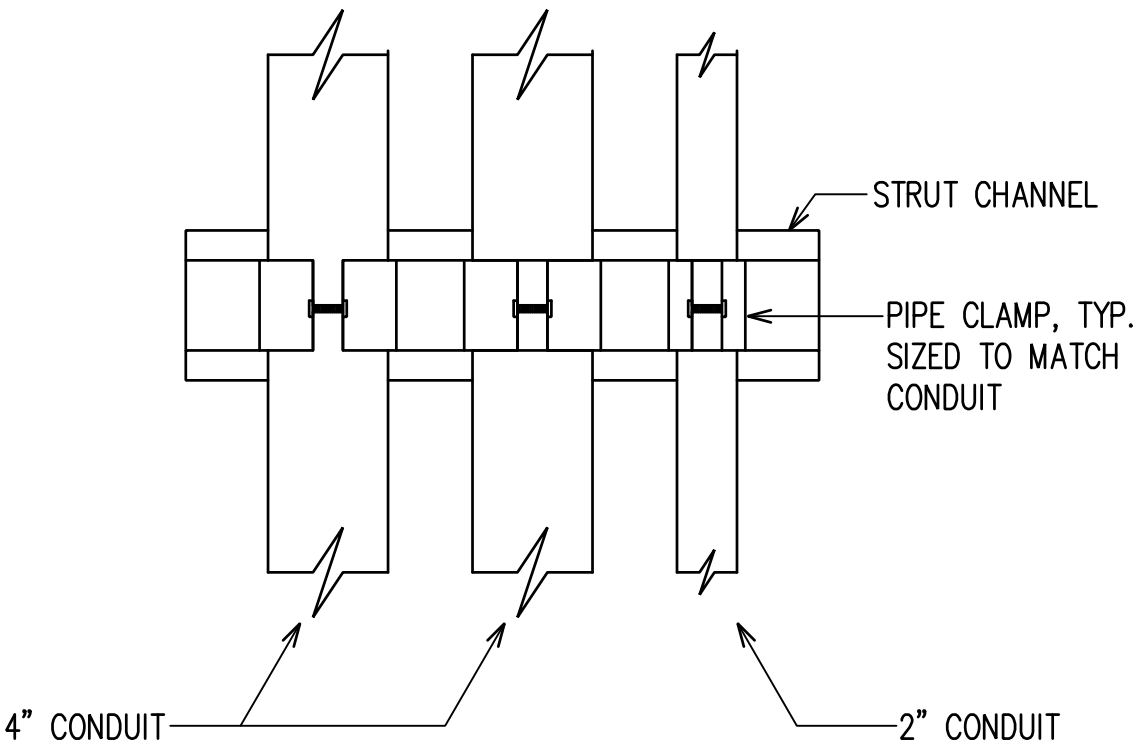
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII
ELECTRICAL SITE PLAN 2

APPROVED: _____			DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS				
DRAWN BY: CAD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____	
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 44 OF 50	SHEETS

FILE	POCKET	FOLDER	NO.

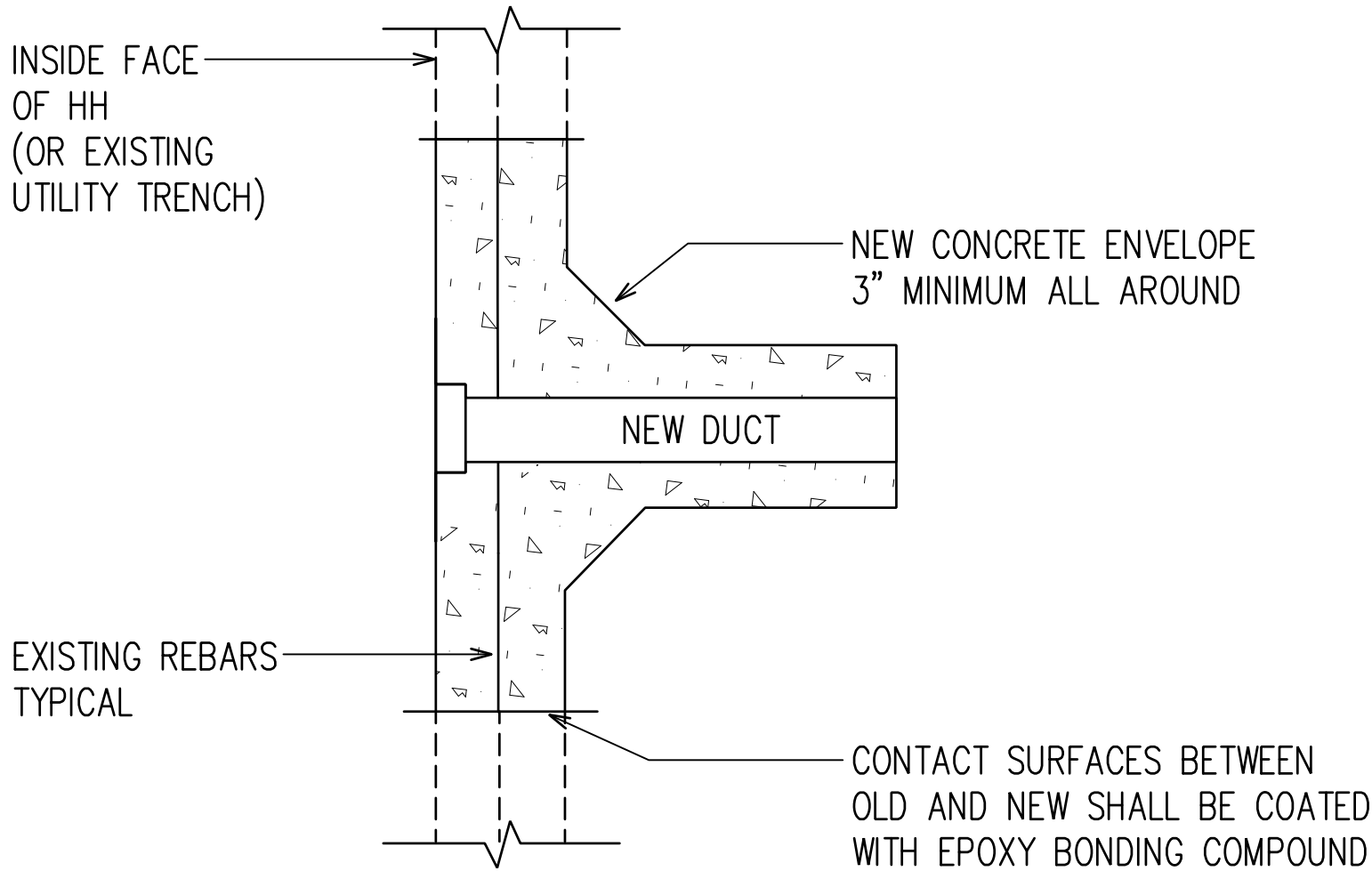


JUNCTION BOX MOUNTING DETAILS
NOT TO SCALE



- NOTE(S):**
- SEE STRUCTURAL DRAWINGS FOR ATTACHMENT DETAIL TO NEW BRIDGE.

CONDUIT MOUNTING DETAILS
NOT TO SCALE



**TYPICAL DUCT ENTRANCE DETAIL
OF EXISTING HANDHOLE**
NOT TO SCALE

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	JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, O'AHU, HAWAII MISCELLANEOUS DETAILS			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: _____
	DRAWN BY: CAD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____
	FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 45 OF 50 SHEETS
FILE		POCKET	FOLDER	NO.

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE AS AMENDED BY CHAPTER 16 OF THE REVISED ORDINANCES OF HONOLULU.
2. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE DRAWINGS AND SPECIFICATIONS.
3. THE GENERAL NOTES AND TYPICAL DETAILS SHALL APPLY UNLESS OTHERWISE SHOWN.
4. DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALES SHOWN ON DRAWINGS.
5. DRAWINGS INDICATE GENERAL AND TYPICAL DETAILS OF CONSTRUCTION. WHERE CONDITIONS ARE NOT SPECIFICALLY INDICATED BUT ARE OF SIMILAR CHARACTER TO DETAILS SHOWN, SIMILAR DETAILS OF CONSTRUCTION SHALL BE USED, SUBJECT TO REVIEW BY THE ENGINEER.
6. ALL INFORMATION SHOWN ON THE DRAWINGS RELATIVE TO EXISTING CONDITIONS IS GIVEN AS THE BEST PRESENT KNOWLEDGE, BUT WITHOUT GUARANTEE OF ACCURACY. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS PRIOR TO THE START OF THE JOB AND NOTIFY ALL DISCREPANCIES TO THE ARCHITECT.
7. ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT BEFORE PROCEEDING WITH ANY WORK SO INVOLVED.
8. DURING THE CONSTRUCTION PERIOD THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF THE BUILDING AND THE PROTECTION OF ADJACENT PROPERTIES, STRUCTURES, STREETS AND UTILITIES FROM DAMAGE. THE CONTRACTOR SHALL PROVIDE ADEQUATE SHORING, BRACING AND GUYS IN ACCORDANCE WITH ALL NATIONAL, STATE AND LOCAL SAFETY STANDARDS. ANY DEVIATION MUST BE APPROVED BY OSHA.
9. ALL ERECTION PROCEDURES SHALL CONFORM TO OSHA STANDARDS. ANY DEVIATION MUST BE APPROVED BY OSHA.
10. THE CONTRACTOR SHALL NOTIFY THE OFFICER-IN CHARGE TWO (2) WORKING WEEKS PRIOR TO BEGINNING ANY WORK WHICH WILL CONCEAL STRUCTURAL ELEMENT SUCH AS POURING CONCRETE (CONCEALING REINFORCING).

FOUNDATION / RETAINING WALL

1. FOUNDATION DESIGN IS BASED ON THE GEOTECHNICAL ENGINEERING EXPLORATION REPORT TITLED 'GEOTECHNICAL ENGINEERING EXPLORATION - MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS - MAKAHA, OAHU HAWAII - W.O. 1956-00' BY GEOLABS, INC. DATED 11/19/2021.
2. FOUNDATIONS SHALL BEAR ON THE RECOMPACTED INSITU SOIL. FOOTING SUBGRADES SHALL BE RECOMPACTED TO A MINIMUM OF 90 PERCENT RELATIVE COMPACTION. SOFT OR LOOSE MATERIAL ENCOUNTERED AT THE BOTTOM OF FOOTING EXCAVATIONS SHALL BE OVEREXCAVATED TO EXPOSE FIRM MATERIAL THEN BACKFILLED WITH SELECT GRANULAR MATERIALS, MOISTURE CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO 90% OF RELATIVE COMPACTION PER ASTM D1557.
3. THE FOUNDATIONS SHALL BE EMBEDDED A MINIMUM OF 24 INCHES BELOW THE LOWEST ADJACENT FINISH GRADES. FOR SLOPING GROUND CONDITIONS THE FOOTING SHALL EXTEND DEEPER TO OBTAIN A MINIMUM 6 FOOT SETBACK DISTANCE MEASURED FROM THE OUTSIDE EDGE OF FOOTING TO FACE OF SLOPE.
4. BACKFILL BEHIND RETAINING WALLS SHALL BE ONSITE GRANULAR SOIL OR SELECT GRANULAR BACKFILL MATERIALS. THE BACKFILL MATERIAL FROM THE TOP OF FOOTING TO THE BOTTOM OF THE WEEP HOLES SHALL CONSIST OF RELATIVELY IMPERVIOUS MATERIAL. IN ADDITION, THE TOP 12 INCHES OF BACKFILL SHALL CONSIST OF RELATIVELY IMPERVIOUS MATERIALS TO REDUCE WATER INFILTRATION BEHIND THE RETAINING WALL.
5. THE BACKFILL MATERIAL SHALL BE PLACED IN 8 INCH LOOSE LIFTS, MOISTURE CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO BETWEEN 90 TO 95 PERCENT RELATIVE COMPACTION.
6. ALL WATER, MUD AND DEBRIS SHALL BE REMOVED FROM THE BOTTOM OF FOOTING EXCAVATIONS PRIOR TO THE PLACEMENT OF CONCRETE.
7. DRAINAGE SYSTEM BEHIND THE BRIDGE ABUTMENT SHALL CONSIST OF A 4 INCH DIAMETER PERFORATED PIPE (PERFORATIONS FACING DOWN) IN A 12 INCH WIDE ZONE OF 3B FINE GRAVEL WRAPPED IN GEOTEXTILE FILTER FABRIC. THE PIPE SHALL BE PLACED AT THE BOTTOM OF THE WALL AND BE SLOPED TO DAYLIGHT.

8. DRAIN ROCK SHALL BE WRAPPED IN A GEOTEXTILE FILTER FABRIC SUCH AS MIRAFI 140N OR SIMILAR AND SHALL CONFORM TO THE FOLLOWING GRADATION:
- | SIEVE SIZE | % PASSING BY DRY WEIGHT |
|------------|-------------------------|
| 1-1/2 INCH | 90 - 100 |
| 3/4 INCH | 50 - 100 |
| NO. 4 | 0 - 50 |
| NO. 200 | 0 - 5 |
- STANDARD SIZE AGGREGATES NO. 6, 57 AND 67 AND 1-1/2 INCH FILTER MATERIALS SHOULD SATISFY THIS GRADATION REQUIREMENT.
9. AN ASPHALT EMULSION SEALER/ DAMP PROOFING SHALL BE APPLIED ON THE RETAINING SIDE OF THE STEM WALL/ FOOTING JOINT. THE SEALER SHALL EXTEND A MINIMUM OF SIX INCHES ON THE WALL AND FOOTING.

REINFORCED CONCRETE

1. ALL CONCRETE WORK SHALL CONFORM TO ACI 318-14.
2. ALL CONCRETE SHALL BE NORMAL WEIGHT (150 PCF) WITH AGGREGATES CONFORMING TO ASTM C-33. UNLESS OTHERWISE NOTED, THE COMPRESSIVE STRENGTHS OF CONCRETE AT 28 DAYS AND MAXIMUM AGGREGATE SIZES SHALL BE AS FOLLOWS:
- | | STRENGTH | AGGREGATE SIZE |
|---------|-----------|----------------|
| FOOTING | 3,000 PSI | 3/4" |
| WALL | 3,000 PSI | 3/4" |
3. MAXIMUM WATER-CEMENT RATIO SHALL NOT EXCEED 0.55.
4. ALL REINFORCING STEEL EXCEPT TIES AND STIRRUPS SHALL CONFORM TO ASTM A615 GRADE 60. TIES, STIRRUPS AND REBARS TO BE WELDED SHALL BE ASTM A615 GRADE 40.
5. UNLESS OTHERWISE NOTED, SPLICES, LAPS, DOWEL EXTENSIONS AND EMBEDMENTS SHALL BE 48 BAR DIAMETERS BUT NOT LESS THAN 24" MINIMUM.
6. ALL REINFORCING BARS MARKED CONTINUOUS (CONT.) ON THE PLANS SHALL BE LAPPED 48 BAR DIAMETERS MINIMUM. BUT NOT LESS THAN 2'-0".
7. STAGGER ALL SPLICES WHERE POSSIBLE.
8. REBARS SHALL BE SUPPORTED, BENT AND PLACED AS PER 'MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES' ACI 315 (LATEST).
9. MINIMUM COVER IN INCHES FOR REBARS FOR CAST-IN-PLACE CONCRETE:
- | | |
|-----------------------------|----|
| CONCRETE CAST AGAINST EARTH | 3" |
|-----------------------------|----|
- FORMED CONCRETE EXPOSED TO EARTH OR WEATHER:
- | | |
|----------------|--------|
| #5 AND SMALLER | 1-1/2" |
| #6 AND LARGER | 2" |
- CONCRETE NOT EXPOSED TO EARTH OR WEATHER:
- | | |
|--------------------------|--------|
| SLABS, WALLS, AND JOISTS | 3/4" |
| BEAMS AND COLUMNS | 1-1/2" |

10. WELDED WIRE FABRIC SHALL BE GALVANIZED AND CONFORM TO ASTM A-185.
11. UNLESS OTHERWISE SHOWN LAP OUTERMOST CROSS WIRES OF EACH SHEET OF WELDED WIRE FABRIC ONE SPACING OF CROSS WIRES PLUS 2" MINIMUM.
12. AT TIME CONCRETE IS PLACED, REINFORCING SHALL BE FREE FROM MUD, OIL, LAITANCE OR OTHER COATINGS ADVERSELY AFFECTING BOND CAPACITY.
13. REINFORCEMENT, ANCHOR BOLTS, SIMPSON CONNECTORS, DOWELS AND ALL OTHER EMBEDDED ITEMS SHALL BE POSITIVELY SECURED BEFORE POURING.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL PIPES SHALL CONFORM TO ASTM A53 GRADE B. CHANNELS, ANGLES, PLATES, BARS AND MISCELLANEOUS STEEL SHAPES SHALL CONFORM TO ASTM A-36. FABRICATION AND ERECTION SHALL BE IN ACCORDANCE WITH THE A.I.S.C. SPECIFICATIONS FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, LATEST EDITION. SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION.
2. ALL BOLTS SHALL CONFORM TO ASTM A307.

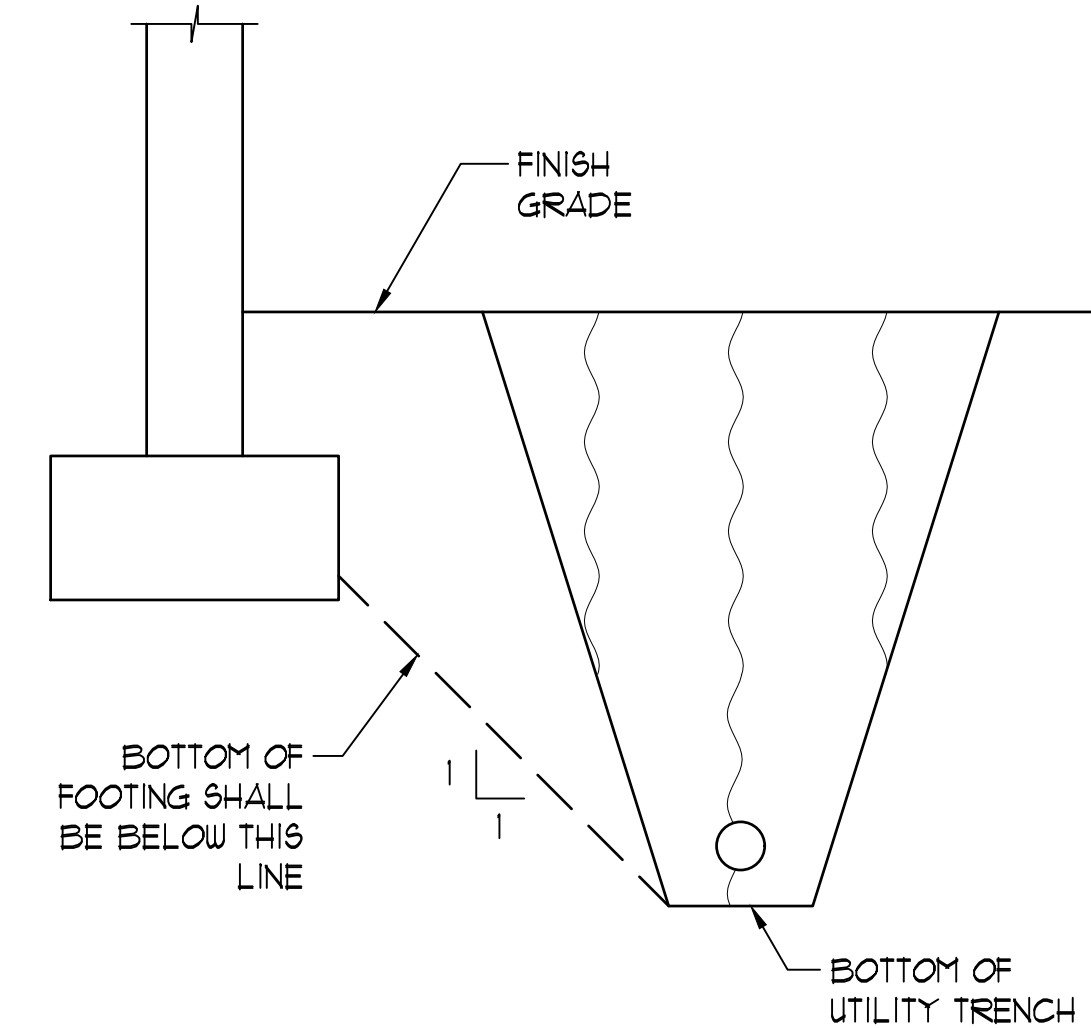
3. WELDING: ALL WELDING IS TO COMPLY WITH AWS. SPECIFICATIONS AND IS TO BE DONE BY CERTIFIED WELDERS. ALL WELDING IS TO BE DONE BY ELECTRIC ARC PROCESS AND SHALL BE PERFORMED WITH APPROVED ELECTRODES AS REQUIRED BY I.B.C. WELDS ARE DESIGNED AT FULL STRESS AND MUST BE DONE IN THE SHOP OF A LICENSED FABRICATOR.
4. ALL WELDS NOT SHOWN SHALL BE FULL PENETRATION WELDS CAPABLE OF DEVELOPING THE FULL STRENGTH OF THE CONNECTING MEMBERS.
5. THE CONTRACTOR SHALL DETAIL ALL MEMBERS AND CONNECTIONS NOT SHOWN AND SHALL SUBMIT THEM TO THE ENGINEER FOR REVIEW AND APPROVAL. COST OF THESE MEMBERS AND CONNECTIONS SHALL BE INCLUDED IN THE CONTRACTOR'S BID PRICE.
6. GALVANIZE ALL STRUCTURAL STEEL SHAPES, PLATES, BOLTS AND ACCESSORIES.

DESIGN CRITERIA

1. CODES: 2018 INTERNATIONAL BUILDING CODE
2. FOUNDATION DESIGN CRITERIA
- | | |
|-------------------------|-----------|
| ALLOWABLE BEARING | 4,000 PSF |
| PASSIVE RESISTANCE | 300 PCF |
| COEFFICIENT OF FRICTION | 0.35 |
| RETAINING WALL | |
| ACTIVE PRESSURE | 38 PCF |
| LEVEL BACKFILL | |
4. LIVE LOADS
- AS NOTED ON BRIDGE DRAWINGS
- VEHICLE SURCHARGE ON ABUTMENT BACKFILL 4 FEET
- VEHICLE SURCHARGE ON WALL AT ROAD 2 FEET
3. LATERAL FORCES
- | | |
|-----------------------------|-------|
| SEISMIC | |
| MAPPED SPECTRAL RESPONSE | |
| S _s | 0.532 |
| S ₁ | 0.145 |
| SITE CLASS | D |
| S _{ps} | 0.487 |
| S _{pi} | 0.224 |
| SEISMIC IMPORTANCE FACTOR I | 1.0 |
| RISK CATEGORY | II |
| SEISMIC DESIGN CATEGORY | D |
- | | |
|--------------------------------------|---------|
| WIND | |
| RISK CATEGORY | II |
| BASIC WIND SPEED | |
| (3 SECOND GUST) | 140 MPH |
| WIND EXPOSURE | B |
| K _{zt} TOPOGRAPHIC FACTOR | 1.0 |
| K _d DIRECTIONALITY FACTOR | 0.10 |

SPECIAL INSPECTION

1. ITEMS REQUIRING SPECIAL INSPECTION:
- REINFORCING STEEL (PERIODIC)
- EPOXY ANCHORS (CONTINUOUS)
- CONCRETE (2018 IBC TABLE 1105.3)
2. NOTIFY SPECIAL INSPECTOR 4 WORKING DAYS PRIOR TO NEED OF INSPECTION SERVICES.
3. THE CONTRACTOR SHALL BE FAMILIAR WITH THE SPECIAL INSPECTION REQUIREMENTS INCLUDING THE IDENTITY AND CONTACT INFORMATION OF THE SPECIAL INSPECTOR RESPONSIBLE FOR EACH REQUIREMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE SPECIAL INSPECTOR IN A TIMELY MANNER IF SPECIAL INSPECTIONS ARE NOT DONE THE CERTIFICATE OF OCCUPANCY MAY NOT BE ISSUED BY THE COUNTY.

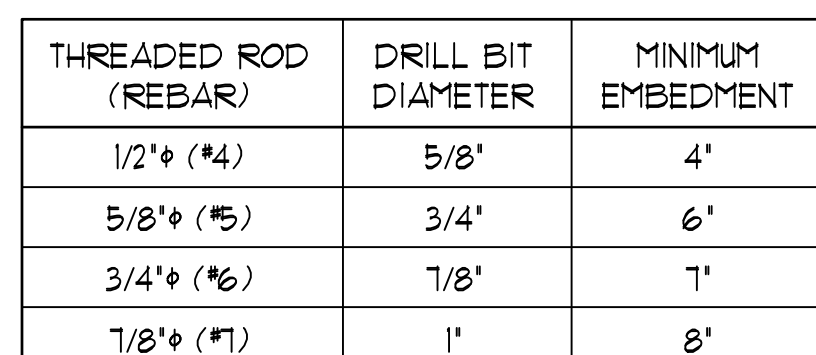


FOOTING ADJACENT TO UTILITY TRENCH

NO SCALE

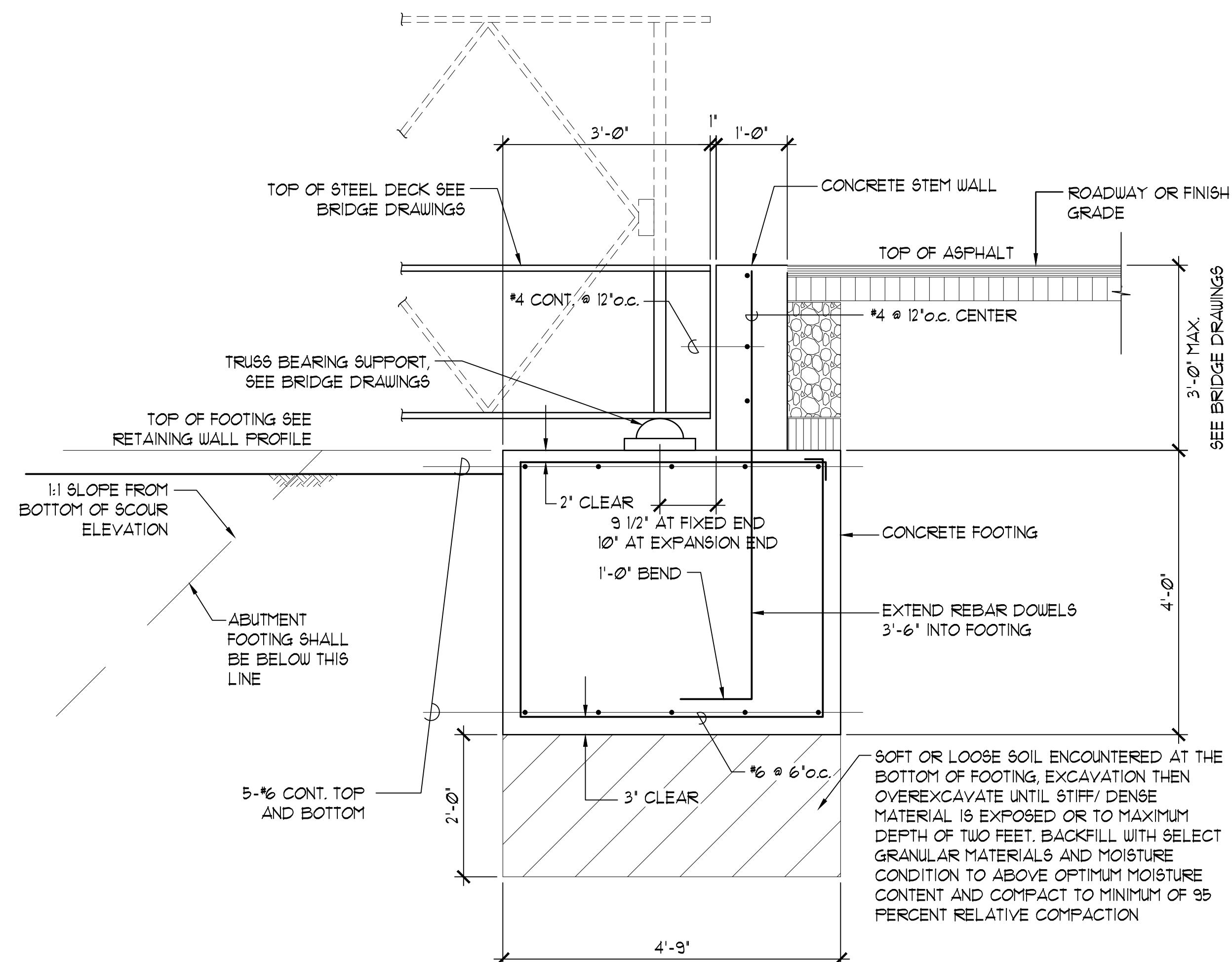
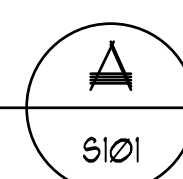


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Adrian Lee SIGNATURE Exp: 4/30/24		JOB XX-XXXX MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIR MAKAHA, O'AHU, HAWAII	
LISCENSED PROFESSIONAL ENGINEER No. 9164-S HAWAII, U.S.A.		GENERAL NOTES AND TYPICAL DETAIL	
APPROVED: _____		DATE: _____	
MANAGER AND CHIEF ENGINEER, BWS			
DRAWN BY: MA	ENGINEER: AL	CHECKED BY: AL	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 46 OF 50 SHEETS
FILE	POCKET	FOLDER	NO.

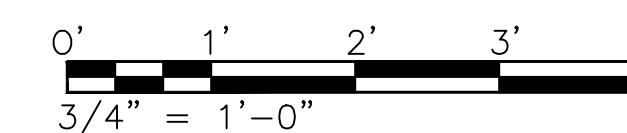
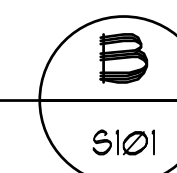


- A. PRE APPROVAL FOR SIMPSON STRONG TIE SET-XP EPOXY TIE ADHESIVE. ALL SUBSTITUTION REQUEST SHALL BE SUBMITTED WITH CURRENT ICC-ESR REPORT TO ENGINEER FOR REVIEW AND APPROVAL.
- B. ALL THREAD ROD SHALL BE CARBON STEEL CONFORMING TO ASTM F1554, GRADE 36 HOT DIP GALVANIZED. REINFORCING BAR SHALL BE ASTM A615 GRADE 60.
- C. PRE DRILL HOLE WITH DRILL BIT COMPLYING WITH ANSI B212.5-1934.
- D. CLEAN HOLE WITH OIL FREE COMPRESSED AIR (80 PSI MINIMUM) AND NYLON BRUSH.
- E. FILL HOLE HALF TO TWO THIRDS FULL WITH ADHESIVE STARTING FROM BOTTOM, THEN INSERT ANCHOR TO BOTTOM OF HOLE AND TWIST CLOCKWISE TO ENSURE ADHESIVE COVERS THE ANCHOR SURFACE. ADHESIVE MUST BE LEVEL WITH CONCRETE SURFACE AFTER INSERTION OF ANCHOR.
- F. ANCHOR INSTALLATION REQUIRES SPECIAL INSPECTION. CONTRACTOR SHALL USE SIMPSON ARC (ADHESIVE RETAINING CAP) AS NEEDED FOR HORIZONTAL AND OVERHEAD APPLICATIONS.
- G. PROVIDE STANDARD WASHER UNDER NUT UNLESS NOTED OTHERWISE.

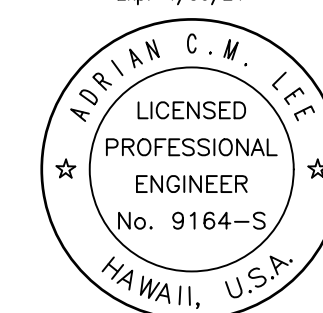
NO SCALE



SC: $3/4" = 1' - \emptyset"$



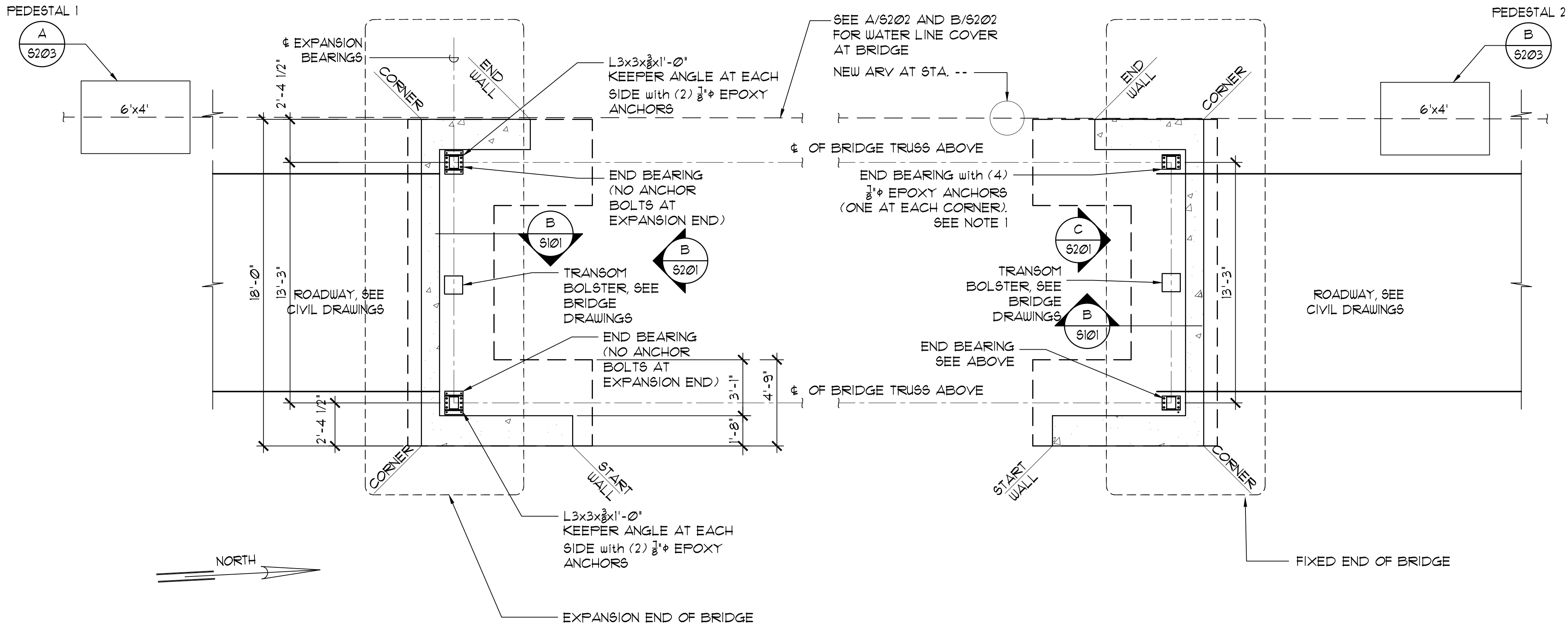
SIGNATURE
Exp: 4/30/24



JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKAHA, O'AHU, HAWAII

APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS				DATE: _____	
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FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 47	OF 50	SHEETS

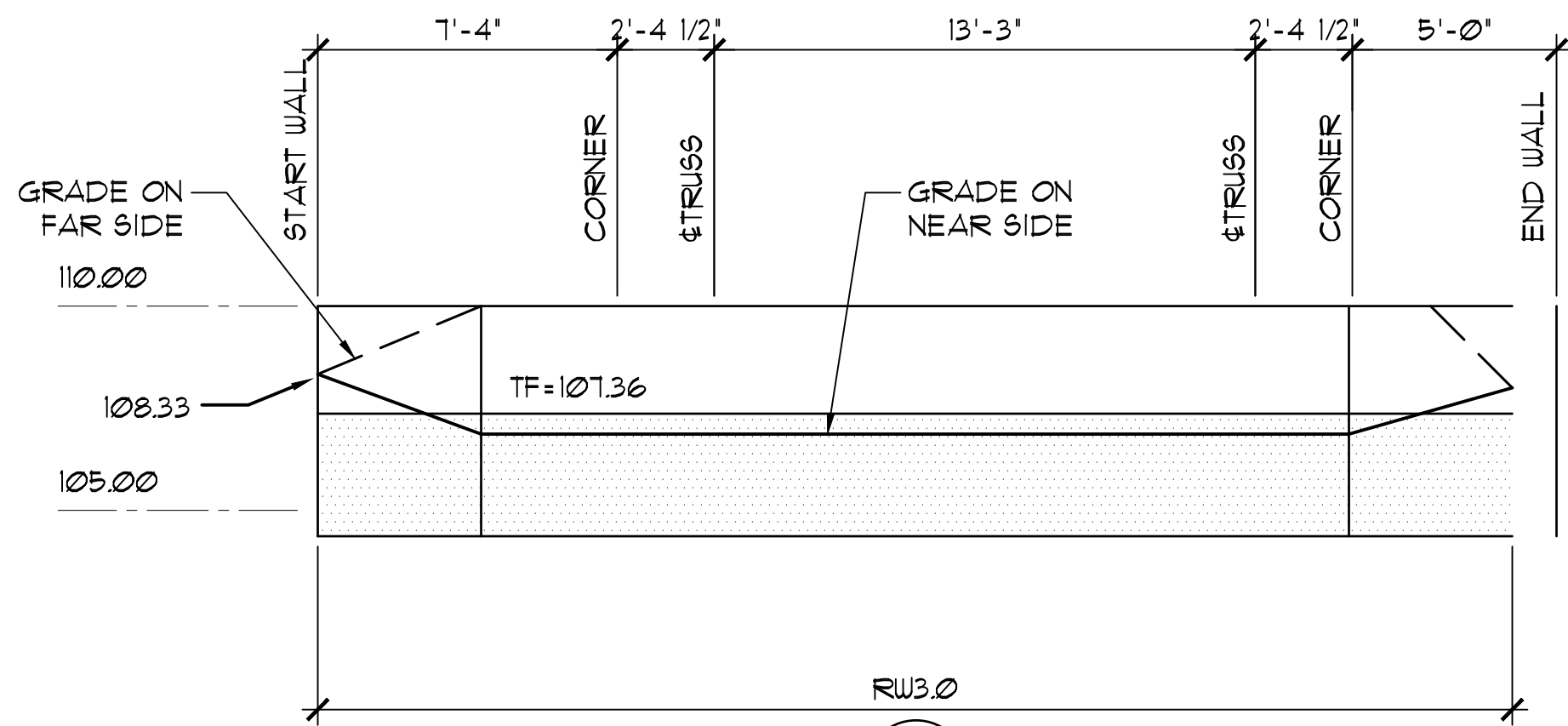
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NOTE:
1. SIZE AND QUANTITY OF EPOXY ANCHORS TO BE VERIFIED BY THE ENGINEER OR RECORD ONCE THE BRIDGE STRUCTURAL CALCULATIONS HAVE BEEN SUBMITTED FOR APPROVAL.

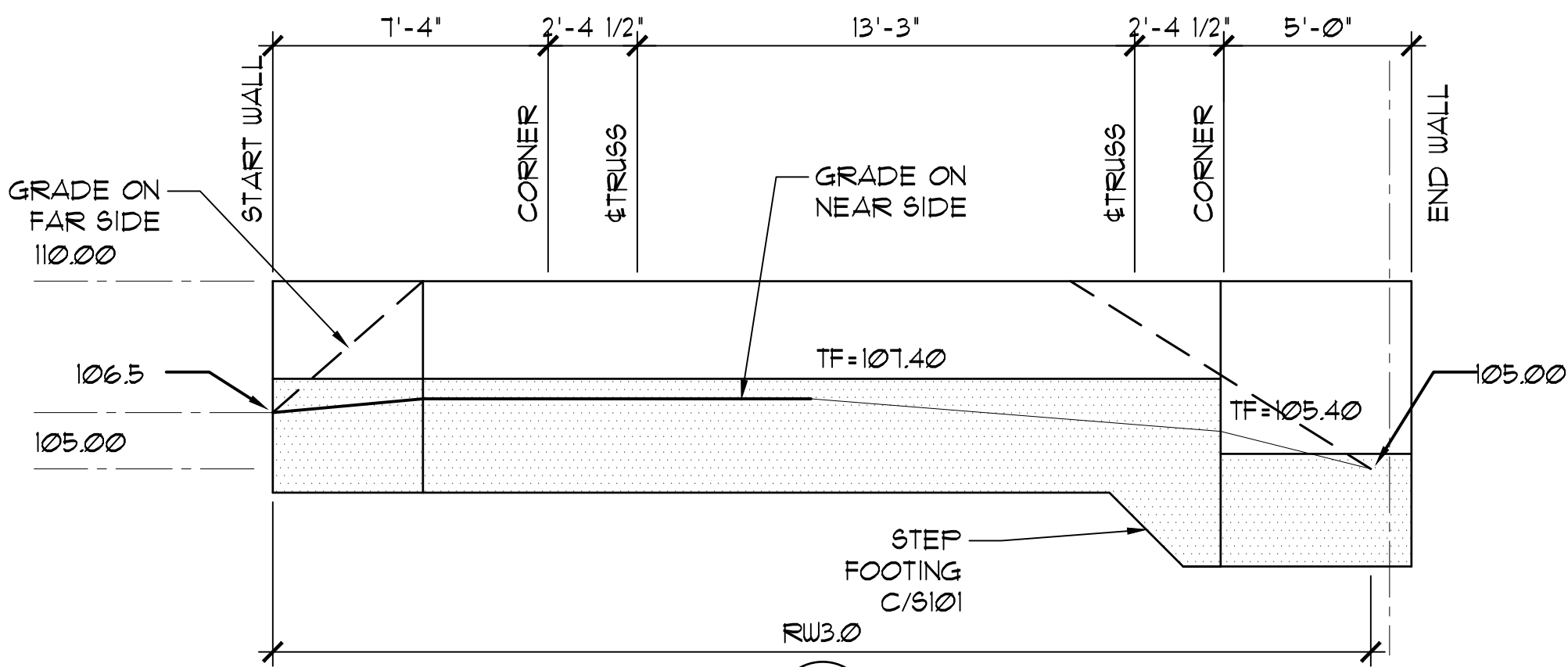
BRIDGE FOUNDATION PLAN

SC: 1/4"=1'-0"



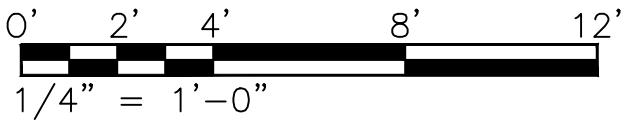
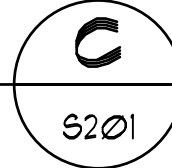
EXPANSION END RETAINING WALL PROFILE

SC: 1/4"=1'-0"



FIXED END RETAINING WALL PROFILE

SC: 1/4"=1'-0"

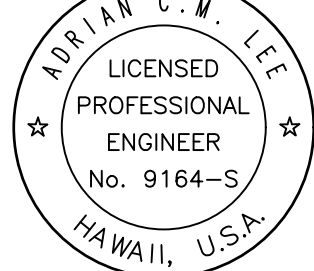


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Adrian Lee

SIGNATURE

Exp: 4/30/24



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

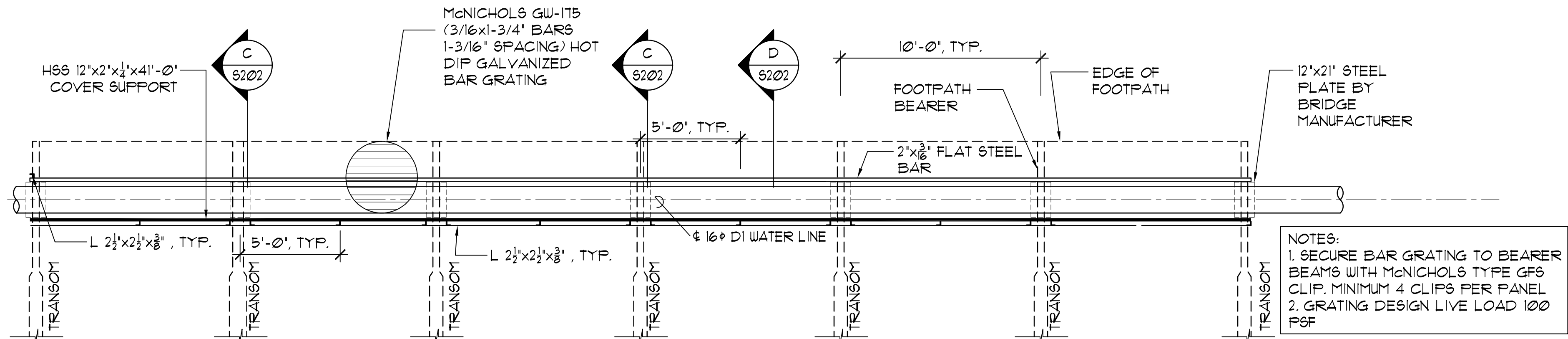
JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKAHA, O'AHU, HAWAII

BRIDGE FOUNDATION PLAN

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	MA	ENGINEER:	AL
CHECKED BY:	AL	FILE NO:	
FIELD BOOK NO:		SCALE:	AS INDICATED
SHEET	48	OF	50
SHEETS			

FILE	POCKET	FOLDER	NO.

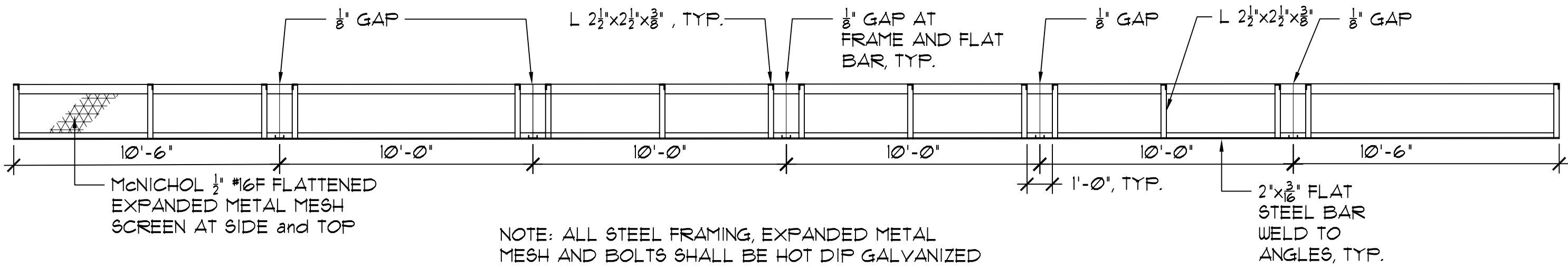
S201



PLAN- PIPE COVER SUPPORT AT BRIDGE LEVEL

SC: 1/4"=1'-0"

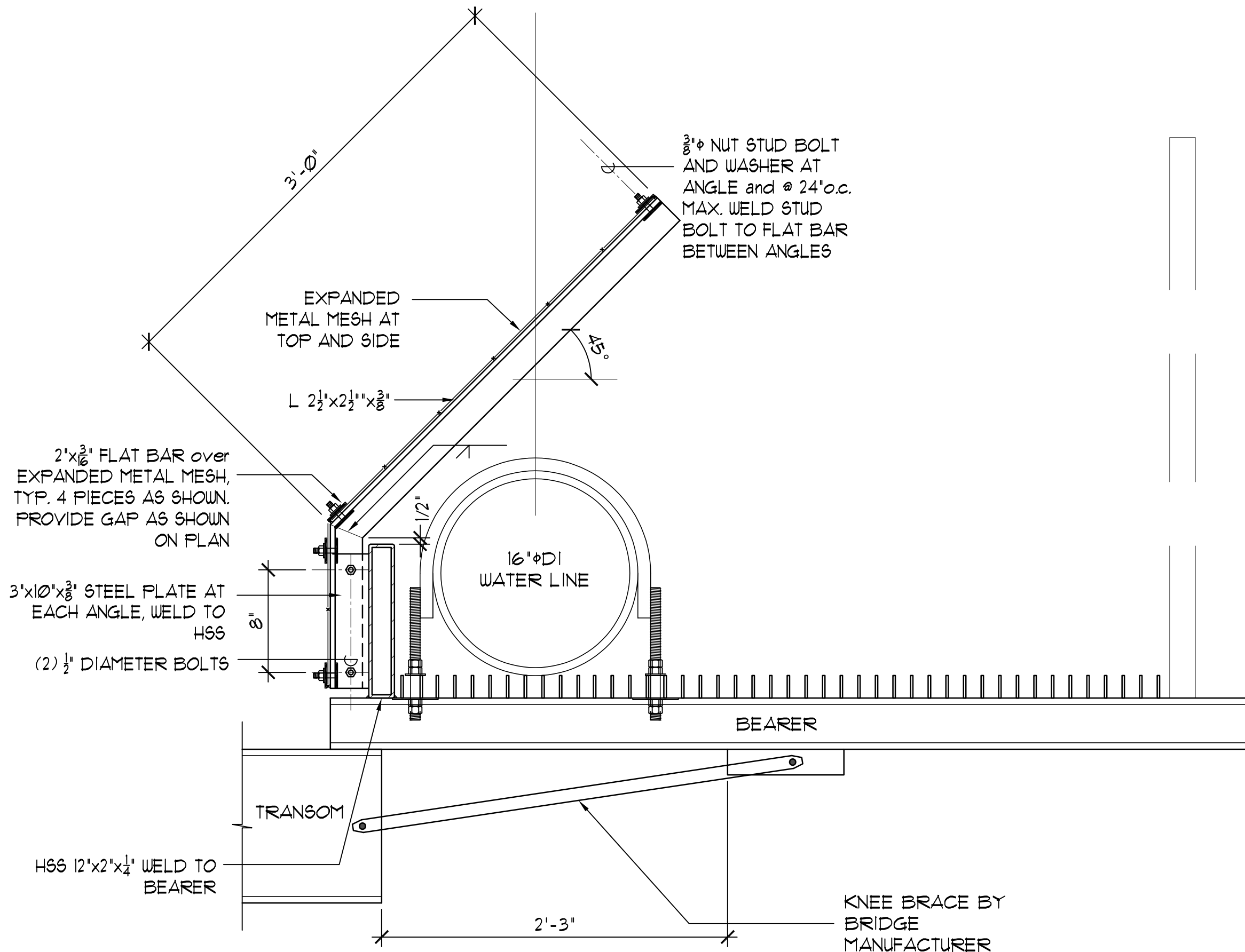
A
S202



PLAN- COVER FRAMING PLAN

SC: 1/4"=1'-0"

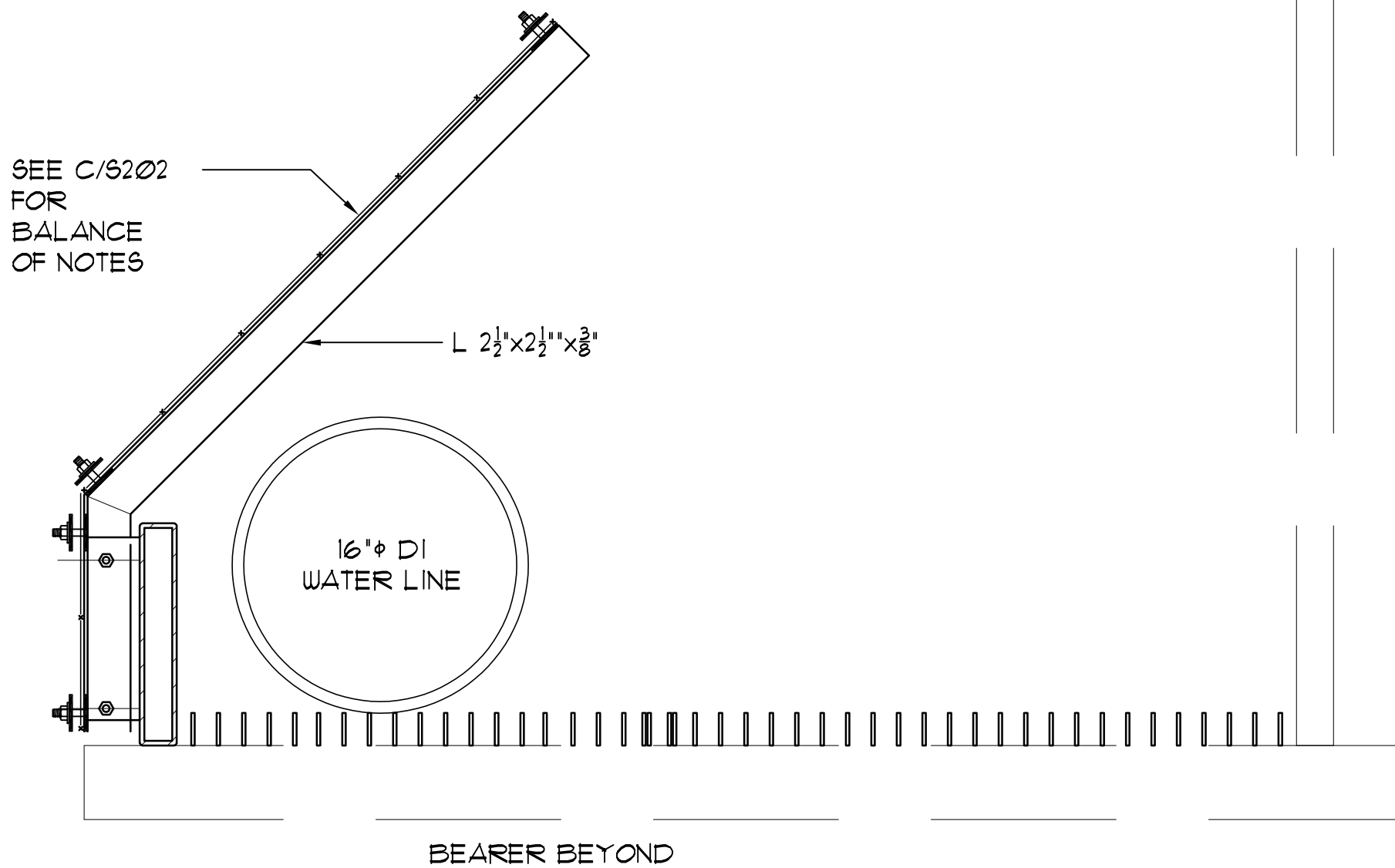
B
S202



BRACKET AT BEARER

SC: 1 1/2"=1'-0"

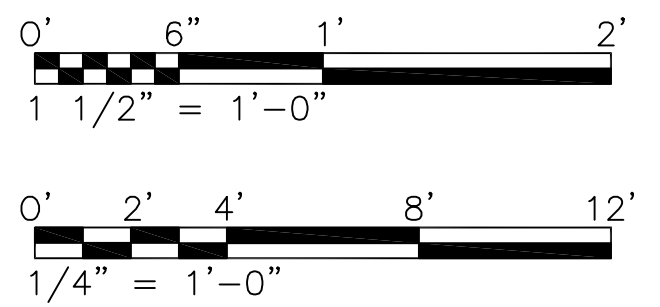
C
S202



BRACKET BETWEEN BEARER

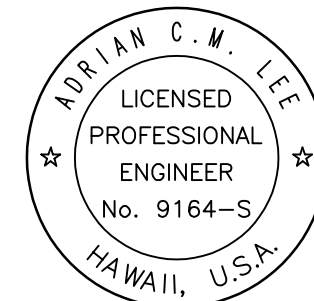
SC: 1 1/2"=1'-0"

D
S202



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Adrian Lee
SIGNATURE
Exp: 4/30/24



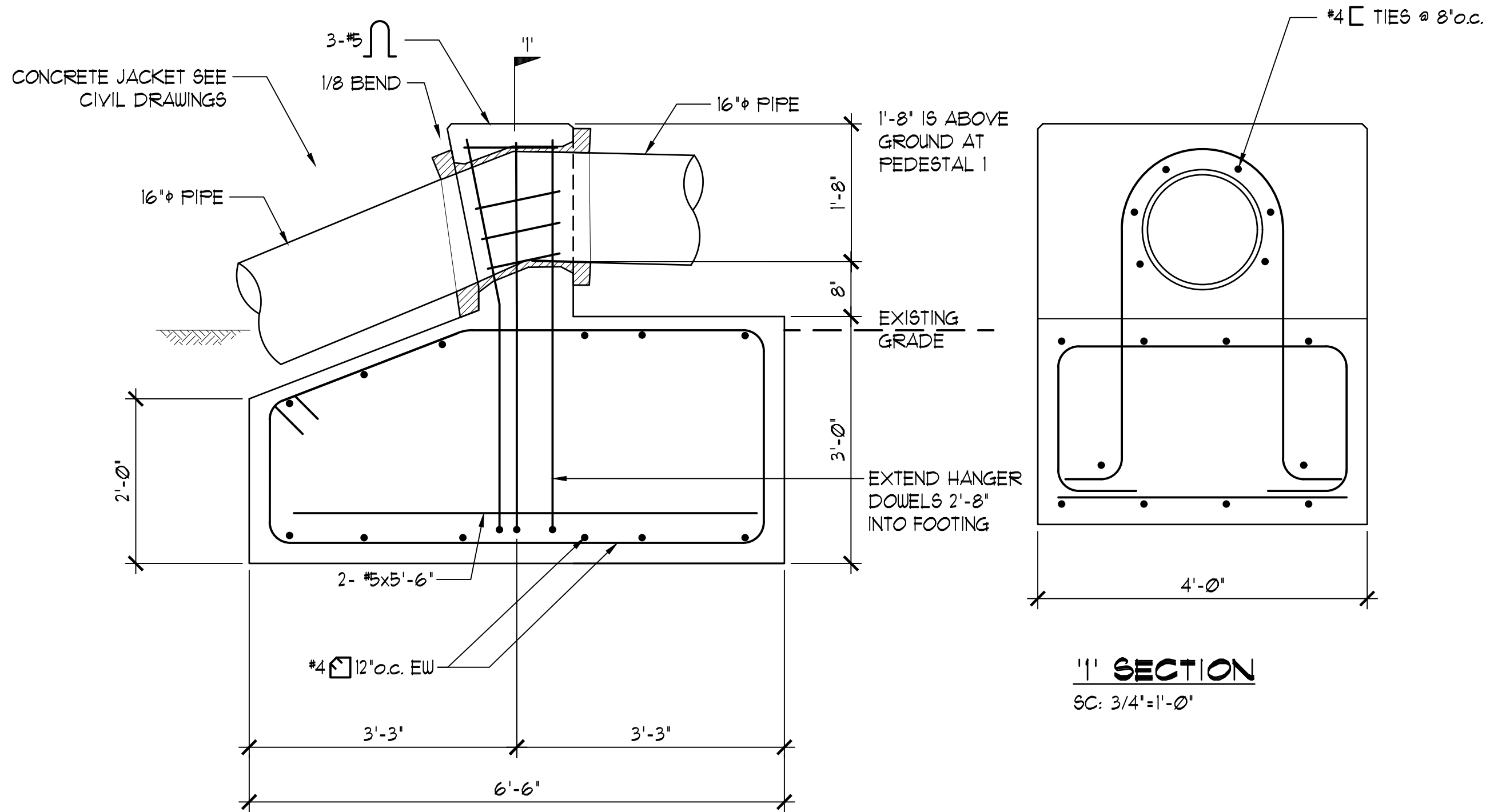
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKAHA, O'AHU, HAWAII

PIPE COVER PLAN AND DETAILS

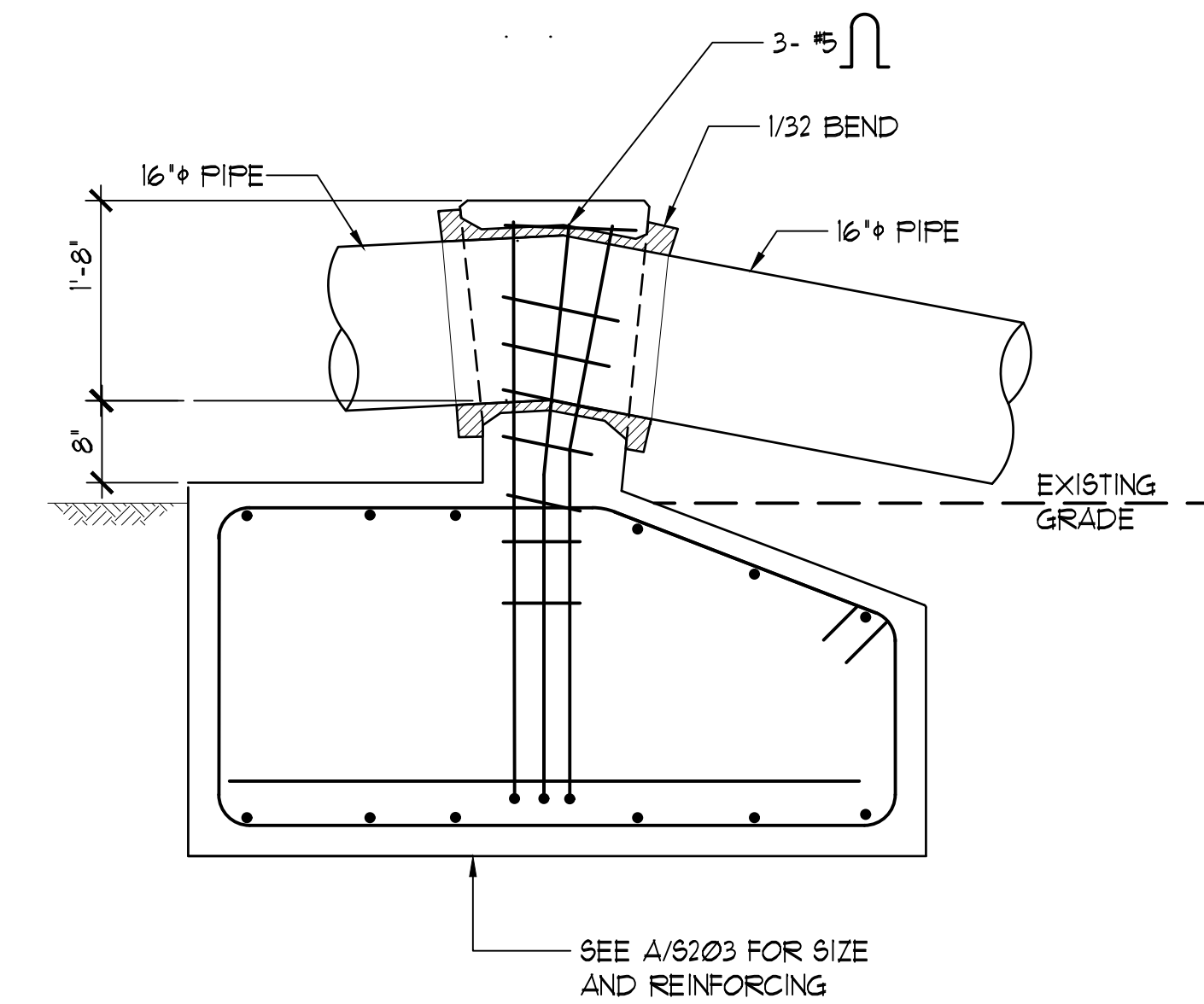
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DRAWN BY: MA	ENGINEER: AL
CHECKED BY: AL	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED
SHEET 49 OF 50 SHEETS	

FILE	POCKET	FOLDER	NO.



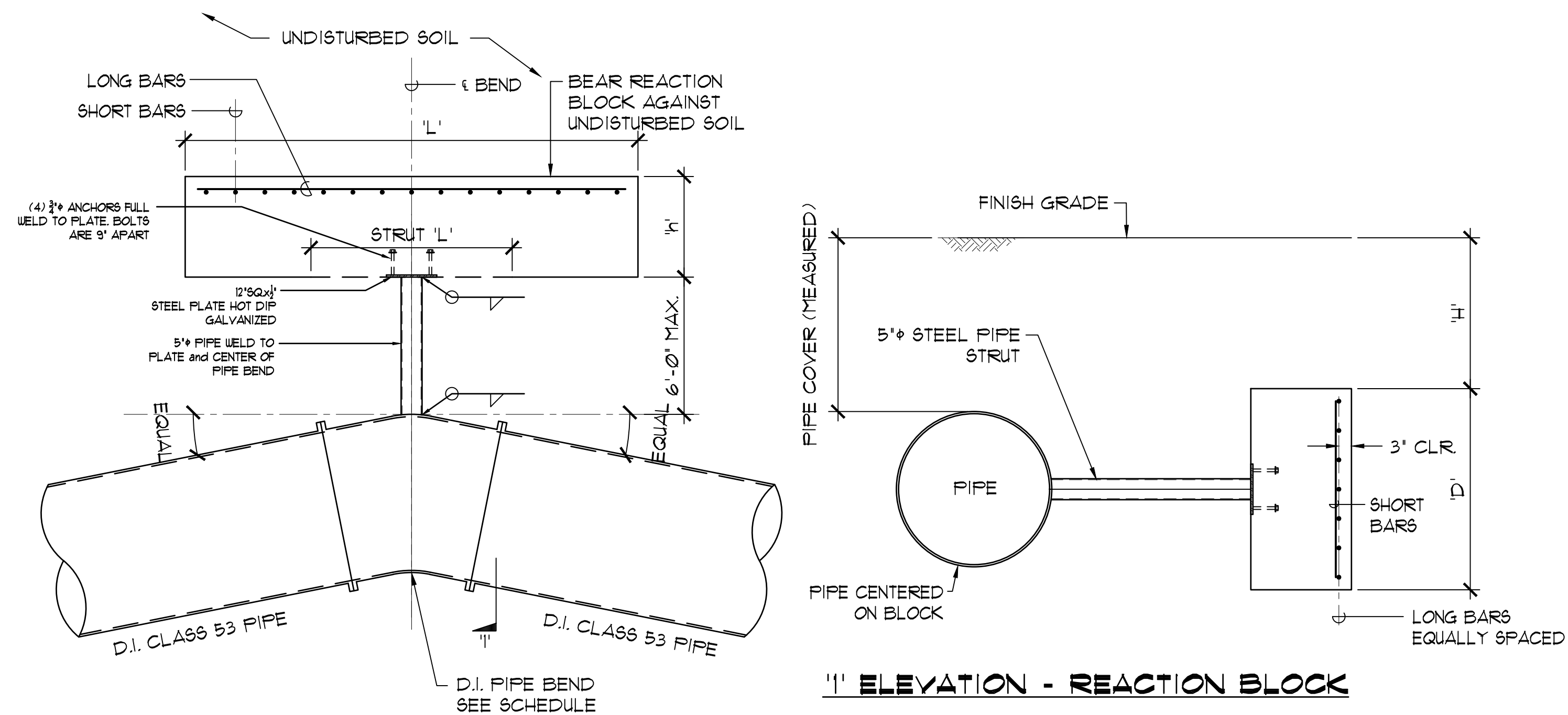
PEDESTAL 1
SC: 3/4'-1'-0"

A
S203



PEDESTAL 2
SC: 3/4'-1'-0"

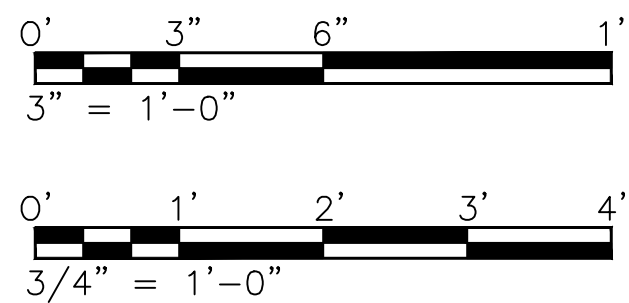
B
S203



PLAN - PIPE BEND REACTION BLOCK
SC: 1/2'-1'-0"

C
S203

THRUST BLOCK SCHEDULE											
STATION	PIPE	BEND	BEND	PIPE COVER	'L'	'D'	'H'	LONG BARS (NO SPLICE)	SHORT BARS	'h'	DETAIL
42+83.25 AR	16"	1/16	22.5°	3'0"	6'-6"	4'-0"	2.67'	6- #5	11- #5	2'- 0"	C/S203
44+71.58 AR	16"	1/32	11.25°	3'0"	3'-0"	2'-0"	2.67'	3- #5	5- #5	2'- 0"	C/S203
0+00 W.L.A	16"	1/8	45°	3'0"	6'-6"	5'-0"	2.67'	7- #6	10- #6	2'- 6"	C/S203
1+88.4 W.L.A	16"	1/8	45°	3'0"	6'-6"	5'-0"	2.67'	7- #6	10- #6	2'- 6"	C/S203



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Adrian Lee
SIGNATURE
Exp: 4/30/24

ADRIAN C. M. LEE
LICENSED PROFESSIONAL ENGINEER
No. 9164-S
HAWAII, U.S.A.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKAHA, O'AHU, HAWAII

REACTION BLOCKS

APPROVED: _____ DATE: _____
MANAGER AND CHIEF ENGINEER, BWS

DRAWN BY: MA ENGINEER: AL CHECKED BY: AL FILE NO: _____
FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 50 OF 50 SHEETS

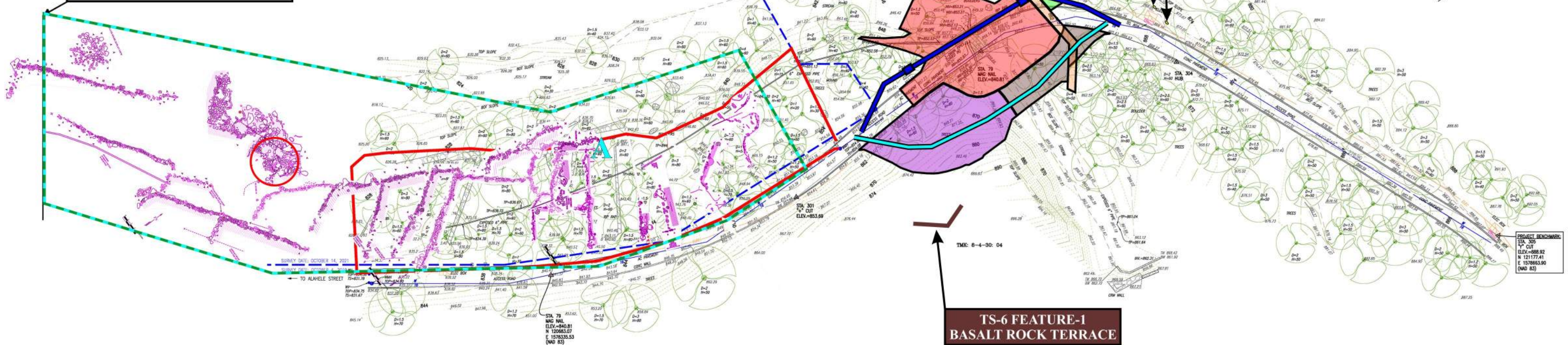
FILE POCKET FOLDER NO.

S203

KEY

- MASS EXCAVATION FOR BRIDGE CONSTRUCTION AREA
- SLOPE REMOVAL AREA FOR TEMPORARY ACCESS ROAD
- MASS EXCAVATION AREA FOR TEMPORARY ACCESS ROAD
- MAKAHA STREAM DIVERSION DITCH/TRENCH
- MASS EXCAVATION OF LAUNCH AREA FOR BRIDGE AND TEMPORARY ELECTRIC AND TELEPHONE

CONSTRUCTION STAGING AREA
SOUTHWEST CORNER



KEY

- ORIGINAL AREA "A" SCS SITE TS-1 SUBJECTED TO ARCHAEOLOGICAL INVENTORY SURVEY; CURRENTLY OFF-LIMITS FOR CONSTRUCTION STAGING AREA UNTIL SHPD DEEMS AREA AS HAVING BEEN PROPERLY RECORDED BY SCS ARCHAEOLOGISTS. ONE PRESERVATION FEATURE, A POSSIBLE RELIGIOUS AGRICULTURAL FEATURE, IS ENCOMPASSED BY A RED COLORED CIRCLE.
- REDUCED AREA "A" FOR PROPOSED CONSTRUCTION STAGING AREA
- TEMPORARY 16 INCH WATERLINE TRENCH
- PEDESTAL FOR ELEVATED PERMANENT 16 INCH WATERLINE

BENCHMARK:
CAC STREET MONUMENT
TOP OF BRASS PIN
ELEV=585.84 FT., MSL

ADJUSTED AND COORDINATES REFERRED TO HAWAII
STATE PLANE, NAD 83, ZONE 5, U.S. FEET
BOUNDARY ORIGIN FROM GOVERNMENT SURVEY
TRIANGULATION STATION "MAKANA"
NAD 83 TO MAKANA = -07.04' DELT

ABBREVIATIONS:

AC	ASPHALT CONCRETE	TEL	TELEPHONE
BM	BOTTOM WALL	TS	TOP OF TIE
CONC	CONCRETE	TW	TOP OF WALL
CMW	CONCRETE MASONRY (BLOCK) WALL	W	WATER
D	DRAINAGE OR DRAIN	WM	WATER MAIN/PIPE
ELEV	ELEVATION	WY	WATER WARE
H	HEIGHT		
WY	WATER		

NOTE:
THIS MAP AND ASSOCIATED DATA FILE IS A REPRESENTATIVE SURVEY OF THE SUBJECT PARCEL OR PROJECT SITE.
THE LOCATION OF BOUNDARIES AND ENCUMBRANCES AFFECTING THE PROJECT SITE ARE TAKEN FROM LATEST
TOP MAPS ONLY. UPON A COPY OF THE CURRENT TITLE REPORT OR DEED TOP AREA WORK PROPERTY
AND ENCUMBRANCE ISSUES ARE CRITICAL TO RECOMMENDED PRIOR TO ANY DESIGN AND CONSTRUCTION WORK.

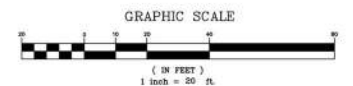
UNDERGROUND UTILITY LINES AND/OR STRUCTURES, IF SHOWN, ARE PROVIDED BASED ON INFORMATION FROM
PLANS/NOTES PROVIDED BY OTHERS, AND NEED TO BE REVIEWED BY PUBLIC UTILITY AGENCIES OR
ASSOCIATED FACILITIES.

UNLESS OTHERWISE NOTED, ALL LOCATIONS OF UNDERGROUND UTILITY LINES AND/OR STRUCTURES ARE
APPROXIMATE. NO GUARANTEE IS MADE ON THE ACCURACY OF COMPLETENESS OF THE INFORMATION
SHOWN. THE USER OF THIS TOPOGRAPHIC SURVEY MAP SHALL VERIFY THE INFORMATION, AS NECESSARY,
DURING DESIGN AND CONSTRUCTION.

TOPOGRAPHIC SURVEY MAP BOARD OF WATER SUPPLY MAKANA WELLS ACCESS ROAD REPAIRS AT MAKANA, WAIANAE, OAHU, HAWAII

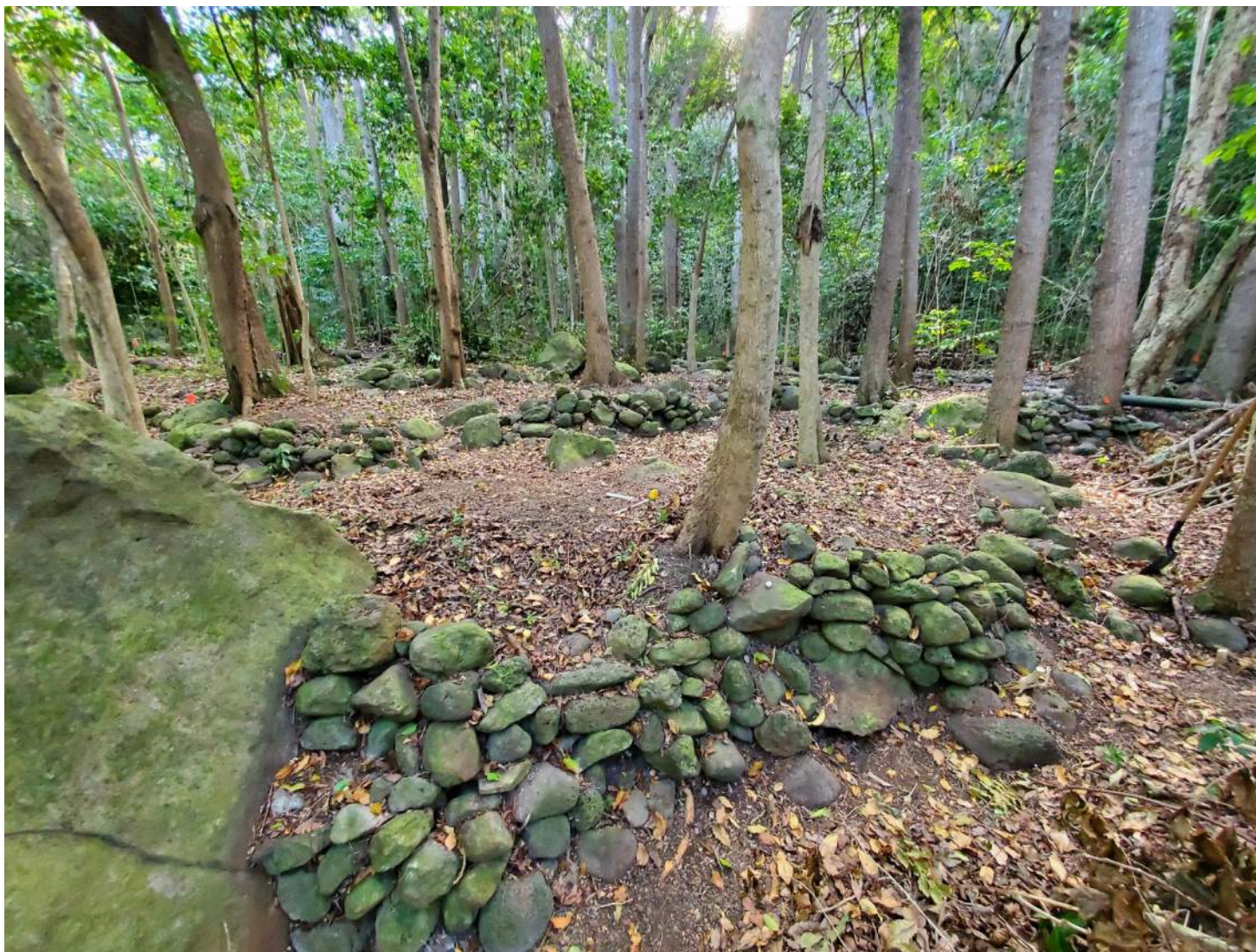
TMK: 8-4-30: 04 (POR.)
SCALE: 1 in. = 20 ft. OCTOBER 21, 2019
JOB NO. 19078 FIELD BOOK: 3727: 1
DRE: SN-M FLD: MP

CONTROLPOINT SURVEYING, INC.
615 Pukalani Blvd., Suite 100
HONOLULU, HAWAII 96813





Construction staging area (Area "A"): Site TS-1 Feature 1 terrace. View to North



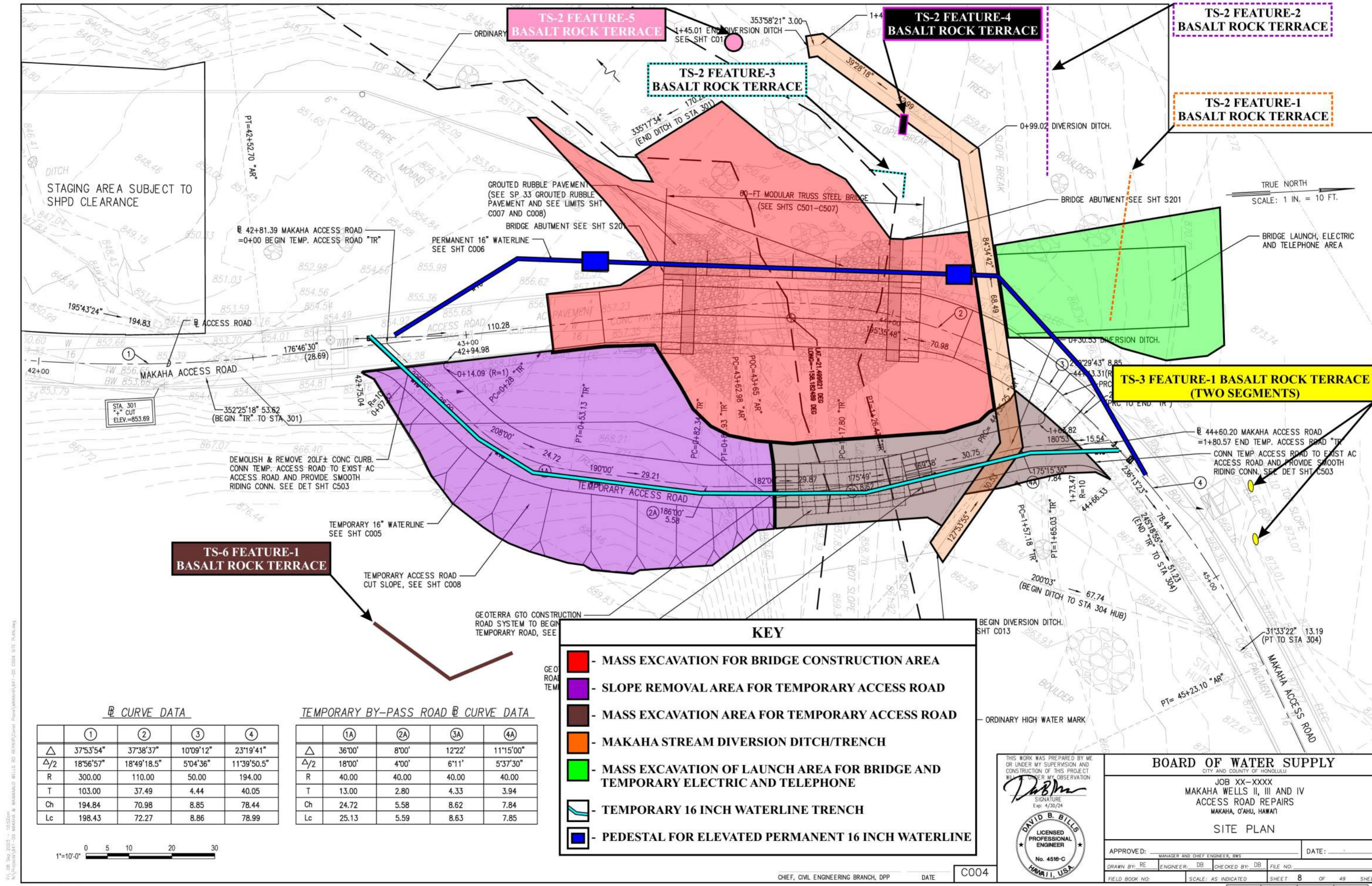
Construction staging area (Area “A”): Site TS-1 Feature 10 Terrace (foreground), Feature 9 terrace (mid-ground). View to northeast



Construction staging area (Area "A"): Site TS-1 Feature 15 terrace. View to southwest



Construction staging area (Area "A"): Site TS-1 Feature 23 remnant of construction material stockpile. View to northeast



@ CURVE DATA

	①	②	③	④
Δ	37°53'54"	37°38'37"	10°09'12"	23°19'41"
Δ/2	18°56'57"	18°49'18.5"	5°04'36"	11°39'50.5"
R	300.00	110.00	50.00	194.00
T	103.00	37.49	4.44	40.05
Ch	194.84	70.98	8.85	78.44
Lc	198.43	72.27	8.86	78.99

TEMPORARY BY-PASS ROAD @ CURVE DATA

	①A	②A	③A	④A
Δ	36°00'	8°00'	12°22'	11°15'00"
Δ/2	18°00'	4°00'	6°11'	5°37'30"
R	40.00	40.00	40.00	40.00
T	13.00	2.80	4.33	3.94
Ch	24.72	5.58	8.62	7.84
Lc	25.13	5.59	8.63	7.85

KEY

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- SLOPE REMOVAL AREA FOR TEMPORARY ACCESS ROAD
- MASS EXCAVATION AREA FOR TEMPORARY ACCESS ROAD
- MAKAHA STREAM DIVERSION DITCH/TRENCH
- MASS EXCAVATION OF LAUNCH AREA FOR BRIDGE AND TEMPORARY ELECTRIC AND TELEPHONE
- TEMPORARY 16 INCH WATERLINE TRENCH
- PEDESTAL FOR ELEVATED PERMANENT 16 INCH WATERLINE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, U.S.A.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIRS
MAKAHA, O'AHU, HAWAII

SITE PLAN

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO.:	
FIELD BOOK NO.:		SCALE:	AS INDICATED
SHEET	8	OF	49
SHEETS			

FILE	POCKET	FOLDER	NO.

T:\18 Sep 2023 - 10:52am
N:\Projects\641-00 MAKAHA & WAIANAE WELLS II, III AND IV ACCESS ROAD REPAIRS\MAKAHA\641-00 C004 SITE PLAN.dwg



Bridge construction area: Site TS-2 Feature 1 terrace east end. View to northwest



Bridge construction area: Site TS-2 Feature 2 terrace west end. View to northeast



Bridge construction area: Site TS-2 Feature 3 terrace. View to northeast



Bridge construction area: Site TS-2 Feature 4 terrace. View to northeast



Bridge construction area: Site TS-2 Feature 5 terrace. View to northwest

MAKAHA PROJECT PHOTOS PER ITEM 6.7 AFFECTED CULVERT



DOWNSTREAM



DOWNSTREAM



DOWNSTREAM



UPSTREAM



DOWNSTREAM



DOWNSTREAM



DOWNSTREAM



UPSTREAM



DOWNSTREAM



ACCESS ROAD OVER CULVERTS



DOWNSTREAM



DOWNSTREAM



UPSTREAM



APPENDIX

CDUA RFJ



August 21, 2023

Michael Cain, Administrator
Department of Land and Natural Resources
Office of Conservation & Coastal Lands
1151 Punchbowl St., Room 131
Honolulu, Hawai 'i 96809-0621



Job No.641-00

***SUBJECT: Makaha Wells II, III and IV
Makaha, Oahu, Hawaii
TMK: 8-4-030: 004
Request for Jurisdictional Determination***

Dear Mr. Cain:

The purpose of this letter is to allow your office to determine if you will be claiming jurisdiction and will be requiring permit processing for the referenced project. The Board of Water Supply (BWS) proposes to replace a failing existing culvert crossing of Makaha Stream on its access road to the subject wells. The culvert crossing has disintegrated and is being replaced by a bridge structure. The 75% Construction plans (11" X 17") for the project are attached as Exhibit 1. A GIS Map is attached as Exhibit 2. Exhibit 3 is a Conservation District Subzone Map locating the Project Site. It appears the Project Site is within the Resource Subzone and would require a permit processed through your office. We would appreciate your review and confirmation of our resource subzone assessment and identification of our DLNR-OCCL permit requirements.

As additional information, we are also attaching the Natural Resources Assessment for the Project (See Exhibit 4) and the Hydrology, Hydraulics and Scour Analysis Report (See Exhibit 5) which have photos of the subject disintegrated culvert crossing.

Should you have any questions, please contact our office.

Very truly yours,

BILLS ENGINEERING INC.

By: 
David B. Bills, President

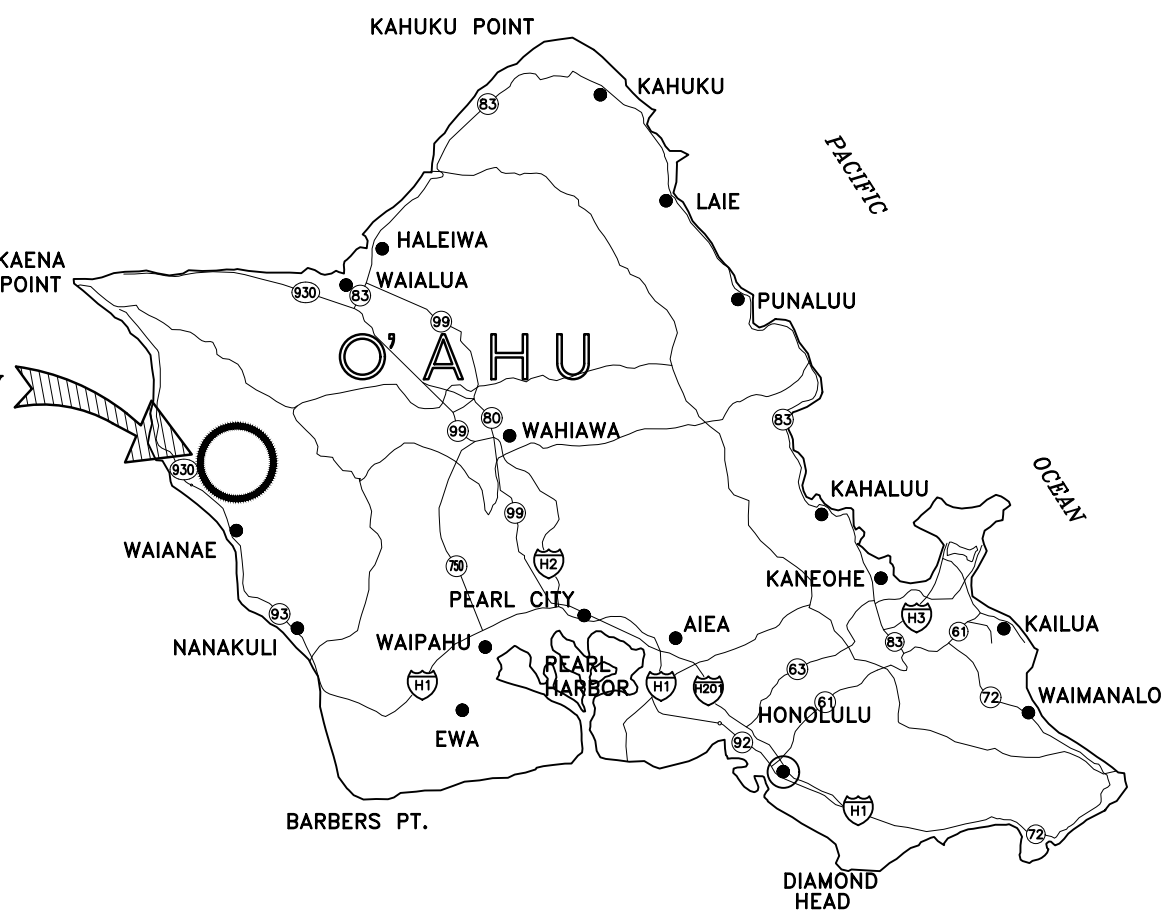
DBB:lk
Encls
cc: Kathryn Fujikami (BWS) email w/encl

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
JOB XX-XX

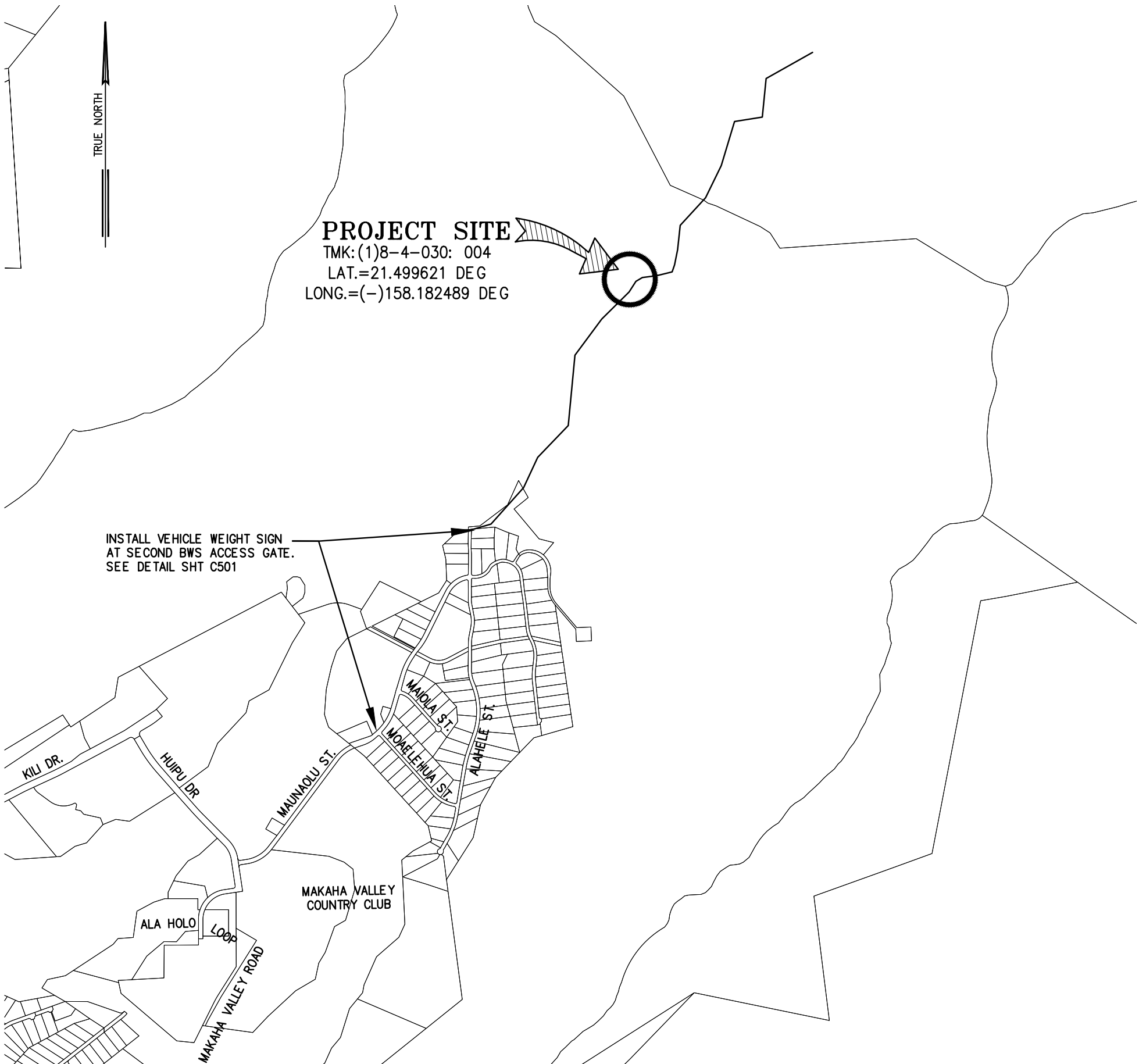
MAKAHA WELLS II, III, AND IV
ACCESS ROAD REPAIRS

MAKAHA, OAHU, HAWAII
TMK: (1) 8 - 4 - 030: 004

MAKAHA WELLS II, III & IV
PROJECT LOCATION
DISCHARGE POINT
PACIFIC OCEAN, CLASS A
LAT. = N 21° 27' 28.79"
LONG. = W 158° 13' 02.50"



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

APPROVED

MANAGER & CHIEF ENGINEER, BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

DATE

DIRECTOR, DEPT OF PLANNING AND PERMITTING CITY AND COUNTY OF HONOLULU
(FOR SITE GRADING ONLY)

DATE

EXHIBIT 1

Mon, 23 Jun 2023 - 8:57pm
NA\Projects\641-00 MAKAHA & WAIANALOA WELLS REPAIR\Const Plans\MAKAHA\641-00 T002 GEN NOTES - 1.dwg

CONSTRUCTION NOTES

1. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1986 AND STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1984, AS AMENDED, OF THE DEPARTMENT OF PUBLIC WORKS, CITY AND COUNTY OF HONOLULU AND THE COUNTIES OF KAUAI, MAUI AND HAWAII.
 2. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.
 3. NO CONTRACTOR SHALL PERFORM ANY CONSTRUCTION OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW INTO EXISTING CITY DRAINAGE SYSTEMS, OR ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.
 4. THE GENERAL CONTRACTOR OF THE PROJECT SHALL BE RESPONSIBLE FOR CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS" AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL", AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
- THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGES(S) FOR THE FOLLOWING:
1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND
 2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.
- IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT [HTTP://HEALTH.HAWAII.GOV/CWB](http://health.hawaii.gov/cwb). THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.
5. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (808-692-8015). FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.
 6. FOR BENCHMARK, SEE SHT C002.

GRADING NOTES

1. ALL GRADING WORK SHALL BE DONE IN ACCORDANCE WITH CHAPTER 14, ARTICLES 13, 14, 15 & 16 AS RELATED TO GRADING, SOIL EROSION AND SEDIMENT CONTROL OF THE REVISED ORDINANCES OF HONOLULU, 1990, AS AMENDED, & SOILS REPORTS BY GEOLABS, INC. ENTITLED "MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS, MAKAHA, OAHU, HAWAII DATED NOVEMBER 19, 2021.
2. NO CONTRACTOR SHALL PERFORM ANY GRADING OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW ONTO ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.
3. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 60.1, "AIR POLLUTION CONTROL".
4. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.
5. ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SURFACE WATERS FROM DAMAGING THE CUT FACE OF AN EXCAVATION OR THE SLOPED SURFACES OF A FILL. FURTHERMORE, ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SEDIMENT-LADEN RUNOFF FROM LEAVING THE SITE.
6. ALL SLOPES AND EXPOSED AREAS SHALL BE SODDED OR PLANTED AS SOON AS FINAL GRADES HAVE BEEN ESTABLISHED. PLANTING SHALL NOT BE DELAYED UNTIL ALL GRADING WORK HAS BEEN COMPLETED. GRADING TO FINAL GRADE SHALL BE CONTINUOUS, AND ANY AREA WITHIN WHICH WORK HAS BEEN INTERRUPTED OR DELAYED SHALL BE PLANTED.
7. FILLS IN SLOPES STEEPER THAN 5:1 SHALL BE KEYED.

GRADING NOTES, CONT'D

8. THE CITY SHALL BE INFORMED OF THE LOCATION OF THE BORROW/DISPOSAL SITE FOR THE PROJECT WHEN THE APPLICATION FOR A GRADING PERMIT IS MADE. THE BORROW/DISPOSAL SITE MUST ALSO FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.
 9. NO GRADING WORK SHALL BE DONE ON SATURDAYS, SUNDAYS AND HOLIDAYS AT ANY TIME WITHOUT PRIOR NOTICE TO THE DIRECTOR D.P.P., PROVIDED SUCH GRADING WORK IS ALSO IN CONFORMANCE WITH THE COMMUNITY NOISE CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 46, "COMMUNITY NOISE CONTROL".
 10. THE LIMITS OF THE AREA TO BE GRADED SHALL BE FLAGGED BEFORE THE COMMENCEMENT OF THE GRADING WORK.
 11. THE GENERAL CONTRACTOR OF THE PROJECT SHALL BE RESPONSIBLE FOR ALL GRADING OPERATIONS TO BE PERFORMED IN CONFORMANCE WITH APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS" AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL", AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
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- IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT [HTTP://HEALTH.HAWAII.GOV/CWB](http://health.hawaii.gov/cwb). THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.
12. WHERE APPLICABLE AND FEASIBLE THE MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTH MOVING PHASE OF THE GRADING IS INITIATED.
 13. TEMPORARY EROSION CONTROLS SHALL NOT BE REMOVED BEFORE PERMANENT EROSION CONTROLS ARE IN-PLACE AND ESTABLISHED.
 14. TEMPORARY EROSION CONTROL PROCEDURES SHALL BE SUBMITTED FOR APPROVAL PRIOR TO APPLICATION FOR GRADING PERMIT.
 15. IF THE GRADING WORK INVOLVES CONTAMINATED SOIL, THEN ALL GRADING WORK SHALL BE DONE IN CONFORMANCE WITH APPLICABLE STATE AND FEDERAL REQUIREMENTS.
 16. BUILDING PERMIT FOR RETAINING WALLS SHALL BE OBTAINED PRIOR TO COMMENCEMENT OF GRADING WORK ON SITE.
 17. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (808-692-8015). FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.
 18. FOR ALL PROJECTS, WHICH WILL DISTURB ONE (1) ACRE OR MORE OF LAND, THE CONTRACTOR SHALL NOT START CONSTRUCTION UNTIL A NOTICE OF GENERAL PERMIT COVERAGE (NGPC) IS RECEIVED FROM THE DEPARTMENT OF HEALTH, STATE OF HAWAII, AND HAS SATISFIED ANY OTHER APPLICABLE REQUIREMENTS OF THE NPDES PERMIT PROGRAM. ALSO, FOR NON-CITY AND OTHER NON-GOVERNMENTAL AGENCY PROJECTS, THE CONTRACTOR SHALL PROVIDE A WRITTEN COPY OF THE NGPC TO THE PERMITTING AND INSPECTION SECTION, CIVIL ENGINEERING BRANCH, D.P.P., AT LEAST SEVEN (7) CALENDAR DAYS BEFORE THE START OF THE CONSTRUCTION. FOR CITY OR OTHER GOVERNMENTAL PROJECTS, THE CONTRACTOR SHOULD PROVIDE A WRITTEN COPY OF THE NGPC TO THE APPROPRIATE CITY DEPARTMENT OR GOVERNMENTAL AGENCY PER THEIR REQUIREMENTS.
 19. ALL GRADING AND CONSTRUCTION WORK SHALL IMPLEMENT MEASURES TO ENSURE THAT THE DISCHARGE OF POLLUTANTS FROM THE CONSTRUCTION SITE WILL BE REDUCED TO THE MAXIMUM EXTENT PRACTICABLE AND WILL NOT CAUSE OR CONTRIBUTE TO AN EXCEEDANCE OF WATER QUALITY STANDARDS.
 20. NON-COMPLIANCE TO ANY OF THE ABOVE REQUIREMENTS SHALL MEAN IMMEDIATE SUSPENSION OF ALL WORK, AND REMEDIAL WORK SHOULD COMMENCE IMMEDIATELY. ALL COSTS INCURRED SHALL BE BILLED TO THE VIOLATORS. FURTHERMORE, VIOLATORS SHALL BE SUBJECTED TO ADMINISTRATIVE, CIVIL AND/OR CRIMINAL PENALTIES.
 21. FOR BENCHMARK SEE SHEET C002.

WATER NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND CONSTRUCTION OF WATER SYSTEM FACILITIES AND APPURTENANCES SHALL BE IN ACCORDANCE WITH THE CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY'S "WATER SYSTEM STANDARDS", DATED 2002, THE "WATER SYSTEM EXTERNAL CORROSION CONTROL STANDARDS", VOLUME 3 DATED 1991, AND ALL SUBSEQUENT AMENDMENTS AND ADDITIONS.
2. THE CONTRACTOR SHALL NOTIFY THE BOARD OF WATER SUPPLY IN WRITING ONE WEEK PRIOR TO COMMENCING WORK.
3. REQUESTS FOR WATER OUTAGES SHALL BE SUBMITTED TO THE BOARD OF WATER SUPPLY CONSTRUCTION INSPECTOR NOT LESS THAN FOURTEEN (14) CALENDAR DAYS IN ADVANCE. THE REQUEST SHALL INDICATE THE SPECIFIC AREA, DATE, TIME, AND THE ANTICIPATED DURATION OF THE PROPOSED OUTAGE. OUTAGES SHALL BE APPROVED AT THE CONVENIENCE OF THE BOARD OF WATER SUPPLY. THE CONTRACTOR SHALL PLAN ALL WORK TO MINIMIZE THE NUMBER AND DURATION OF OUTAGES. THE BOARD OF WATER SUPPLY SHALL PERFORM THE INITIAL NOTIFICATION OF AFFECTED CONSUMERS. HOWEVER, IF A SCHEDULED OUTAGE IS CANCELED FOR THE CONVENIENCE OF THE CONTRACTOR, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE AFFECTED CONSUMERS OF THE CANCELLATION AND RE-NOTIFY THEM NOT LESS THAN ONE (1) AND NOT MORE THAN TWO (2) CALENDAR DAYS PRIOR TO THE RESCHEDULED OUTAGE. CONTRACTOR NOTIFICATIONS SHALL BE AT NO ADDITIONAL COST TO THE BOARD OF WATER SUPPLY.
4. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL ASSUMPTIONS, DEDUCTIONS, OR CONCLUSIONS HE/SHE MAY MAKE OR DERIVE FROM THE SUBSURFACE INFORMATION OR DATA FURNISHED ON THE PLANS. THE CONTRACTOR MUST SATISFY HIMSELF/HERSELF THROUGH HIS/HER OWN INVESTIGATIONS AS TO WHAT SUBSURFACE CONDITIONS ARE TO BE ENCOUNTERED.
5. ANY COST INCURRED BY HAWAII GAS, HECO, OR HAWAIIAN TELCOM BY THIS PROJECT SHALL BE PAID BY THE BOARD OF WATERY SUPPLY THROUGH THE CONTRACTOR. PAYMENT SHALL BE ONLY FOR THE ACTUAL COST AS SHOWN ON THE UTILITY COMPANY'S INVOICE. NO PAYMENT WILL BE MADE FOR PROFIT, TAX, OVERHEAD, AND BOND COST.
6. ALL TRENCHES SHALL BE BACKFILLED AS CALLED FOR UNDER DIVISION 300 - CONSTRUCTION, SECTION 302.03, TRENCH BACKFILL OF THE "WATER SYSTEM STANDARDS", DATED 2002. COMPACTION OF TRENCH BACKFILL SHALL MEET APPLICABLE REQUIREMENTS OF "THE STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION", SEPTEMBER 1986, OF THE COUNTIES OF THE STATE OF HAWAII, OR THE STATE DEPARTMENT OF TRANSPORTATION STANDARDS FOR PROJECTS WITHIN STATE HIGHWAYS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER DISPOSAL OF ALL EFFLUENT ASSOCIATED WITH THE CONSTRUCTION ACTIVITY TO SAFEGUARD PUBLIC HEALTH AND SAFETY IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF HEALTH REQUIREMENTS. ALL PERMITS AND LICENSES FOR CONSTRUCTION WATER DISPOSAL, INCLUDING ALL APPLICATIONS, CHARGES, FEES, AND TAXES, ARE THE RESPONSIBILITY OF THE CONTRACTOR.
8. ALL WATER MAINS AND APPURTENANCES SHALL BE SUBJECTED TO A HYDROSTATIC TEST PRESSURE OF 150 PSI BY THE CONTRACTOR IN ACCORDANCE WITH DIVISION 300 - CONSTRUCTION, SECTION 302.28, PIPE PRESSURE TEST OF THE "WATER SYSTEMS STANDARDS", DATED 2002. DURING THE 30-MINUTE PRESSURE TEST, AND AFTER THE PRESSURE HAS STABILIZED, THE PRESSURE SHALL NOT DROP MORE THAN 10 PSI.
9. ALL AIR RELIEF VALVES SHALL HAVE A MINIMUM WORKING PRESSURE RANGE OF 0 TO 150 PSI.
10. THE USE OF CORROSION RESISTANT COATED COR-TEN T-BOLTS AND NUTS FOR UNDERGROUND MECHANICAL JOINT INSTALLATIONS SHALL BE ALLOWED IN LIEU OF TYPE 316 STAINLESS STEEL BOLTS AND NUTS AS REQUIRED IN DIVISION 200, SECTION 202.02, MECHANICAL JOINT, OF THE 2002 WATER SYSTEM STANDARDS (WSS).

BWS NOTE FOR THIS PROJECT ONLY:

CURRENT BWS POLICY DOES NOT ALLOW FOR THE USE OF PVC PIPE. HOWEVER, FOR THE TEMPORARY 16-INCH WATER LINE FOR THIS PROJECT ONLY, BWS WILL ALLOW THE USE OF C-905 DR 18 PVC AND DUCTILE IRON CLASS 53 FITTINGS IN ACCORDANCE WITH WATER SYSTEM STANDARDS DATE 2002 INSTALLED IN ACCORDANCE WITH MATERIAL AND CONSTRUCTION REQUIREMENTS STATES IN THE STANDARDS. ANY SUBMITTAL SHALL CLEARLY REFERENCE THE USE OF PVC PIPE IS FOR THE TEMPORAY WATER LINE ONLY.

DISABILITY AND COMMUNICATION ACCESS BOARD (DCAB) REQUIREMENTS:

THIS PROJECT SHALL MEET THE ACCESSIBILITY REQUIREMENTS OF HAWAII REVISED STATUTES (HRS) 103-50 AND AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG) SECTIONS 4.1.1(4) AND 4.3.


APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

T002

INDEX TO DRAWINGS		
DRAWING NO.	SHEET NO.	DESCRIPTION
T001	1	TITLE SHEET
T002	2	GENERAL NOTES - 1
T003	3	GENERAL NOTES - 2
T004	4	GENERAL NOTES - 3
C001	5	BUILDING PERMIT SITE PLAN
C002	6	GENERAL PLAN
C003	7	SITE PLAN
C004	8	TEMPORARY UTILITY PLAN FOR CONSTRUCTION PERIOD
C005	9	PLAN - PERMANENT 16-INCH WATER LINE
C006	10	ACCESS ROAD PROFILE /CENTERLINE OF BRIDGE
C007	11	GRADING PLAN-PHASE 1 CONSTRUCTION
C008	12	GRADING PLAN-PHASE 2 CONSTRUCTION
C009	13	SECTION "TR" 1
C010	14	DIVERSION DITCH PROFILE
C011	15	SECTIONS & DIVERSION DITCH DETAILS
C012	16	TEMPORARY ACCESS ROAD PROFILE
C013	17	ESCP - PHASE 1 CONSTRUCTION
C014	18	ESCP - PHASE 2 CONSTRUCTION
C015	19	EROSION & SEDIMENT CONTROL NOTES & DETAILS
C016	20	EXTENDED STREAM SECTION CENTER LINE OF STREAM WITH ACROW BRIDGE
C501	21	SEQUENCE OF SUGGESTED WORK, SIGN POST DETAIL AND TYPICAL ROADWAY SECTIONS
C502	22	MODULAR PANEL TRUSS STEEL BRIDGE GENERAL NOTES AND SPECIFICATIONS
C503	23	MODULAR PANEL TRUSS STEEL BRIDGE ISOMETRIC VIEW
C504	24	MODULAR PANEL TRUSS STEEL BRIDGE GENERAL PLAN ELEVATION AND SECTION
C505	25	MODULAR PANEL TRUSS STEEL BRIDGE TYPICAL CONNECTION DETAILS
C506	26	MODULAR PANEL TRUSS STEEL BRIDGE BEARING LAYOUT AND DETAILS
C507	27	WATER LINE TIE-DOWN STRAP DETAILS
S001	28	GENERAL NOTES AND TYPICAL DETAILS
S101	29	TYPICAL DETAILS
S201	30	BRIDGE FOUNDATION PLAN
S202	31	PIPE COVER PLAN AND DETAILS
S203	32	PEDESTAL 1 AND 2 DETAILS
E001	33	ELECTRICAL SYMBOLS, GENERAL NOTES, DUCT SECTIONS
E002	34	HECO NOTES
E003	35	HECO NOTES
E004	36	HTCO NOTES
E101	37	DEMOLITION ELECTRICAL SITE PLAN 1
E102	38	DEMOLITION ELECTRICAL SITE PLAN 2
E103	39	DEMOLITION ELECTRICAL SITE PLAN 1
E104	40	TEMPORARY ELECTRICAL SITE PLAN 2
E105	41	ELECTRICAL SITE PLAN 1
E106	42	ELECTRICAL SITE PLAN 2
B001	43	BORING LOCATION PLAN
B002	44	BORING LOG LEGENDS
B003	45	ROCK LOG LEGEND & NOTES
B004	46	BORING LOGS

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION		BOARD OF WATER SUPPLY <small>CITY AND COUNTY OF HONOLULU</small>	
		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
GENERAL NOTES - 1			
APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>		DATE: 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 2 OF _____ SHEETS
FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:00am
NA\Projects\Ye41-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\Ye41-00 T003 GEN NOTES - 2.dwg

NOTES FROM GEOTECH REPORT

A GEOTECHNICAL REPORT ENTITLED GEOTECHNICAL ENGINEERING INVESTIGATION MAKAHA WELLS II, III AND IV, MAKAHA, OAHU, HAWAII, DATED NOVEMBER 19, 2021 WAS PREPARED FOR THIS PROJECT. INFORMATION FROM THE GEOTECHNICAL REPORT IS AS FOLLOWS:

1. SOIL-NAILED RETAINING WALL SYSTEM

IT IS UNDERSTOOD THAT A TEMPORARY BYPASS ROAD IS REQUIRED ON THE EASTERN SIDE OF THE EXISTING ACCESS ROAD. THE TEMPORARY BYPASS ROAD WILL REQUIRE CUTTING INTO THE EXISTING SLOPE ADJACENT TO THE ACCESS ROAD. TO STABILIZE THE PROPOSED CUT INTO THE EXISTING SLOPE, IT IS RECOMMENDED TO USE A SOIL-NAILED RETAINING WALL SYSTEM.

BASED ON THE SLOPE FACE INCLINATION OF THE EXISTING SLOPE (APPROXIMATELY ONE HORIZONTAL TO ONE VERTICAL [1H:1V]) AND THE PROPOSED CUT SLOPE, IT IS BELIEVED IT WOULD BE TOO COSTLY TO RESTORE THE "TEMPORARY" CUT SLOPE BACK TO ITS INITIAL CONDITIONS. THEREFORE, THE SOIL-NAILED RETAINING WALL SYSTEM USED TO REINFORCE THE CUT SLOPE HAS BEEN DESIGNED FOR A PERMANENT CONDITION. IT IS UNDERSTOOD THE FINISH SLOPE WILL HAVE AN INCLINATION OF ABOUT 0.5H:1V. BECAUSE THE SOIL-NAILED SYSTEM WILL BE INSTALLED WITHIN A CUT SLOPE CONDITION, TOP-DOWN CONSTRUCTION SHALL BE PERFORMED FOR THE SOIL-NAILED RETAINING WALL INSTALLATION. IT SHOULD BE NOTED THAT DRILLED BORINGS WERE LOCATED ON THE EXISTING ACCESS ROAD ON EITHER SIDE OF THE EMBANKMENT CROSSING. THEREFORE, THE SOIL AND/OR ROCK CONDITIONS OF THE EXISTING SLOPE TO BE CUT FOR THE TEMPORARY ACCESS ROAD WERE NOT EXPLORED. THEREFORE, CONSERVATIVE SOIL PARAMETER ASSUMPTIONS FOR THE DESIGN OF THE SOIL-NAILED RETAINING WALL BASED ON GEOTECHNICAL FIELD OBSERVATIONS AND GEOTECHNICAL EXPERIENCE IN THE PROJECT VICINITY.

CONSTRUCTION OF THE PERMANENT SOIL-NAILED RETAINING WALL SYSTEM SHOULD BE PERFORMED BY A SPECIALTY CONTRACTOR EXPERIENCED IN THE CONSTRUCTION OF SOIL-NAILED RETAINING WALLS. DUE TO THE SPECIALIZED NATURE OF THE CONSTRUCTION, A GEOLABS REPRESENTATIVE SHOULD BE PRESENT TO OBSERVE THE GEOTECHNICAL ASPECTS OF THE SOIL-NAILED RETAINING WALL AND TESTING OF THE SOIL NAILS.

1.A SOIL-NAILED WALL PREPARATION

AT THE ON-SET OF CONSTRUCTION, SURFACE VEGETATION, LOOSE MATERIAL, AND DELETERIOUS MATERIAL SHOULD BE REMOVED FROM THE SLOPE FACE AND ADJACENT AREAS. CARE SHOULD BE TAKEN IN REMOVING MATERIAL SO THAT THE STABILITY OF THE EXISTING SLOPE IS NOT COMPROMISED.

1.B SOIL NAILED WALL

A SOIL-NAILED RETAINING WALL SYSTEM CONSISTS OF A SERIES OF INDIVIDUAL REINFORCING BARS GROUTED INTO DRILLED HOLES TO STABILIZE AN EXCAVATION OR SLOPE. A SHOTCRETE FACING IS GENERALLY APPLIED TO THE FACE OF THE WALL OR SLOPE PROVIDING THE APPEARANCE OF A CONVENTIONAL CONCRETE RETAINING WALL TO PROVIDE A NATURAL ROCK APPEARANCE. THE SHOTCRETE FACING MAY BE SCULPTED AND STAINED TO MATCH THE APPEARANCE OF THE SURROUNDING ENVIRONMENT. THE REINFORCING BARS PROVIDE ADDITIONAL TENSILE AND SHEAR STRENGTH TO THE WALL. THE REINFORCED SOIL MASS BEHAVES IN A MANNER SIMILAR TO A GRAVITY RETAINING WALL BUT LACKS A FOOTING.

THE SOIL NAILS SHOULD BE INSTALLED BY DRILLING A MINIMUM 6-INCH DIAMETER HOLE WITH AN INCLINATION OF APPROXIMATELY 15 DEGREES FROM HORIZONTAL. THE SOIL NAIL BAR SHOULD CONSIST OF AN ASTM A615 GRADE 75 THREADED BAR WITH A MINIMUM BAR DIAMETER OF 1 INCH. DUE TO THE PROXIMITY OF THE SOIL-NAILED WALL TO THE PACIFIC OCEAN, IT IS RECOMMENDED USING A DOUBLE CORROSION PROTECTION SYSTEM FOR THE NAILS CONSISTING OF EPOXY-COATED BARS SURROUNDED BY NEAT CEMENT GROUT OR SAND-CEMENT MIXTURE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 POUNDS PER SQUARE INCH (PSI).

BASED ON GEOTECHNICAL SOIL NAIL ANALYSIS, IT IS RECOMMENDED USING DESIGN NAIL LENGTHS OF 32 FEET EXTENDING INTO THE PROPOSED CUT SLOPE FACE. THE SOIL NAILS SHOULD BE SPACED 4 FEET ON-CENTER VERTICALLY AND HORIZONTALLY. THE FIRST NAIL SHOULD BE INSTALLED ABOUT 2 FEET BELOW THE TOP OF THE CUT SLOPE.

BASED ON THE ABOVE DESIGN PARAMETERS, THE SOIL-NAILED RETAINING WALL SYSTEM SHOULD HAVE A FACTOR OF SAFETY OF 1.5 OR GREATER FOR THE COMBINED INTERNAL AND EXTERNAL STABILITY FOR THE STATIC LOADING CONDITION.

1.C SOIL NAIL INSTALLATION

A SHOTCRETE FLASH COAT SHOULD FIRST BE APPLIED TO THE FACE OF THE PROPOSED CUT SLOPE TO FACILITATE THE INSTALLATION OF THE SOIL NAILS. SOIL NAIL INSTALLATION ACTIVITIES SHOULD AVOID CAUSING INSTABILITY TO THE CUT SLOPE.

POTENTIALLY DIFFICULT DRILLING CONDITIONS MAY BE ENCOUNTERED DURING THE INSTALLATION OF THE SOIL NAILS DUE TO THE POSSIBLE PRESENCE OF COBBLES, BOULDERS, AND BASALT ROCK FORMATION. UTILIZING A TEMPORARY CASING MAY BE REQUIRED TO MAINTAIN AN OPEN HOLE FOR THE SOIL NAIL INSTALLATION.

1.D SOIL NAIL TESTING

IT IS RECOMMENDED PERFORMING A MINIMUM OF ONE PRE-PRODUCTION VERIFICATION TEST ON A SACRIFICIAL SOIL NAIL INSTALLED NEAR THE TOP OF THE PROPOSED CUT SLOPE. IN ADDITION, PROOF TESTS SHOULD BE PERFORMED ON AT LEAST 10 PERCENT OF THE PRODUCTION SOIL NAILS DURING CONSTRUCTION TO CONFIRM THE BOND STRESSES USED IN THE DESIGN.

THE VERIFICATION TEST SHOULD BE LOADED GRADUALLY TO 150 PERCENT OF THE DESIGN LOAD (25 KIPS) FOR THE CREEP TEST AND SUBSEQUENTLY TO THE MAXIMUM TEST LOAD OF ABOUT 200 PERCENT OF THE DESIGN LOAD. IN ADDITION, THE LOAD AT EVERY LOADING INCREMENT SHOULD BE HELD FOR AT LEAST 10 MINUTES, AND CREEP TESTS SHOULD BE HELD FOR AT LEAST 60 MINUTES. IT SHOULD BE NOTED THAT THE VERIFICATION SOIL NAIL BAR SHOULD CONSIST OF AT LEAST AN ASTM A615 GRADE 75 NO. 9 BAR TO WITHSTAND THE MAXIMUM TEST LOAD (50 KIPS).

THE PROOF TESTS SHOULD CONSIST OF SUBJECTING THE SOIL NAIL TO AT LEAST 150 PERCENT OF THE DESIGN LOADS AND THE LOAD SHOULD BE HELD FOR AT LEAST 10 MINUTES (UNTIL STABLE). THE PROOF TEST NAILS MAY BE INCORPORATED INTO THE PERMANENT SOIL NAIL RETAINING WALL PROVIDED THEY SATISFY THE TEST CRITERIA. PULLOUT TESTS AND CREEP TESTS ON THE SOIL NAILS ARE INTEGRAL COMPONENTS OF THE DESIGN FOR THE SOIL NAIL RETAINING WALL SYSTEM. THEREFORE, IT IS RECOMMENDED CONDUCTING PULLOUT TESTS AND CREEP TESTS IN THE PRESENCE OF A GEOLABS REPRESENTATIVE.

1.E SHOTCRETE FACING

SHOTCRETE PLACEMENT SHOULD BE PERFORMED BY AN EXPERIENCED NOZZLEMAN. PRIOR TO PRODUCTION SHOTCRETING, IT IS RECOMMENDED THAT UNREINFORCED TEST PANELS OF SHOTCRETE BE CONSTRUCTED FOR INSPECTION. THE SHOTCRETE FACING MAY BE SCULPTURED IF DESIRED. THEREFORE, ADEQUATE THICKNESS OF THE FINAL FACING SHOULD BE PROVIDED TO ACCOMMODATE THE SCULPTURED SURFACING.

1.F DRAINAGE

THE SOIL-NAILED RETAINING WALL SHOULD BE WELL-DRAINED TO REDUCE THE POTENTIAL FOR THE BUILD-UP OF HYDROSTATIC PRESSURES. DRAINAGE ELEMENTS CONSISTING OF 2-FOOT WIDE STRIPS OF A PREFABRICATED DRAINAGE COMPOSITE PRODUCT MAY BE USED ON THE FACE OF THE SLOPE. INSTEAD OF A SHOTCRETE FLASH COAT USED FOR TEMPORARY STABILIZATION, THE PREFABRICATED DRAINAGE COMPOSITE PRODUCT SHOULD EXTEND FROM THE TOP OF THE SLOPE TO THE BASE OF THE SLOPE AND HYDRAULICALLY CONNECTED TO A WEEP HOLE NEAR THE BASE OF THE WALL.

2. TEMPORARY ACCESS ROAD

BASED ON THE INFORMATION PROVIDED, IT IS UNDERSTOOD THAT THE EXISTING STREAM WILL BE DIVERTED TO FACILITATE THE CONSTRUCTION OF THE ACROW BRIDGE. THE STREAM DIVERSION WILL ALSO ALLOW A TEMPORARY EMBANKMENT BYPASS ROAD TO BE CONSTRUCTED ON THE EAST SIDE OF THE EXISTING EMBANKMENT CROSSING. THE TEMPORARY ACCESS ROAD WILL BE CONSTRUCTED CLOSE TO THE EXISTING ACCESS ROAD GRADE. SOME MINOR FILL WILL BE REQUIRED WHERE THE TEMPORARY ACCESS ROAD CROSSES THE EXISTING STREAM.

FILL USED TO CONSTRUCT THE TEMPORARY ACCESS ROAD ACROSS THE EXISTING STREAM SHOULD CONSIST OF 3-INCH MINUS IMPORTED GRANULAR FILL MATERIAL WRAPPED IN A WOVEN GEOTEXTILE FABRIC, SUCH AS MIRAFIT F700 OR EQUIVALENT. THE 3-INCH MINUS FILL MATERIALS SHOULD BE PLACED IN LEVEL LIFTS OF ABOUT 8 INCHES THICK OR LESS.

TO RESIST EROSION DUE TO HEAVY RAINFALL AND POSSIBLE STREAM DIVERSION OVERFLOW EVENTS, IT IS RECOMMENDED USING A LIGHT PAVEMENT SECTION FOR THE TEMPORARY ACCESS ROAD. THE RECOMMENDED TEMPORARY PAVEMENT SECTION IS PROVIDED BELOW.

TEMPORARY ACCESS ROAD (FLEXIBLE PAVEMENT)

2.0-INCH ASPHALTIC CONCRETE
4.0-INCH AGGREGATE BASE COURSE (95 PERCENT RELATIVE COMPACTION)
6.0-INCH TOTAL PAVEMENT THICKNESS ON MOIST COMPACTED SUBGRADE
THE SUBGRADE SOILS SHOULD BE SCARIFIED TO A MINIMUM DEPTH OF ABOUT 8 INCHES. MOISTURE-CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION. RELATIVE COMPACTION REFERS TO THE IN-PLACE DRY DENSITY OF SOIL EXPRESSED AS A PERCENTAGE OF THE MAXIMUM DRY DENSITY OF THE SAME SOIL ESTABLISHED IN ACCORDANCE WITH ASTM D1557. OPTIMUM MOISTURE IS THE WATER CONTENT (PERCENTAGE BY DRY WEIGHT) CORRESPONDING TO THE MAXIMUM DRY DENSITY.

WHERE MINOR SHRINKAGE CRACKS ARE OBSERVED AFTER SUBGRADE PREPARATION, WE RECOMMEND THOROUGHLY MOISTENING THE SOIL TO CLOSE THE CRACKS PRIOR TO RECOMPACTING. SATURATION AND SUBSEQUENT YIELDING OF THE EXPOSED SUBGRADE DUE TO INCLEMENT WEATHER AND POOR DRAINAGE MAY REQUIRE OVER-EXCAVATION OF THE SOFT AREAS AND REPLACEMENT WITH SELECT GRANULAR FILL.

THE AGGREGATE BASE COURSE MATERIALS SHOULD MEET THE REQUIREMENTS STIPULATED IN SECTION 31 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, CITY AND COUNTY OF HONOLULU (SEPTEMBER 1986). AGGREGATE BASE COURSE MATERIALS SHOULD BE MOISTURE-CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT, PLACED IN LEVEL LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION. CALIFORNIA BEARING RATIO TESTS SHOULD BE PERFORMED ON THE ACTUAL SUBGRADE SOILS ENCOUNTERED DURING CONSTRUCTION TO CONFIRM THE ADEQUACY OF THE ABOVE SECTIONS.

3. ACROW BRIDGE FOUNDATIONS

IT IS UNDERSTOOD THAT THE EXISTING STREAM CROSSING WILL BE RECONSTRUCTED USING AN ACROW BRIDGE. BASED ON THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE PROJECT SITE, IT IS BELIEVED THAT SHALLOW SPREAD AND/OR CONTINUOUS FOOTINGS BEARING ON THE NEARLY-LEVEL IN-SITU SOILS MAY BE USED FOR SUPPORT OF THE PROPOSED BRIDGE STRUCTURE. AN ALLOWABLE BEARING PRESSURE OF UP TO 4,000 PSF MAY BE USED TO DESIGN SHALLOW FOUNDATIONS BEARING ON THE RECOMPACTED IN-SITU STIFF TO HARD SILTY CLAY AND CLAYEY SILT. THIS BEARING VALUE IS FOR SUPPORTING DEAD-PLUS-LIVE LOADS AND MAY BE INCREASED BY ONE-THIRD (1/3) FOR TRANSIENT LOADS, SUCH AS THOSE CAUSED BY WIND OR SEISMIC FORCES.

BASED ON THE SCOUR ANALYSIS PERFORMED BY RIVER FOCUS, WE UNDERSTAND THAT THE EXPECTED DESIGN SCOUR DEPTH IS ABOUT 12 TO 15 FEET BELOW THE TOP OF THE EXISTING EMBANKMENT CROSSING. HOWEVER, WE ALSO UNDERSTAND THAT THE EXISTING EMBANKMENT WILL BE DEMOLISHED SO THAT THE STREAM CHANNEL CAN BE DEEPEEN BELOW THE ACROW BRIDGE. BASED ON THE INFORMATION PROVIDED, THE BOTTOM OF THE DEEPEENED STREAM CHANNEL AT ELEVATION +849.25 FEET LIES AT THE SIDE SLOPES AND BOTTOM OF THE CHANNEL WILL BE ARMORED WITH RIP-RAP PROTECTION AND THE RIP-RAP PROTECTION WILL BE DESIGNED TO PREVENT SCOUR BENEATH THE ACROW BRIDGE. THEREFORE, THE BRIDGE FOUNDATIONS WILL BE PROTECTED FROM FUTURE SCOUR AND DO NOT NEED TO EXTEND BELOW THE ANTICIPATED SCOUR DEPTH.

FOOTING SUBGRADES SHOULD BE RECOMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION TO PROVIDE A RELATIVELY FIRM AND UNYIELDING SURFACE PRIOR TO THE PLACEMENT OF REINFORCING STEEL OR CONCRETE. RELATIVE COMPACTION REFERS TO THE IN-PLACE DRY DENSITY OF SOIL EXPRESSED AS A PERCENTAGE OF THE MAXIMUM DRY DENSITY OF THE SAME SOIL ESTABLISHED IN ACCORDANCE WITH ASTM D1557. OPTIMUM MOISTURE IS THE WATER CONTENT (PERCENTAGE BY DRY WEIGHT) CORRESPONDING TO THE MAXIMUM DRY DENSITY.

SOFT AND/OR LOOSE MATERIALS ENCOUNTERED AT THE BOTTOM OF FOOTING EXCAVATIONS SHOULD BE OVER-EXCAVATED UNTIL STIFF/DENSE MATERIALS ARE ENCOUNTERED. THE OVER-EXCAVATION SHOULD BE FILLED WITH SELECT GRANULAR MATERIALS. MOISTURE-CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 90 PERCENT RELATIVE COMPACTION.

IN GENERAL, THE BOTTOM OF FOOTINGS SHOULD BE EMBEDDED A MINIMUM OF 18 INCHES BELOW THE LOWEST ADJACENT FINISHED GRADE. FOOTINGS LOCATED ADJACENT TO SLOPES OR ON SLOPES SHOULD BE EMBEDDED TO A SUFFICIENT DEPTH TO PROVIDE A MINIMUM HORIZONTAL SETBACK DISTANCE OF AT LEAST 6 FEET MEASURED FROM THE OUTSIDE EDGE OF THE FOOTING TO THE FACE OF THE SLOPE.

FOUNDATIONS NEXT TO UTILITY TRENCHES OR EASEMENTS SHOULD BE EMBEDDED BELOW A 1H:1V IMAGINARY PLANE EXTENDING UPWARD FROM THE BOTTOM EDGE OF THE UTILITY TRENCH OR AS DEEP AS THE INVERTS OF THE UTILITY LINES. THIS REQUIREMENT IS NECESSARY TO AVOID SURCHARGING ADJACENT BELOW-GRADE STRUCTURES WITH ADDITIONAL STRUCTURE LOADS AND TO REDUCE THE POTENTIAL FOR APPRECIABLE FOUNDATION SETTLEMENT.

IF THE FOUNDATIONS ARE DESIGNED AND CONSTRUCTED AS RECOMMENDED HEREIN, IT IS ESTIMATED TOTAL SETTLEMENT OF FOOTINGS SUPPORTED ON THE RECOMPACTED IN-SITU SOILS TO BE ON THE ORDER OF 1 INCH OR LESS. DIFFERENTIAL SETTLEMENTS BETWEEN ADJACENT FOOTINGS SUPPORTED ON SIMILAR MATERIALS SHOULD BE ON THE ORDER OF ABOUT 0.5 INCHES OR LESS.

LATERAL LOADS ACTING ON THE STRUCTURE MAY BE RESISTED BY FRICTION DEVELOPED BETWEEN THE BOTTOM OF THE FOUNDATION AND THE BEARING SOIL AND BY PASSIVE EARTH PRESSURE ACTING AGAINST THE NEAR-VERTICAL FACES OF THE FOUNDATION SYSTEM. A COEFFICIENT OF FRICTION OF 0.35 MAY BE USED FOR FOOTINGS BEARING ON THE RECOMPACTED IN-SITU SOILS. RESISTANCE DUE TO PASSIVE EARTH PRESSURE MAY BE ESTIMATED USING AN EQUIVALENT FLUID PRESSURE OF 300 POUNDS PER SQUARE FOOT PER FOOT OF DEPTH (PCF). THIS ASSUMES THAT THE SOILS AROUND THE FOOTINGS ARE WELL-COMPACTED, UNLESS COVERED BY PAVEMENTS OR SLABS, THE PASSIVE RESISTANCE IN THE UPPER 12 INCHES OF SOIL SHOULD BE NEGLECTED.

A GEOLABS REPRESENTATIVE SHOULD OBSERVE THE FOOTING EXCAVATIONS PRIOR TO PLACING REINFORCING STEEL OR CONCRETE TO CONFIRM THE FOUNDATION BEARING CONDITIONS AND THE REQUIRED EMBEDMENT DEPTHS.

4. RETAINING STRUCTURES

WE ANTICIPATE THAT RETAINING WALLS MAY BE NECESSARY AT THE ACROW BRIDGE ABUTMENTS. BASED ON OUR FIELD EXPLORATION RESULTS, THE FOLLOWING GUIDELINES MAY BE USED FOR THE DESIGN OF RETAINING STRUCTURES FOR THE ACCESS ROAD REPAIR PROJECT.

4.A RETAINING STRUCTURE FOUNDATIONS

IN GENERAL, RETAINING WALL FOUNDATIONS SHOULD BE DESIGNED IN ACCORDANCE WITH RECOMMENDATIONS PRESENTED IN THE ACROW BRIDGE FOUNDATIONS SECTION HEREIN. WALL FOOTINGS SHOULD BE AT LEAST 18 INCHES WIDE AND SHOULD BE EMBEDDED A MINIMUM OF 24 INCHES BELOW THE LOWEST ADJACENT FINISHED GRADES. FOR SLOPING GROUND CONDITIONS, THE BOTTOM OF THE FOOTING SHOULD EXTEND DEEPER TO OBTAIN A MINIMUM 6-FOOT SETBACK DISTANCE MEASURED HORIZONTALLY FROM THE OUTSIDE EDGE OF THE FOOTING TO THE FACE OF THE SLOPE. WALL FOOTINGS ORIENTED PARALLEL TO THE DIRECTION OF THE SLOPE SHOULD BE CONSTRUCTED IN STEPPED FOOTINGS.

4.B LATERAL EARTH PRESSURES

RETAINING STRUCTURES SHOULD BE DESIGNED TO RESIST THE LATERAL EARTH PRESSURES DUE TO THE ADJACENT SOILS AND SURCHARGE EFFECTS. THE RECOMMENDED LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES EXPRESSED IN EQUIVALENT FLUID PRESSURE OF POUNDS PER SQUARE FOOT PER FOOT OF DEPTH (PCF) ARE PRESENTED IN THE FOLLOWING TABLE:

LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES			
BACKFILL CONDITION	EARTH PRESSURE COMPONENT	ACTIVE (PCF)	AT-REST (PCF)
LEVEL BACKFILL	HORIZONTAL	38	58
	VERTICAL	NONE	NONE
MAXIMUM 2H:1V SLOPING BACKFILL	HORIZONTAL	57	75
	VERTICAL	20	27

THE VALUES PROVIDED IN THE TABLE ABOVE ASSUME THAT ON-SITE GRANULAR SOILS OR SELECT GRANULAR FILL WILL BE USED TO BACKFILL BEHIND THE RETAINING STRUCTURES. IT IS ASSUMED THAT THE BACKFILL BEHIND THE RETAINING STRUCTURES WILL BE MOISTURE-CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO BETWEEN 90 AND 95 PERCENT RELATIVE COMPACTION PER ASTM D1557. OVER-COMPACTION OF THE RETAINING STRUCTURE BACKFILL SHOULD BE AVOIDED.

IN GENERAL, AN ACTIVE CONDITION MAY BE USED FOR GRAVITY WALLS AND RETAINING STRUCTURES THAT ARE FREE TO DEFLECT BY AS MUCH AS 0.5 PERCENT OF THE STRUCTURE HEIGHT. IF THE TOPS OF STRUCTURES ARE NOT FREE TO DEFLECT BEYOND THIS DEGREE, OR ARE RESTRAINED, THE RETAINING STRUCTURES SHOULD BE DESIGNED FOR THE AT-REST CONDITION. THESE LATERAL EARTH PRESSURES DO NOT INCLUDE HYDROSTATIC PRESSURES THAT MIGHT BE CAUSED BY GROUNDWATER TRAPPED BEHIND THE STRUCTURES.

SURCHARGE STRESSES DUE TO AREAL SURCHARGES, LINE LOADS, AND POINT LOADS WITHIN A HORIZONTAL DISTANCE EQUAL TO THE DEPTH OF THE STRUCTURE SHOULD BE CONSIDERED IN THE DESIGN. FOR UNIFORM SURCHARGE STRESSES IMPOSED ON THE LOADED SIDE OF THE STRUCTURE, A RECTANGULAR DISTRIBUTION WITH A UNIFORM PRESSURE EQUAL TO 33 PERCENT OF THE VERTICAL SURCHARGE PRESSURE ACTING OVER THE ENTIRE HEIGHT OF THE STRUCTURE, WHICH IS FREE TO DEFLECT (CANTILEVER), MAY BE USED IN THE DESIGN. FOR RETAINING STRUCTURES THAT ARE RESTRAINED, A RECTANGULAR DISTRIBUTION EQUAL TO 50 PERCENT OF THE VERTICAL SURCHARGE PRESSURE ACTING OVER THE ENTIRE HEIGHT OF THE STRUCTURE MAY BE USED FOR DESIGN. ADDITIONAL ANALYSES DURING DESIGN MAY BE NEEDED TO EVALUATE THE SURCHARGE EFFECTS OF POINT LOADS AND LINE LOADS.

DYNAMIC LATERAL EARTH FORCES DUE TO SEISMIC LOADING MAY BE ESTIMATED BY USING 6.3H² POUNDS PER LINEAR FOOT OF WALL LENGTH FOR LEVEL BACKFILL CONDITIONS, WHERE H IS THE HEIGHT OF THE WALL IN FEET. IT SHOULD BE NOTED THAT THE DYNAMIC LATERAL EARTH FORCES PROVIDED ASSUME THAT THE WALL WILL BE ALLOWED TO DEFLECT BY ABOUT 1 TO 2 INCHES IN THE EVENT OF AN EARTHQUAKE. THE RESULTANT FORCE SHOULD BE ASSUMED TO ACT THROUGH THE MID-HEIGHT OF THE WALL. AN APPROPRIATELY REDUCED FACTOR OF SAFETY MAY BE USED WHEN DYNAMIC LATERAL EARTH FORCES ARE ACCOUNTED FOR IN THE DESIGN OF THE RETAINING STRUCTURES.

4.C DRAINAGE

RETAINING WALLS SHOULD BE WELL-DRAINED TO REDUCE THE BUILD-UP OF HYDROSTATIC PRESSURES. A TYPICAL DRAINAGE SYSTEM WOULD CONSIST OF A 12-INCH-WIDE ZONE OF PERMEABLE MATERIAL, SUCH AS NO. 38 FINE GRAVEL (ASTM C33, NO. 67 GRADATION), PLACED DIRECTLY AROUND A PERFORATED PIPE (PERFORATIONS FACING DOWN) AT THE BASE OF THE WALL TO DISCHARGE TO AN APPROPRIATE DRAINAGE OR WEEP HOLE. AN ALTERNATIVE, A PREFABRICATED DRAINAGE PRODUCT, SUCH AS MIRADRAIN, MAY BE USED INSTEAD OF THE DRAINAGE MATERIAL. THE PREFABRICATED DRAINAGE PRODUCT SHOULD ALSO BE CONNECTED HYDRAULICALLY TO A PERFORATED PIPE AT THE BASE OF THE WALL.

THE BACKFILL FROM THE BOTTOM OF THE WALL TO THE BOTTOM OF THE WEEP HOLE SHOULD CONSIST OF RELATIVELY IMPERVIOUS MATERIALS TO REDUCE THE POTENTIAL FOR SIGNIFICANT WATER INFILTRATION INTO THE SUBSURFACE. IN ADDITION, THE UPPER 12 INCHES OF THE RETAINING WALL BACKFILL SHOULD CONSIST OF RELATIVELY IMPERVIOUS MATERIALS TO REDUCE THE POTENTIAL FOR SIGNIFICANT WATER INFILTRATION BEHIND THE RETAINING STRUCTURE UNLESS COVERED BY CONCRETE SLABS AT THE SURFACE.

5. RIP-RAP ABUTMENT PROTECTION

IT IS UNDERSTOOD THAT THE EXISTING STREAM CHANNEL AND SLOPES ADJACENT TO THE PROPOSED ACROW BRIDGE ABUTMENTS WILL BE DEEPEENED AND LINED WITH RIP-RAP. IN GENERAL, THE RIP-RAP-LINED CHANNEL SHOULD HAVE A SLOPE FACE INCLINATION OF 1.5H:1V OR FLATTER IN THE DIRECTION PARALLEL TO THE BRIDGE. IT IS UNDERSTOOD THAT THE UPSTREAM AND DOWNSTREAM SLOPES ADJACENT TO THE ABUTMENTS WILL BE COMPOSED OF ENTIRELY RIP-RAP MATERIAL. THEREFORE, FOR THE RIP-RAP-LINED SLOPE FACES RUNNING PERPENDICULAR TO THE ACROW BRIDGE, THE SLOPE FACE INCLINATION MAY BE INCREASED TO UP TO 1H:1V.

THE PROJECT HYDRAULIC ENGINEER SHOULD PROVIDE THE RIP-RAP GRADATION REQUIREMENTS BASED ON THE ANTICIPATED SCOUR AND STREAMFLOW VELOCITIES.

6.0 PAVEMENT DESIGN

BASED ON THE GEOTECHNICAL FIELD EXPLORATION AND LABORATORY TESTING, THE ON-SITE CLAYEY SOILS EXHIBIT FAIR PAVEMENT SUPPORT CHARACTERISTICS. BASED ON THE PRELIMINARY CBR AND SWELL VALUES OF THE ON-SITE CLAYEY SOILS, THE FOLLOWING FLEXIBLE PAVEMENT SECTION MAY BE USED FOR THE PRELIMINARY DESIGN:

FLEXIBLE PAVEMENT

2.0-INCH ASPHALTIC CONCRETE
6.0-INCH AGGREGATE BASE COURSE (95 PERCENT RELATIVE COMPACTION)
8.0-INCH TOTAL PAVEMENT THICKNESS ON COMPACTED SUBGRADE
THE SUBGRADE SOILS SHOULD BE SCARIFIED TO A MINIMUM DEPTH OF ABOUT 8 INCHES. MOISTURE-CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION. RELATIVE COMPACTION REFERS TO THE IN-PLACE DRY DENSITY OF SOIL EXPRESSED AS A PERCENTAGE OF THE MAXIMUM DRY DENSITY OF THE SAME SOIL ESTABLISHED IN ACCORDANCE WITH ASTM D1557. OPTIMUM MOISTURE IS THE WATER CONTENT (PERCENTAGE BY DRY WEIGHT) CORRESPONDING TO THE MAXIMUM DRY DENSITY.

WHERE MINOR SHRINKAGE CRACKS ARE OBSERVED AFTER SUBGRADE PREPARATION, WE RECOMMEND THOROUGHLY MOISTENING THE SOIL TO CLOSE THE CRACKS PRIOR TO RECOMPACTING. SATURATION AND SUBSEQUENT YIELDING OF THE EXPOSED SUBGRADE DUE TO INCLEMENT WEATHER AND POOR DRAINAGE MAY REQUIRE OVER-EXCAVATION OF THE SOFT AREAS AND REPLACEMENT WITH SELECT GRANULAR FILL.

THE AGGREGATE BASE COURSE MATERIALS SHOULD MEET THE REQUIREMENTS STIPULATED IN SECTION 31 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, CITY AND COUNTY OF HONOLULU (SEPTEMBER 1986). AGGREGATE BASE COURSE MATERIALS SHOULD BE MOISTURE-CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT, PLACED IN LEVEL LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION. CALIFORNIA BEARING RATIO TESTS SHOULD BE PERFORMED ON THE ACTUAL SUBGRADE SOILS ENCOUNTERED DURING CONSTRUCTION TO CONFIRM THE ADEQUACY OF THE ABOVE SECTIONS.

PAVED AREAS SHOULD BE SLOPED, AND DRAINAGE GRADIENTS SHOULD BE MAINTAINED TO CARRY SURFACE WATER OFF-SITE. SURFACE WATER PONDING SHOULD NOT BE ALLOWED ON-SITE DURING OR AFTER CONSTRUCTION.

7.0 SITE GRADING

BASED ON THE INFORMATION PROVIDED, IT IS UNDERSTOOD THAT THE FOLLOWING EARTHWORK ACTIVITIES WILL BE REQUIRED FOR THE PROJECT CONSTRUCTION.

EXCAVATE AN APPROXIMATELY 13-FOOT DEEP CUT TO DEMOLISH THE EXISTING EMBANKMENT CROSSING AND DEEPEN THE STREAM CHANNEL.

EXCAVATE A 29-FOOT TALL CUT INTO THE EXISTING SLOPE TO CONSTRUCT THE TEMPORARY ACCESS ROAD.

EXCAVATE A 4-FOOT DEEP BASIN TO COLLECT STREAM WATER AND STREAM DEBRIS FOR THE STREAM DIVERSION.

RELATIVELY MINOR FILL TO CREATE THE TEMPORARY ACCESS ROAD.

A GEOLABS REPRESENTATIVE SHOULD MONITOR SITE GRADING OPERATIONS TO OBSERVE WHETHER UNDESIRABLE MATERIALS ARE ENCOUNTERED DURING THE EXCAVATION AND SCARIFICATION PROCESS AND TO CONFIRM WHETHER THE EXPOSED SOIL CONDITIONS ARE SIMILAR TO THOSE ASSUMED IN THIS REPORT.

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

T003

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GENERAL NOTES - 2			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 3	OF _____ SHEETS
FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:03am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 T004 GEN NOTES - 3.dwg

NOTES FROM GEOTECH REPORT (CONT'D)

7.E CUT AND FILL SLOPES

BASED ON THE SUBSURFACE CONDITIONS ENCOUNTERED IN THE BORINGS, IT IS ANTICIPATED THAT CUT SLOPES WOULD EXPOSE SOILS CONSISTING OF STIFF TO HARD SILTS/CLAYS AND COBBLES AND BOULDERS. IN GENERAL, IT IS BELIEVED THAT CUT SLOPES INTO THE SOIL MATERIAL MAY BE CUT AT AN INCLINATION OF 2H:1V OR FLATTER.

FILL SLOPES SHOULD BE DESIGNED WITH A SLOPE INCLINATION OF 2H:1V OR FLATTER. FILLS PLACED ON SLOPES STEEPER THAN 5H:1V SHOULD BE KEYED AND BENCHED INTO THE EXISTING SLOPE TO PROVIDE STABILITY OF THE NEW FILL AGAINST SLIDING. THE FILLING OPERATIONS SHOULD START AT THE LOWEST POINT AND CONTINUE UP IN LEVEL HORIZONTAL COMPACTED LAYERS IN ACCORDANCE WITH THE ABOVE FILL PLACEMENT RECOMMENDATIONS.

FILL SLOPES GREATER THAN 5 FEET IN HEIGHT SHOULD BE CONSTRUCTED BY OVERFILLING AND CUTTING BACK TO THE DESIGN SLOPE RATIO TO OBTAIN A WELL-COMPACTED SLOPE FACE. TRACK-ROLLING OF SLOPES MORE THAN 5 FEET IN HEIGHT SHOULD NOT BE ACCEPTED. IF OVER-CUTTING OF A SLOPE OCCURS, KEYING AND BENCHING REQUIREMENTS SHOULD BE IMPLEMENTED INSTEAD OF BACKFILLING THE SLOPE TO THE DESIGN GRADE WITH SLIVER FILLS. WATER SHOULD BE DIVERTED AWAY FROM THE TOPS OF SLOPES AND SLOPE PLANTING SHOULD BE PROVIDED AS SOON AS POSSIBLE TO REDUCE THE POTENTIAL FOR EROSION OF THE FINISHED SLOPES.

8. UNDERGROUND UTILITIES

IT IS UNDERSTOOD THAT THE EXISTING WATERLINE WILL BE REROUTED BENEATH THE TEMPORARY ACCESS ROAD. THE PORTION OF THE WATERLINE BENEATH THE EXISTING EMBANKMENT CROSSING WILL BE CUT AND DEMOLISHED DURING THE ACROW BRIDGE CONSTRUCTION.

THE CONTRACTOR SHOULD DETERMINE THE METHODS AND EQUIPMENT TO BE USED FOR EXCAVATION, SUBJECT TO PRACTICAL LIMITS AND SAFETY CONSIDERATIONS. THE EXCAVATION SHOULD COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REQUIREMENTS. THE CONTRACTOR SHOULD BE RESPONSIBLE FOR TRENCH SHORING DESIGN AND INSTALLATION. TRENCH SHORING AND BRACING SHOULD CONFORM TO THE APPROPRIATE HEALTH AND SAFETY REQUIREMENTS.

IN GENERAL, IT IS RECOMMENDED PROVIDING GRANULAR BEDDING CONSISTING OF 6 INCHES OF NO. 38 FINE GRAVEL (ASTM C33, NO. 67 GRADATION) UNDER THE PIPES. THE INITIAL BACKFILL UP TO ABOUT 12 INCHES ABOVE THE PIPES SHOULD CONSIST OF FREE-DRAINING BACKFILLS, SUCH AS NO. 38 FINE GRAVEL, TO REDUCE THE POTENTIAL FOR PIPE DAMAGE FROM COMPACTION OF THE BACKFILL. IT IS CRITICAL TO USE A FREE-DRAINING GRANULAR MATERIAL TO REDUCE THE POTENTIAL FOR THE FORMATION OF VOIDS BELOW THE HAUNCHES OF PIPES AND TO PROVIDE ADEQUATE SUPPORT FOR THE SIDES OF THE PIPES. THE USE OF ON-SITE SOILS AS BACKFILL DIRECTLY AROUND UTILITY PIPES IS NOT RECOMMENDED.

THE UPPER PORTION OF THE TRENCH BACKFILL FROM THE LEVEL 12 INCHES ABOVE THE PIPES TO THE FINISHED SUBGRADE SHOULD CONSIST OF THE APPROVED ON-SITE SOILS WITH A MAXIMUM PARTICLE SIZE OF 3 INCHES OR LESS, OR SELECT GRANULAR FILL MATERIAL. THE BACKFILL MATERIAL SHOULD BE MOISTURE-CONDITIONED TO ABOUT 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT, PLACED IN LEVEL LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED TO A MINIMUM OF 90 PERCENT RELATIVE COMPACTION. THE UPPER 3 FEET OF THE TRENCH BACKFILL BELOW PAVEMENTS OR AREAS SUBJECTED TO VEHICULAR TRAFFIC SHOULD BE COMPACTED TO A MINIMUM OF 95 PERCENT RELATIVE COMPACTION. MECHANICAL COMPACTION EQUIPMENT SHOULD BE USED TO COMPACT THE MATERIALS AT THE PROJECT SITE. WATER TAMPING, JETTING, OR PONDING SHOULD NOT BE USED TO COMPACT THE BACKFILL MATERIAL.

9. SERVICES DURING CONSTRUCTION

GEOLABS, INC. SHOULD BE RETAINED TO PROVIDE GEOTECHNICAL ENGINEERING SERVICES DURING CONSTRUCTION OF THE PROPOSED PROJECT. THE CRITICAL ITEMS OF CONSTRUCTION MONITORING THAT REQUIRE "SPECIAL INSPECTION" INCLUDE THE FOLLOWING:

- OBSERVATION OF SOIL NAIL LOAD TEST PROGRAM
- OBSERVATION OF PRODUCTION SOIL NAIL INSTALLATION AND PROOF TESTING
- OBSERVATION OF SHOTCRETE PLACEMENT
- OBSERVATION OF CHANNEL EXCAVATION AND RIP-RAP PLACEMENT
- OBSERVATION OF SUBGRADE PREPARATION
- OBSERVATION OF GENERAL FILL AND BACKFILL PLACEMENT
- OBSERVATION OF SHALLOW FOUNDATION EXCAVATION AND PREPARATION

A GEOLABS REPRESENTATIVE ALSO SHOULD MONITOR THE OTHER ASPECTS OF EARTHWORK CONSTRUCTION TO OBSERVE COMPLIANCE WITH THE INTENT OF THE DESIGN CONCEPTS, SPECIFICATIONS, OR RECOMMENDATIONS AND TO EXPEDITE SUGGESTIONS FOR DESIGN CHANGES THAT MAY BE REQUIRED IN THE EVENT THAT SUBSURFACE CONDITIONS DIFFER FROM THOSE ANTICIPATED AT THE TIME THIS REPORT WAS PREPARED. GEOLABS SHOULD BE ACCORDED THE OPPORTUNITY TO PROVIDE GEOTECHNICAL ENGINEERING SERVICES DURING CONSTRUCTION TO CONFIRM OUR ASSUMPTIONS IN PROVIDING THE RECOMMENDATIONS PRESENTED HEREIN.


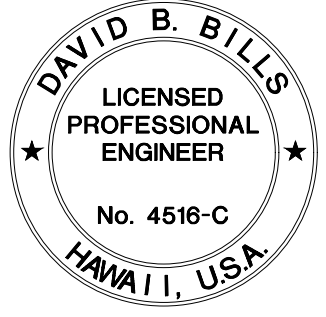
IF THE ACTUAL EXPOSED SUBSURFACE CONDITIONS ENCOUNTERED DURING CONSTRUCTION DIFFER FROM THOSE ASSUMED OR CONSIDERED IN THIS REPORT, GEOLABS SHOULD BE CONTACTED TO REVIEW AND/OR REVISE THE GEOTECHNICAL RECOMMENDATIONS PRESENTED HEREIN.

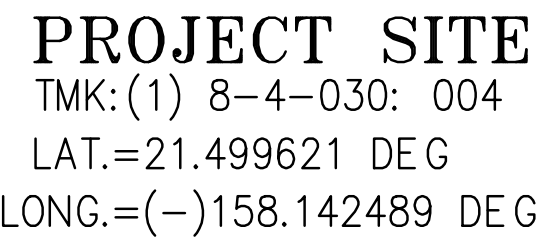
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	JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII			
	GENERAL NOTES — 3			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: 2023
	DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 4 OF _____	SHEETS
FILE	POCKET	FOLDER	NO.	



EXISTING MAKAHA
525' RESERVOIR

- RESERVOIR ACCESS ROAD

EXISTING MAUNA OLU
875' RESERVOIR

KEPUHI NEW

KILI DR.

HUIPU DR

MAUNAOLU ST.

MAKAHA VALLEY
COUNTRY CLUB

ALA HOLO

MAKAHA VALLEY ROAD

SHERATON MAKAHA RESORT

МАКАНА

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A circular professional engineer seal. The outer ring contains the text "DAVID B. BILLS" at the top and "HAWAII, U.S.A." at the bottom, separated by two stars. The inner circle contains the text "LICENSED PROFESSIONAL ENGINEER" and "No. 4516-C".

BOARD OF WATER SUPPLY

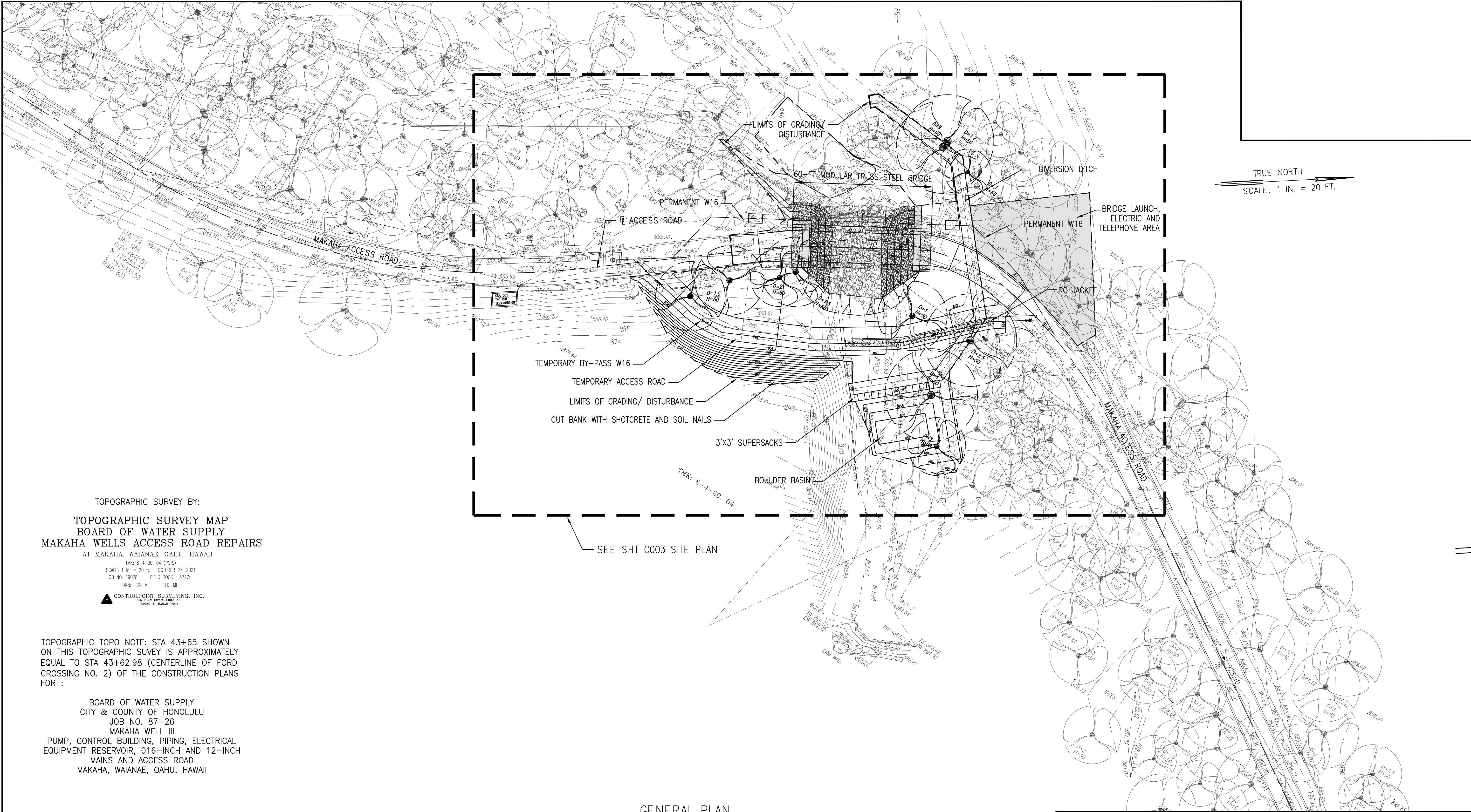
CITY AND COUNTY OF HONOLULU


JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

BUILDING PERMIT SITE PLAN

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TOPOGRAPHIC SURVEY BY:
TOPOGRAPHIC SURVEY MAP
BOARD OF WATER SUPPLY
MAKAHA WELLS ACCESS ROAD REPAIRS
AT MAKAHA, WAIANA'E, OAHU, HAWAII
TMK: 8-4-30: 04 (POR)
SCALE: 1 in. = 20 ft. OCTOBER 27, 2021
JOB NO. 19078 FIELD BOOK : 3727: 1
DRN: SN-M FLD: MP
 CONTROLPOINT SURVEYING, INC.
815 Puka Street, Suite 700
HONOLULU, HAWAII 96814

TOPOGRAPHIC TOPO NOTE: STA 43+65 SHOWN
ON THIS TOPOGRAPHIC SURVEY IS APPROXIMATELY
EQUAL TO STA 43+62.98 (CENTERLINE OF FORD
CROSSING NO. 2) OF THE CONSTRUCTION PLANS
FOR :

BOARD OF WATER SUPPLY
CITY & COUNTY OF HONOLULU
JOB NO. 87-26
MAKAHA WELL III
PUMP, CONTROL BUILDING, PIPING, ELECTRICAL
EQUIPMENT RESERVOIR, 016-INCH AND 12-INCH
MAINS AND ACCESS ROAD
MAKAHA, WAIANA'E, OAHU, HAWAII

GENERAL PLAN
SCALE: 1" = 20'-0"


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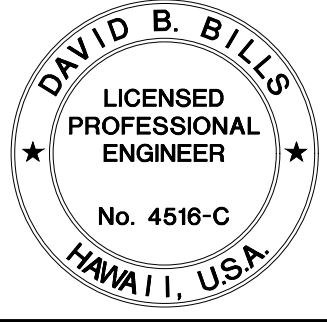
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DATE

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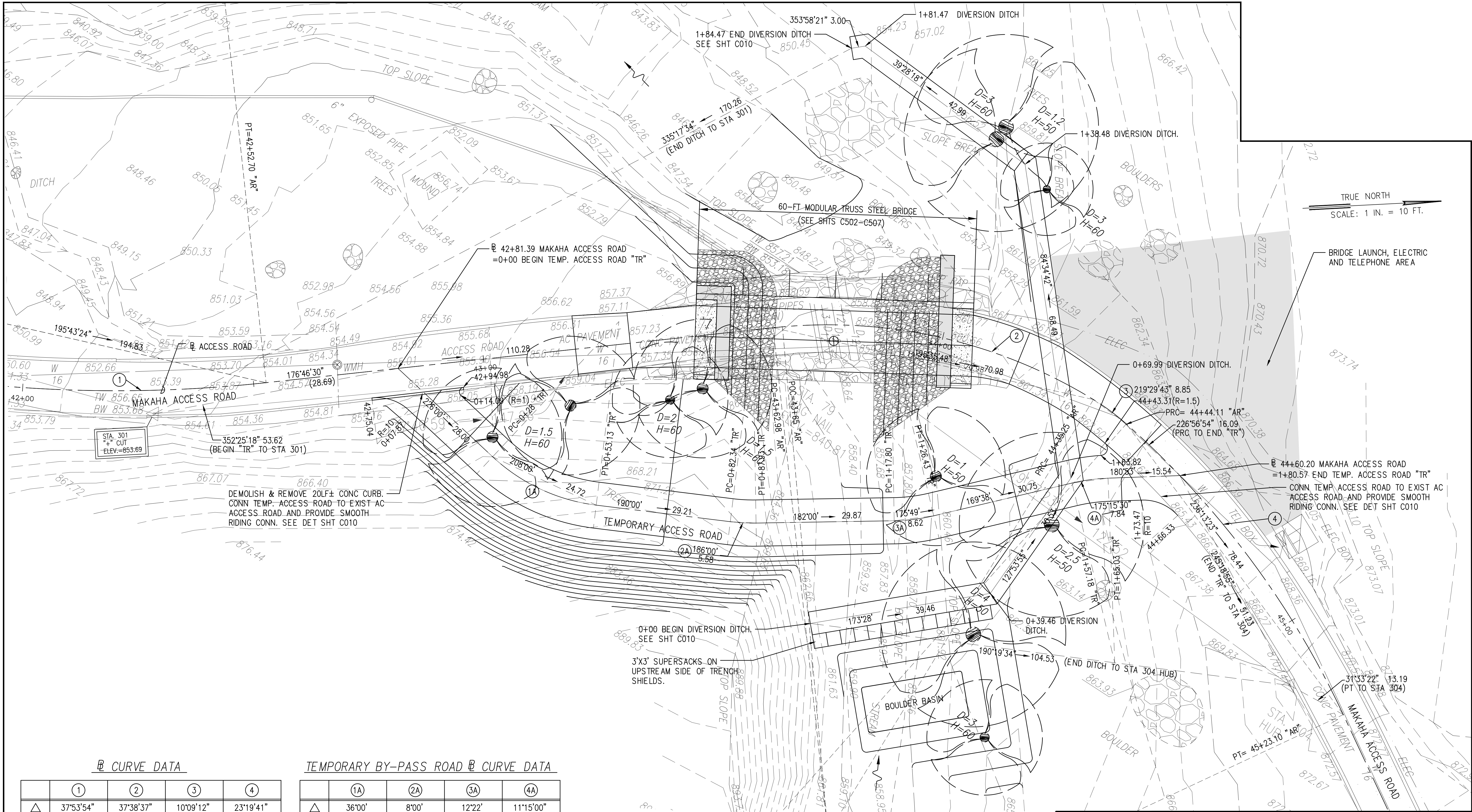
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JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII			
GENERAL PLAN			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS			DATE: 2023
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Mon, 23 Jun 2023 - 9:10am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C003 SITE PLAN.dwg



TRUE NORTH
SCALE: 1 IN. = 10 FT.

BRIDGE LAUNCH, ELECTRIC
AND TELEPHONE AREA

① CURVE DATA

	①	②	③	④
△	37°53'54"	37°38'37"	10°09'12"	23°19'41"
△/2	18°56'57"	18°49'18.5"	5°04'36"	11°39'50.5"
R	300.00	110.00	50.00	194.00
T	103.00	37.49	4.44	40.05
Ch	194.84	70.98	8.85	78.44
Lc	198.43	72.27	8.86	78.99

TEMPORARY BY-PASS ROAD ① CURVE DATA

	1A	2A	3A	4A
△	36°00'	8°00'	12°22'	11°15'00"
△/2	18°00'	4°00'	6°11'	5°37'30"
R	40.00	40.00	40.00	40.00
T	13.00	2.80	4.33	3.94
Ch	24.72	5.58	8.62	7.84
Lc	25.13	5.59	8.63	7.85

SITE PLAN
SCALE: 1" = 10'-0"

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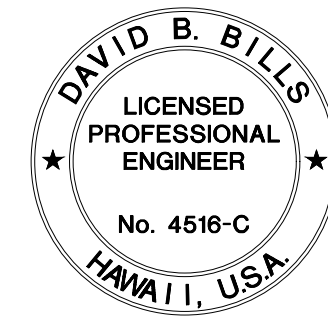
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David B. Bills
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Exp: 4/30/24



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

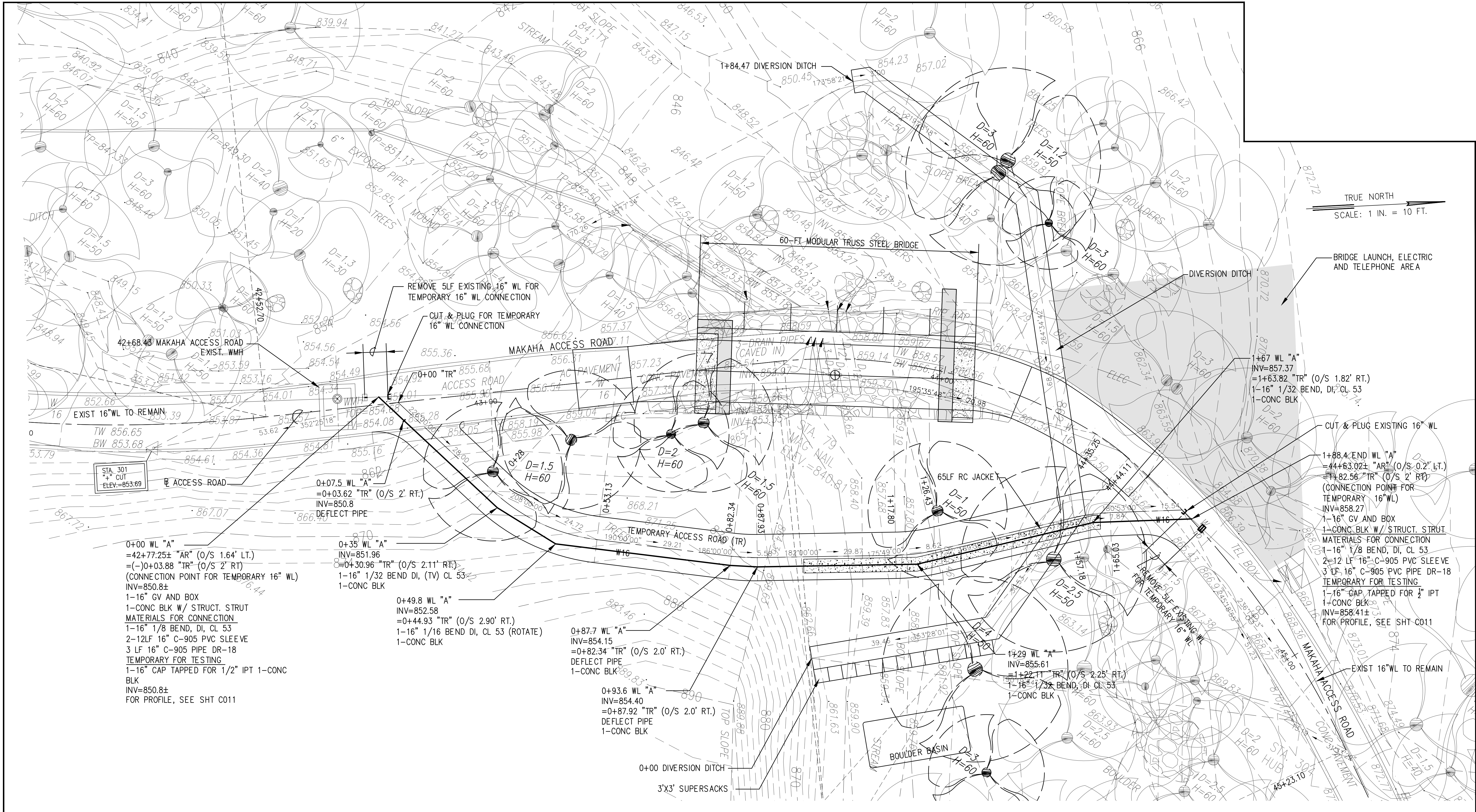
JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

SITE PLAN

APPROVED: _____		DATE: 2023	
MANAGER AND CHIEF ENGINEER, BWS			
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO:
FIELD BOOK NO:		SCALE: AS INDICATED	SHEET 7 OF SHEETS

FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:12am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C004 TEMPORARY UTILITY PLAN FOR CONSTRUCTION PERIOD.dwg



TRUE NORTH
SCALE: 1 IN. = 10 FT.

NOTE:
SEE SHT E101 FOR TEMPORARY
ELECTRICAL AND TELEPHONE

UTILITY PLAN
SCALE: 1" = 10'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C004

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WILL BE UNDER MY OBSERVATION

David B. Bills
SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED
PROFESSIONAL
ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

TEMPORARY UTILITY PLAN FOR CONSTRUCTION PERIOD

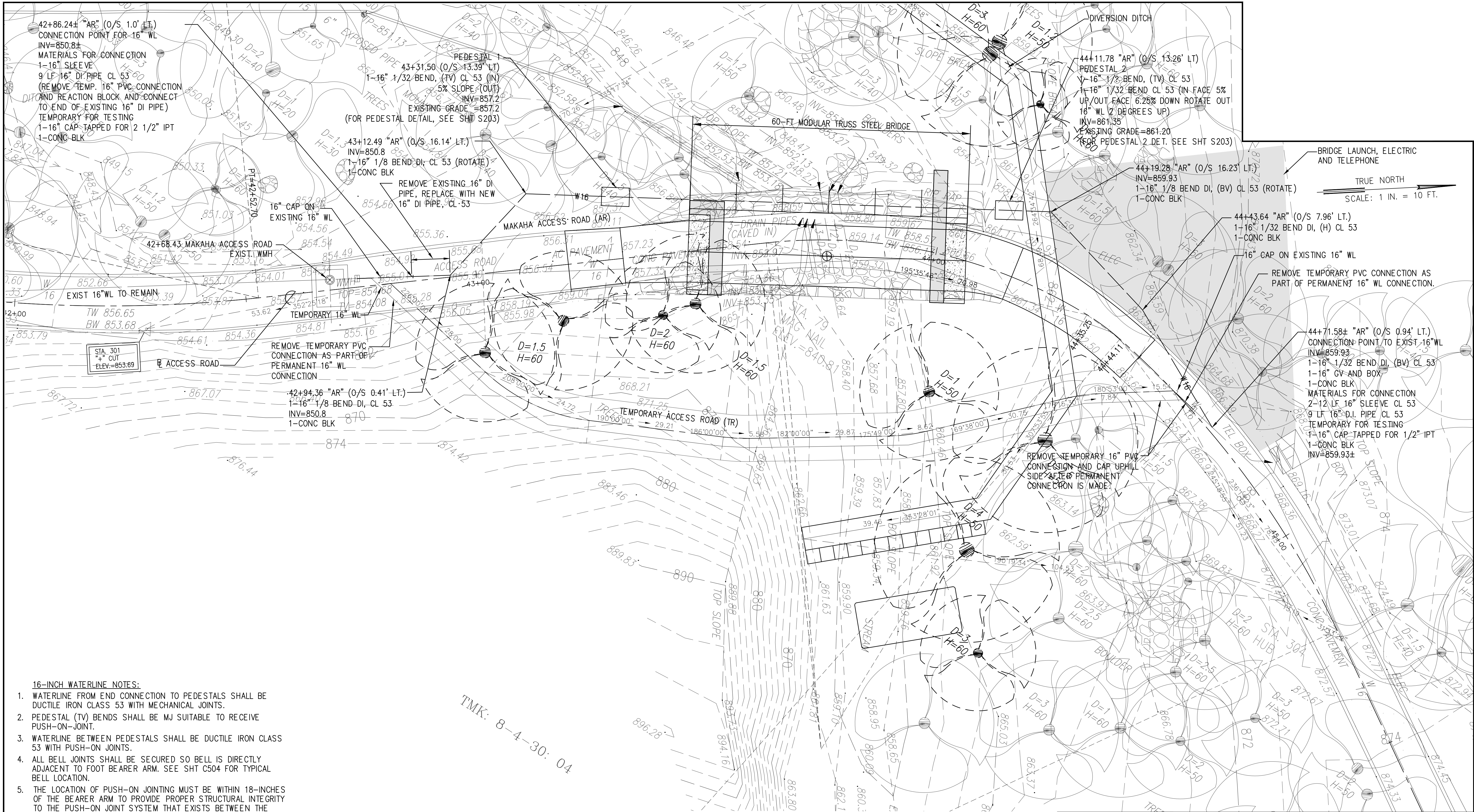
APPROVED: _____ DATE: 2023

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 8 OF SHEETS

FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:14am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C005 PLAN - PERMANENT 16-INCH WL.dwg



16-INCH WATERLINE NOTES:

1. WATERLINE FROM END CONNECTION TO PEDESTALS SHALL BE DUCTILE IRON CLASS 53 WITH MECHANICAL JOINTS.
2. PEDESTAL (TV) BENDS SHALL BE MJ SUITABLE TO RECEIVE PUSH-ON JOINT.
3. WATERLINE BETWEEN PEDESTALS SHALL BE DUCTILE IRON CLASS 53 WITH PUSH-ON JOINTS.
4. ALL BELL JOINTS SHALL BE SECURED SO BELL IS DIRECTLY ADJACENT TO FOOT BEARER ARM. SEE SHT C504 FOR TYPICAL BELL LOCATION.
5. THE LOCATION OF PUSH-ON JOINTING MUST BE WITHIN 18-INCHES OF THE BEARER ARM TO PROVIDE PROPER STRUCTURAL INTEGRITY TO THE PUSH-ON JOINT SYSTEM THAT EXISTS BETWEEN THE PEDESTALS. PIPE JOINTING, IF REQUIRED, AT MID BEARER ARM LOCATIONS SHALL BE FLANGE X FLANGE.
6. DUCTILE IRON (DI) WITH PUSH-ON JOINTS COME WITH TWO RINGS DRAWN ON THE PLAIN END SIDE. FOR ONE LINE PLAIN END PIPE THE LINE SHALL BE WITHIN THE BELL JOINT. FOR TWO LINE PLAIN END PIPE, ONE LINE SHALL BE INSIDE THE BELL JOINT AND THE SECOND LINE SHALL BE OUTSIDE OF THE BELL JOINT.

PLAN - PERMANENT 16-INCH WATER LINE

SCALE: 1" = 10'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C005

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Exp: 4/30/24

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

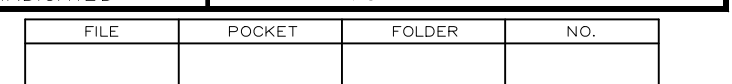
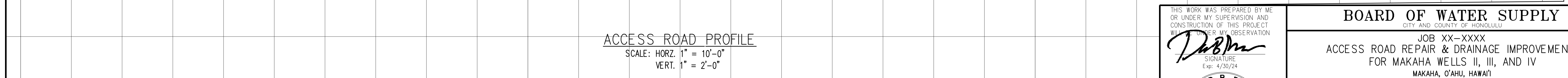
PLAN - PERMANENT 16-INCH WATER LINE

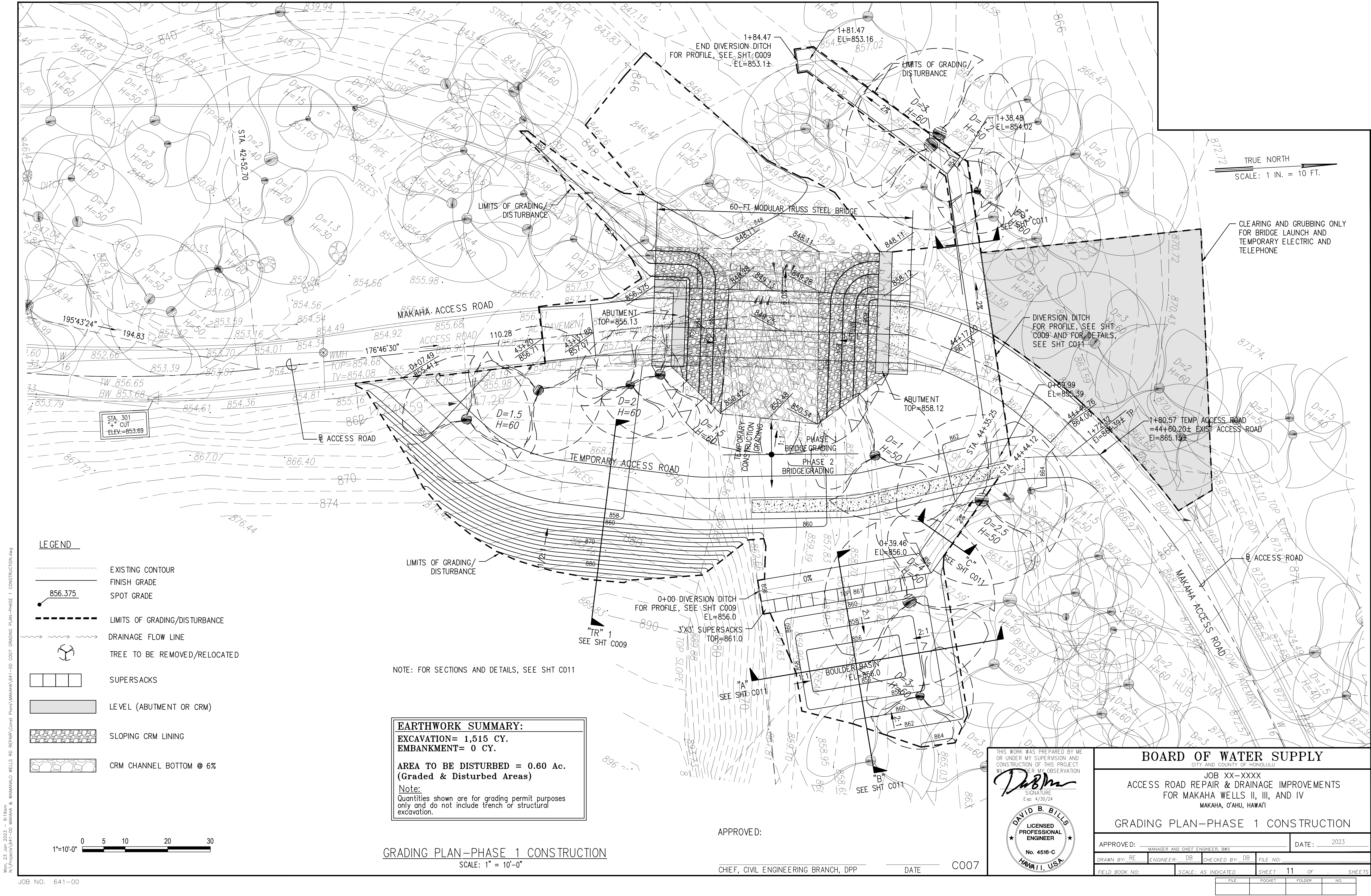
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DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 9 OF SHEETS

FILE	POCKET	FOLDER	NO.





Mon, 23 Jun 2023 - 9:19am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C007 GRADING PLAN-PHASE 1 CONSTRUCTION.dwg

- LEGEND**
- EXISTING CONTOUR
 - FINISH GRADE
 - SPOT GRADE
 - LIMITS OF GRADING/DISTURBANCE
 - DRAINAGE FLOW LINE
 - TREE TO BE REMOVED/RELOCATED
 - SUPERSACKS
 - LEVEL (ABUTMENT OR CRM)
 - SLOPING CRM LINING
 - CRM CHANNEL BOTTOM @ 6%

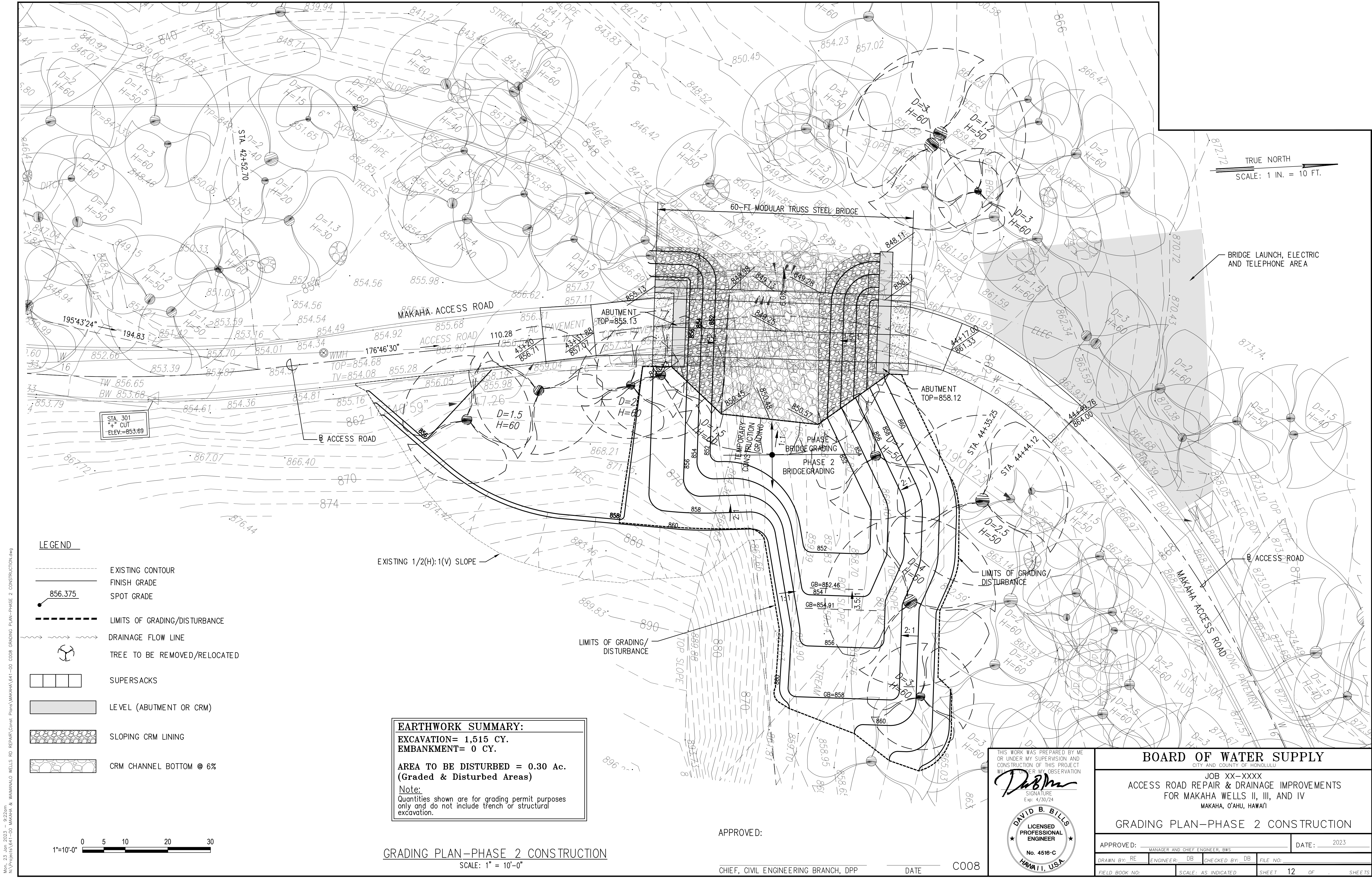
NOTE: FOR SECTIONS AND DETAILS, SEE SHT C011

EARTHWORK SUMMARY:
EXCAVATION= 1,515 CY.
EMBANKMENT= 0 CY.
AREA TO BE DISTURBED = 0.60 Ac. (Graded & Disturbed Areas)
Note: Quantities shown are for grading permit purposes only and do not include trench or structural excavation.

GRADING PLAN-PHASE 1 CONSTRUCTION
SCALE: 1" = 10'-0"

APPROVED: _____
CHIEF, CIVIL ENGINEERING BRANCH, DPP
DATE C007

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION		BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU	
SIGNATURE Exp: 4/30/24		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
DAVID B. BILLS LICENSED PROFESSIONAL ENGINEER No. 4516-C HAWAII, USA		GRADING PLAN-PHASE 1 CONSTRUCTION	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO:
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 11 OF	SHEETS
FILE	POCKET	FOLDER	NO.



Mon, 23 Jun 2023 - 9:22am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C008 GRADING PLAN-PHASE 2 CONSTRUCTION.dwg

- LEGEND**
- EXISTING CONTOUR
 - FINISH GRADE
 - SPOT GRADE
 - LIMITS OF GRADING/DISTURBANCE
 - DRAINAGE FLOW LINE
 - TREE TO BE REMOVED/RELOCATED
 - SUPERSACKS
 - LEVEL (ABUTMENT OR CRM)
 - SLOPING CRM LINING
 - CRM CHANNEL BOTTOM @ 6%

EARTHWORK SUMMARY:
EXCAVATION= 1,515 CY.
EMBANKMENT= 0 CY.
AREA TO BE DISTURBED = 0.30 Ac. (Graded & Disturbed Areas)
Note: Quantities shown are for grading permit purposes only and do not include trench or structural excavation.

GRADING PLAN-PHASE 2 CONSTRUCTION
SCALE: 1" = 10'-0"

APPROVED:

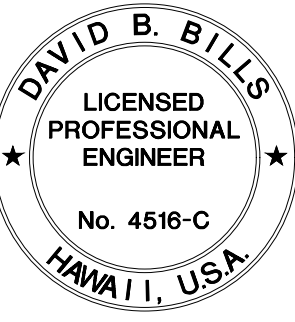
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C008

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David B. Bills
SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

GRADING PLAN-PHASE 2 CONSTRUCTION

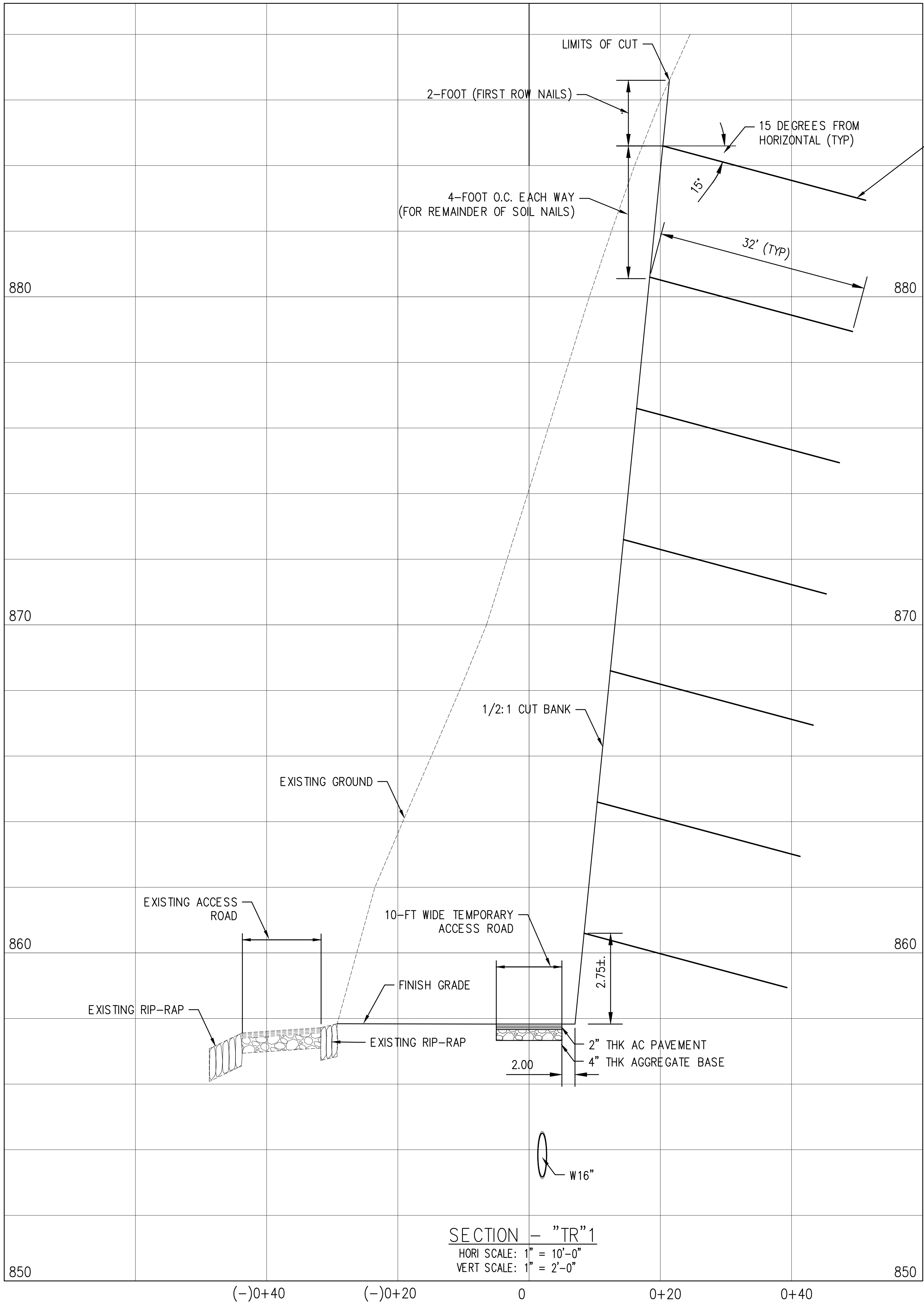
APPROVED: _____ DATE: 2023

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO:

FIELD BOOK NO: SCALE: AS INDICATED SHEET 12 OF SHEETS

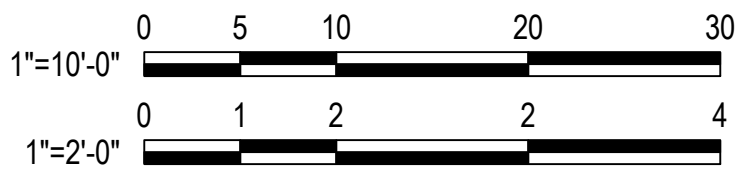
FILE	POCKET	FOLDER	NO.

Mon, 23 Jan 2023 - 9:25pm
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C009 SECTION - TR 1.dwg



SOIL NAILS IN 6-INCH DIAMETER HOLE.
SOIL NAIL BAR MINIMUM DIAMETER 1-INCH
ASTM GRADE 75 THREADED BAR DOUBLE
COATED EPOXY SYSTEM SURROUNDED BY
NEAT GROUT OR SAND (4,000 PSI) TYP.

- SOIL NAIL NOTES:
1. REFER TO GEOTECHNICAL NOTES FROM GEOTECHNICAL REPORT ON SHEETS T003 AND T004 SECTION 1 SOIL NAILED RETAINING WALL SYSTEM AND THE COMPLETE GEOTECHNICAL REPORT.
 2. CONTRACTOR SHALL PROVIDE SOIL NAIL PATTERN ON FACE OF SLOPE FOR GEOTECHNICAL REVIEW PRIOR TO COMMENCEMENT OF SOIL NAIL INSTALLATION.

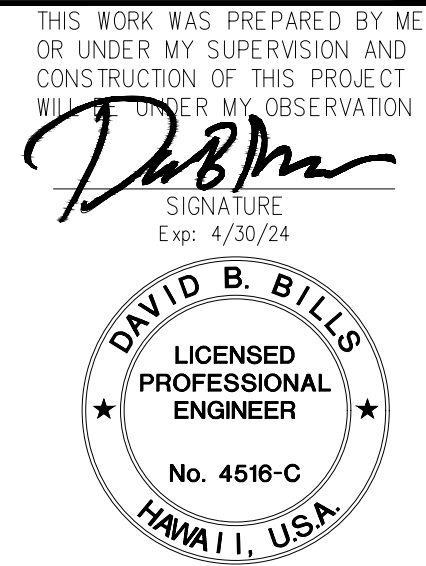


APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C009



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

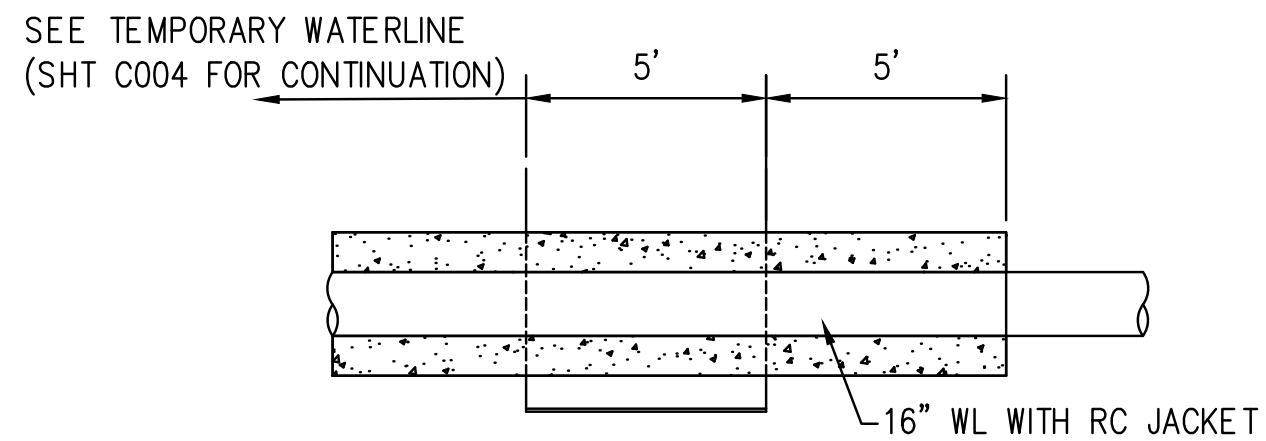
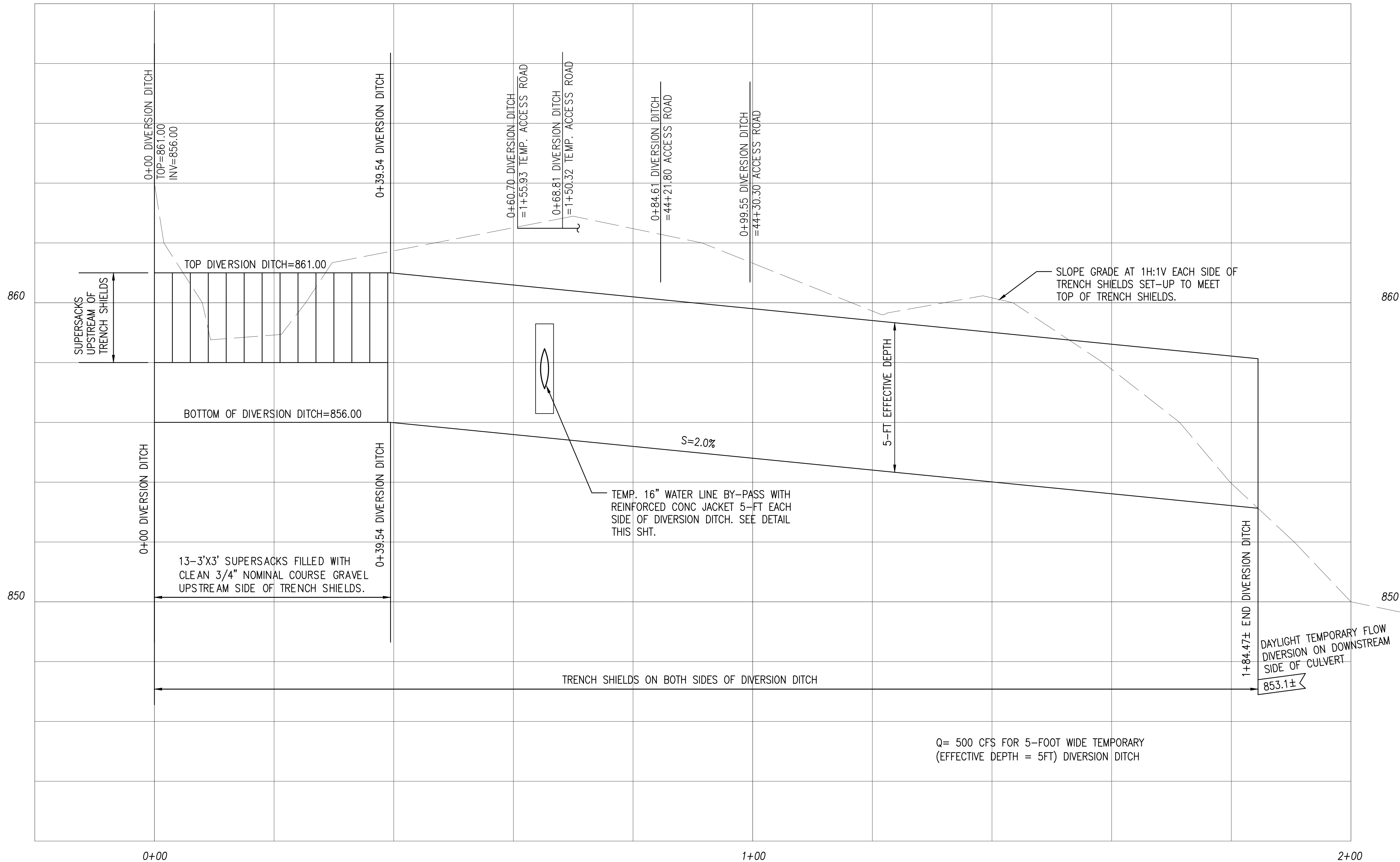
JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

SECTION "TR" 1

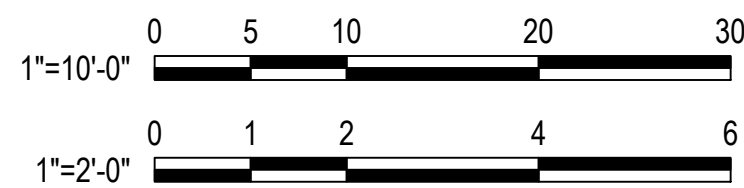
APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	2023
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 13 OF	SHEETS

FILE	POCKET	FOLDER	NO.

Mon, 23 Jan 2023 - 9:27am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C010 DIVERSION DITCH PROFILE.dwg



NOTE:
FOR DIVERSION DETAILS, SEE SHEET C011



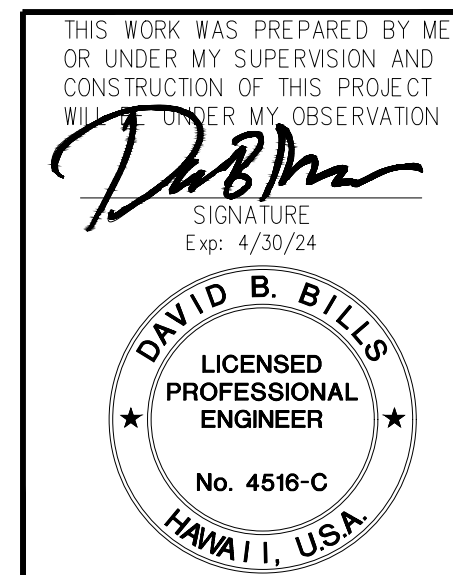
DIVERSION DITCH PROFILE
SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C010



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

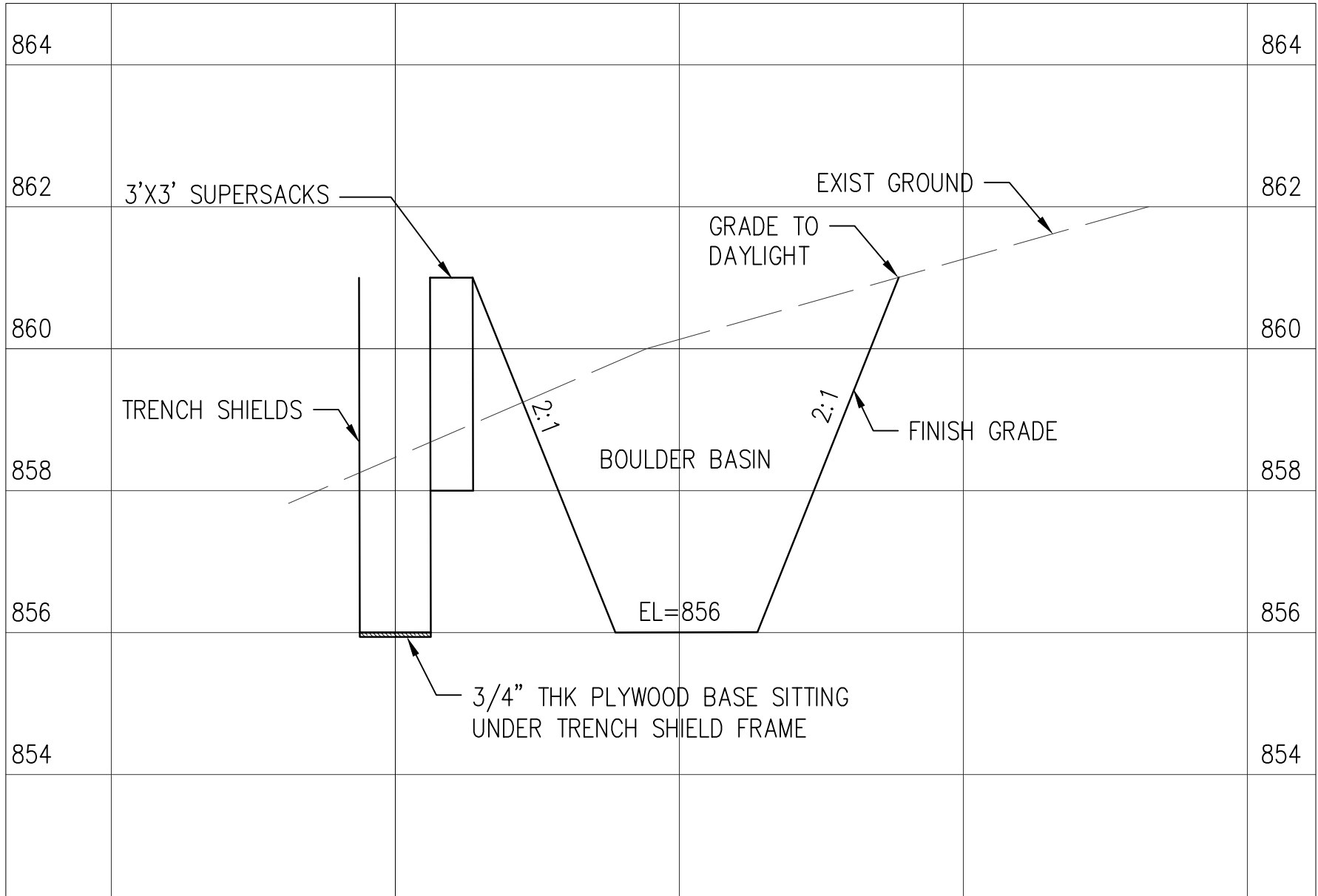
JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

DIVERSION DITCH PROFILE

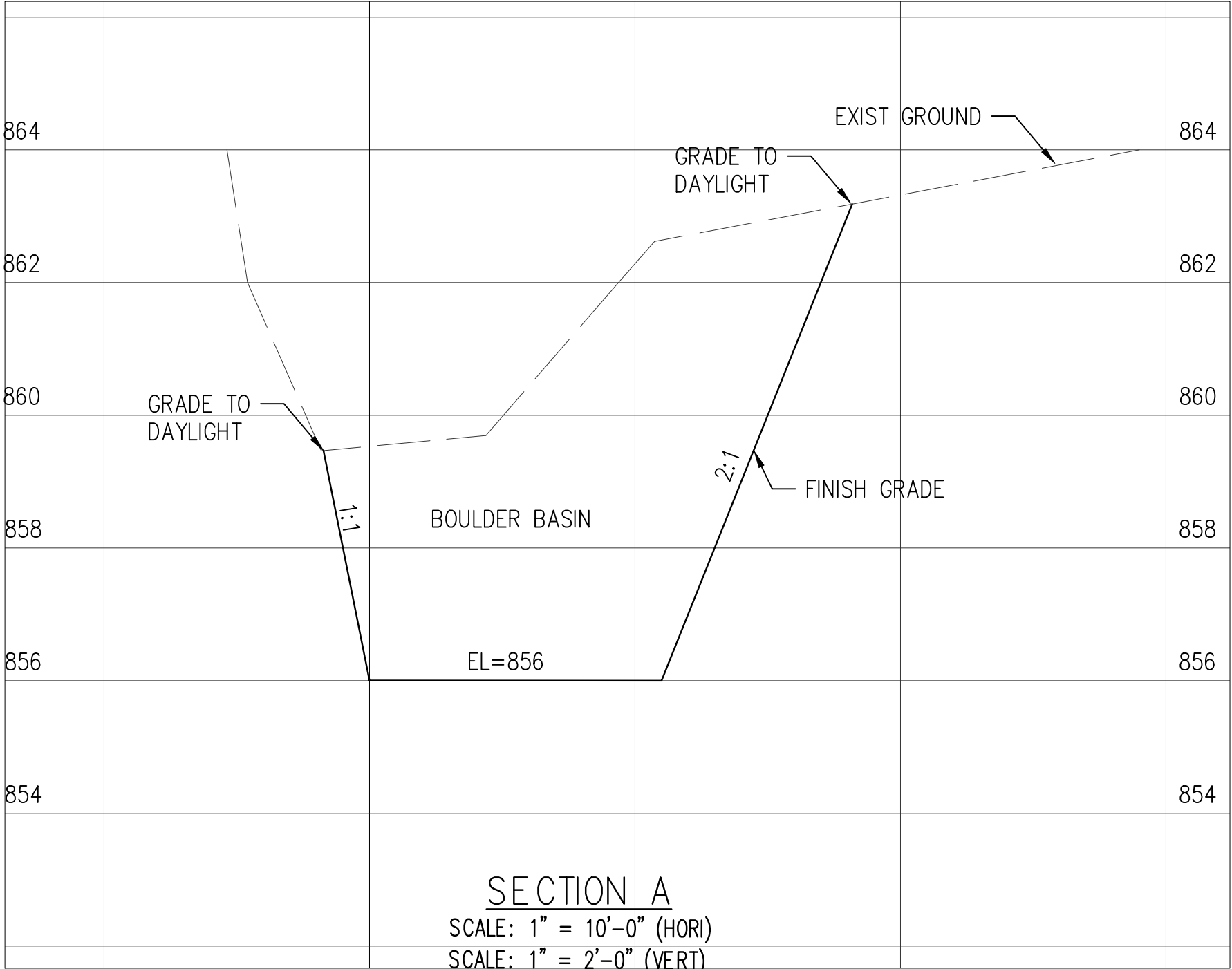
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FILE	POCKET	FOLDER	NO.

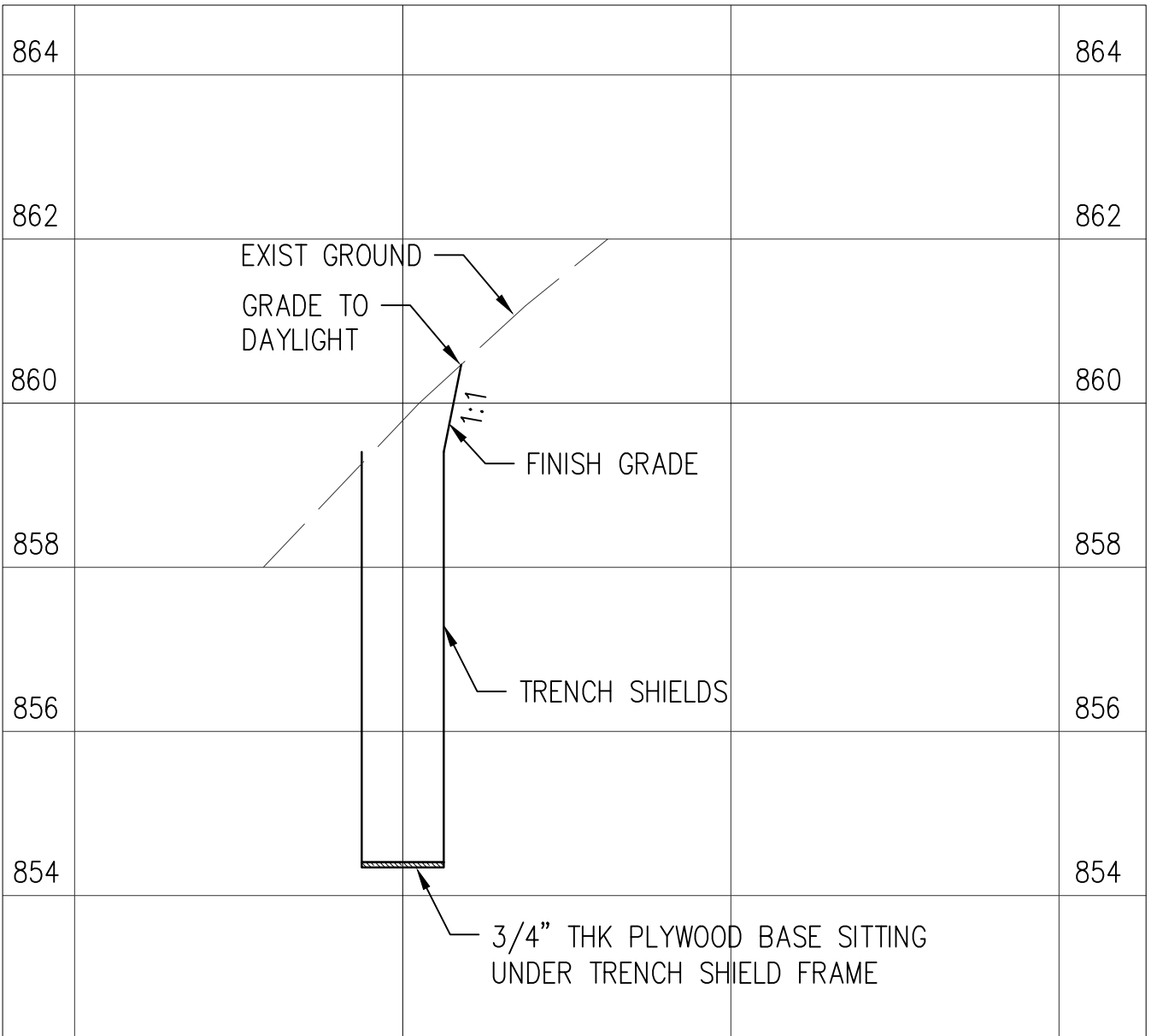
Mon, 23 Jan 2023 - 9:29am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C011 SECTIONS & DIVERSION DITCH DETAILS.dwg



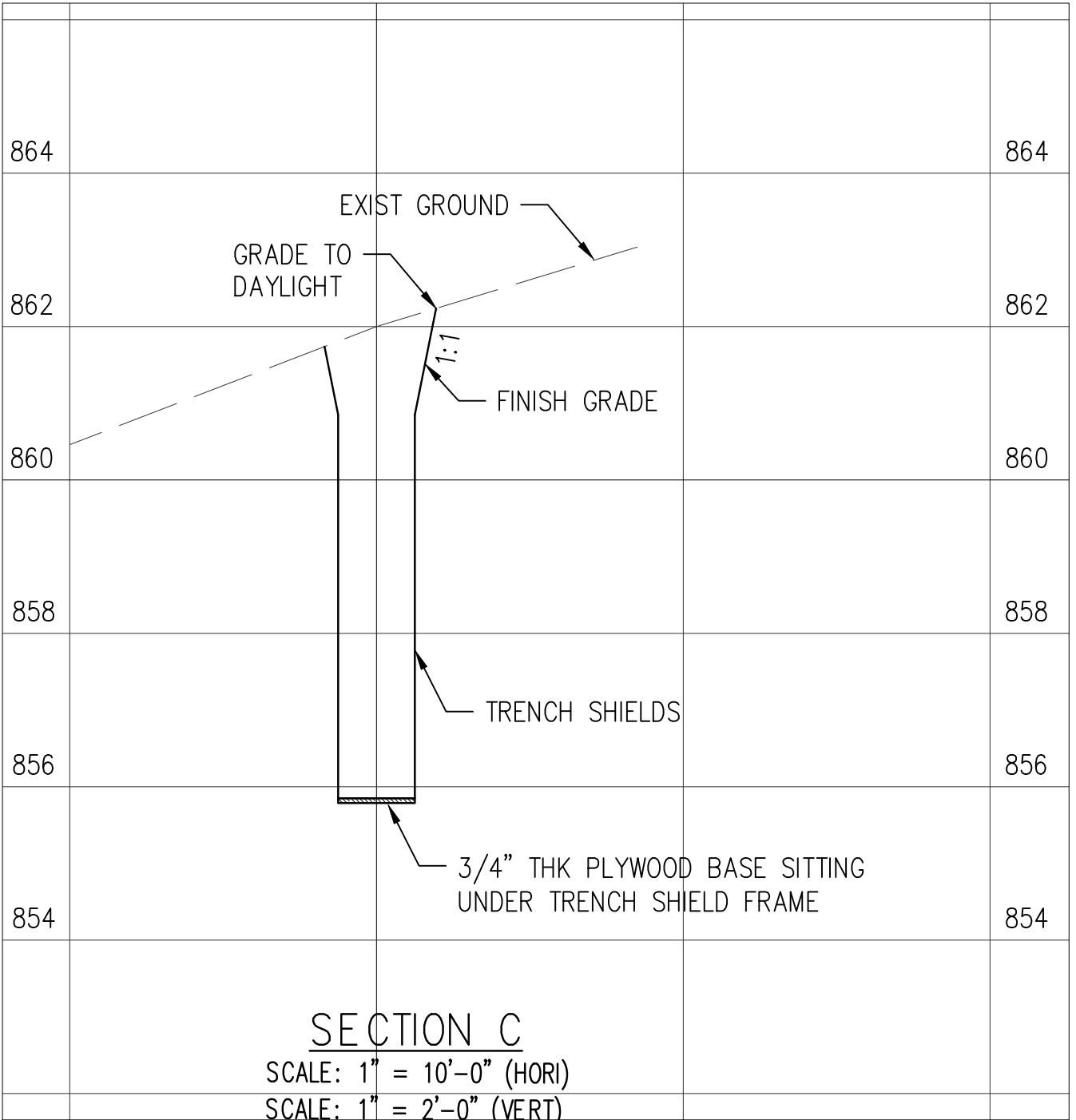
SECTION B
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)



SECTION A
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)



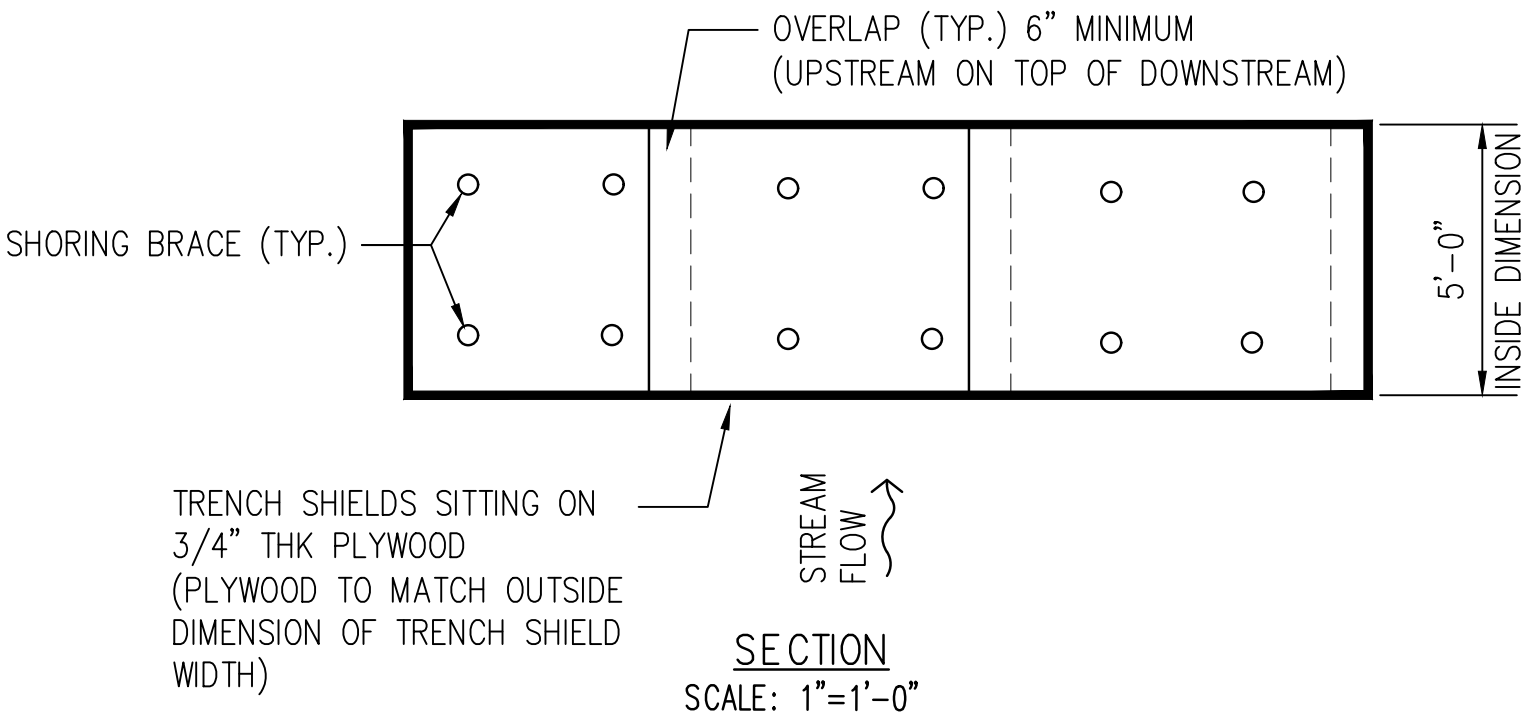
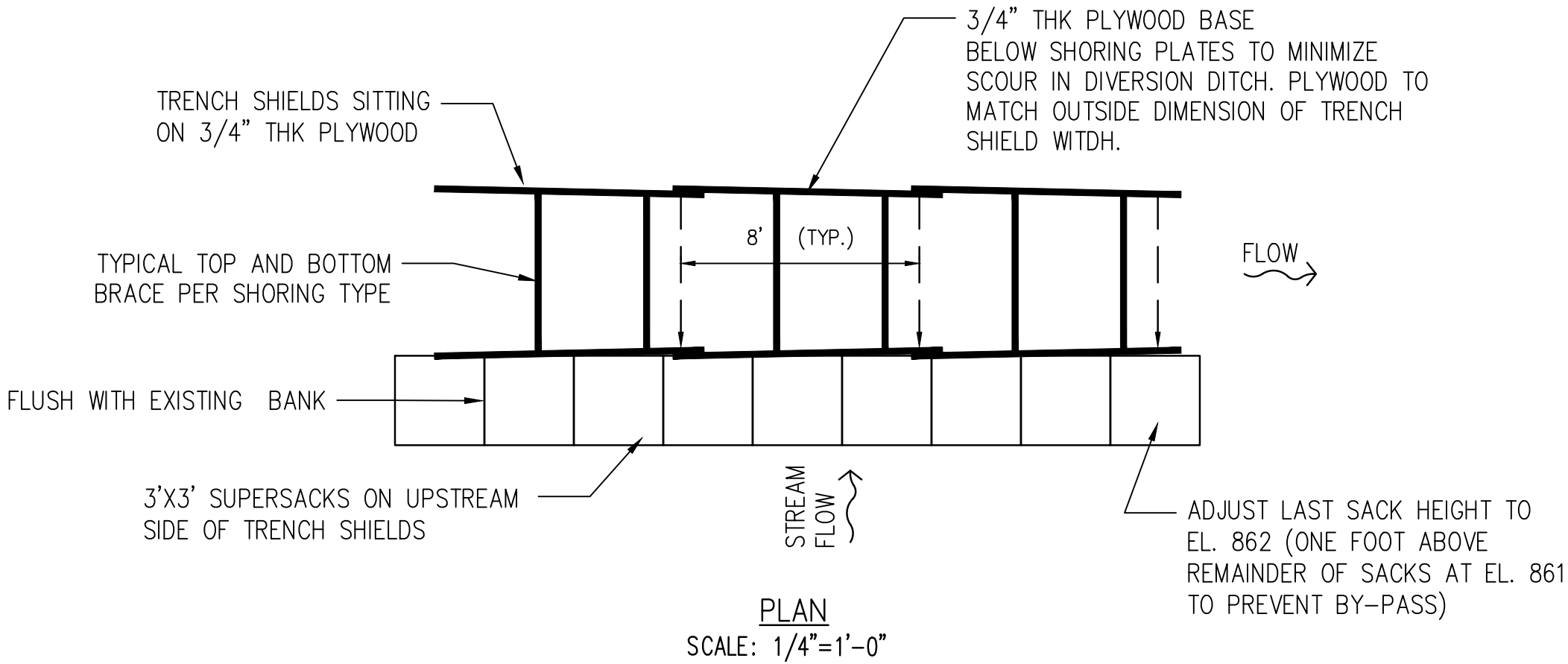
SECTION D
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)



SECTION C
SCALE: 1" = 10'-0" (HORI)
SCALE: 1" = 2'-0" (VERT)



TYPICAL TRENCH SHIELDS
NOT TO SCALE



NOTE:

TOTAL LENGTH OF DIVERSION TRENCH IS 185± LINEAR FEET

DIVERSION DITCH USING SHORING PLATES
SCALE: AS SHOWN

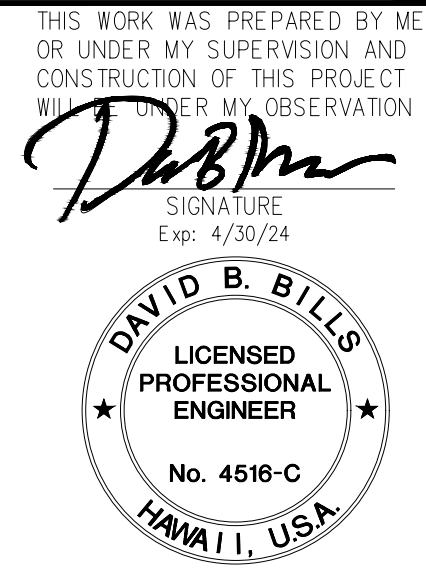
- NOTES:
- AN ALTERNATIVE TO PLYWOOD IS PLACING A 6-INCH LAYER OF 1500 PSI CLSM AT CHANNEL FLOOR. USE BOND BREAKER BETWEEN CLSM AND SHIELD TO ALLOW SALVAGE OF SHIELDS.
 - JOINT BETWEEN SHIELDS SHALL BE WATERPROOFED TO PREVENT WATER OUT MIGRATION FROM DIVERSION DITCH.

APPROVED:

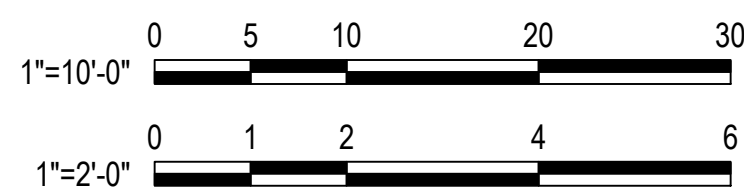
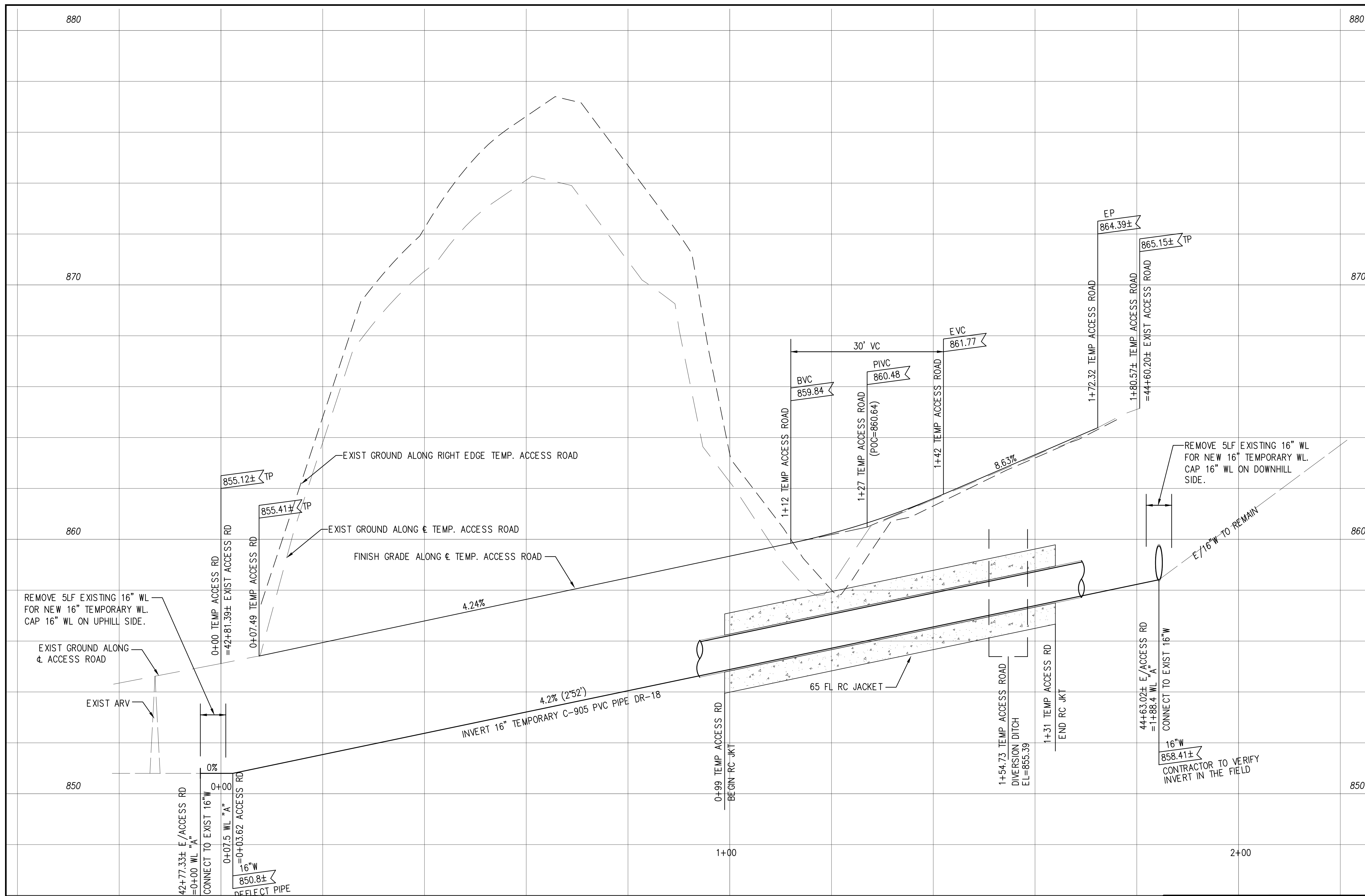
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C011



BOARD OF WATER SUPPLY			
CITY AND COUNTY OF HONOLULU			
JOB XX-XXXX			
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS			
FOR MAKAHA WELLS II, III, AND IV			
MAKAHA, O'AHU, HAWAII			
SECTIONS & DIVERSION DITCH DETAILS			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS			DATE: 2023
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 15	OF _____ SHEETS
FILE	POCKET	FOLDER	NO.



TEMPORARY ACCESS ROAD PROFILE

SCALE: HORZ. 1" = 10'-0"
VERT. 1" = 2'-0"

APPROVED:

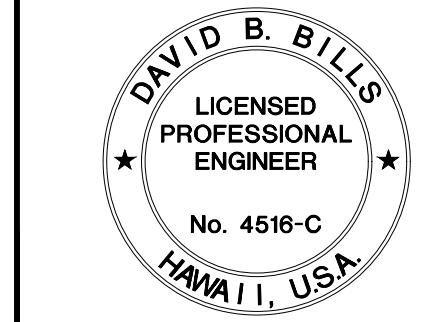
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE _____

C012

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SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY

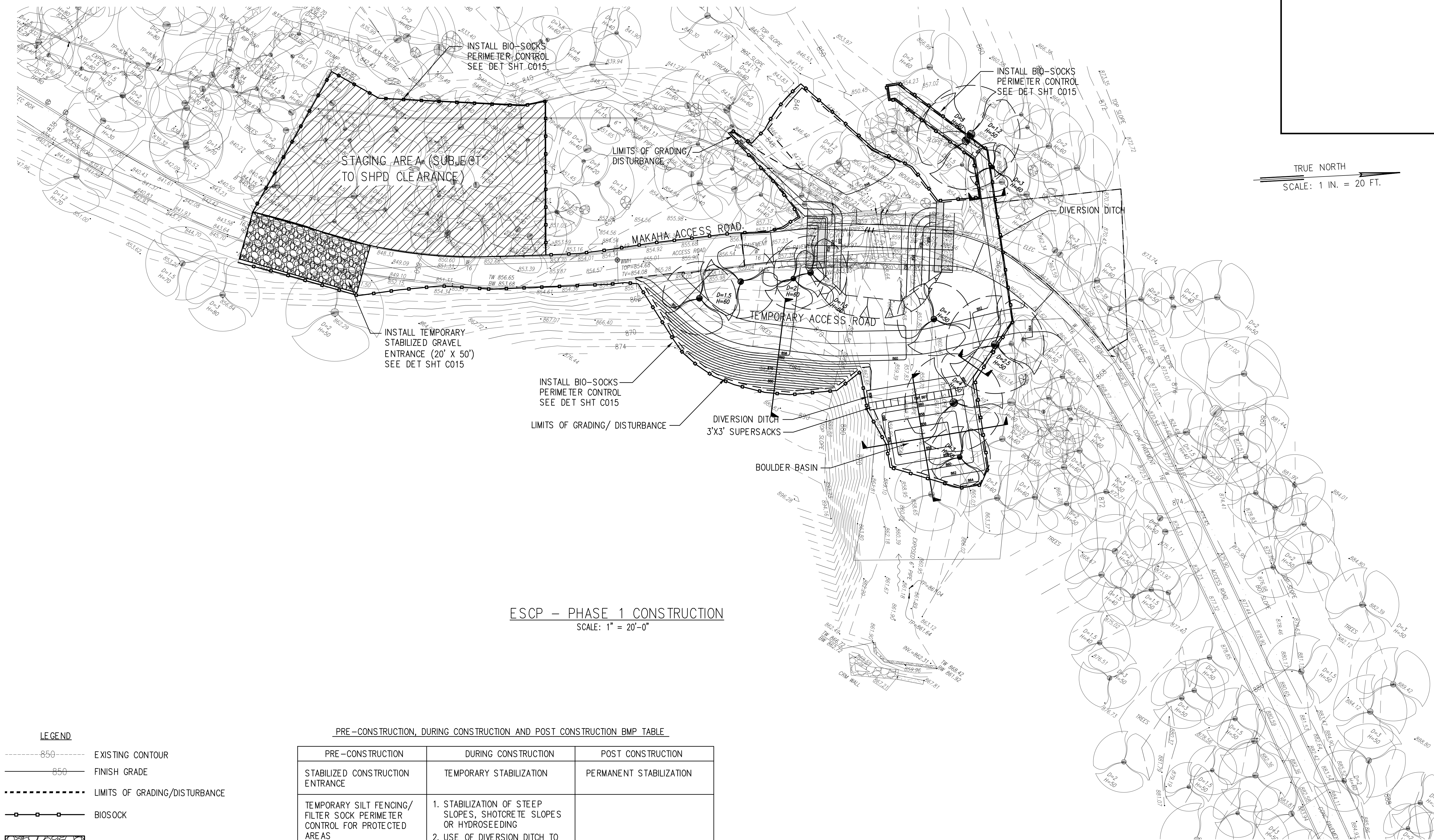
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>		DATE: _____ 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 16 OF _____ SHEETS	

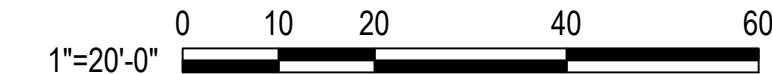
FILE	POCKET	FOLDER	NO.

Mon, 23 Jan 2023 - 9:34am
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C013 ESCP-PHASE 1 CONSTRUCTION.dwg



ESCP – PHASE 1 CONSTRUCTION
SCALE: 1" = 20'-0"

- LEGEND**
- 850----- EXISTING CONTOUR
 - 850———— FINISH GRADE
 - LIMITS OF GRADING/DISTURBANCE
 - BIO SOCK
 - ▨ STABILIZED GRAVEL ENTRANCE
 - ▨ STAGING AREA
 - ~~~~~ EXISTING DRAINAGE FLOW



PRE-CONSTRUCTION, DURING CONSTRUCTION AND POST CONSTRUCTION BMP TABLE

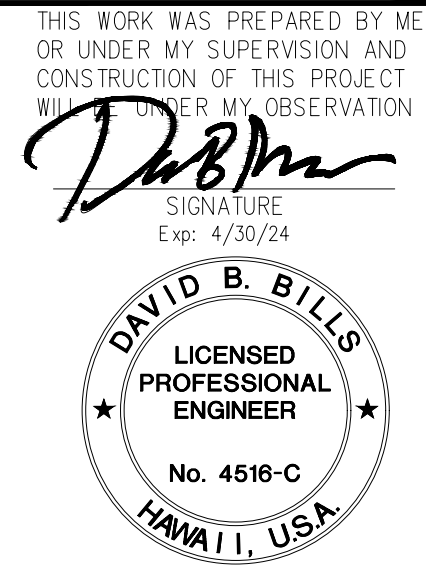
PRE-CONSTRUCTION	DURING CONSTRUCTION	POST CONSTRUCTION
STABILIZED CONSTRUCTION ENTRANCE	TEMPORARY STABILIZATION	PERMANENT STABILIZATION
TEMPORARY SILT FENCING/ FILTER SOCK PERIMETER CONTROL FOR PROTECTED AREAS	1. STABILIZATION OF STEEP SLOPES, SHOTCRETE SLOPES OR HYDROSEEDING 2. USE OF DIVERSION DITCH TO BY-PASS STREAM FLOW UP TO 500 CFS. RESTORATION IF FLOWS OVERTOP DIVERSION DITCH. 3. USE OF BIO-SOCKS AT LIMITS OF GRADING OUTSIDE STREAM CHANNEL 4. MAINTAIN BOULDER BASIN IN STREAM CHANNEL AND CHECK AFTER FLOW OCCURS THROUGH BASIN	

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C013



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

ESCP – PHASE 1 CONSTRUCTION

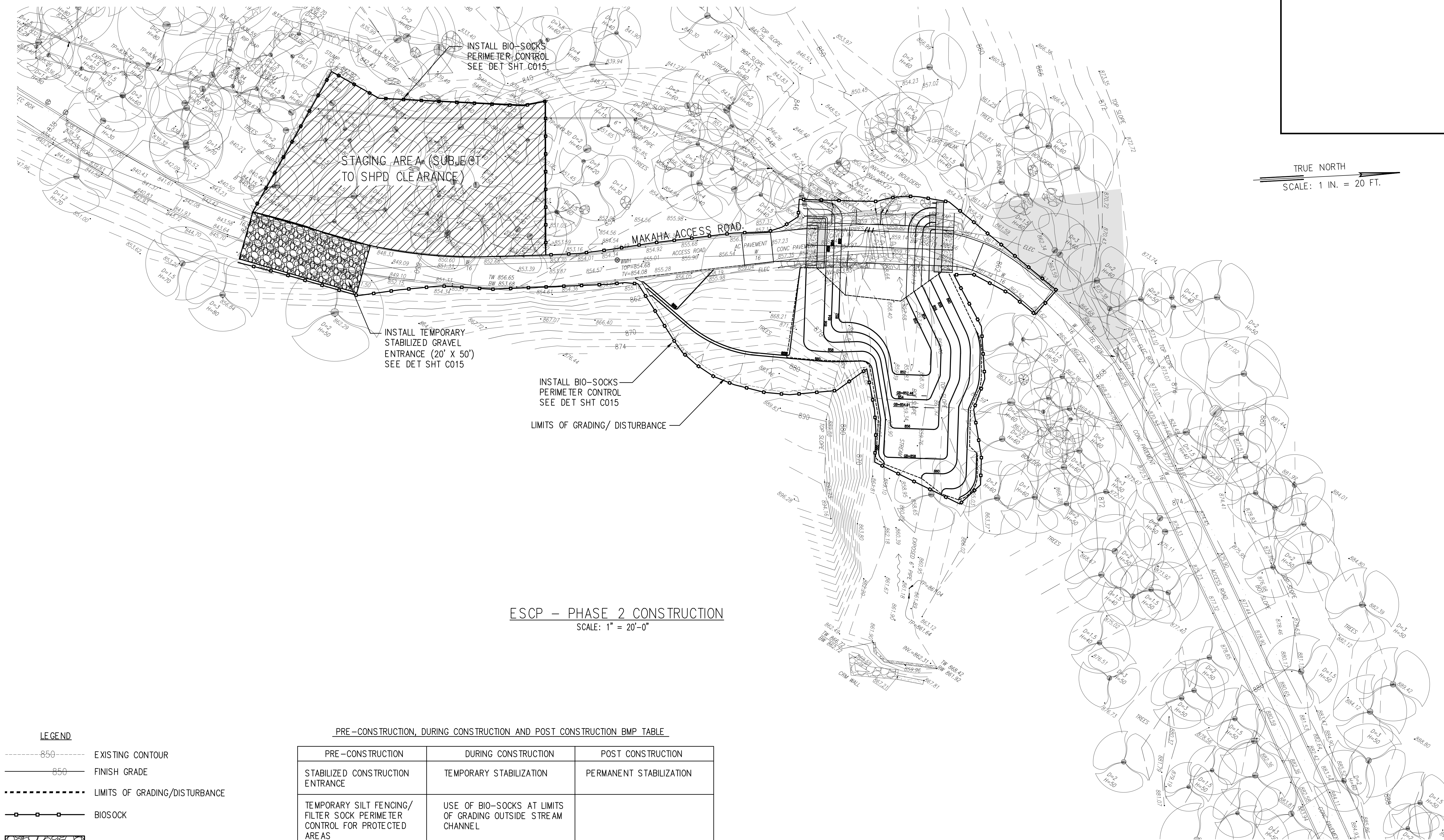
APPROVED: _____ DATE: 2023

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO:

FIELD BOOK NO: SCALE: AS INDICATED SHEET 17 OF SHEETS

FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:48pm
N:\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C014 ESCP-PHASE 2 CONSTRUCTION.dwg



TRUE NORTH
SCALE: 1 IN. = 20 FT.

ESCP - PHASE 2 CONSTRUCTION
SCALE: 1" = 20'-0"

LEGEND

- 850----- EXISTING CONTOUR
- 850----- FINISH GRADE
- LIMITS OF GRADING/DISTURBANCE
- BIOSOCK
- STABILIZED GRAVEL ENTRANCE
- STAGING AREA
- EXISTING DRAINAGE FLOW

PRE-CONSTRUCTION, DURING CONSTRUCTION AND POST CONSTRUCTION BMP TABLE

PRE-CONSTRUCTION	DURING CONSTRUCTION	POST CONSTRUCTION
STABILIZED CONSTRUCTION ENTRANCE	TEMPORARY STABILIZATION	PERMANENT STABILIZATION
TEMPORARY SILT FENCING/ FILTER SOCK PERIMETER CONTROL FOR PROTECTED AREAS	USE OF BIO-SOCKS AT LIMITS OF GRADING OUTSIDE STREAM CHANNEL	
	PERFORM IN-STREAM GRADING AT PERIODS OF NO STREAM FLOW	

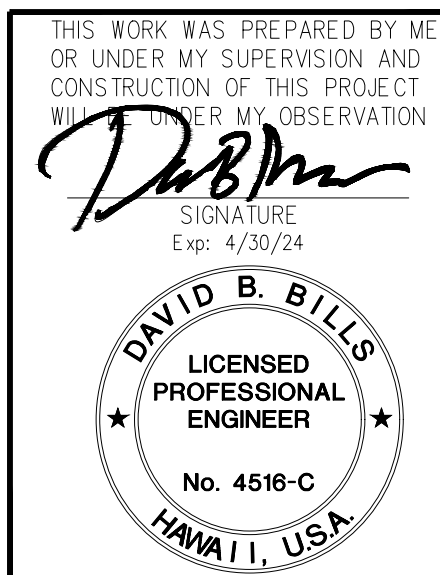
1"=20'-0"
0 10 20 40 60

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C014



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

ESCP - PHASE 2 CONSTRUCTION

APPROVED: _____ DATE: 2023

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 18 OF SHEETS

FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:50am
NA\Projects\E41-00 MAKAHA & WAIMANALO WELLS REPAIR\Const Plans\MAKAHA\E41-00 C015 ESCP NOTES AND DETAILS.dwg

EROSION AND SEDIMENT CONTROL PLAN NOTES:

PROJECT SEQUENCE:

1. INSTALL STABILIZED CONSTRUCTION INGRESS/EGRESS, SEDIMENT FILTER FOR CATCH BASINS, & PERIMETER CONTROL FOR PROTECTED AREAS.
2. PROCEED WITH CLEARING AND GRUBBING OF AREAS WHERE SHOTCRETE IS TO BE APPLIED.
3. PROCEED WITH THE INSTALLATION OF SHOTCRETE SLOPE STABILIZATION.
4. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
5. INSPECTIONS SHALL BE PERFORMED WEEKLY.

RAIN RESPONSE PLAN NOTES:

1. THE FOLLOWING SHALL BE PERFORMED WHEN HEAVY RAIN, TROPICAL STORM OR HURRICANE IS IMMINENT, OR IS FORECASTED IN THE NEXT 48 HOURS.
2. TEMPORARILY SUSPEND ACTIVE GRADING.
3. INSPECT ALL PERIMETER CONTROLS AND INLET PROTECTION DEVICES AND MAINTAIN AS NEEDED. IF A SEVERE STORM IS EXPECTED, REMOVE INLET PROTECTION DEVICES TO PREVENT FLOODING ON SURROUNDING STREETS.
4. COVER OR RELOCATE MATERIAL STOCKPILES AND LIQUID MATERIAL CONTAINERS TO AVOID CONTACT WITH RAINWATER.
5. PLACE SPILL PANS OR OIL-ONLY SPILL PADS UNDER CONSTRUCTION VEHICLES TO PREVENT RUNOFF FROM CONTACTING ANY SPILLED PETROLEUM PRODUCTS. PROPERLY DISPOSE OF ANY ACCUMULATED OILY WATER AFTER THE RAIN EVENT.
6. RE-INSPECT AFTER THE APPROACHING HEAVY RAINS, TROPICAL STORM OR HURRICANE, AND REPLACE OR MAINTAIN BMPS AS NEEDED.

GOOD HOUSEKEEPING BMPS NOTES:

1. STREET SWEEPING, VACUUMING. ALL POLLUTANTS DISCHARGED FROM CONSTRUCTION SITE TO OFFSITE AREAS MUST BE SWEEPED OR VACUUMED EACH DAY BEFORE LEAVING THE JOB SITE.
2. MATERIALS DELIVERY, STORAGE AND USE MANAGEMENT. PREVENT, REDUCE OR ELIMINATE THE DISCHARGE OF POLLUTANTS FROM MATERIAL DELIVERY, STORAGE AND USE TO THE STORM WATER SYSTEM OR WATERCOURSES BY MINIMIZING THE STORAGE OF HAZARDOUS MATERIALS ONSITE, STORING MATERIALS IN A DESIGNATED AREA, INSTALLING SECONDARY CONTAINMENT. CONSTRUCTION MATERIALS, WASTE, TOXIC AND HAZARDOUS SUBSTANCES, STOCKPILES AND OTHER SOURCES OF POLLUTANT SHALL NOT BE STORED IN BUFFER AREAS, NEAR AREAS OF CONCENTRATED FLOW, OR AREAS ABUTTING THE MS4, RECEIVING WATERS, OR DRAINAGE IMPROVEMENTS THAT DISCHARGE OFFSITE. PRIMARY AND SECONDARY CONTAINMENT CONTROLS AND COVERS SHALL BE IMPLEMENTED TO THE MEP.
3. SPILL PREVENTION AND CONTROL. CREATE AND IMPLEMENT SPILL PREVENTION AND RESPONSE PLAN TO ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO THE MS4 AND RECEIVING WATERS FROM LEAKS AND SPILLS BY REDUCING THE CHANCE FOR SPILLS, ABSORBING, CONTAINING, AND CLEANING UP SPILLS AND PROPERLY DISPOSING OF SPILL MATERIALS. AT A MINIMUM, ALL PROJECTS SHALL CLEANUP ALL LEAKS AND SPILLS IMMEDIATELY.
4. HAZARDOUS MATERIALS. PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM HAZARDOUS WASTE THROUGH PROPER MATERIAL USE AND WASTE DISPOSAL. IN THE EVENT THAT HAZARDOUS MATERIALS ARE DISCHARGED TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL IMMEDIATELY NOTIFY THE DEPARTMENT OF FACILITIES MAINTENANCE, HONOLULU FIRE DEPARTMENT, AND HONOLULU POLICE DEPARTMENT OF THE DISCHARGE BY TELEPHONE. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE, AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.
5. NONHAZARDOUS MATERIALS. IN THE EVENT THAT NONHAZARDOUS MATERIALS ARE DISCHARGE TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL NOTIFY THE CITY DEPARTMENT OF FACILITIES MAINTENANCE BY TELEPHONE NO LATER THAN THE NEXT BUSINESS DAY. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.
6. VEHICLE AND EQUIPMENT CLEANING. ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT CLEANING OPERATIONS BY USING OFFSITE FACILITIES WHEN FEASIBLE, WASHING IN DESIGNATED, CONTAINED AREAS ONLY, AND ELIMINATING DISCHARGES TO THE STORM DRAIN SYSTEM BY EVAPORATING AND/OR TREATING WASH WATER, AS APPROPRIATE OR INFILTRATING WASH WATER FOR EXTERIOR CLEANING ACTIVITIES THAT USE WATER ONLY.
7. VEHICLE AND EQUIPMENT FUELING. PREVENT FUEL SPILLS AND LEAKS BY USING OFFSITE FACILITIES, FUELING ONLY IN DESIGNATED AREAS, ENCLOSING OR COVERING STORED FUEL, AND IMPLEMENTING SPILL CONTROLS SUCH AS SECONDARY CONTAINMENT AND ACTIVE MEASURES USING SPILL RESPONSE KITS.
8. VEHICLE AND EQUIPMENT MAINTENANCE. ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT MAINTENANCE OPERATIONS BY USING OFFSITE FACILITIES WHEN FEASIBLE, PERFORMING WORK IN DESIGNATED AREAS ONLY, USING SPILL PADS UNDER VEHICLES AND EQUIPMENT, CHECKING FOR LEAKS AND SPILLS, AND CONTAINING AND CLEANING UP SPILLS IMMEDIATELY.
9. SOLID WASTE MANAGEMENT. PREVENT OR REDUCE DISCHARGE OF POLLUTANTS TO THE LAND, GROUNDWATER, IN STORM WATER, FROM SOLID WASTE OR CONSTRUCTION AND DEMOLITION WASTE, BY PROVIDING DESIGNATED WASTE COLLECTION AREAS. COLLECT SITE TRASH DAILY, AND ENSURE THAT CONSTRUCTION WASTE IS COLLECTED, REMOVED, AND DISPOSED OF, ONLY AT AUTHORIZED DISPOSAL AREAS.
10. SANITARY/SEPTIC WASTE MANAGEMENT. TEMPORARY AND PORTABLE SANITARY AND SEPTIC WASTE SYSTEMS SHALL BE MOUNTED OR STAKED IN, WELL-MAINTAINED, AND SCHEDULED FOR REGULAR WASTE DISPOSAL AND SERVICING. SOURCES OF SANITARY AND/OR SEPTIC WASTE SHALL NOT BE STORED NEAR THE MS4 OR RECEIVING WATERS.
11. STOCKPILE MANAGEMENT. STOCKPILES SHALL NOT BE LOCATED IN DRAINAGE WAYS, WITHIN 50- FEET FROM AREAS OF CONCENTRATED FLOWS, AND ARE NOT ALLOWED IN THE CITY RIGHT-OF-WAY. SEDIMENT BARRIERS OR SILT FENCES SHALL BE USED AROUND THE BASE OF ALL STOCKPILES. STOCKPILES SHALL NOT EXCEED 15 FEET IN HEIGHT. STOCKPILES GREATER THAN 15 FEET IN HEIGHT SHALL REQUIRE 8 FOOT WIDE BENCHING IN ACCORDANCE WITH ROH CHAPTER 14, ARTICLE 15. STOCKPILES MUST BE COVERED WITH PLASTIC SHEETING OR A COMPARABLE MATERIAL IF THEY WILL NOT BE ACTIVELY USED WITHIN 7 DAYS.
12. LIQUID WASTE MANAGEMENT. LIQUID WASTE SHALL BE CONTAINED IN A CONTROLLED AREA SUCH AS A HOLDING PIT, SEDIMENT BASIN, ROLL-OFF BIN, OR PORTABLE TANK, OF SUFFICIENT VOLUME AND TO CONTAIN THE LIQUID WASTES GENERATED. CONTAINMENT AREAS OR DEVICES MUST BE IMPERMEABLE AND LEAK FREE AND SHOULD NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNEL OR STORM DRAINS.
13. CONCRETE WASTE MANAGEMENT. PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM CONCRETE WASTE BY CONDUCTING WASHOUT OFFSITE OR PERFORMING ONSITE WASHOUT, IN A DESIGNATED AREA CONSTRUCTED AND MAINTAINED IN SUFFICIENT QUANTITY AND SIZE TO CONTAIN ALL LIQUID AND CONCRETE WASTE GENERATED BY WASHOUT OPERATIONS. PLASTIC LINING MATERIAL SHALL BE A MINIMUM OF 10 MILLIMETER POLYETHYLENE SHEETING AND SHALL BE FREE OF HOLES, TEARS, OR OTHER DEFECTS THAT COMPROMISE THE IMPERMEABILITY OF THE MATERIAL. CONTAINMENT AREAS AND DEVICES SHALL NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNELS, OR STORM DRAINS. WASHOUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASHOUT IS 75 PERCENT FULL. ONCE CONCRETE WASTES ARE WASHED INTO DESIGNATED AREA AND ALLOWED TO HARDEN, THE CONCRETE SHALL BE BROKEN UP, REMOVED, AND DISPOSED OF AS SOLID WASTES.
14. CONTAMINATED SOIL MANAGEMENT. AT A MINIMUM, CONTAIN CONTAMINATED MATERIAL SOIL BY SURROUNDING WITH IMPERMEABLE LINED BERMS OR COVER EXPOSED CONTAMINATED MATERIAL WITH PLASTIC SHEETING. CONTAMINATED SOIL SHALL BE DISPOSED OF PROPERLY IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS.
15. BMP & SITE MAINTENANCE. RELOCATE, RECONSTRUCT AND MAINTAIN BMPS AS NEEDED TO KEEP THEM EFFECTIVE AT ALL TIMES. PROCEED WITH CONSTRUCTION WITH LEAST POSSIBLE DISTURBANCE OF VEGETATIVE AREAS AND STRUCTURES. REMOVE OR DISMANTLE TEMPORARY EROSION CONTROL STRUCTURES AFTER CONSTRUCTION OF LINING ARE COMPLETE. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION. INSPECTIONS SHALL BE PERFORMED WEEKLY.
16. DUST CONTROL. THE CONTRACTOR, AT HIS/HER OWN EXPENSE, SHALL KEEP THE PROJECT AND ITS SURROUNDING AREAS FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH.

EROSION PREVENTION/SEDIMENT CONTROL NOTES:

1. THE CONTRACTOR SHALL FOLLOW THE GUIDELINES IN THE CITY & COUNTY OF HONOLULU'S "RULES RELATING TO WATER QUALITY".
2. MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTHWORK IS INITIATED.
3. TEMPORARY STABILIZATION IS REQUIRED ON DISTURBED AREAS WHICH ARE AT FINAL GRADE OR WHEN THE DISTURBED AREA WILL NOT BE WORKED FOR 7 CONSECUTIVE DAYS OR MORE.
4. PERMANENT STABILIZATION. ALL DISTURBED AREAS SHALL BE PERMANENTLY STABILIZED USING VEGETATIVE COVERING, PAVEMENT, OR EQUIVALENT, PRIOR TO REMOVING EROSION AND SEDIMENT MEASURES. TRAPPED SEDIMENT AND AREAS OF DISTURBED SOIL WHICH RESULT FROM THE REMOVAL OF THE TEMPORARY MEASURES SHALL BE IMMEDIATELY AND PERMANENTLY STABILIZED.
5. PRESERVE EXISTING VEGETATION. CLEARLY MARK THE AREAS TO BE PRESERVED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING SHALL BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.
6. MINIMIZE SOIL COMPACTION AREAS. WHERE FINAL STABILIZATION OR INFILTRATION PRACTICES ARE TO BE INSTALLED, AREA SHALL BE PROTECTED FROM EXCESSIVE COMPACTION DURING CONSTRUCTION. VEHICLE AND EQUIPMENT USE SHALL BE RESTRICTED OR TECHNIQUES TO CONDITION THE SOILS TO SUPPORT VEGETATION SHALL BE IMPLEMENTED IN THE AREAS THAT HAVE BEEN COMPACTED AND ARE DESIGNATED TO REMAIN VEGETATIVE OR POST-CONSTRUCTION INFILTRATION AREAS. CLEARLY MARK THE AREAS TO BE AVOIDED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING SHALL BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.
7. PERIMETER CONTROLS ARE REQUIRED DOWN SLOPE OF ALL DISTURBED AREAS.
8. INLET PROTECTION (SEDIMENT FILTER)
 - A) ALL STORM DRAIN INLETS ONSITE AND THOSE OFFSITE WHICH MAY RECEIVE RUNOFF FROM THE SITE SHALL USE AN INLET PROTECTION DEVICE UNLESS THEY ARE DIRECTED TO A SEDIMENT BASIN.
 - B) SEDIMENT LEVELS MAY NOT EXCEED ONE THIRD OF THE HEIGHT OF A SEDIMENT BARRIER OR INLET PROTECTION DEVICE AT ANY POINT ALONG THE LENGTH OF THE SEDIMENT BARRIER OR THE INLET PROTECTION DEVICE.
 - C) SEDIMENT BARRIERS AND INLET PROTECTION DEVICES SHALL BE UNCLOGGED AND CLEANED WHEN PERFORMANCE IS COMPROMISED.
 - D) TORN, WEATHERED, OR SAGGING, SEDIMENT BARRIERS OR INLET PROTECTION DEVICES SHALL BE REPAIRED OR REPLACED IMMEDIATELY.
9. TRACKING CONTROL
 - A) MINIMIZE SEDIMENT TRACK-OUT ONTO OFFSITE STREETS, OTHER PAVED AREAS, AND SIDEWALKS FROM VEHICLES EXITING THE CONSTRUCTION SITE BY RESTRICTING VEHICLE TRAFFIC TO PROPERLY DESIGNATED AREAS AND USING ADDITIONAL CONTROLS TO REMOVE SEDIMENT FROM VEHICLE TIRES PRIOR TO EXITING THE SITE.
 - B) VEHICULAR PARKING AND MOVEMENTS ON PROJECT SITE SHALL BE CONFINED TO PAVED SURFACES OF PREDEFINED PARKING AREAS AND VEHICLE PATHS, WHICH SHALL BE MARKED WITH FLAGS OR BOUNDARY FENCING.
 - C) ALL POLLUTANTS AND MATERIALS THAT ARE DROPPED, WASHED, TRACKED, SPILLED OR OTHERWISE DISCHARGED FROM A PROJECT TO OFFSITE STREETS, OTHER PAVED AREAS, SIDEWALKS OR THE MS4 SHALL BE CLEANED USING DRY METHODS SUCH AS SWEEPING OR VACUUMING.
 - D) WASHING POLLUTANTS AND MATERIALS THAT ARE DISCHARGED FROM THE PROJECT SITE TO THE MS4 INTO DRAIN INLETS OR CATCH BASINS IS PROHIBITED UNLESS THE MATERIAL IS SEDIMENT AND THE INLETS ARE DIRECTED TO A SEDIMENT BASIN OR SEDIMENT TRAP.
10. SLOPE PROTECTION IS REQUIRED ON AREAS WITH SLOPES GREATER THAN 15% AND ON AREAS OF MODERATE SLOPE THAT ARE PRONE TO EROSION UNLESS THEY ARE BEING ACTIVELY WORKED. USE DIVERSION UPSTREAM OF SLOPE (DIKES, SWALES, SLOPE DRAINS) TO DIVERT WATER AROUND THE SLOPE. PROVIDE A 10-FT BUFFER ZONE AT THE TOE OF SLOPE. ONLY 5 ACRES MAY BE DISTURBED AT ANYTIME ON SLOPES GREATER THAN 15%.
11. BEST MANAGEMENT PRACTICES (BMPS) SHALL NOT BE REMOVED UNTIL FINAL STABILIZATION IS COMPLETE FOR THAT PHASE.
12. REFER TO CITY & COUNTY OF HONOLULU BEST MANAGEMENT PRACTICES MANUAL – CONSTRUCTION, FOR MORE INFORMATION ON BMPS.
13. A PERSON RESPONSIBLE FOR IMPLEMENTING THE ESCP AT THE PROJECT SITE ("ESCP COORDINATOR") MUST BE DESIGNATED PRIOR TO PERMIT ISSUANCE USING THE FORM PROVIDED IN APPENDIX A TO THE RULES RELATING TO WATER QUALITY.
14. A BRIEF EXPLANATION OF WHY THE OMITTED BMP IS UNNECESSARY AND IMPRACTICABLE FOR THE PROJECT HAS BEEN PROVIDED UNDER SEPARATE DOCUMENTATION TO DPP. AS CONSTRUCTION PROGRESSES, REVISIONS MAY BE NECESSARY AND SHALL BE PROVIDED TO DPP INSPECTORS BY THE CONTRACTOR.
 - A) SEDIMENT BARRIERS
15. CONTRACTOR SHALL COMPLY WITH THE PROJECT SCHEDULE REQUIREMENTS OF THE CITY'S RULES RELATING TO WATER QUALITY AND IS TO SUBMIT THE SCHEDULED START DATE TWO WEEKS PRIOR.

LIST OF BMPS:

PRE CONSTRUCTION:

1. STABILIZED CONSTRUCTION INGRESS/EGRESS
2. FILTER SOCK PERIMETER CONTROL

DURING CONSTRUCTION:

1. RELOCATE, RECONSTRUCT AND MAINTAIN BMPS AS NEEDED TO KEEP THEM EFFECTIVE AT ALL TIMES.
2. PROCEED WITH CONSTRUCTION WITH LEAST POSSIBLE DISTURBANCE OF VEGETATIVE AREAS AND STRUCTURES.
3. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
4. INSPECTIONS SHALL BE PERFORMED WEEKLY.
5. RECONSTRUCT WALL(S) AND REINSTALL LANDSCAPING AS REQUIRED TO MATCH EXISTING CONDITIONS OR BETTER.
6. TEMPORARY STABILIZATION.

POST-CONSTRUCTION

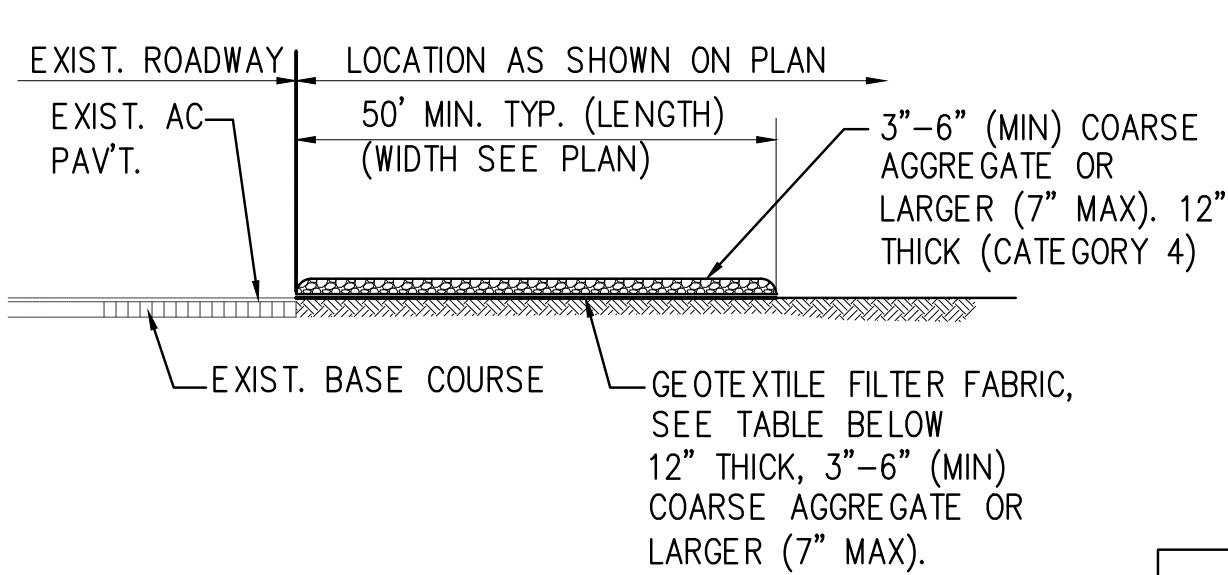
1. PERMANENT STABILIZATION

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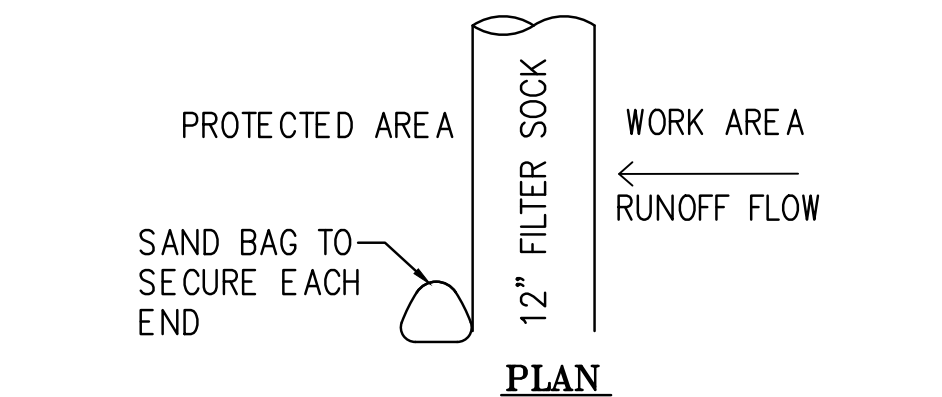
CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

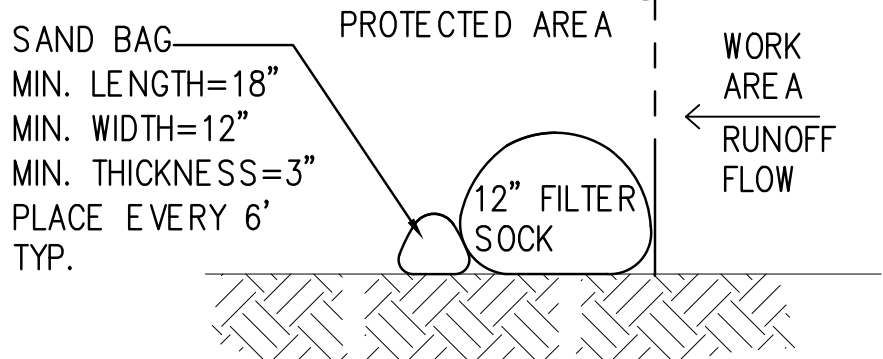
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SECTION



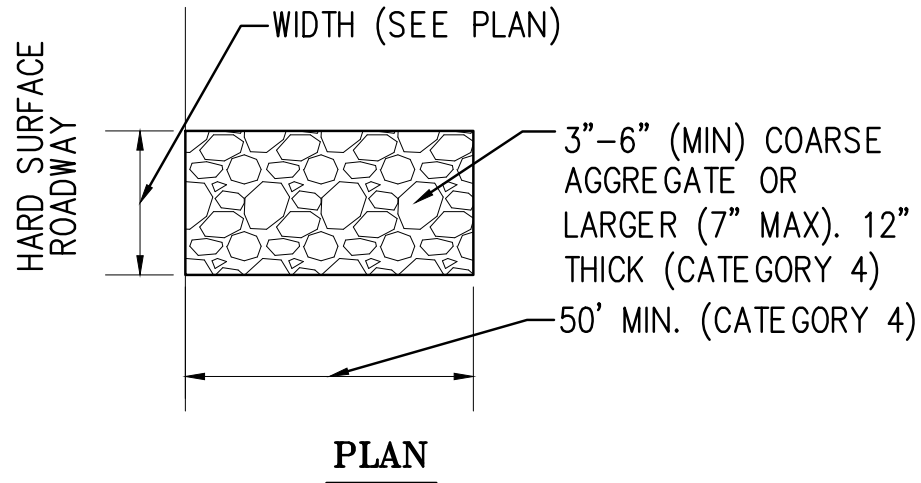
PLAN



SECTION

FILTER SOCK DETAILS

NOT TO SCALE

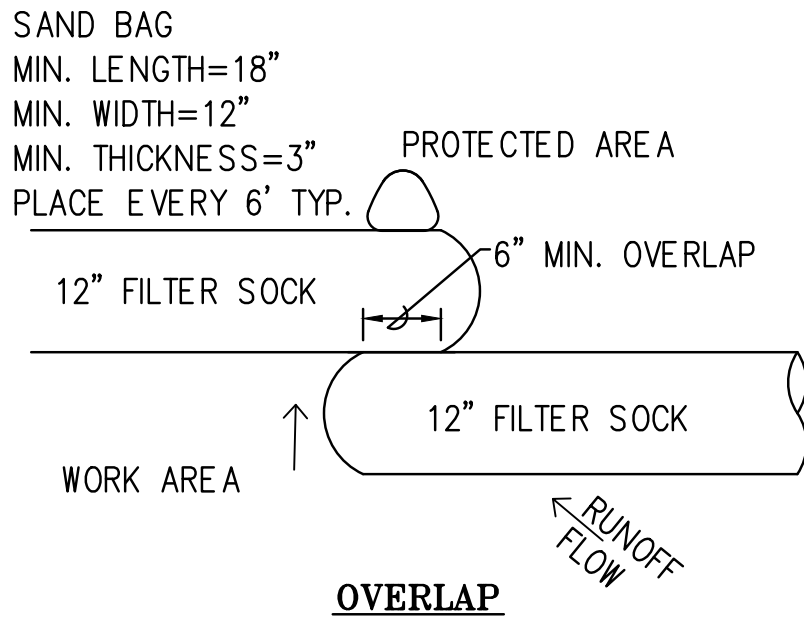


PLAN

TABLE A GEOTEXTILE REQUIREMENTS	
PHYSICAL PROPERTY	REQUIREMENTS
GRAB TENSILE STRENGTH	220 LB (ASTM D1682)
ELONGATION FAILURE	60% (ASTM D1682)
MULLEN BURST STRENGTH	430 LB (ASTM D3768)
PUNCTURE STRENGTH	125 LB (ASTM D751, MODIFIED)
EQUIVALENT OPENING	SIZE 40-80 (U.S. STD SIEVE, CW-02215)

CONSTRUCTION INGRESS/EGRESS DETAILS

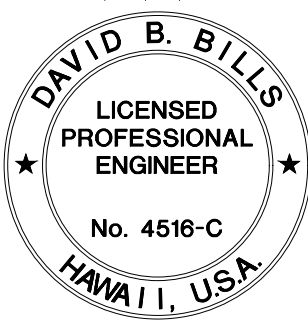
NOT TO SCALE



OVERLAP

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

David B. Bills
SIGNATURE
Exp: 4/30/24



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

EROSION SEDIMENT CONTROL PLAN
NOTES AND DETAILS

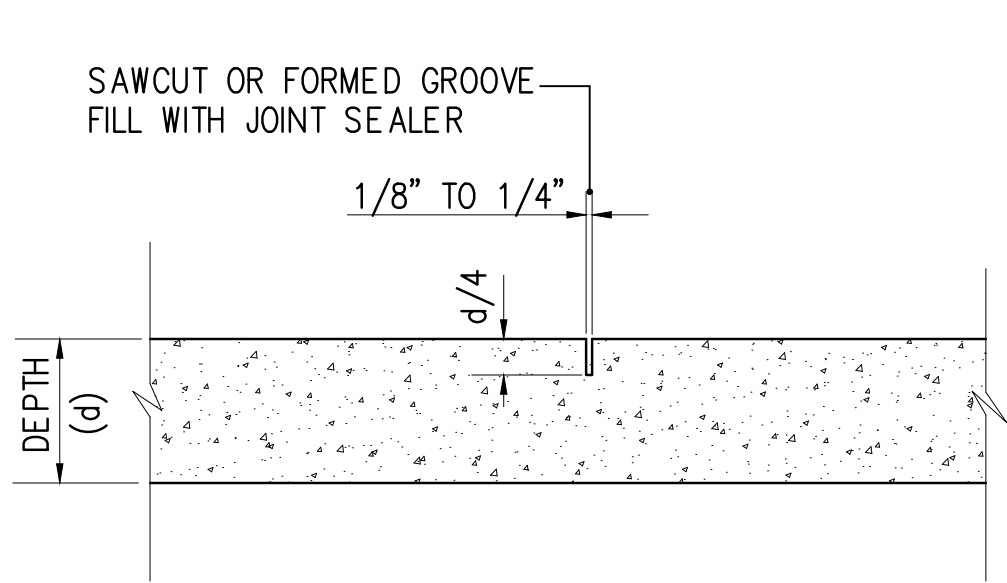
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FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 19 OF _____ SHEETS

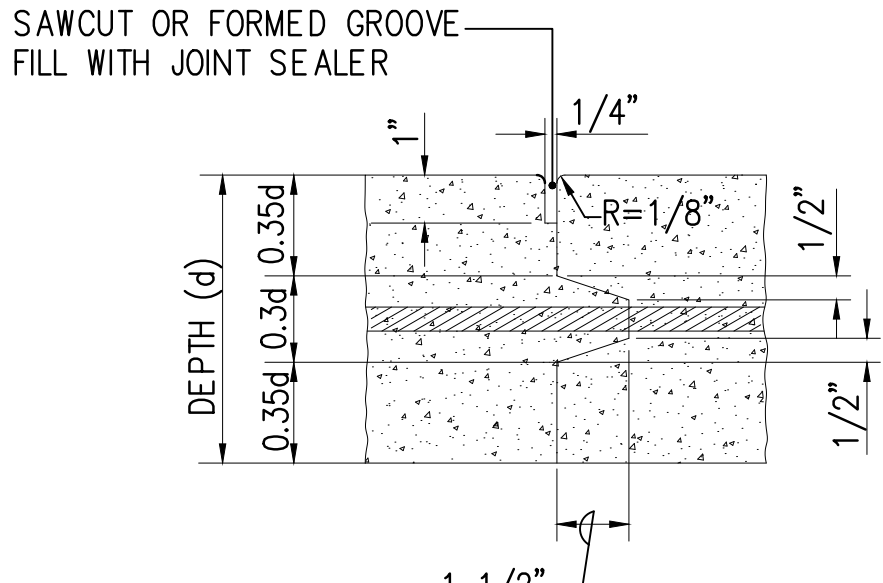
FILE	POCKET	FOLDER	NO.

Mon, 23 Jun 2023 - 9:55pm
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKHA\641-00 CS01_SEQ OF WORK AND TYP DETS.dwg



TRANSVERSE CONTRACTION JOINT

SCALE : 1 1/2" = 1'-0"



COLD JOINT BETWEEN CONCRETE PADS

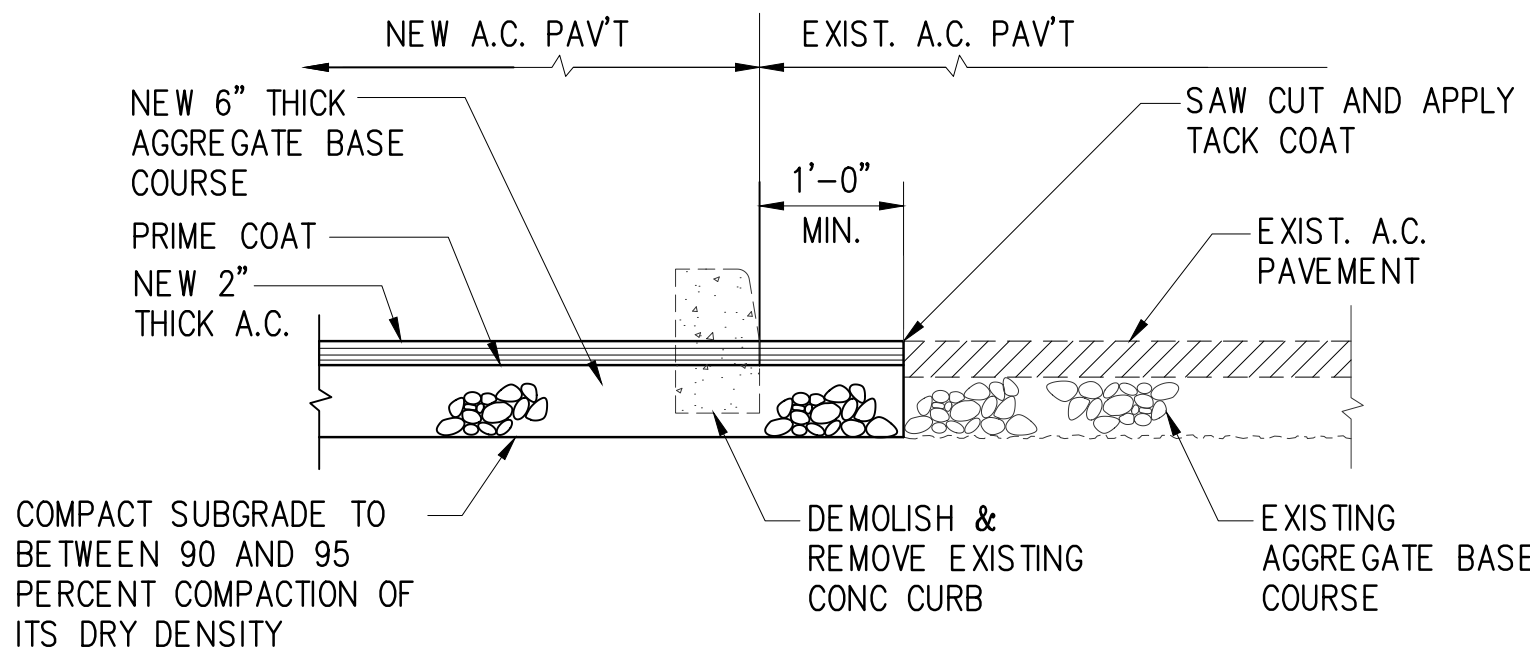
SCALE: 3" = 1'-0"

CONCRETE PAVEMENT AND JOINT NOTES:

1. ALL CONCRETE SHALL BE DWS 2500
2. CONTRACTION JOINTS SHALL BE PROVIDED AT 12-FOOT INTERVAL
3. COLD JOINTS BETWEEN CONCRETE POURS SHALL BE USED FOR POURS THAT ARE NOT CONTINUOUS. REBAR SHALL BE PAINTED AND GREASED

CONCRETE PAVEMENT JOINT DETAILS

SCALE : AS SHOWN



AC PAVEMENT CONNECTION DETAIL

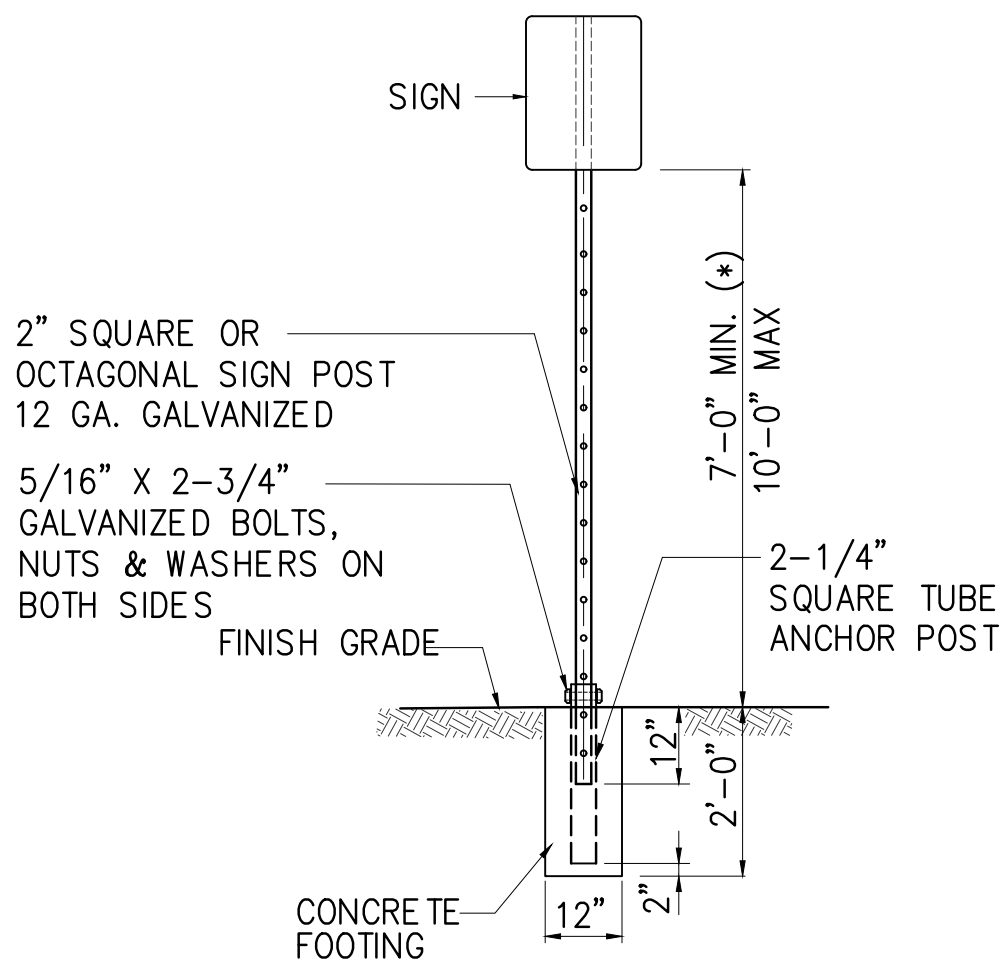
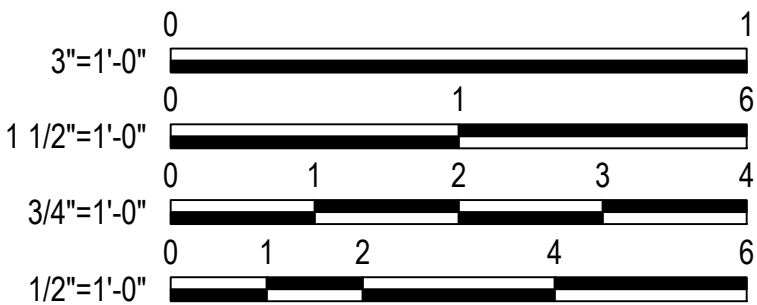
SCALE: 3/4"=1'-0"



R12-V6 SIGN INSTALLED ON SIGN POST

NOT TO SCALE

NOTE: PLACE VEHICLE WEIGHT SIGN AT SECOND ACCESS GATE AT BEGINNING OF BWS ACCESS ROAD (SEE SHT T001 LOCATION MAP)

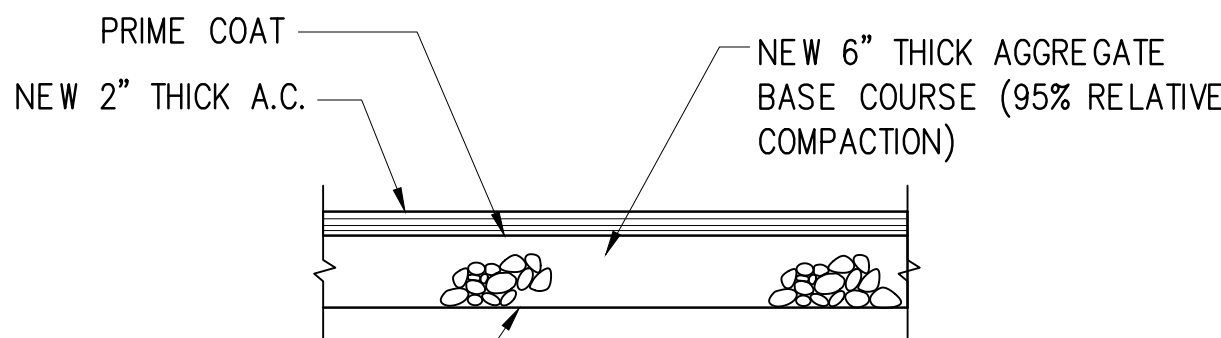


ANCHOR POSTS NOTES:

1. KEEP INSIDE OF 2-1/4" ANCHOR POST FREE FROM IMPEDIMENTS THAT MAY PREVENT PROPER SEATING OF 2" SIGN POST.
2. SQUARE TUBING SIGN POST SHALL BE TELESOPING TYPE WITH 7/16" DIA. HOLES AT 1"O.C. ON FOUR SIDES.
3. OCTAGON SIGN POST SHALL BE TELESOPING TYPE WITH 7/16" DIA. HOLES AT 1" O.C. ON TWO SIDES.
4. USE 5/16" X 2-3/4" BOLTS TO SECURE THE OCTAGONAL AND SQUARE TUBING POST ONTO THE 2-1/4" SQUARE TUBE ANCHOR POST.

INSTALLATION OF NEW SIGN POST W/ CONCRETE FOOTING

SCALE: 1/2"=1'-0"

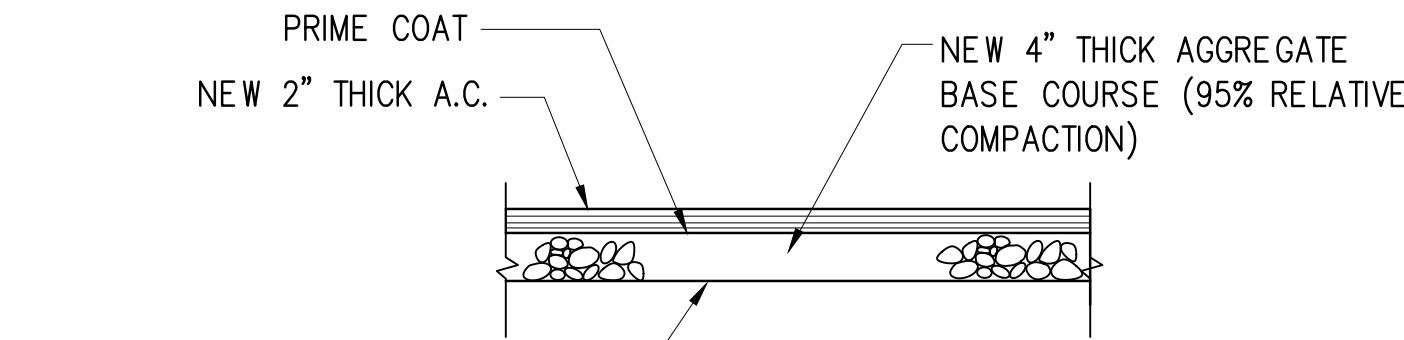


FLEXIBLE PAVEMENT

THE SUBGRADE SOILS SHOULD BE SCARIFIED TO A MINIMUM DEPTH OF ABOUT 8 INCHES MOISTURE-CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION.

AC PAVEMENT DETAIL (NEW ACCESS ROAD)

SCALE: 3/4"=1'-0"



FLEXIBLE PAVEMENT

FILL USED TO CONSTRUCT THE TEMPORARY ACCESS ROAD ACROSS THE EXISTING STREAM SHOULD CONSIST OF 3-INCH MINUS IMPORTED GRANULAR FILL MATERIAL WRAPPED IN A WOVEN GEOTEXTILE FABRIC, SUCH AS MIRAFI FW700 OR EQUIVALENT. THE 3-INCH MINUS FILL MATERIALS SHOULD BE PLACED IN LEVEL LIFTS OF ABOUT 8 INCHES THICK OR LESS.

AC PAVEMENT DETAIL (TEMPORARY ACCESS ROAD)

SCALE: 3/4"=1'-0"

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C501

SUGGESTED SEQUENCE OF WORK

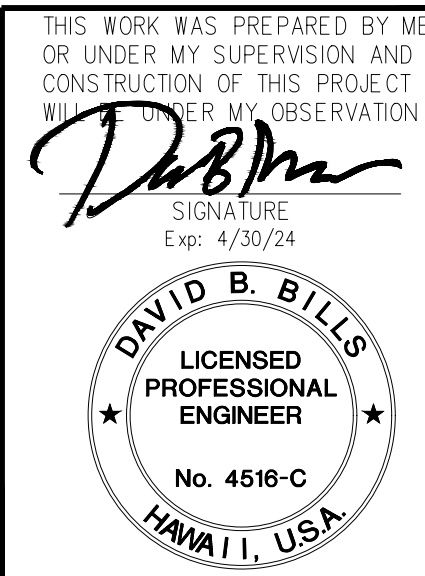
1. SET UP PROJECT SITE FOR TEMPORARY CONSTRUCTION FEATURES INCLUDING:
 - A. STAGING AREA INCLUDING INSTALLATION OF BIO-SOCK AT PERIMETER OF THE WHOLE WORK AREA AND FEATURES OF THE PROJECT EROSION CONTROL NOTES AND PLANS.
 - B. CUT FOR SECTION "TR1" INCLUDING EXCAVATION, PLACEMENT OF SHOTCRETE AND SOIL NAILS.
 - C. DIVERSION DITCH INCLUDING EXCAVATION, SETTING PLYWOOD BOTTOM AND INSTALLATION OF TRENCH SHIELDS.
 - D. INSTREAM BOULDER BASIN AND SUPER-SACKS INCLUDING EXCAVATION FOR SUPER-SACK SHELF AND BOULDER BASIN.
 - E. INSTALLATION OF TEMPORARY ACCESS ROAD INCLUDING TEMPORARY C-900 16-INCH WATER LINE WITH RC JACKET ON SECTION PASSING THROUGH STREAM. DO NOT MAKE CONNECTIONS AT EACH END OF TEMPORARY WATER LINE UNTIL ALL CONNECTION MATERIALS ARE AVAILABLE, PRE-FABRICATED AND READY TO INSTALL AND CHLORINATE UNDER THE REQUIRED MAXIMUM WATER LINE OUTAGE TIME (____ HOURS).
 - F. SET POLES FOR TEMPORARY ELECTRIC AND TELEPHONE INCLUDING LINE SETTING UP TO POINT OF ELECTRICAL CONNECTION AND TELEPHONE CONNECTION AT EACH END. COORDINATE ELECTRICAL AND TELEPHONE CONNECTION TO COMPLY WITH MAXIMUM DOWNTIME ALLOWED BY BWS (____ HOURS).

1. CONSTRUCTION WORK-PHASE 1

- A. INSTALL BRIDGE ABUTMENTS FOR BOTH SIDES OF BRIDGE.
- B. CONDUCT PHASE 1 GRADING. IT IS RECOMMENDED THAT GRADING PROCEED FROM DOWNSTREAM TO UP STREAM TO PREVENT PONDING SHOULD THE DIVERSION DITCH EXCEED ITS MAXIMUM FLOW. GRADING SHALL BE TO FINISHED GRADE FOR AREAS OUTSIDE THE BRIDGE CRM. WHERE CRM WILL BE PLACED THE EXCAVATION SHALL BE TO FINISHED GRADE PLUS 3- FEET TO ALLOW FOR CRM PLACEMENT. CARE SHOULD BE TAKEN IN THE VICINITY OF THE BRIDGE ABUTMENTS TO ENSURE THERE IS NOT OVER-EXCAVATION THAT COULD IMPACT THE ABUTMENT AND ABUTMENT FOUNDATION.
- C. PLACE GROUTED CRM AS INDICATED ON THE PLANS.
- D. UPON COMPLETION OF PHASE 1 GRADING THE BRIDGE STRUCTURE CAN BE SET.
- E. ONCE THE BRIDGE IS SET THE PERMANENT WATER (INCLUDING PEDESTALS 1 AND 2) CAN BE INSTALLED WITH NEW 16-INCH WATER LINE EXTENDED TO CLOSE PROXIMITY OF THE PERMANENT POINT OF CONNECTION ON EACH SIDE OF THE BRIDGE.
- F. PHYSICAL AND PERMANENT WATER LINE CONNECTION CAN BE MADE WHEN ALL CONNECTION MATERIALS ARE AVAILABLE AND ORGANIZED TO ALLOW DIS-CONNECTION OF THE TEMPORARY WATER LINE AND RE-CONNECTION OF THE PERMANENT WATER LINE IN THE MAXIMUM TIME ALLOWED FOR WATER OUTAGE (____ HOURS).
- G. ONCE THE BRIDGE IS SET THE PERMANENT ELECTRIC AND TELEPHONE CONNECTIONS CAN BE INSTALLED AND EXTENDED TO CLOSE PROXIMITY OF THE PERMANENT POINT OF CONNECTION ON EACH SIDE OF THE BRIDGE.
- H. PHYSICAL AND PERMANENT ELECTRIC AND TELEPHONE CONNECTION CAN BE MADE WHEN ALL CONNECTION MATERIALS ARE AVAILABLE AND ORGANIZED TO ALLOW DIS-CONNECTION OF THE TEMPORARY OVERHEAD SYSTEM AND RE-CONNECTION OF THE PERMANENT ELECTRIC AND TELEPHONE IN THE MAXIMUM TIME ALLOWED FOR SYSTEM OUTAGE (____ HOURS).
- I. UPON BRIDGE INSTALLATION OF BRIDGE, PERMANENT WATER IS FUNCTIONAL AND PERMANENT ELECTRIC AND TELEPHONE IS FUNCTIONAL, THE DIVERSION DITCH CAN BE DEMOLISHED AND ABANDONED, THE SUPER-SACKS CAN BE REMOVED, THE TEMPORARY BOULDER BASIN CAN BE ABANDONED (AND NOT FILLED) AND THE TEMPORARY ACCESS ROAD (INCLUDING TEMPORARY PVC WATER LINE) CAN BE REMOVED. THERE IS NO NEED TO RESTORE EXISTING GRADE TO PRE-CONSTRUCTION CONDITIONS SINCE PHASE 2 GRADING WILL ALTER THE PRE-EXISTING GRADE.
- J. THE "TR1" CUT WILL REMAIN AND DOES NOT NEED TO BE RESTORED TO PRE-CONSTRUCTION CONDITIONS. (THIS ITEM IS SUBJECT TO CHANGE BASED ON SHPD AND BWS DIRECTION).

2. CONSTRUCTION-PHASE 2

- A. COMPLETE PHASE 2 GRADING PER PLANS.
- B. THE PROJECT SHOULD BE READY FOR FINAL INSPECTION AFTER COMPLETION OF ALL THE FOREGOING.
- C. FINAL PROJECT CLOSE-OUT IS SUBJECT TO RESTORATION OF STAGING AREA AND REMOVAL OF STABILIZED CONSTRUCTION INSPECTION AND CLOSE-OUT OF ALL CONSTRUCTION ITEMS INCLUDING BWS BRANCH AND INSPECTOR SIGN-OFF.



BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

SEQUENCE OF SUGGESTED WORK, SIGN POST DETAIL,
AND TYPICAL CONCRETE ROADWAY SECTIONS

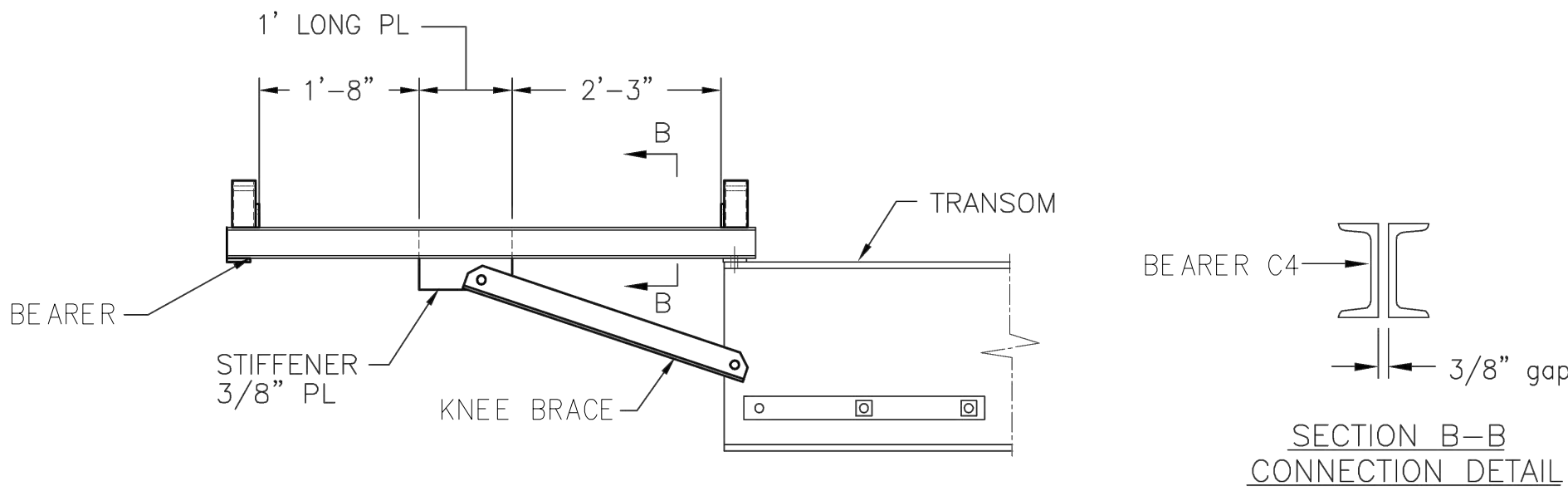
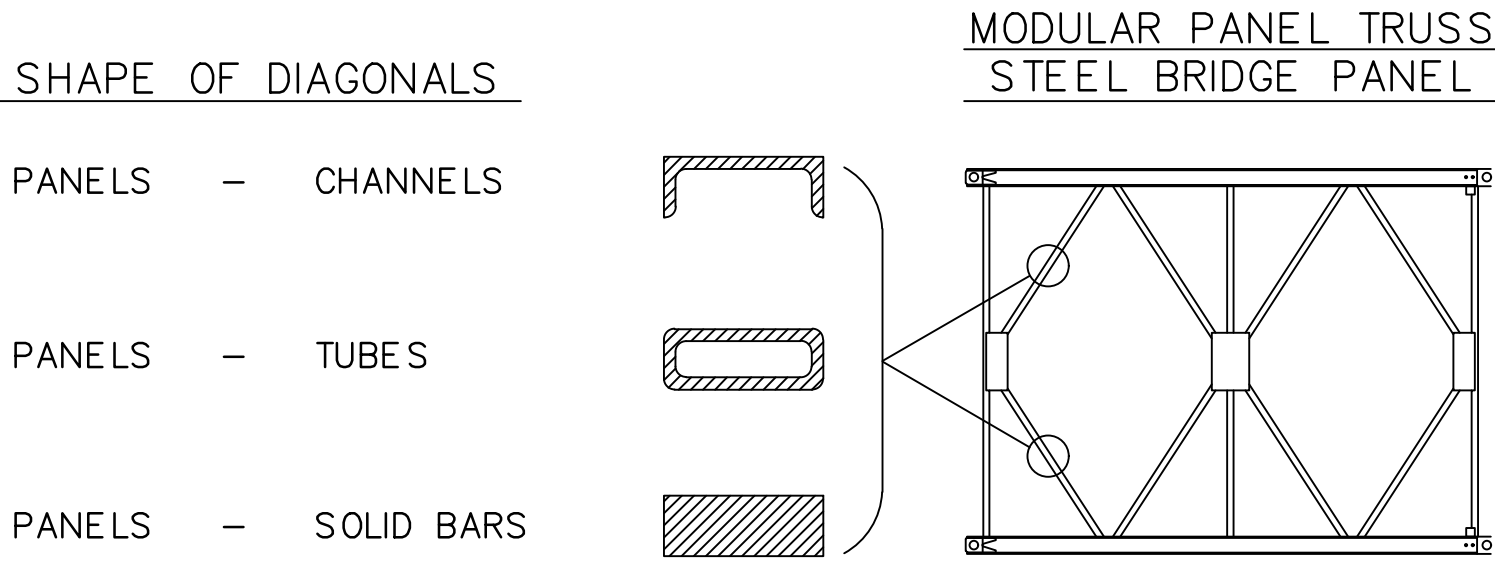
APPROVED: _____ DATE: 2023

DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET 21 OF SHEETS

FILE	POCKET	FOLDER	NO.

TRUSS PANEL TYPES

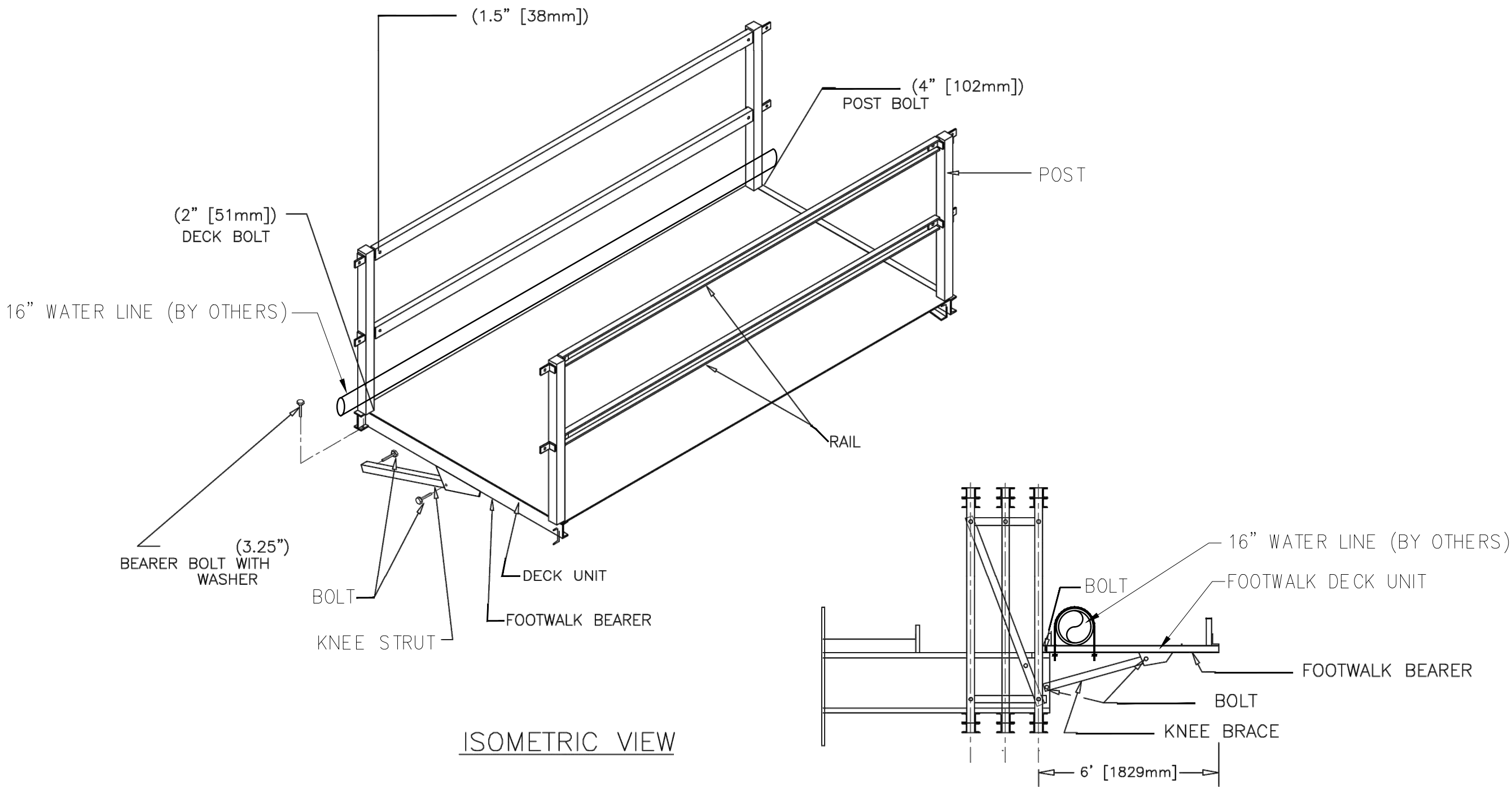


FOOTWALK BEARER CONNECTION

NOT TO SCALE

BRIDGE BOLT TORQUE VALUES

NAME	DIA ϕ	UNDER HEAD LENGTH $\pm 1/8$ "	TORQUE (FT/LBS)
SHORT BRACE BOLT	1"	2 3/4"	450
LONG RAKER BOLT	1"	4"	450
TRANSOM SHEAR BOLT	1"	5 1/2"	450
TRANSOM BOLT	1"	4 1/4"	450
DECK T BOLT	3/4"	N/A	110
BRACE BOLT	1"	3 1/2"	450
CHORD BOLT	1 1/4"	3 1/2"	650



ISOMETRIC VIEW

SIDEWALK CONNECTION DETAIL

NOT TO SCALE

ACROW CREATING ENGINEERED SOLUTIONS WORLDWIDE®
CORPORATION OF AMERICA
181 NEW ROAD, PARLISPPANY, NJ 07054

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DRAWN BY: RL	DATE: JANUARY 12 2008	CONTRACT NO.
CHECKED BY: BIL	SCALE: N.T.S.	
APPROVED BY: WIC		
DRAWING NO.		REV.
SHT 1 OF 1		

DESIGN SPECIFICATION
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7th EDITION, 2014 WITH 2015 AND 2016 INTERIM REVISIONS

LIVE LOAD
1 LANES OF HL-93 (0.64 KIP/FOOT)

DEAD LOAD
ANTI-SKID EPOXY COATED DECK
TRUSS MOUNTED GUARDRAIL (W-SHAPE)

- BRIDGE SPECIFICATIONS
- (a) PANEL CHORDS, DIAGONALS & VERTICALS, PANEL REINFORCING CHORDS AND RAKERS
AASHTO M223 Gd. 65
 - (b) DECKING, RAKER BRACE, TRANSOM, DIAGONAL BRACE, CHORD BRACE, SWAYBRACE, TRANSOM BRACE
AASHTO M223 Gd. 50
 - (c) PANEL PINS
ASTM A193 Gd. B7
 - (d) BOLTS
AASHTO M164M-A325

FINISH
ALL MAJOR COMPONENTS GALVANIZED TO AASHTO M111-ASTM A123. ALL BOLTS ARE HOT DIPPED GALVANIZED. PINS ARE ELECTRO GALVANIZED.

SHOP DRAWINGS
MANUFACTURER TO PROVIDE SHOP DRAWINGS AFTER ALL CITY AND COUNTY PLAN APPROVALS

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

APPROVED:

CHIEF, CIVIL ENGINEERING BRANCH, DPP

DATE

C502

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David B. Bills
SIGNATURE
Exp: 4/30/24

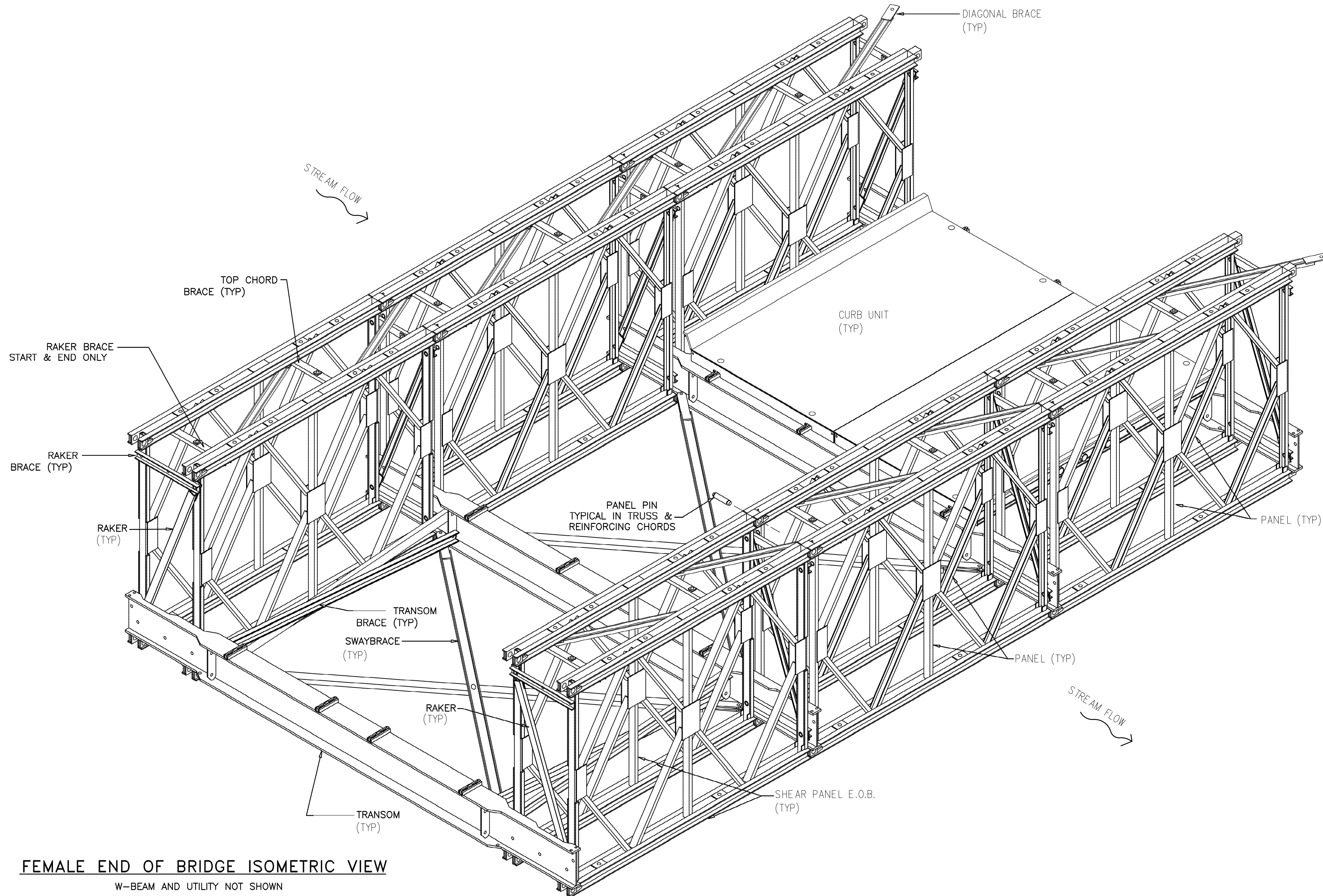
DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
MAKAHA WELLS II, III AND IV
ACCESS ROAD REPAIR
MAKAHA, O'AHU, HAWAII

MODULAR PANEL TRUSS STEEL BRIDGE
GENERAL NOTES AND SPECIFICATIONS

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	
DRAWN BY:	RE	ENGINEER:	DB
CHECKED BY:	DB	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET 22 OF	SHEETS
FILE	POCKET	FOLDER	NO.



BRIDGE ISOMETRIC VIEW

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

C503

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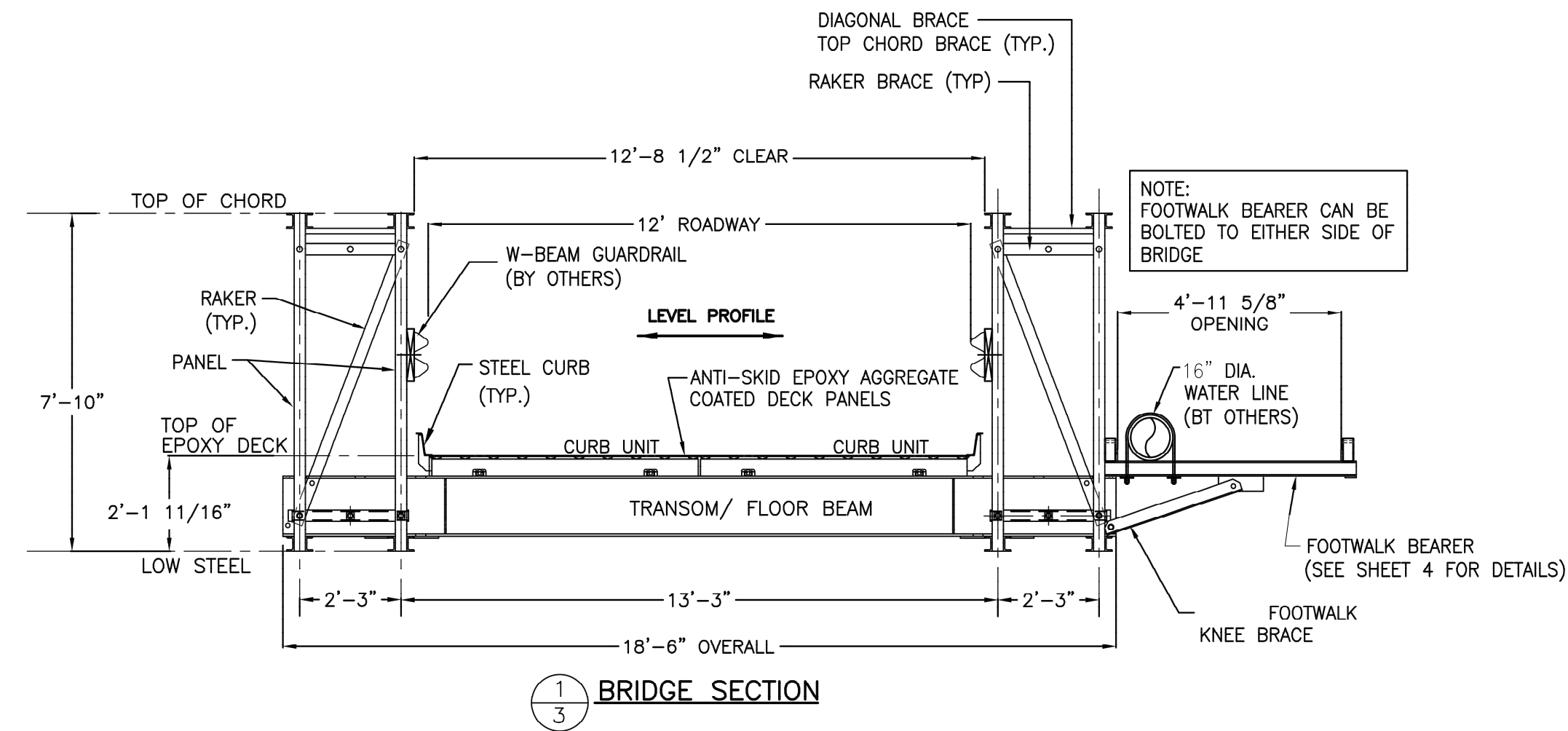
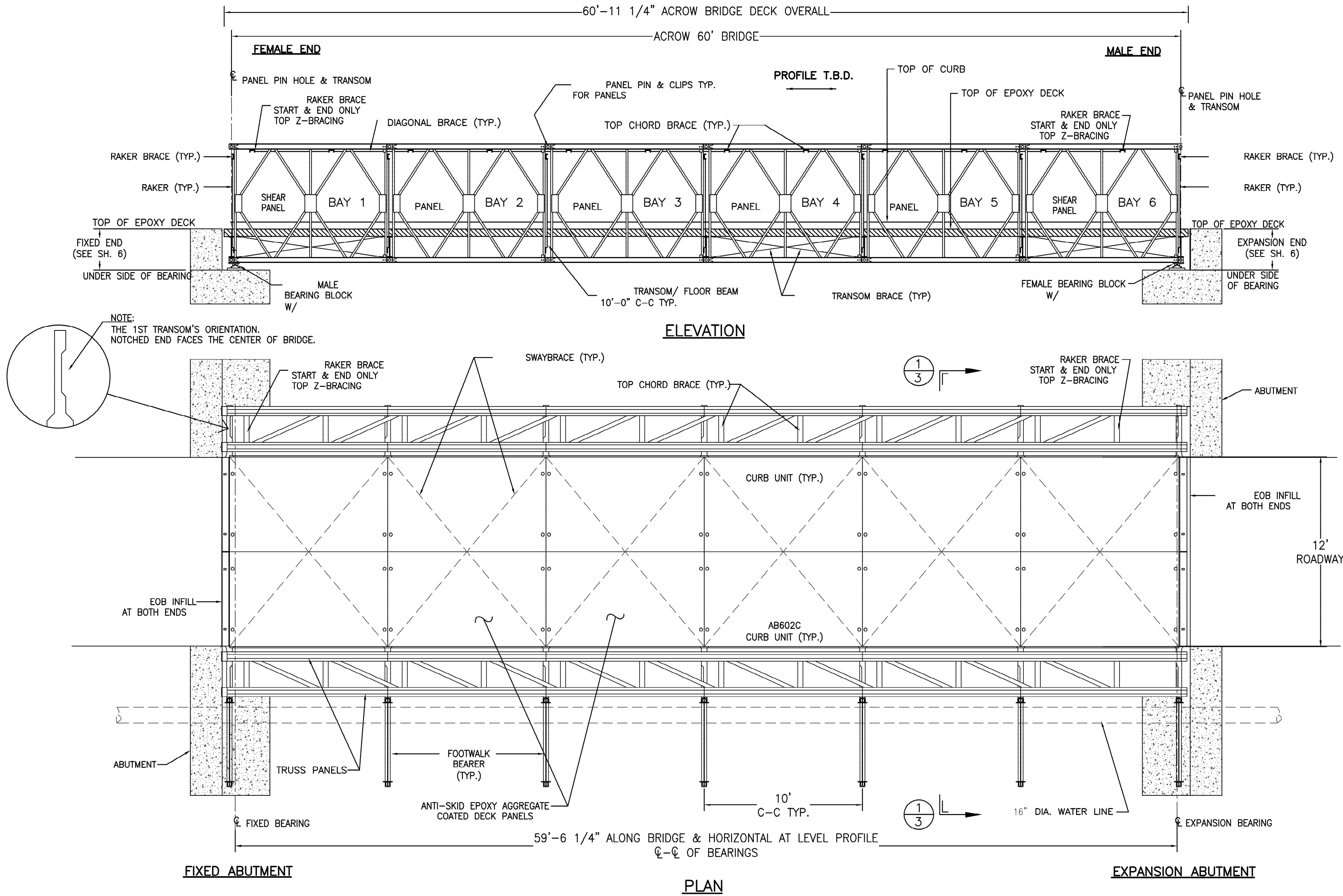
David B. Bills
SIGNATURE
Exp: 4/30/22

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, U.S.A.

BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU			
JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII			
MODULAR PANEL TRUSS STEEL BRIDGE ISOMETRIC VIEW			
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS			DATE: 2021
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 23 OF _____	SHEETS

FILE	POCKET	FOLDER	NO.
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Mon, 23 Jan 2023 - 10:05am
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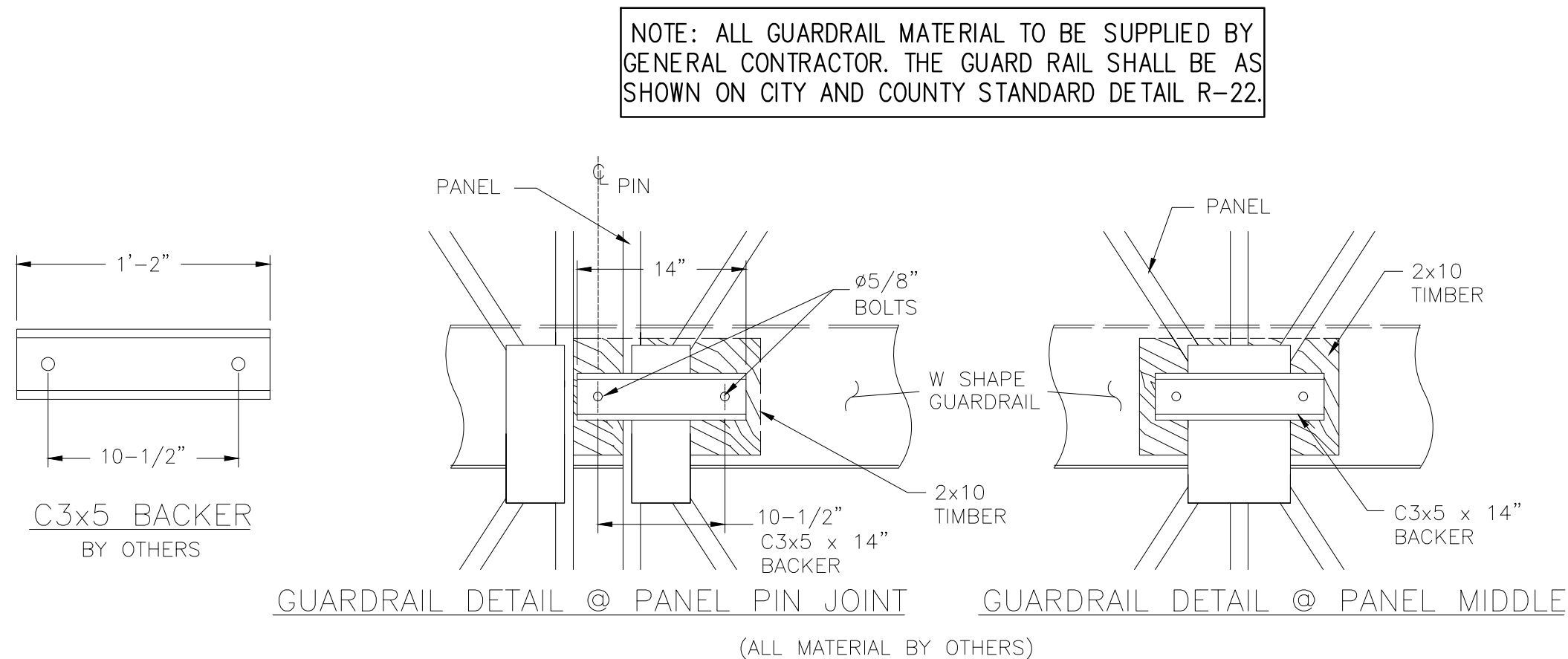
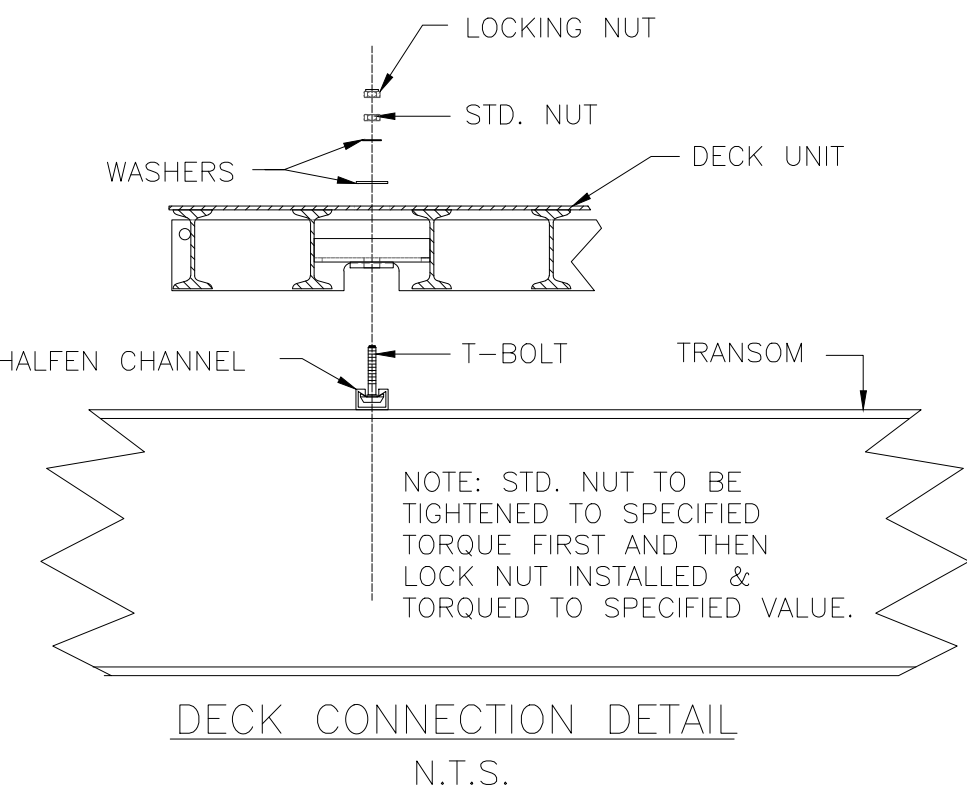
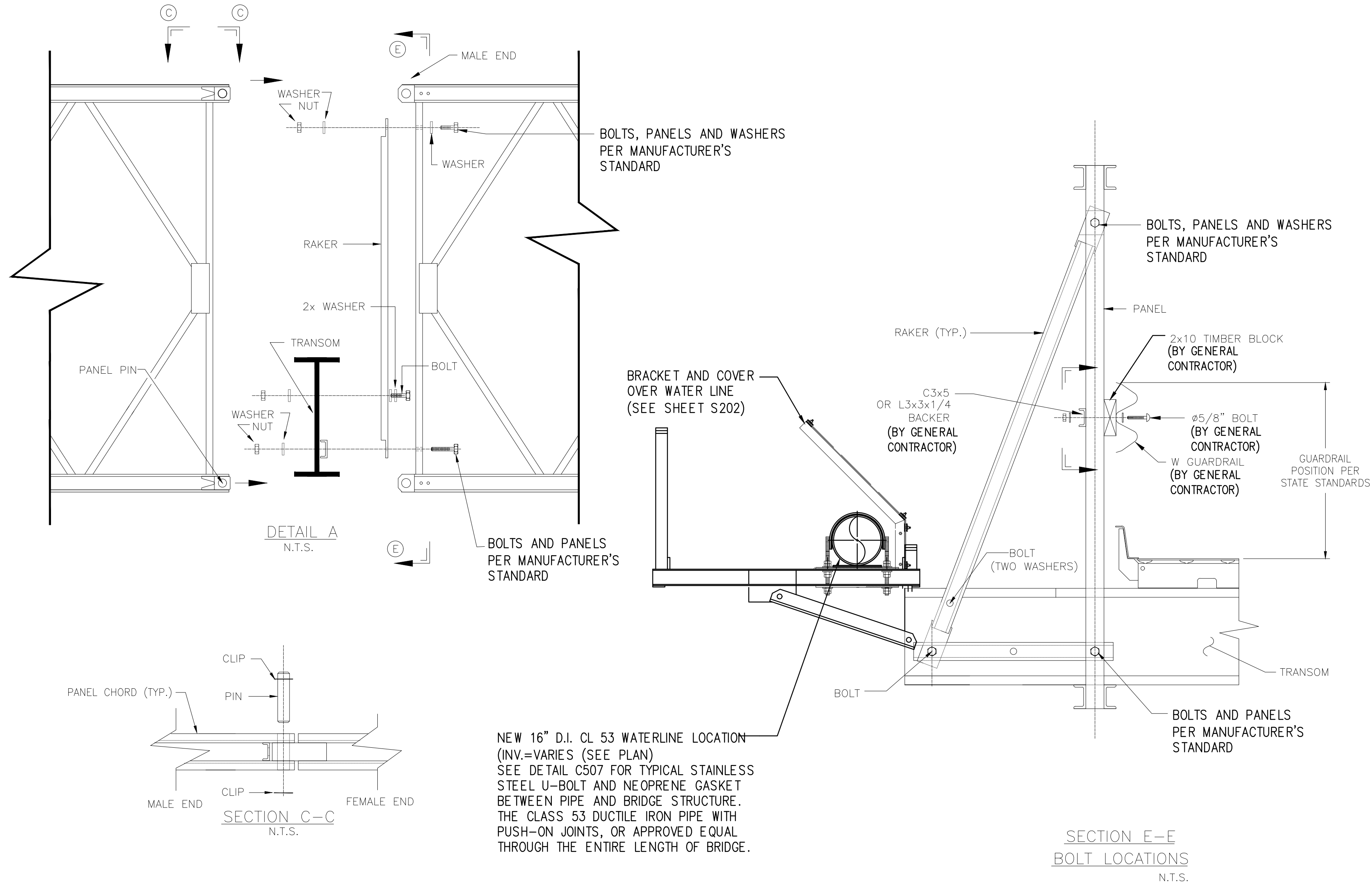


Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

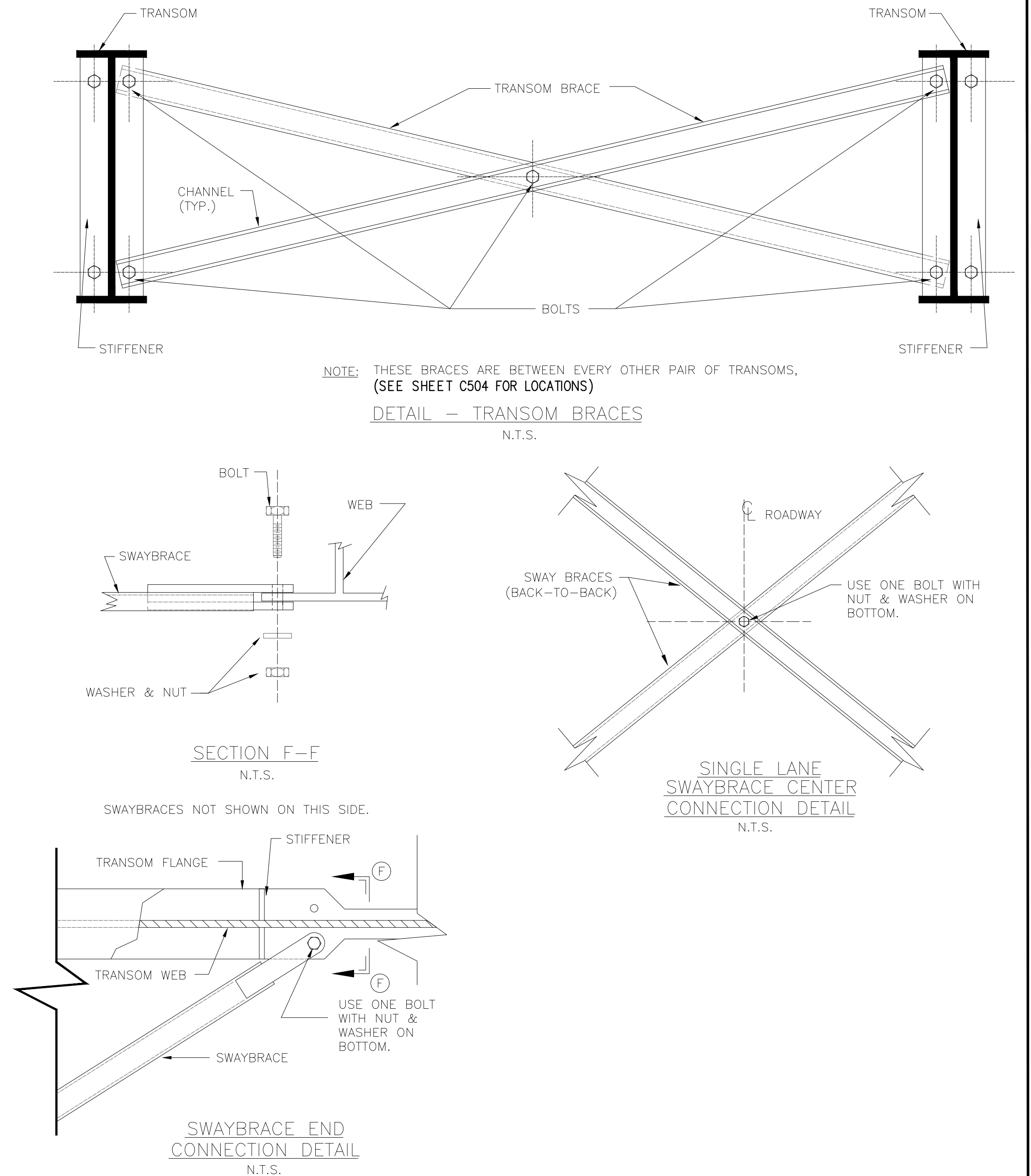
C504

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SIGNATURE Exp: 4/30/24 DAVID B. BILLS LICENSED PROFESSIONAL ENGINEER No. 4516-C HAWAII, USA		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII MODULAR PANEL TRUSS STEEL BRIDGE GENERAL PLAN ELEVATION AND SECTION	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____		SCALE: AS INDICATED	SHEET 24 OF _____ SHEETS
FILE	POCKET	FOLDER	NO.

Mon, 23 Jan 2023 - 10:09am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 C505.MPTS BRIDGE-04.dwg



Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments



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SIGNATURE
Exp: 4/30/24

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

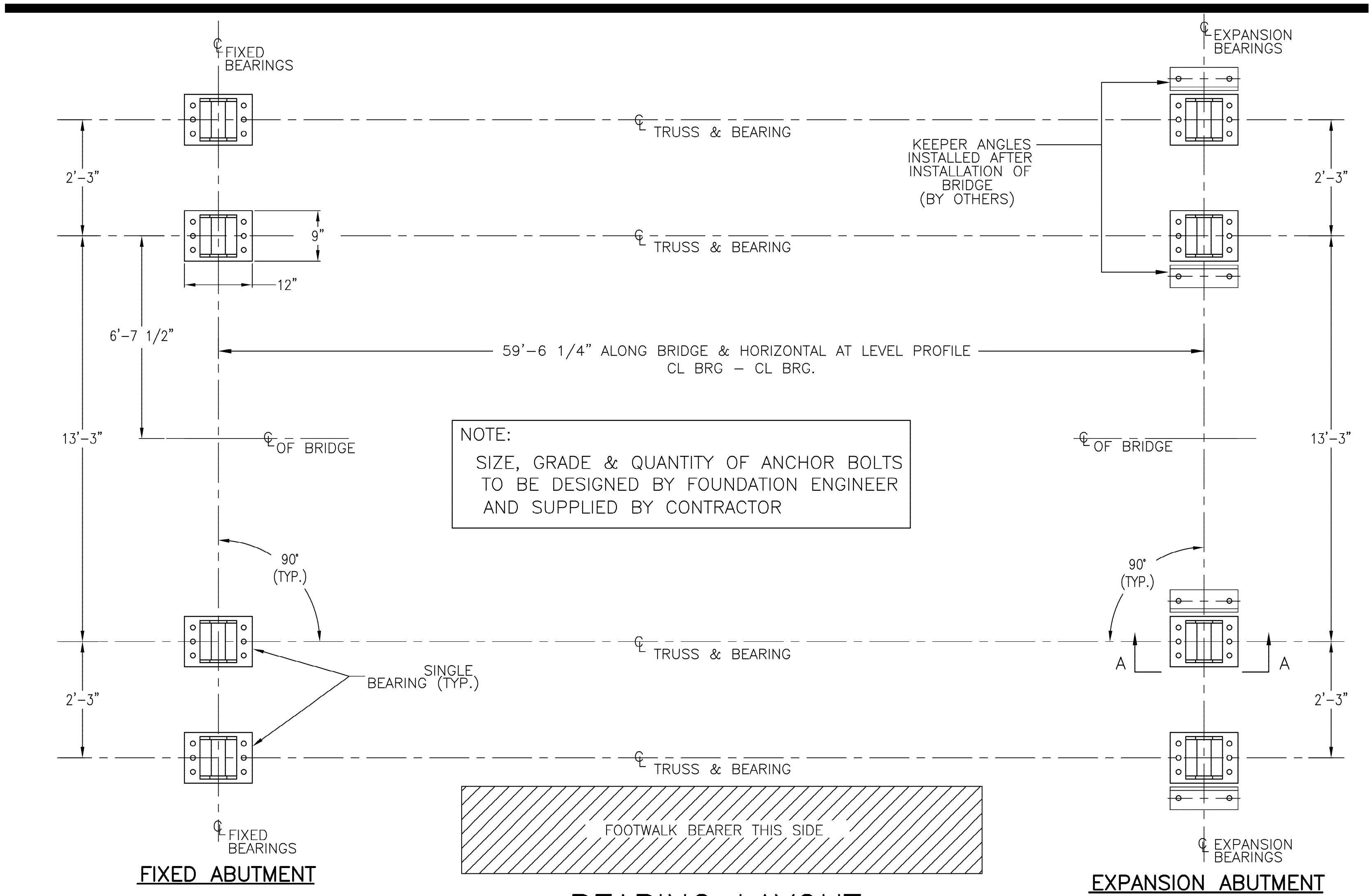
JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII
MODULAR PANEL TRUSS STEEL BRIDGE
TYPICAL CONNECTION DETAILS

APPROVED: _____ DATE: 2023
DRAWN BY: RE ENGINEER: DB CHECKED BY: DB FILE NO: _____
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FILE	POCKET	FOLDER	NO.

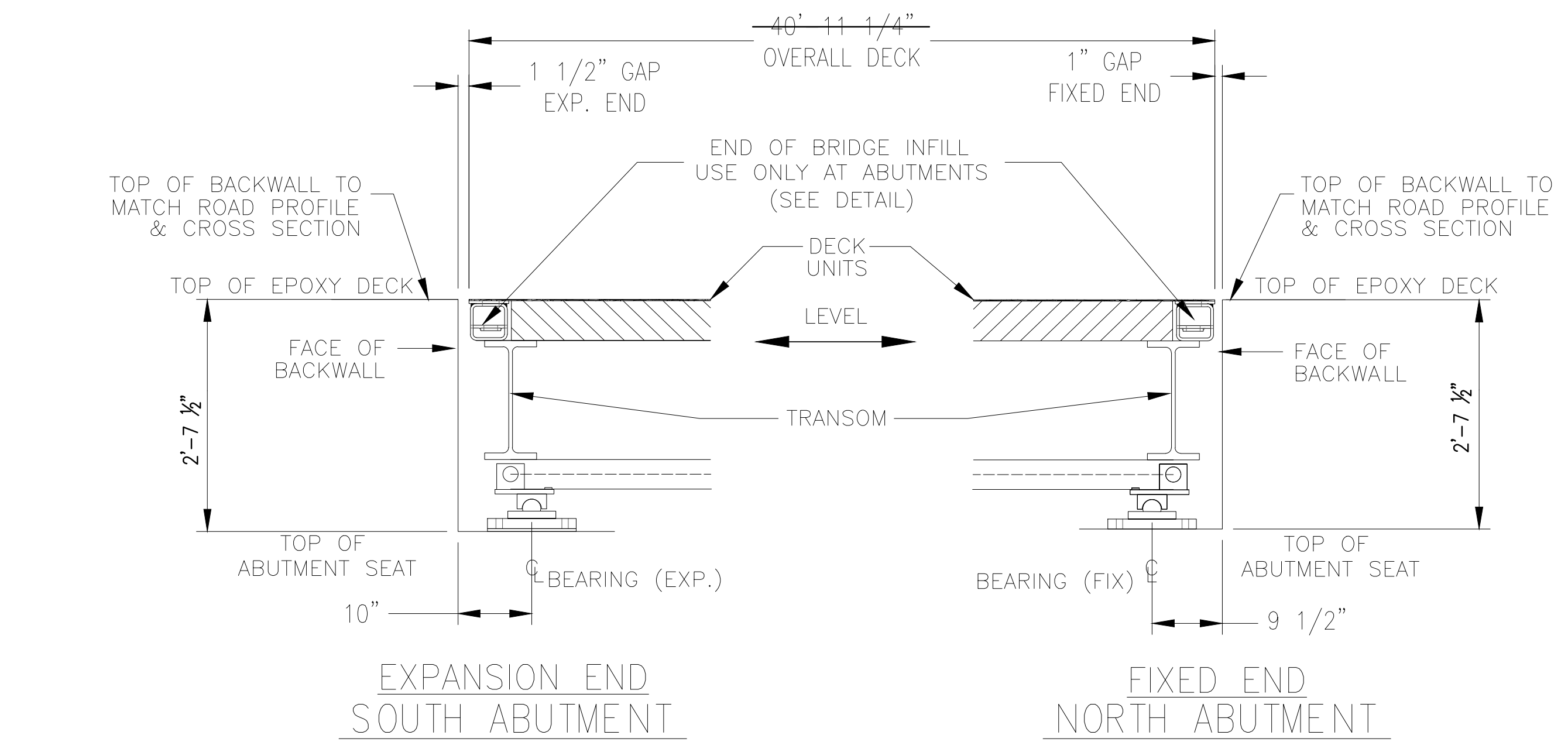
C505

Mon, 23 Jun 2023 - 10:14am
NA\Projects\641-00 MAKAHA & WAIMANALO WELLS RD REPAIR\Const Plans\MAKAHA\641-00 CS06.MPTS BRIDGE-05.dwg



BEARING LAYOUT

(ALL DIMENSIONS AT 70°F)



Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

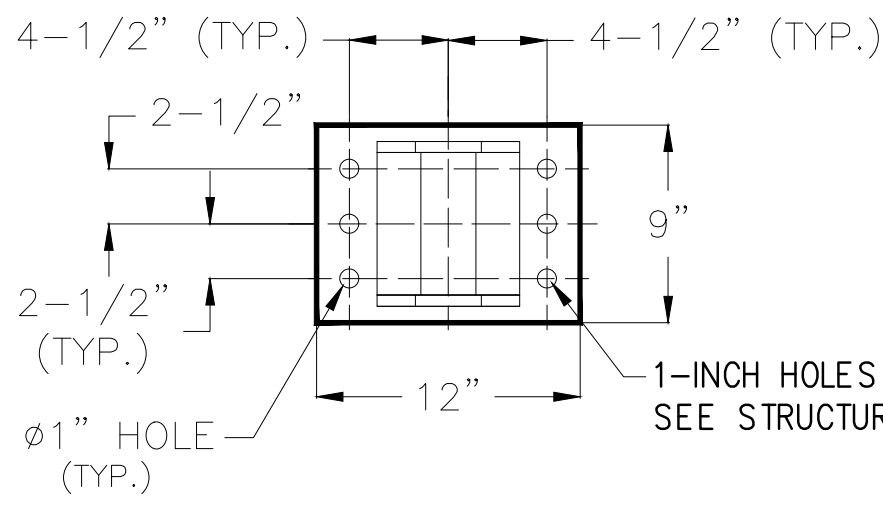
* HOLE AND BOLT SIZE TO BE
VERIFIED WHEN SHOP
DRAWINGS AND
MANUFACTURER'S STRUCTURAL
CALCULATIONS ARE PROVIDED

1-INCH HOLES AND 7/8-INCH BOLTS (TYP.)*
SEE STRUCTURAL DRAWING S201.

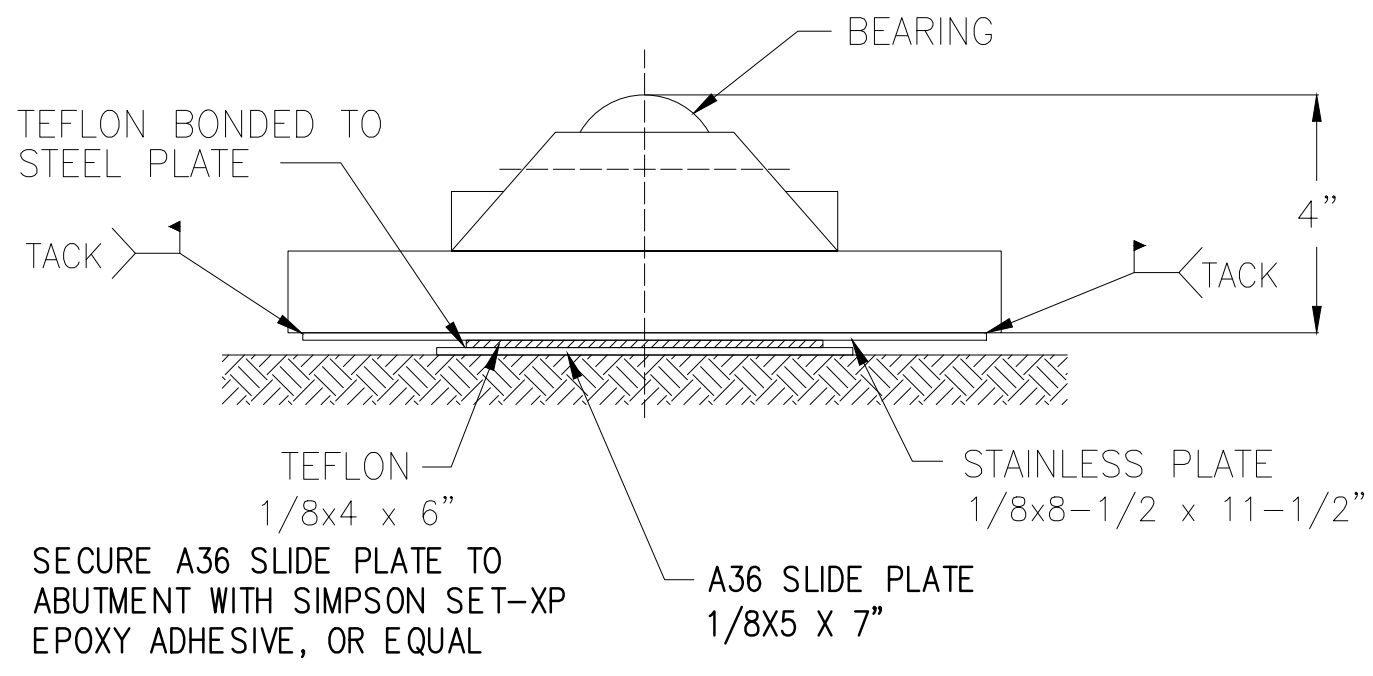
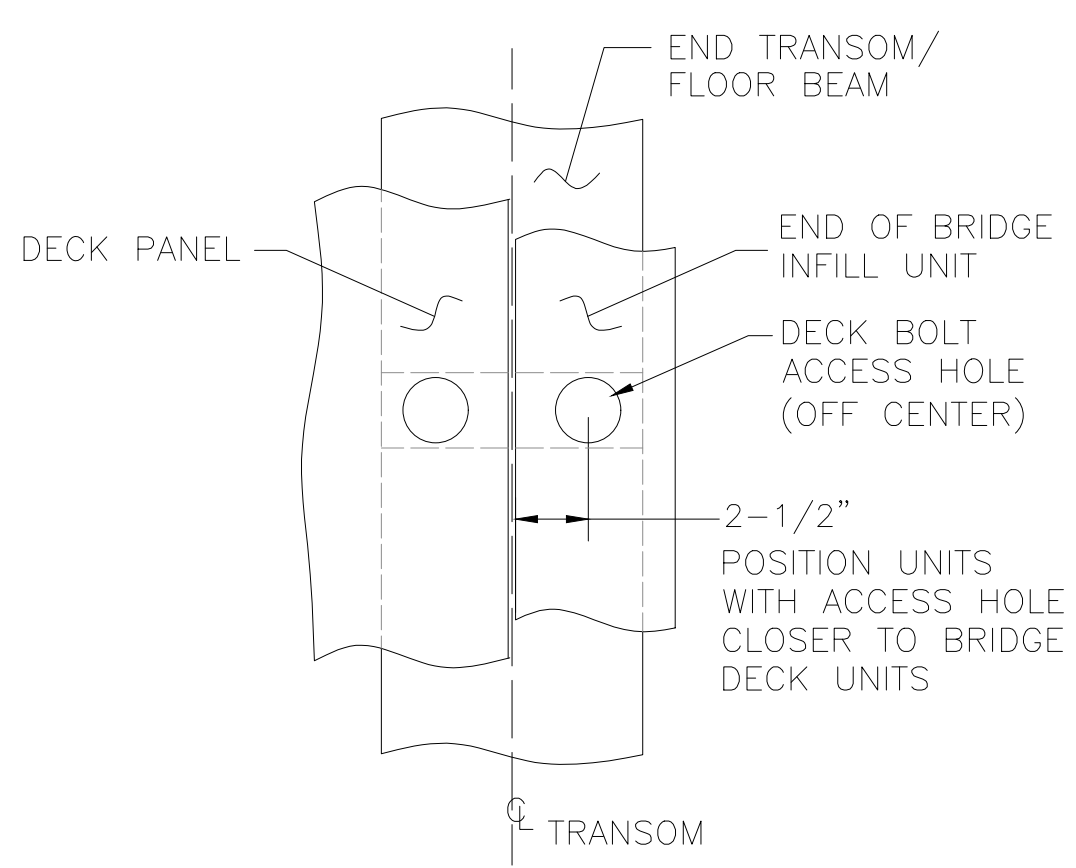
MIN. 3x3x3/8"
KEEPER ANGLE

DO NOT INSTALL ANCHOR
BOLTS IN EXPANSION
BEARING PLATE

1-INCH HOLES AND 7/8-INCH BOLTS (TYP.)*
SEE STRUCTURAL DRAWING S201.

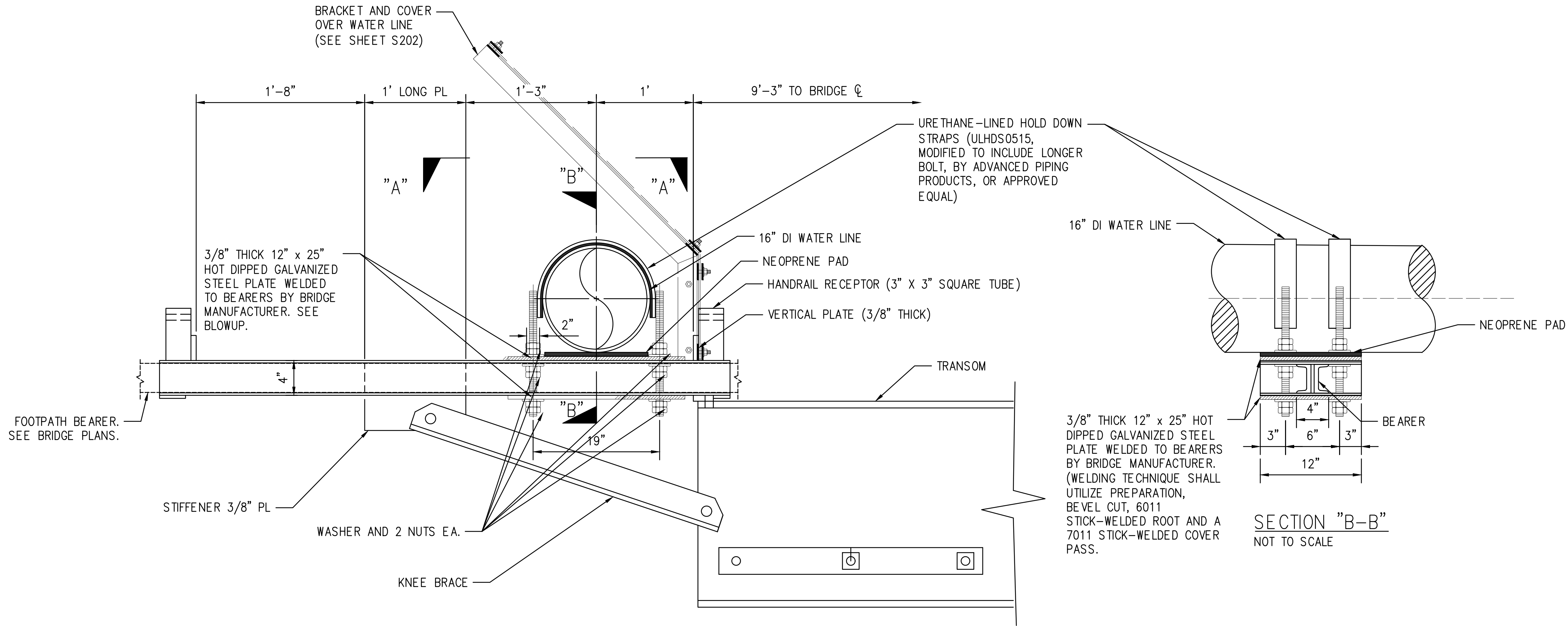


EXPANSION END - BEARING DETAIL

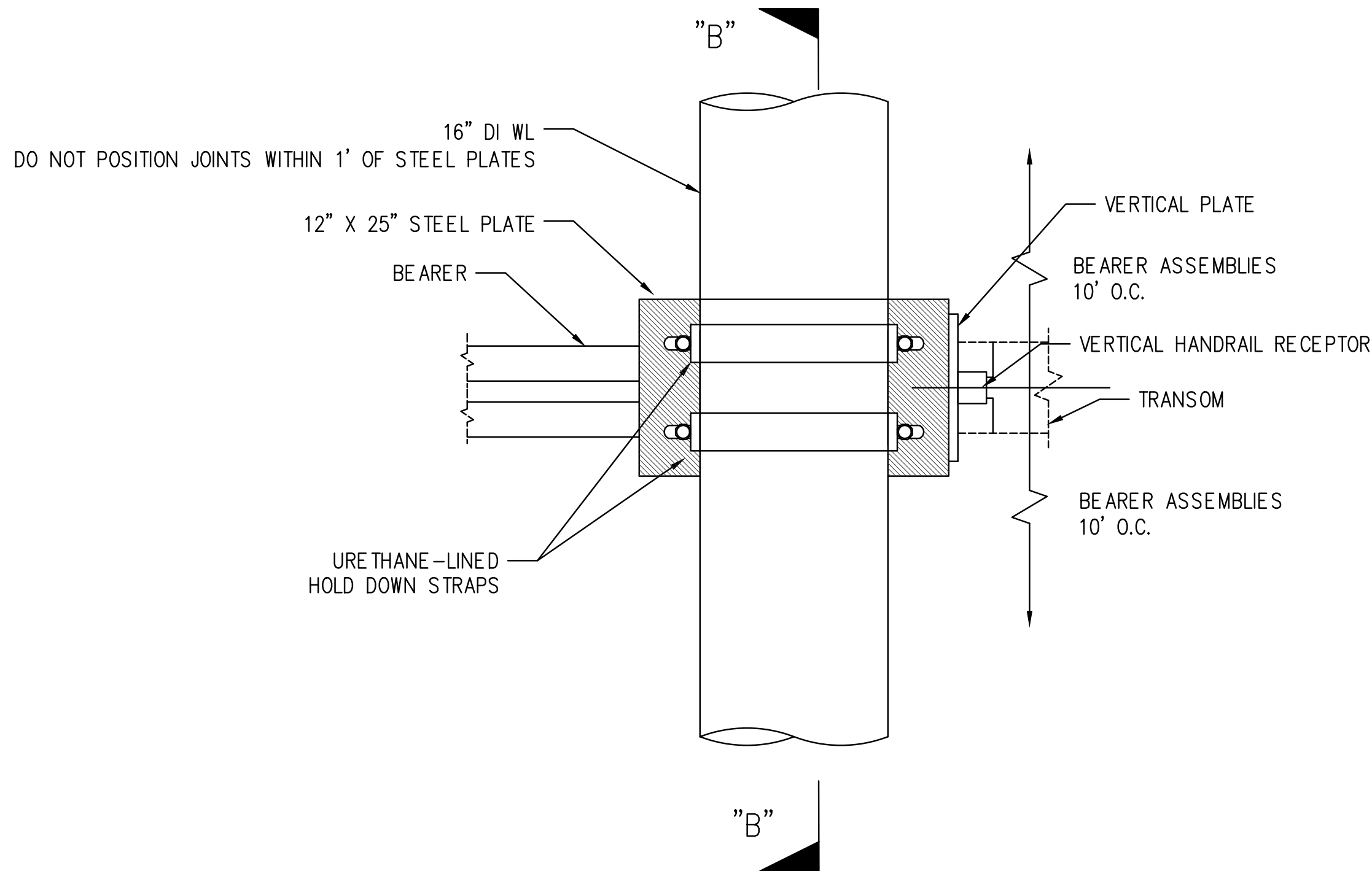


THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION		BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU	
SIGNATURE Exp: 4/30/24		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
DRAWN BY: RE		ENGINEER: DB	
CHECKED BY: DB		FILE NO:	
FIELD BOOK NO:		SCALE: AS INDICATED	
SHEET 26 OF SHEETS		DATE: 2023	
FILE	POCKET	FOLDER	NO.

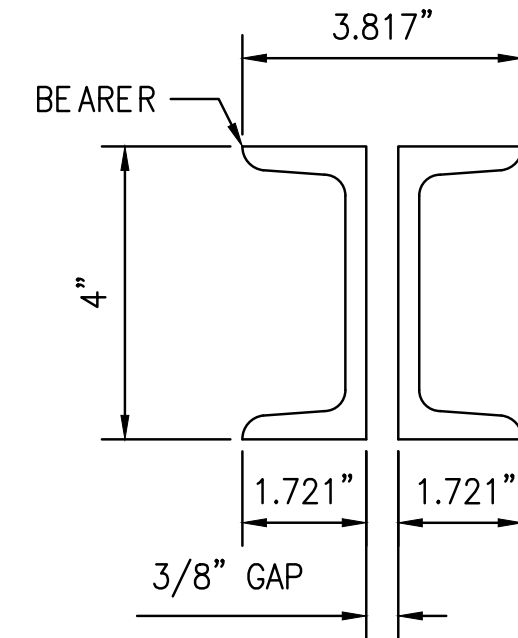
C506



ELEVATION DETAIL
NOT TO SCALE



PLAN VIEW SECTION "A-A"
NOT TO SCALE

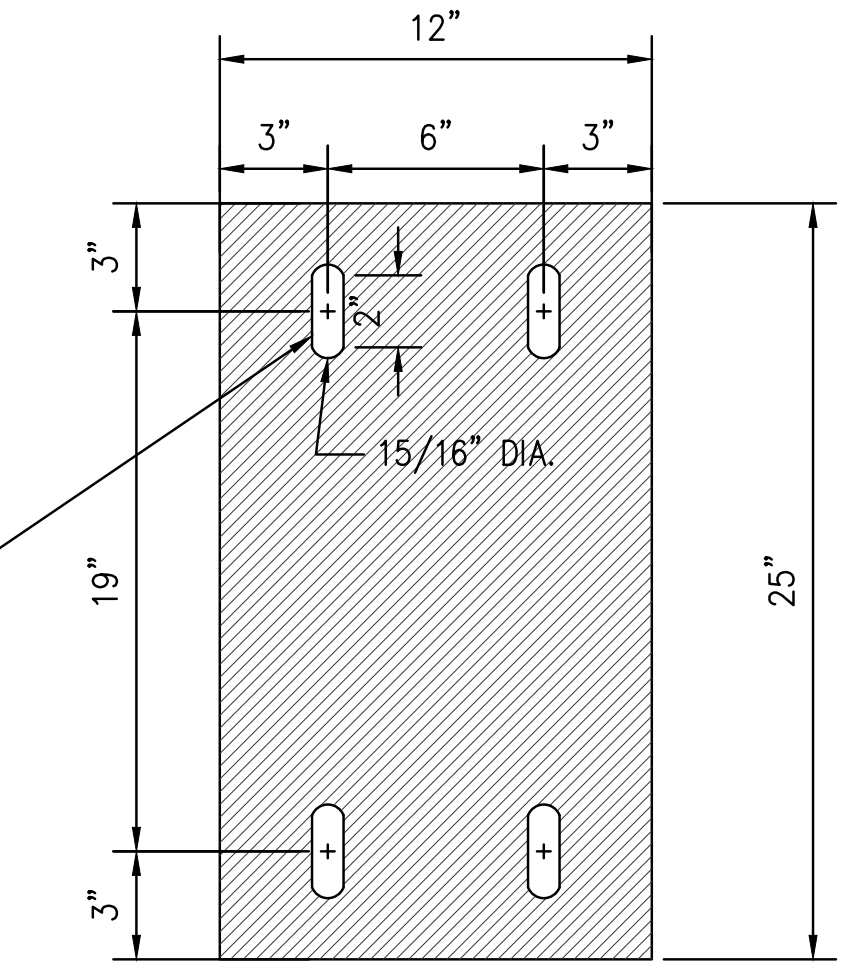


BEARER DIMENSIONS
NOT TO SCALE

NOTES:

- HOLD DOWN STRAP TO BE HOT-DIPPED GALVANIZED
- LINER TO BE APP-UT80A URETHANE OR APPROVED EQUAL

2" LONG (CENTER-CENTER) HOLE SLOTS FOR 7/8" BOLTS. HOLES TO BE VERIFIED WITH HOLD-DOWN STRAP MANUFACTURER PRIOR TO SUBMITTING SHOP DRAWINGS.



12" X 25" HOT DIPPED GALVANIZED
STEEL PLATE BLOW UP
NOT TO SCALE

Details of Bridge design shall be deferred submittals, per sec. 107.3.4.1 2012 IBC and local amendments

C507

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION		BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU	
JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII		WATER LINE TIE-DOWN STRAP DETAILS	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2023	
DRAWN BY: RE	ENGINEER: DB	CHECKED BY: DB	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET 27 OF _____	SHEETS
FILE	POCKET	FOLDER	NO.

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE AS AMENDED BY CHAPTER 16 OF THE REVISED ORDINANCES OF HONOLULU.

2. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE DRAWINGS AND SPECIFICATIONS.

3. THE GENERAL NOTES AND TYPICAL DETAILS SHALL APPLY UNLESS OTHERWISE SHOWN.

4. DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALES SHOWN ON DRAWINGS.

5. DRAWINGS INDICATE GENERAL AND TYPICAL DETAILS OF CONSTRUCTION. WHERE CONDITIONS ARE NOT SPECIFICALLY INDICATED BUT ARE OF SIMILAR CHARACTER TO DETAILS SHOWN, SIMILAR DETAILS OF CONSTRUCTION SHALL BE USED, SUBJECT TO REVIEW BY THE ENGINEER.

6. ALL INFORMATION SHOWN ON THE DRAWINGS RELATIVE TO EXISTING CONDITIONS IS GIVEN AS THE BEST PRESENT KNOWLEDGE, BUT WITHOUT GUARANTEE OF ACCURACY. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS PRIOR TO THE START OF THE JOB AND NOTIFY ALL DISCREPANCIES TO THE ARCHITECT.

7. ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT BEFORE PROCEEDING WITH ANY WORK SO INVOLVED.

8. DURING THE CONSTRUCTION PERIOD THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF THE BUILDING AND THE PROTECTION OF ADJACENT PROPERTIES, STRUCTURES, STREETS AND UTILITIES FROM DAMAGE. THE CONTRACTOR SHALL PROVIDE ADEQUATE SHORING, BRACING AND GUYS IN ACCORDANCE WITH ALL NATIONAL, STATE AND LOCAL SAFETY

9. ALL ERECTION PROCEDURES SHALL CONFORM TO OSHA STANDARDS. ANY DEVIATION MUST BE APPROVED BY OSHA

10. THE CONTRACTOR SHALL NOTIFY THE OFFICER-IN CHARGE TWO (2) WORKING WEEKS PRIOR TO BEGINNING ANY WORK WHICH WILL CONCEAL STRUCTURAL ELEMENT SUCH AS POURING CONCRETE (CONCEALING REINFORCING).

FOUNDATION / RETAINING WALL

1. FOUNDATION DESIGN IS BASED ON THE GEOTECHNICAL ENGINEERING EXPLORATION REPORT TITLED '...' BY... DATED...

2. FOUNDATIONS SHALL BEAR ON THE RECOMPACTED INSITU STIFF TO VERY STIFF SILTY CLAY. FOOTING SUBGRADES SHALL BE RECOMPACTED TO A MINIMUM OF 95 PERCENT RELATIVE COMPACTION. SOFT OR LOOSE MATERIAL ENCOUNTERED AT THE BOTTOM OF FOOTING EXCAVATIONS SHALL BE OVEREXCAVATED TO EXPOSE FIRM MATERIAL OR TO A MAXIMUM DEPTH OF TWO FEET THEN BACKFILLED WITH SELECT GRANULAR MATERIALS, MOISTURE CONDITIONED TO ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% OF RELATIVE COMPACTION PER ASTM D1557.

3. THE FOUNDATIONS SHALL BE EMBEDDED A MINIMUM OF 24 INCHES BELOW THE LOWEST ADJACENT FINISH GRADES. FOR SLOPING GROUND CONDITIONS THE FOOTING SHALL EXTEND DEEPER TO OBTAIN A MINIMUM 6 FOOT SETBACK DISTANCE MEASURED FROM THE OUTSIDE EDGE OF FOOTING TO FACE OF SLOPE.

4. BACKFILL BEHIND RETAINING WALLS SHALL BE ONSITE GRANULAR SOIL OR SELECT GRANULAR BACKFILL MATERIALS. THE BACKFILL MATERIAL FROM THE TOP OF FOOTING TO THE BOTTOM OF THE WEEP HOLES SHALL CONSIST OF RELATIVELY IMPERVIOUS MATERIAL. IN ADDITION, THE TOP 12 INCHES OF BACKFILL SHALL CONSIST OF RELATIVELY IMPERVIOUS MATERIALS TO REDUCE WATER INFILTRATION BEHIND THE RETAINING WALL.

5. THE BACKFILL MATERIAL SHALL BE PLACED IN 8 INCH LOOSE LIFTS, MOISTURE CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO BETWEEN 90 TO 95 PERCENT RELATIVE COMPACTION.

6. ALL WATER, MUD AND DEBRIS SHALL BE REMOVED FROM THE BOTTOM OF FOOTING EXCAVATIONS PRIOR TO THE PLACEMENT OF CONCRETE.

7. WEEPHOLES, 4 INCHES IN DIAMETER, SHALL BE PLACED AT CORNERS AND SPACED NOT MORE THAN 6 FEET ON CENTER HORIZONTALLY AND VERTICALLY ALONG WALLS. A 12" THICK INCH MINIMUM SECTION OF CONTINUOUS DRAIN ROCK SHALL BE PLACED ALONG THE ENTIRE LENGTH OF WALLS CONNECTING THE WEEPHOLES.

8. DRAIN ROCK SHALL BE WRAPPED IN A GEOTEXTILE FILTER FABRIC SUCH AS MIRAFI 140N OR SIMILAR AND SHALL CONFORM TO THE FOLLOWING GRADATION:

SIEVE SIZE	% PASSING BY DRY WEIGHT
1-1/2 INCH	90 - 100
3/4 INCH	50 - 100
NO. 4	0 - 50
NO. 200	0 - 5

STANDARD SIZE AGGREGATES NO. 6, 57 AND 67 AND 1-1/2 INCH FILTER MATERIALS SHOULD SATISFY THIS GRADATION REQUIREMENT.

9. AN ASPHALT EMULSION SEALER/ DAMP PROOFING SHALL BE APPLIED ON THE RETAINING SIDE OF THE STEM WALL/ FOOTING JOINT. THE SEALER SHALL EXTEND A MINIMUM OF SIX INCHES ON THE WALL AND FOOTING.

REINFORCED CONCRETE

1. ALL CONCRETE WORK SHALL CONFORM TO ACI 318-11.

2. ALL CONCRETE SHALL BE NORMAL WEIGHT (150 PCF) WITH AGGREGATES CONFORMING TO ASTM C-33. UNLESS OTHERWISE NOTED, THE COMPRESSIVE STRENGTHS OF CONCRETE AT 28 DAYS AND MAXIMUM AGGREGATE SIZES SHALL BE AS FOLLOWS:

	STRENGTH	AGGREGATE SIZE
FOOTING	3,500 PSI (DWS3500)	3/4"
WALL	3,500 PSI (DWS3500)	3/4"

3. MAXIMUM WATER-CEMENT RATIO SHALL NOT EXCEED 0.55.

4. ALL REINFORCING STEEL EXCEPT TIES AND STIRRUPS SHALL CONFORM TO ASTM A615 GRADE 60. TIES, STIRRUPS AND REBARS TO BE WELDED SHALL BE ASTM A615 GRADE 40.

5. UNLESS OTHERWISE NOTED, SPLICES, LAPS, DOWEL EXTENSIONS AND EMBEDMENTS SHALL BE 48 BAR DIAMETERS BUT NOT LESS THAN 24" MINIMUM.

6. ALL REINFORCING BARS MARKED CONTINUOUS (CONT.) ON THE PLANS SHALL BE LAPPED 48 BAR DIAMETERS MINIMUM. BUT NOT LESS THAN 2'-0".

7. STAGGER ALL SPLICES WHERE POSSIBLE.

8. REBARS SHALL BE SUPPORTED, BENT AND PLACED AS PER 'MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES' ACI 315 (LATEST).

9. MINIMUM COVER IN INCHES FOR REBARS FOR CAST-IN-PLACE CONCRETE:

CONCRETE CAST AGAINST EARTH	3"
FORMED CONCRETE EXPOSED TO EARTH OR WEATHER:	
#5 AND SMALLER	1-1/2"
#6 AND LARGER	2"

CONCRETE NOT EXPOSED TO EARTH OR WEATHER:	
SLABS, WALLS, AND JOISTS	3/4"
BEAMS AND COLUMNS	1-1/2"

10. WELDED WIRE FABRIC SHALL BE GALVANIZED AND CONFORM TO ASTM A-185.

11. UNLESS OTHERWISE SHOWN LAP OUTERMOST CROSS WIRES OF EACH SHEET OF WELDED WIRE FABRIC ONE SPACING OF CROSS WIRES PLUS 2' MINIMUM.

12. AT TIME CONCRETE IS PLACED, REINFORCING SHALL BE FREE FROM MUD, OIL, LAITANCE OR OTHER COATINGS ADVERSELY AFFECTING BOND CAPACITY.

13. REINFORCEMENT, ANCHOR BOLTS, SIMPSON CONNECTORS, DOWELS AND ALL OTHER EMBEDDED ITEMS SHALL BE POSITIVELY SECURED BEFORE POURING.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL PIPES SHALL CONFORM TO ASTM A53 GRADE B. CHANNELS, ANGLES, PLATES, BARS AND MISCELLANEOUS STEEL SHAPES SHALL CONFORM TO ASTM A-36. FABRICATION AND ERECTION SHALL BE IN ACCORDANCE WITH THE A.I.S.C. SPECIFICATIONS FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, LATEST EDITION. SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION.

2. ALL BOLTS SHALL CONFORM TO ASTM A307.

3. WELDING: ALL WELDING IS TO COMPLY WITH AWS. SPECIFICATIONS AND IS TO BE DONE BY CERTIFIED WELDERS. ALL WELDING IS TO BE DONE BY ELECTRIC ARC PROCESS AND SHALL BE PERFORMED WITH APPROVED ELECTRODES AS REQUIRED BY I.B.C. WELDS ARE DESIGNED AT FULL STRESS AND MUST BE DONE IN THE SHOP OF A LICENSED FABRICATOR.

4. ALL WELDS NOT SHOWN SHALL BE FULL PENETRATION WELDS CAPABLE OF DEVELOPING THE FULL STRENGTH OF THE CONNECTING MEMBERS.

5. THE CONTRACTOR SHALL DETAIL ALL MEMBERS AND CONNECTIONS NOT SHOWN AND SHALL SUBMIT THEM TO THE ENGINEER FOR REVIEW AND APPROVAL. COST OF THESE MEMBERS AND CONNECTIONS SHALL BE INCLUDED IN THE CONTRACTOR'S BID PRICE.

6. GALVANIZE ALL STRUCTURAL STEEL SHAPES, PLATES, BOLTS AND ACCESSORIES.

DESIGN CRITERIA

1. CODES: 2018 INTERNATIONAL BUILDING CODE

FOUNDATION DESIGN CRITERIA	
ALLOWABLE BEARING	4,000 PSF
PASSIVE RESISTANCE	290 PCF
COEFFICIENT OF FRICTION	0.35
RETAINING WALL	
ACTIVE PRESSURE	38 PCF
LEVEL BACKFILL	

4. LIVE LOADS

AS NOTED ON BRIDGE DRAWINGS

VEHICLE SURCHARGE ON ABUTMENT BACKFILL 4 FEET

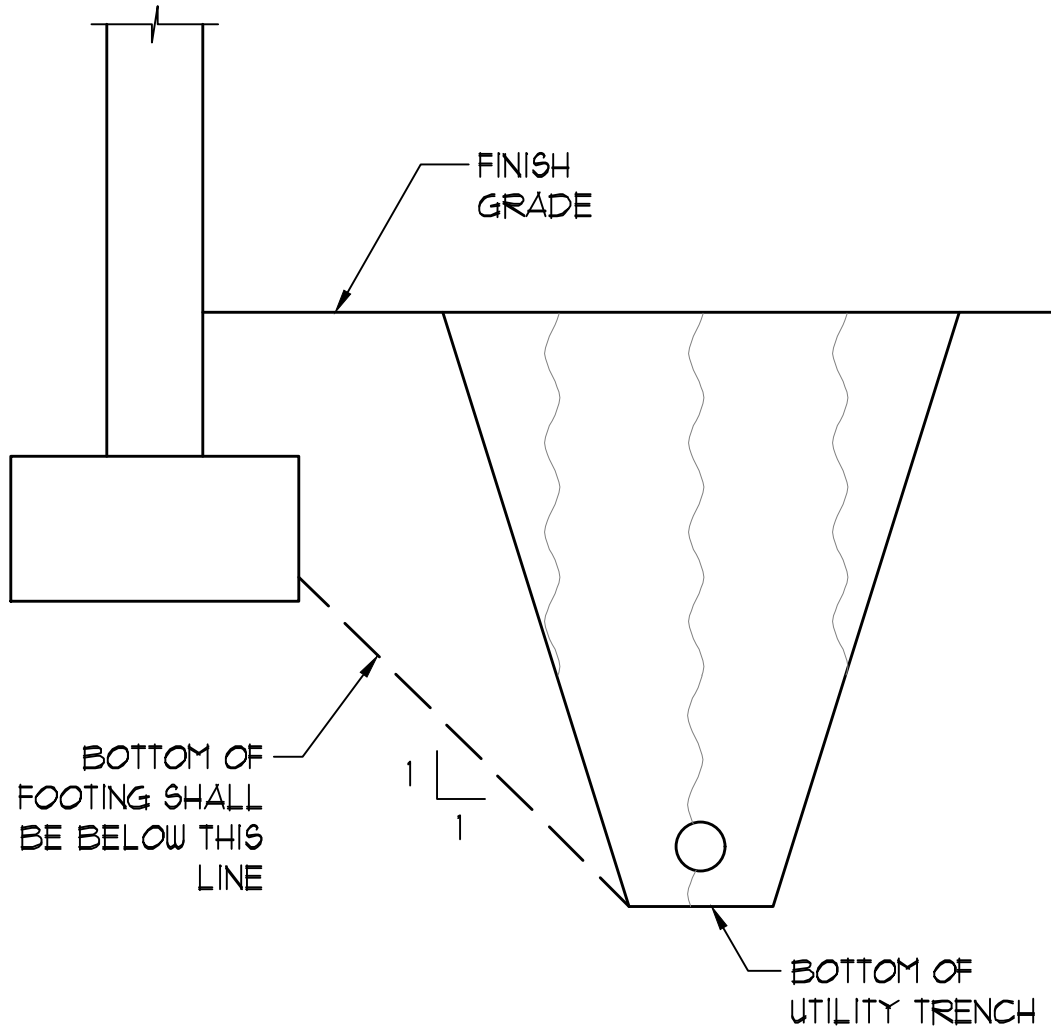
VEHICLE SURCHARGE ON WALL AT ROAD 2 FEET

3. LATERAL FORCES	
SEISMIC	
MAPPED SPECTRAL RESPONSE	
S _s	0.532
S ₁	0.145
SITE CLASS	D
S _{ps}	0.487
S _{pi}	0.224
SEISMIC IMPORTANCE FACTOR I	1.0
RISK CATEGORY	II
SEISMIC DESIGN CATEGORY	D

WIND	
RISK CATEGORY	II
BASIC WIND SPEED	
(3 SECOND GUST)	140 MPH
WIND EXPOSURE	B
K _{zt} TOPOGRAPHIC FACTOR	1.0
K _d DIRECTIONALITY FACTOR	0.10

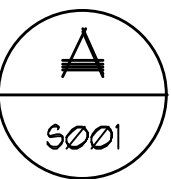
SPECIAL INSPECTION

1. ITEMS REQUIRING SPECIAL INSPECTION:
- REINFORCING STEEL (PERIODIC)
- EPOXY ANCHORS (CONTINUOUS)
- CONCRETE (2018 IBC TABLE 1105.3)
2. NOTIFY SPECIAL INSPECTOR 4 WORKING DAYS PRIOR TO NEED OF INSPECTION SERVICES.
3. THE CONTRACTOR SHALL BE FAMILIAR WITH THE SPECIAL INSPECTION REQUIREMENTS INCLUDING THE IDENTITY AND CONTACT INFORMATION OF THE SPECIAL INSPECTOR RESPONSIBLE FOR EACH REQUIREMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE SPECIAL INSPECTOR IN A TIMELY MANNER IF SPECIAL INSPECTIONS ARE NOT DONE. THE CERTIFICATE OF OCCUPANCY MAY NOT BE ISSUED BY THE COUNTY.



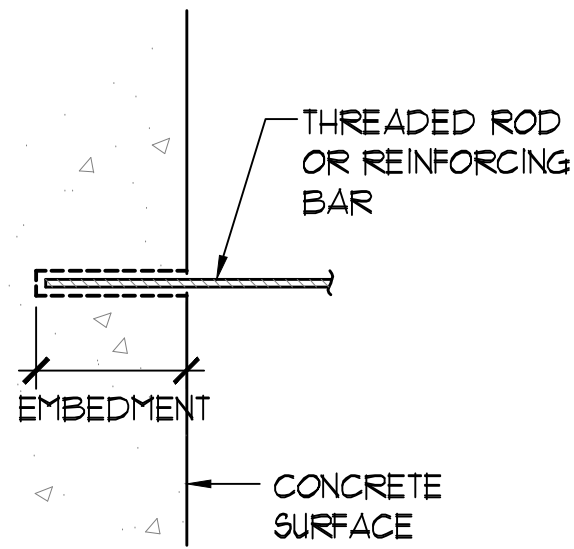
FOOTING ADJACENT TO UTILITY TRENCH

NO SCALE



S001

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	JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII			
	GENERAL NOTES AND TYPICAL DETAIL			
	APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: ____ 2021	
	DRAWN BY: MA	ENGINEER: AL	CHECKED BY: AL	FILE NO: _____
	FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET ____ OF ____	SHEETS
FILE	POCKET	FOLDER	NO.	

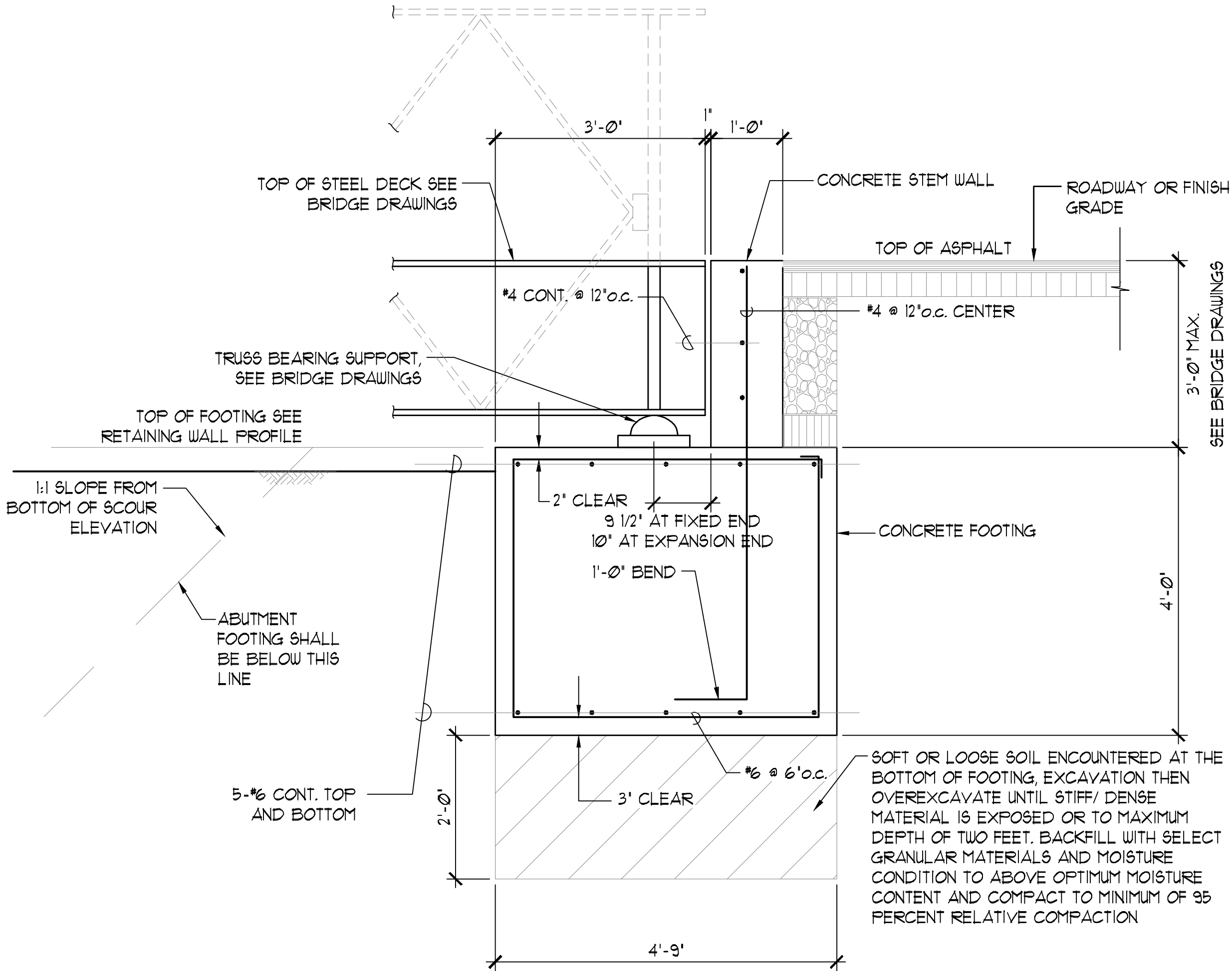
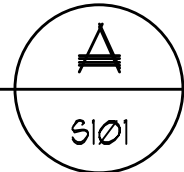


THREADED ROD (REBAR)	DRILL BIT DIAMETER	MINIMUM EMBEDMENT
1/2"φ (#4)	5/8"	4"
5/8"φ (#5)	3/4"	6"
3/4"φ (#6)	7/8"	7"
7/8"φ (#7)	1"	8"

- NOTES:
- PRE APPROVAL FOR SIMPSON STRONG TIE SET-XP EPOXY TIE ADHESIVE. ALL SUBSTITUTION REQUEST SHALL BE SUBMITTED WITH CURRENT ICC-ESR REPORT TO ENGINEER FOR REVIEW AND APPROVAL.
 - ALL THREAD ROD SHALL BE CARBON STEEL CONFORMING TO ASTM F1554, GRADE 36 HOT DIP GALVANIZED. REINFORCING BAR SHALL BE ASTM A615 GRADE 60.
 - PRE DRILL HOLE WITH DRILL BIT COMPLYING WITH ANSI B212.5-1994.
 - CLEAN HOLE WITH OIL FREE COMPRESSED AIR (80 PSI MINIMUM) AND NYLON BRUSH.
 - FILL HOLE HALF TO TWO THIRDS FULL WITH ADHESIVE STARTING FROM BOTTOM, THEN INSERT ANCHOR TO BOTTOM OF HOLE AND TWIST CLOCKWISE TO ENSURE ADHESIVE COVERS THE ANCHOR SURFACE. ADHESIVE MUST BE LEVEL WITH CONCRETE SURFACE AFTER INSERTION OF ANCHOR.
 - ANCHOR INSTALLATION REQUIRES SPECIAL INSPECTION. CONTRACTOR SHALL USE SIMPSON ARC (ADHESIVE RETAINING CAP) AS NEEDED FOR HORIZONTAL AND OVERHEAD APPLICATIONS.
 - PROVIDE STANDARD WASHER UNDER NUT UNLESS NOTED OTHERWISE.

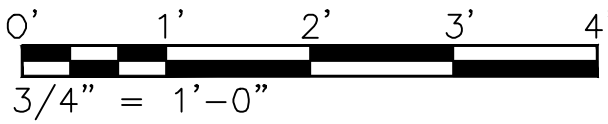
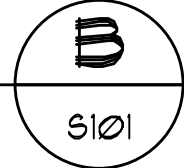
EPOXY ANCHOR DETAIL

NO SCALE



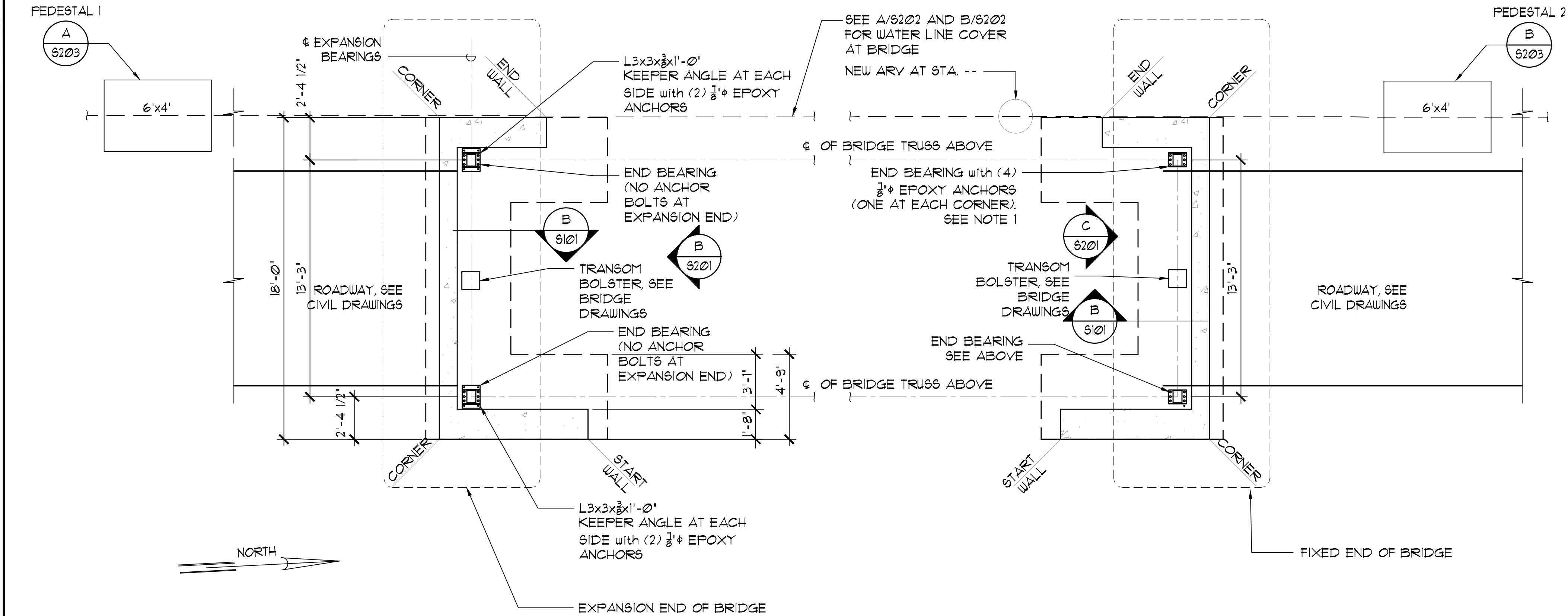
RETAINING WALL RW3.0 / BRIDGE ABUTMENT

SC: 3/4"=1'-0"



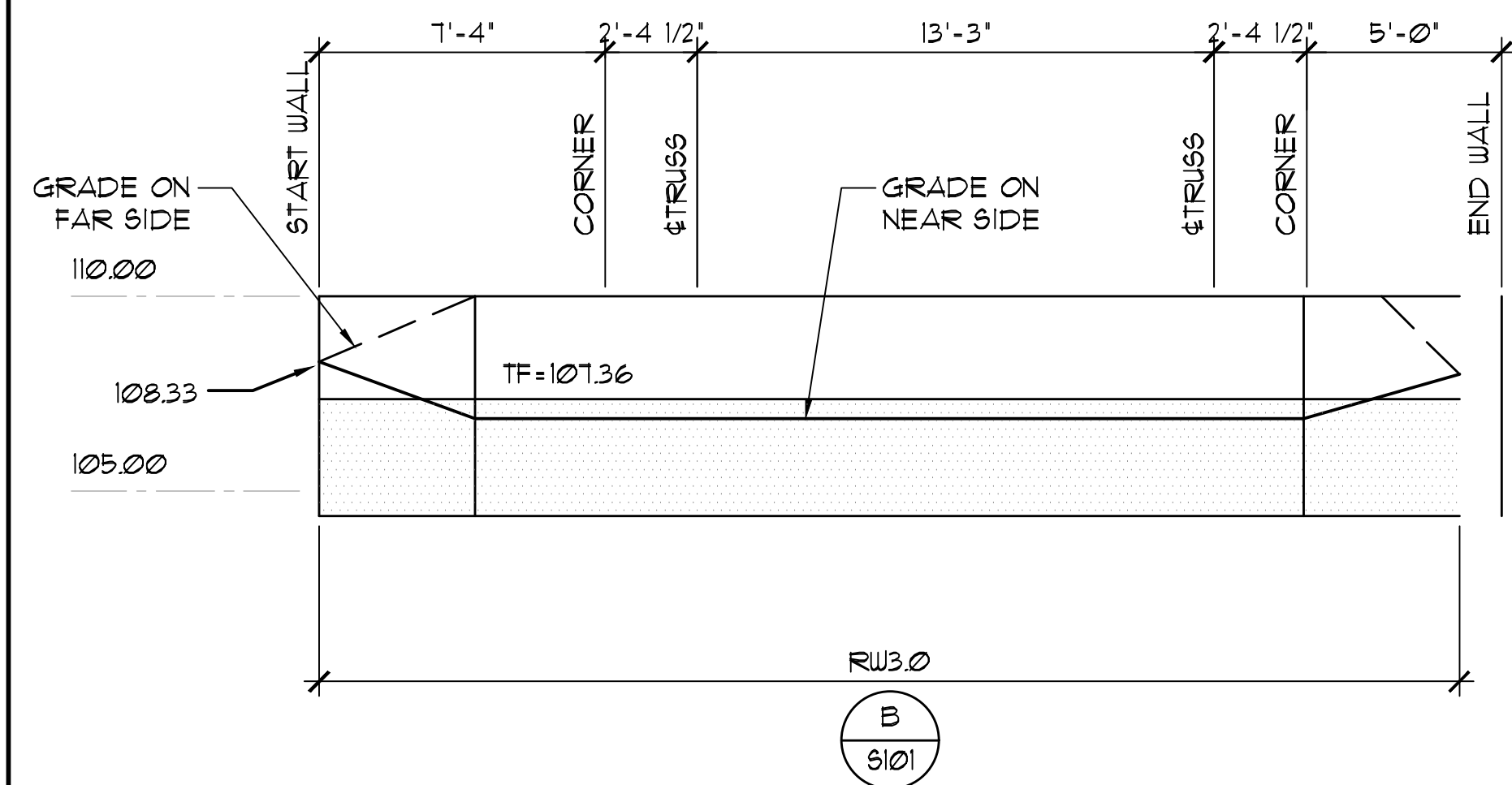
S101

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JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII		TYPICAL DETAILS	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2021	
DRAWN BY: MA	ENGINEER: AL	CHECKED BY: AL	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET _____ OF _____	SHEETS
FILE	POCKET	FOLDER	NO.

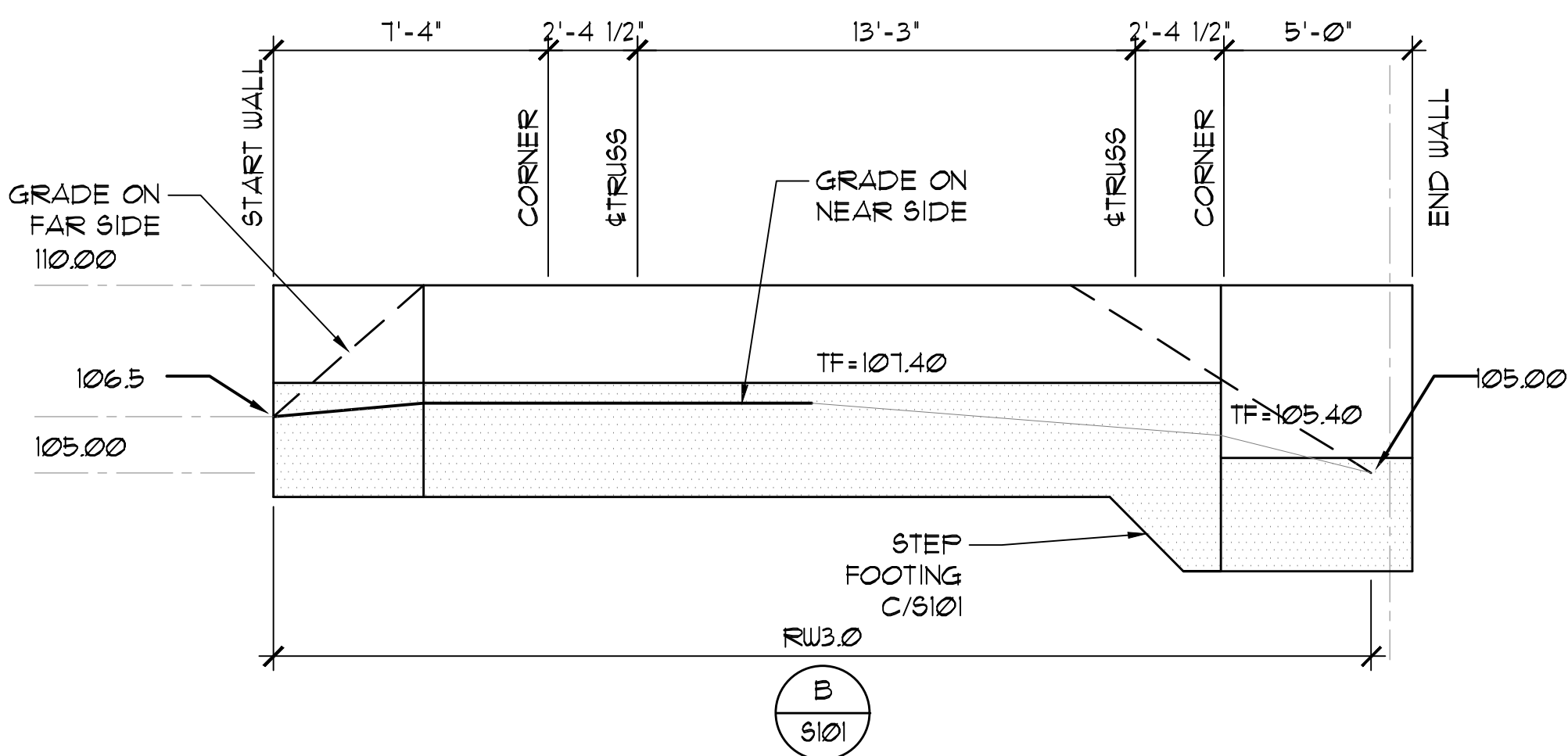


NOTE:
1. SIZE AND QUANTITY OF EPOXY ANCHORS TO BE VERIFIED BY THE ENGINEER OR RECORD ONCE THE BRIDGE STRUCTURAL CALCULATIONS HAVE BEEN SUBMITTED FOR APPROVAL.

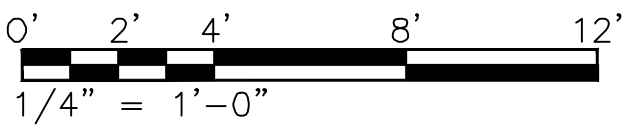
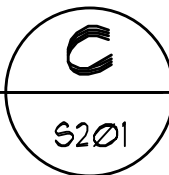
BRIDGE FOUNDATION PLAN
SC: 1/4"=1'-0"



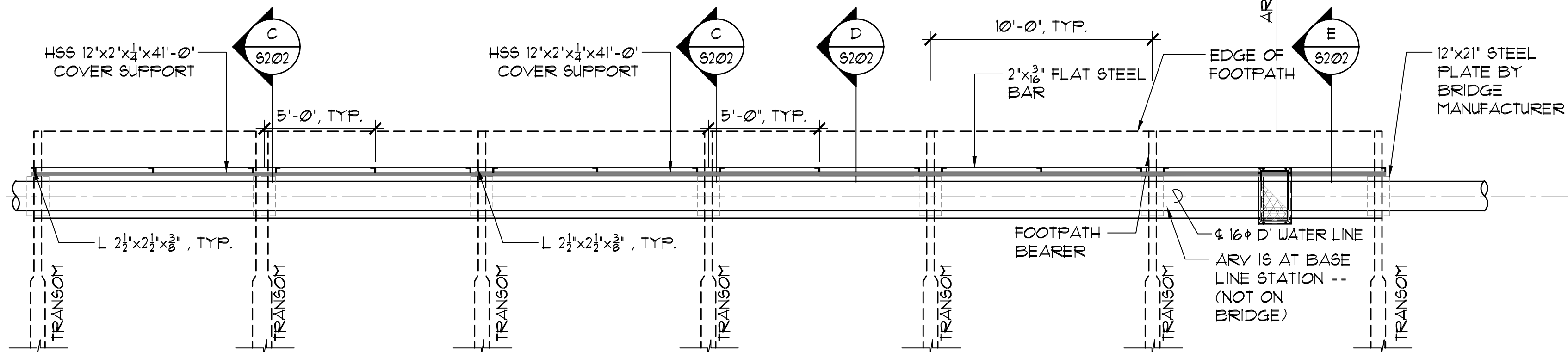
EXPANSION END RETAINING WALL PROFILE
SC: 1/4"=1'-0"



FIXED END RETAINING WALL PROFILE
SC: 1/4"=1'-0"

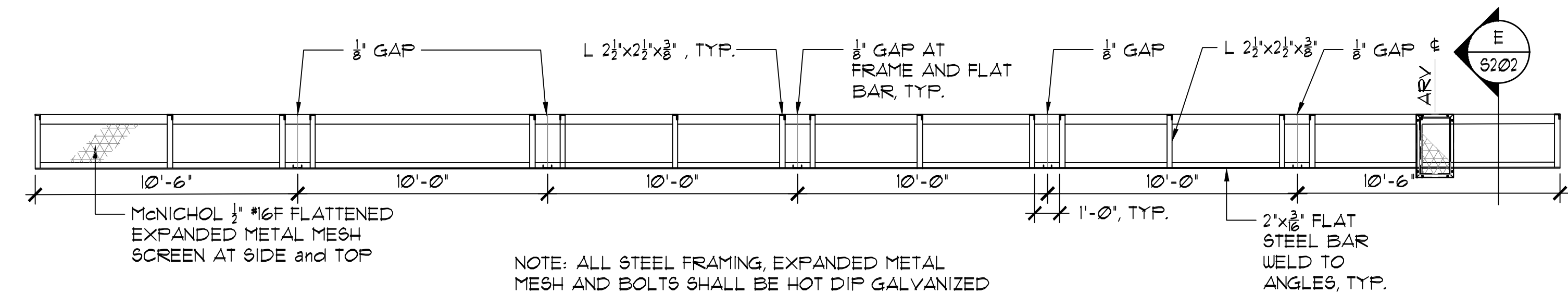


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SIGNATURE Exp: 4/30/22		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
APPROVED: _____		DATE: 2021	
DRAWN BY: MA		ENGINEER: AL	CHECKED BY: AL
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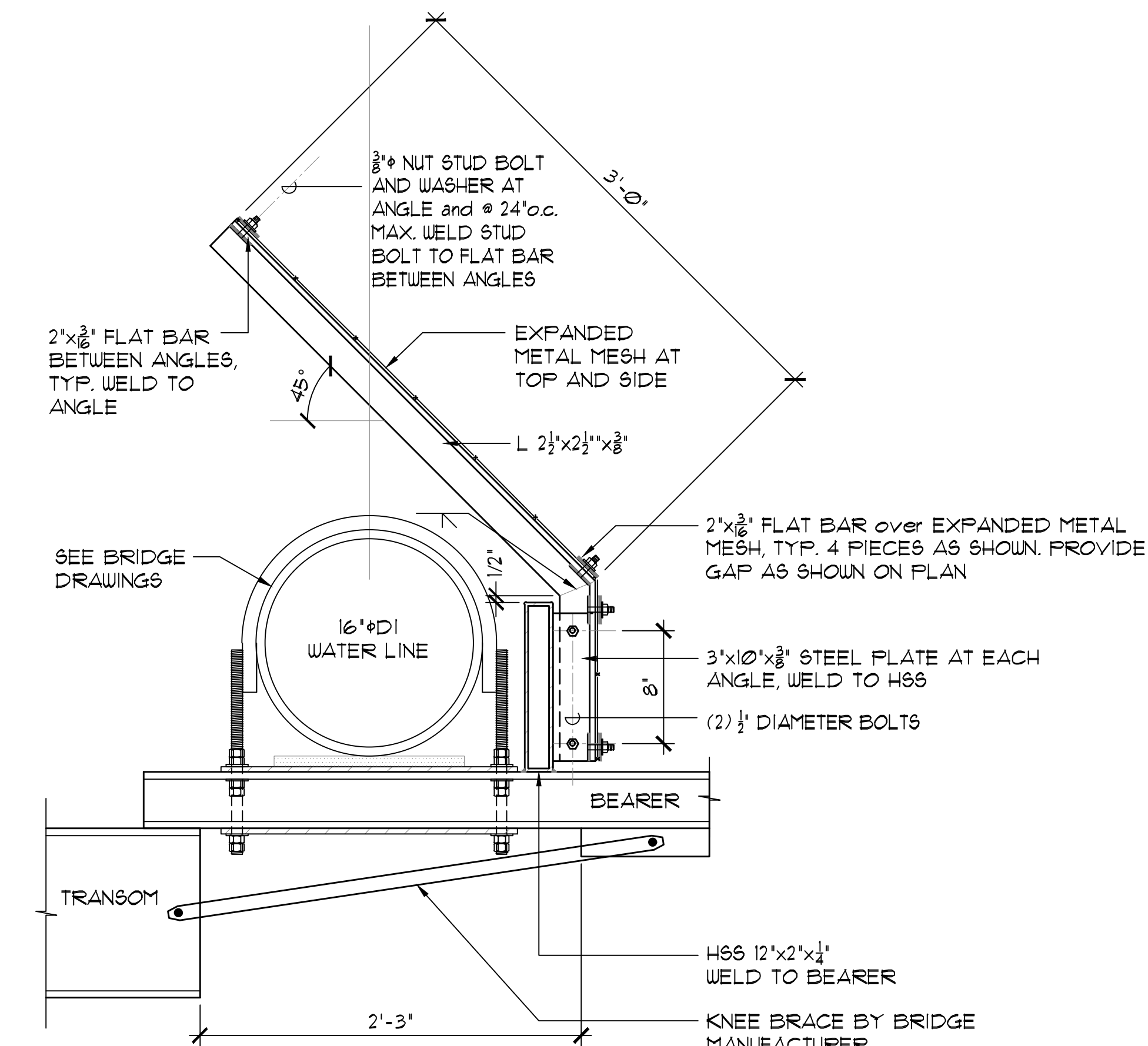
PLAN- PIPE COVER SUPPORT AT BRIDGE LEVEL

SC: 1/4"=1'-0"



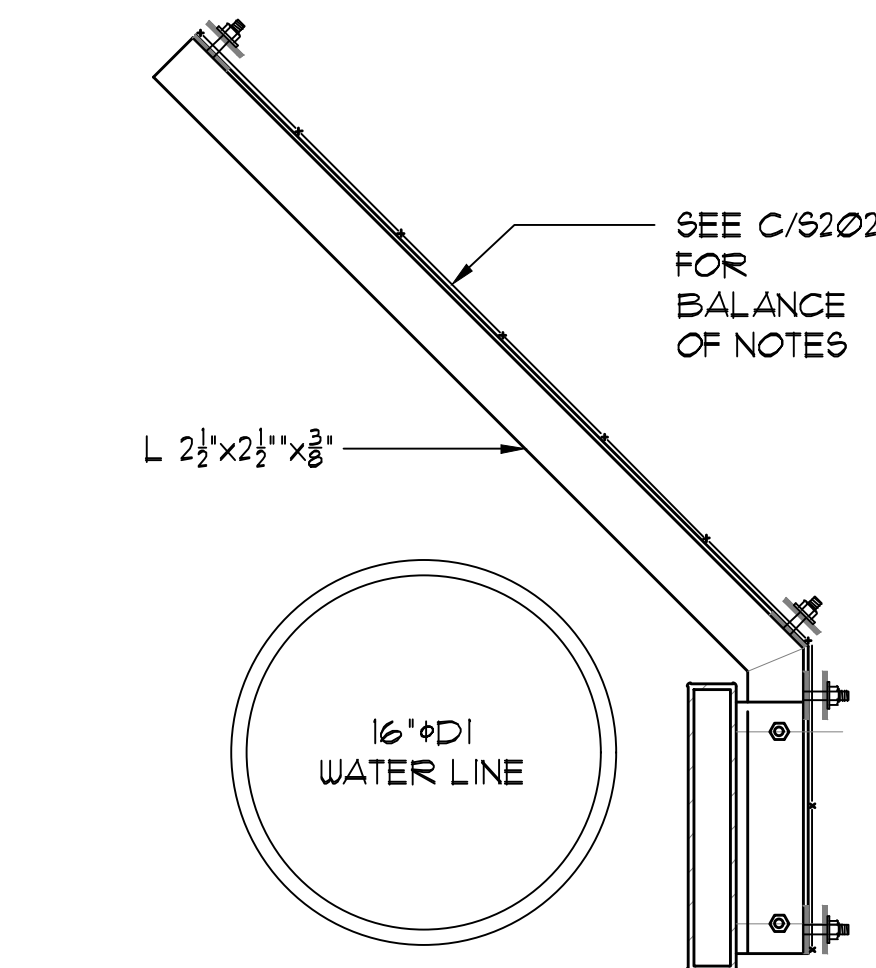
PLAN- COVER FRAMING PLAN

SC: 1/4"=1'-0"



BRACKET AT BEARER

SC: 1 1/2"=1'-0"



BRACKET BETWEEN BEARER

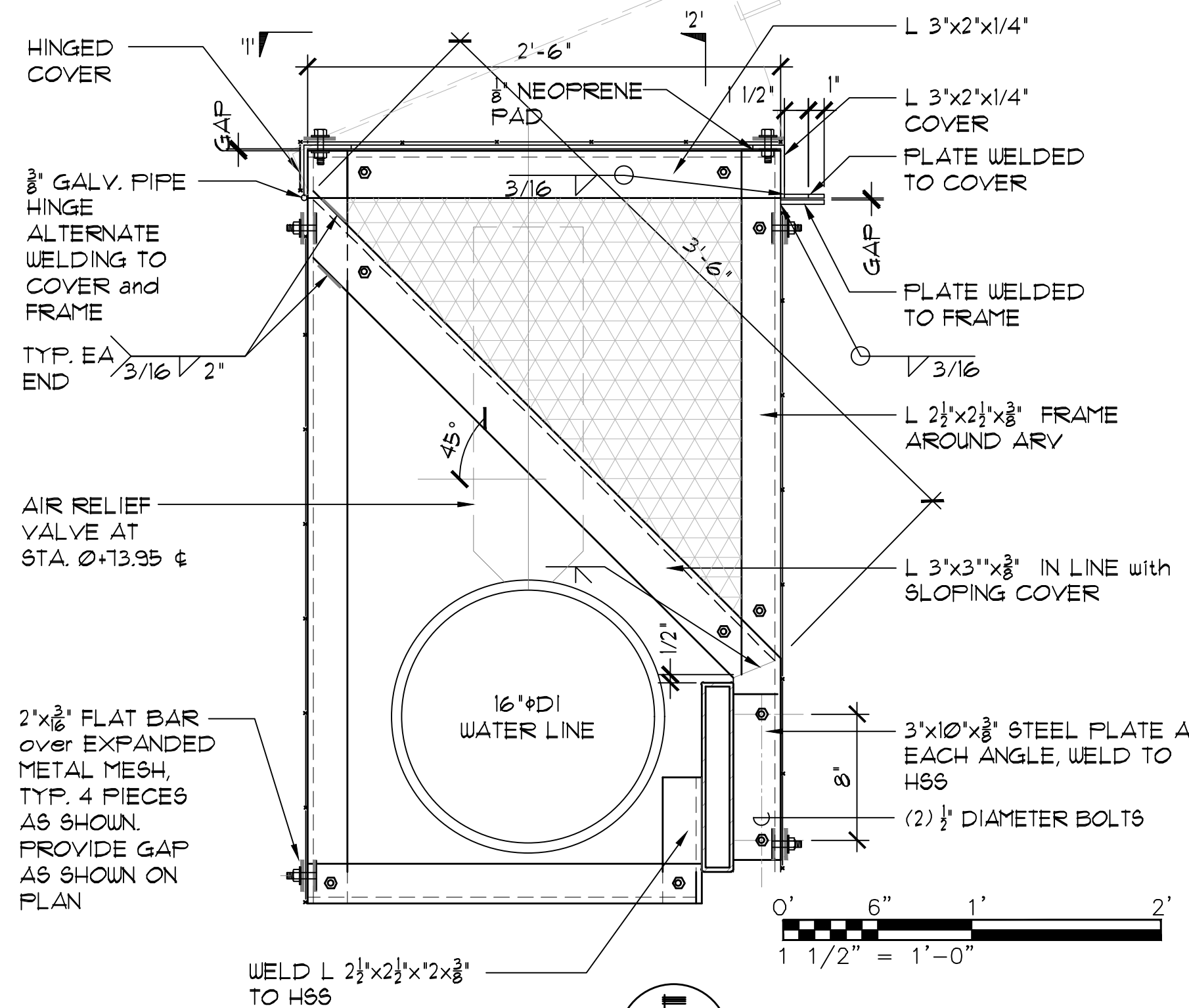
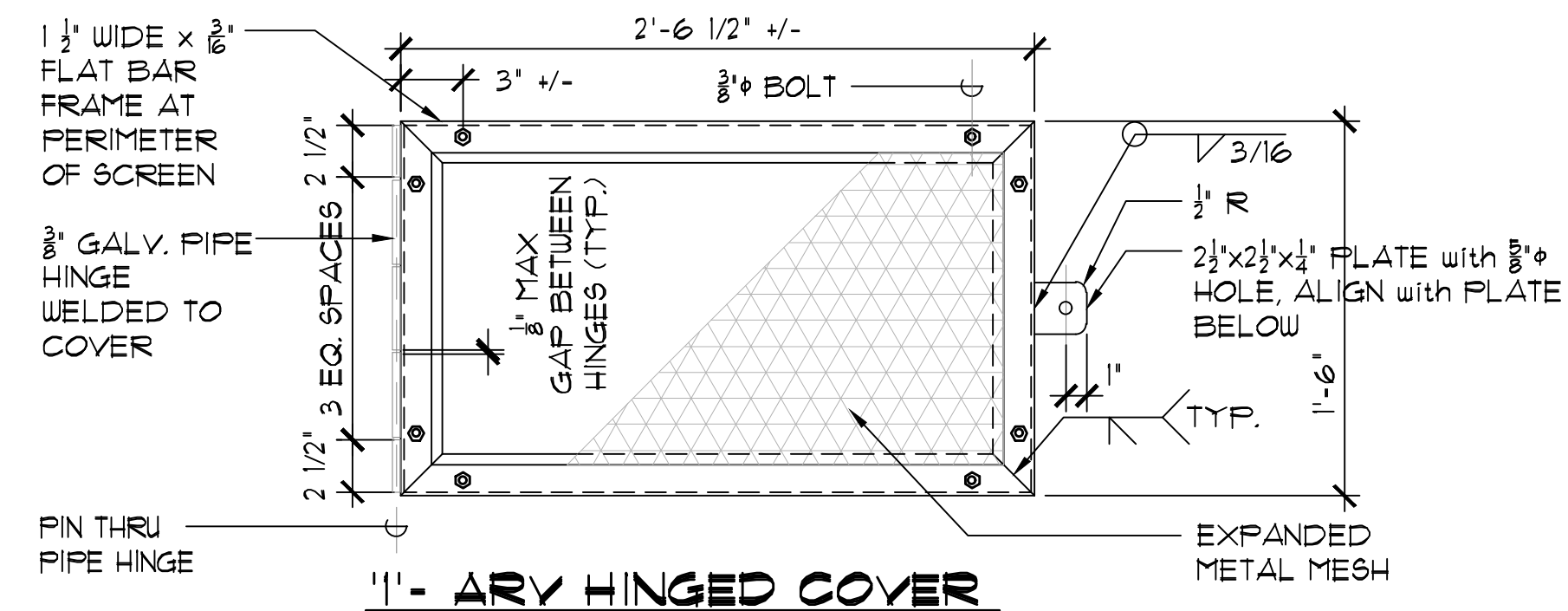
SC: 1 1/2"=1'-0"

A
S202

B
S202

AIR RELIEF VALVE BRACKET

SC: 1 1/2"=1'-0"



S202

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR
MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

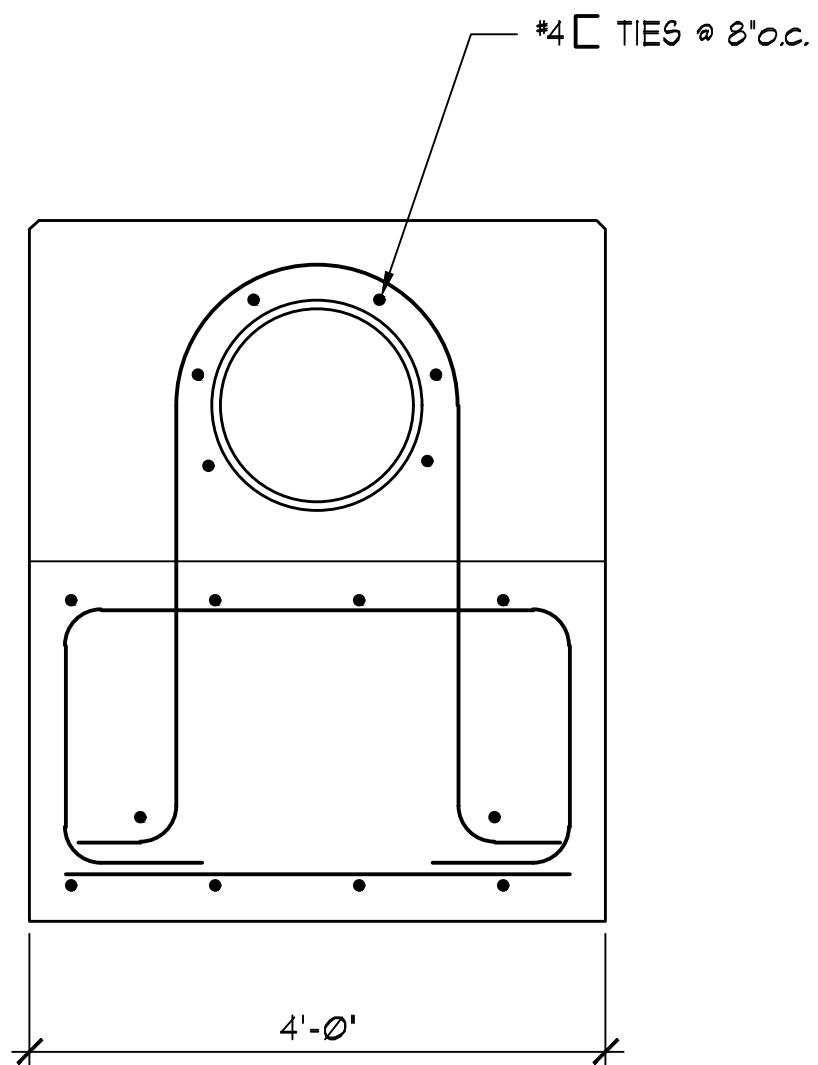
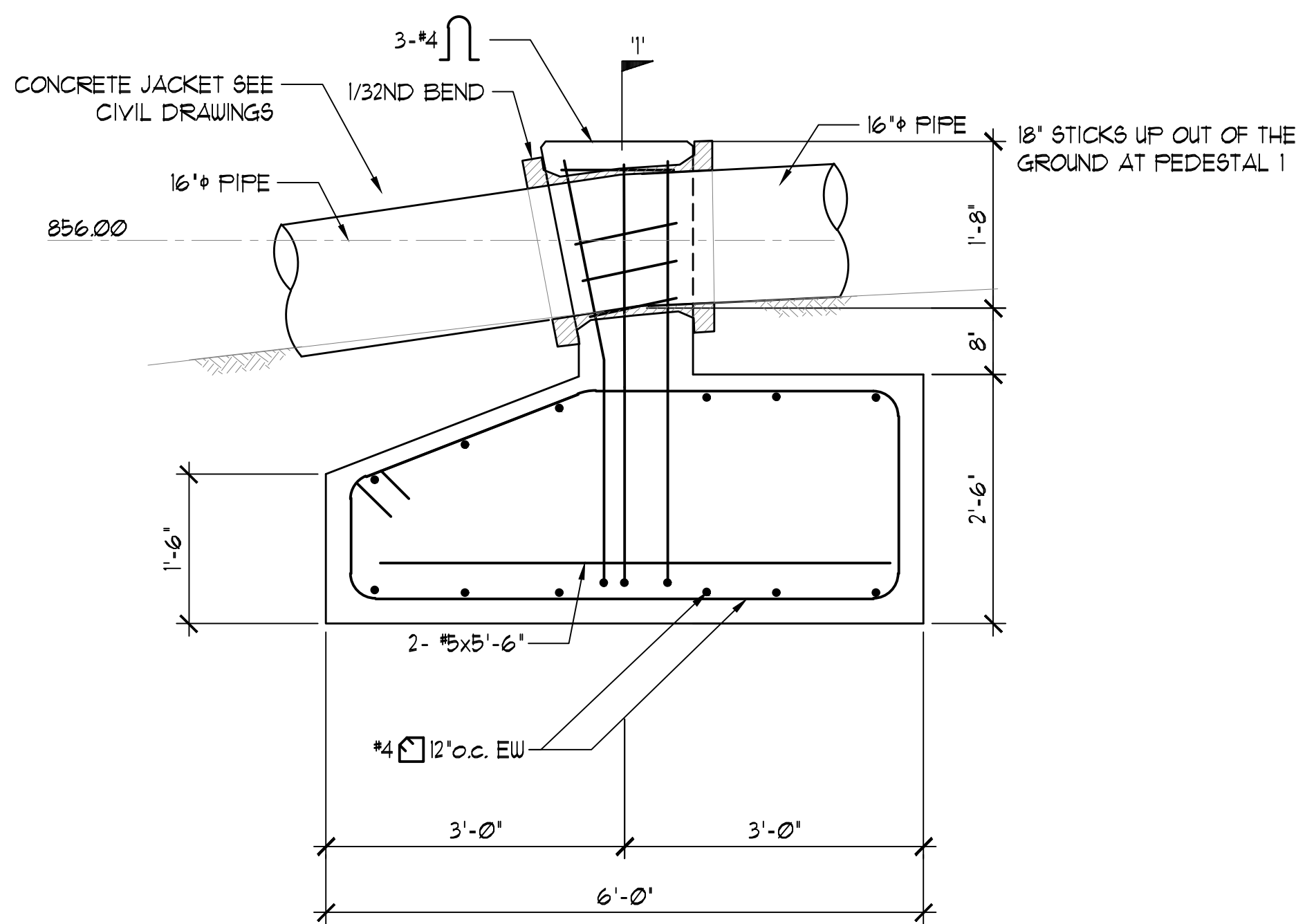
PIPE COVER PLAN AND DETAILS

APPROVED: _____ DATE: 2021

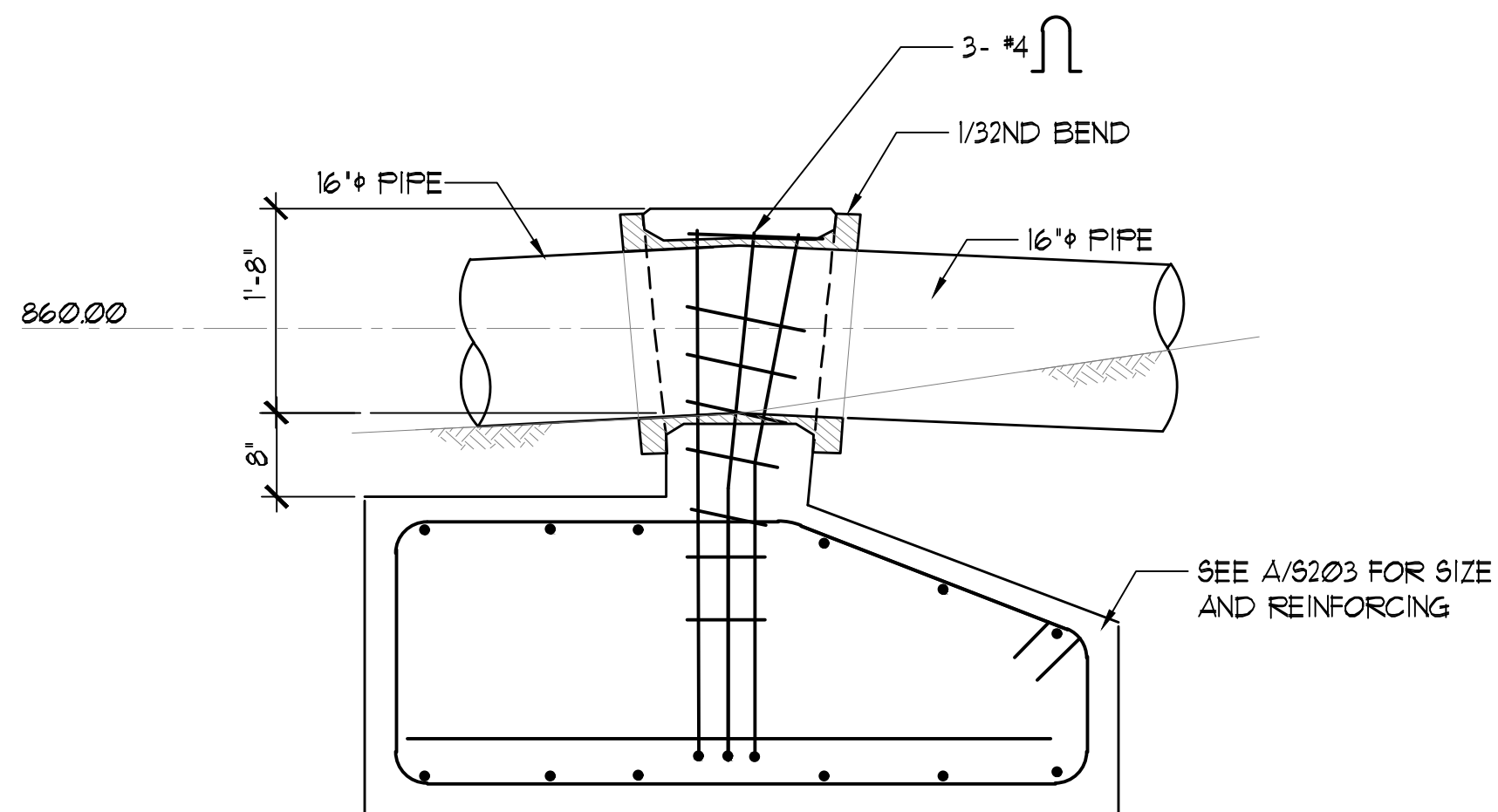
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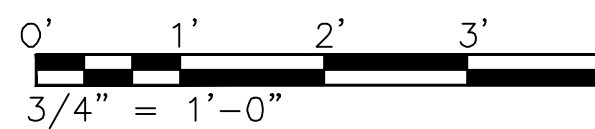


1' SECTION
SC: 3/4"=1'-0"



PEDESTAL 2
SC: 3/4"=1'-0"

PEDESTAL 1
SC: 3/4"=1'-0"



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SIGNATURE
Exp: 4/30/22

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR
MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

PEDESTAL 1 AND 2 DETAILS

APPROVED:	MANAGER AND CHIEF ENGINEER, BWS	DATE:	2021
DRAWN BY:	MA	ENGINEER:	AL
CHECKED BY:	AL	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET	OF SHEETS

FILE	POCKET	FOLDER	NO.

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Mon, 22 Nov 2021 1:00:20pm
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ELECTRICAL SYMBOLS		
EXIST SYMBOL	NEW SYMBOL	DESCRIPTION
		LARGE JUNCTION BOX, SIZE AS NOTED, WALL MTD
		ELECTRICAL OVERHEAD LINE
		TELECOMMUNICATIONS OVERHEAD LINE
		JOINT UTILITY POLE
		HTCO 2' X 6' PULLBOX. PROVIDE 2X6 PRECAST CONCRETE PULLBOX PER HTCO STD DWG NO. 34078. INSCRIBE COVER WITH "HTCO"
		HECO 4' X 6' HANDHOLE. PROVIDE 4X6 PRECAST CONCRETE PULLBOX PER HECO STD DWG NO. 101024. INSCRIBE COVER W/ "HECO"
		GUY WIRE AND ANCHOR
		CONDUIT CONCEALED IN SLAB OR BELOW GRADE
		EXPOSED CONDUIT
		FLEXIBLE METALLIC CONDUIT
		OVERHEAD UTILITY LINE
		ELECTRICAL DUCTLINE WITH DUCT SECTION DESIGNATORS; ITEMS IN CIRCLE INDICATES DUCT SECTION TYPE; DUCT DESIGNATORS IN ADJACENT CIRCLES INDICATES DUCTS INSTALLED IN COMMON TRENCH AND COMBINED CONCRETE ENCASEMENT WITH REQUIRED DUCT SEPARATIONS; DUCT DESIGNATION CUT LINE INDICATES VIEW OF DUCT SECTION; SHOWN WITH DUCT COMPLEMENTS TYPE "EA" DUCT SECTION WITH 2-5"E DUCTS AND TYPE "TA" DUCT SECTION WITH 2-4"T DUCTS IN COMMON TRENCH AND CONCRETE ENCASEMENT (E=ELECTRIC, T=TELEPHONE, V=CATV, L=STREET LIGHT, P=SECONDARY POWER);
		NOTE SYMBOL, SEE PLAN FOR NOTES

GENERAL NOTES:

- PLANS DO NOT INDICATE COMPLETE EXISTING ELECTRICAL CONDITIONS. CONTRACTOR SHALL VISIT JOBSITE TO BECOME FAMILIAR WITH ALL EXISTING CONDITIONS AND EXTENT OF DEMOLITION AND NEW WORK PRIOR TO THE START OF CONSTRUCTION.
- PRIOR TO THE START OF CONSTRUCTION, CONTRACTOR SHALL VISIT JOBSITE AND REPORT ANY DISCREPANCIES AND/OR DIFFERENCE IN DRAWINGS, WITH RESPECT TO EXISTING CONDITIONS, TO THE ENGINEER.
- CONTRACTOR SHALL RESOLVE ALL DISCREPANCIES AND QUESTIONS PRIOR TO THE START OF WORK. NO EXTRA PAYMENT SHALL BE ALLOWED ON ACCOUNT OF WORK MADE NECESSARY BY CONTRACTOR'S FAILURE TO VISIT THE SITE AND/OR FAILURE TO RESOLVE DISCREPANCIES AND QUESTIONS.
- BEFORE ANY ELECTRICAL WIRING IS CUT, CONTRACTOR SHALL VERIFY USAGE OF WIRING TO ENSURE THAT REQUIRED SERVICES ARE NOT DISCONTINUED.
- REMOVE ALL EXISTING EXPOSED CONDUIT AND WIRES NOT TO REMAIN IN SERVICE; CONCEALED RACEWAYS NO LONGER REQUIRED SHALL BE CUT, CAPPED AND ABANDONED IN PLACE WITH ALL WIRES REMOVED.
- PROVIDE METAL SEALS FOR ALL ABANDONED RACEWAY OPENINGS IN BOXES, CABINETS, AND EQUIPMENT ENCLOSURES; SEALS SHALL RETAIN NEMA RATING OF REMAINING BOXES, CABINETS, AND EQUIPMENT ENCLOSURES.
- FOR EXISTING CIRCUITS WHERE SOME ELECTRICAL ITEMS ARE REMOVED, CONTRACTOR SHALL PROVIDE ALL NECESSARY RACEWAYS, WIRES, BOXES, ETC., PER NEC REQUIREMENTS, TO ENSURE ELECTRICAL CONTINUITY AND PROPER OPERATION OF REMAINING CIRCUIT COMPONENTS.
- RETURN ALL SALVAGEABLE APPARATUS, AS DETERMINED BY THE BWS OR ITS REPRESENTATIVES, TO A SITE DESIGNATED BY THE BWS OR ITS REPRESENTATIVES, AT NO ADDITIONAL COST TO THE BWS. DISPOSE OF ALL UNWANTED MATERIALS.
- PRIOR TO PENETRATING OR DISTURBING ANY SURFACES IDENTIFIED AS CONTAINING HAZARDOUS MATERIALS, HAVE SURFACE/MATERIAL ABATED OR TREATED SO AS NOT TO CONTAMINATE SPACE OR AREA. REFER TO HAZARDOUS MATERIAL HANDLING REQUIREMENTS.
- ELECTRICAL TRENCH WORK SHALL BE COORDINATED WITH MECHANICAL TRENCHING REQUIREMENTS.

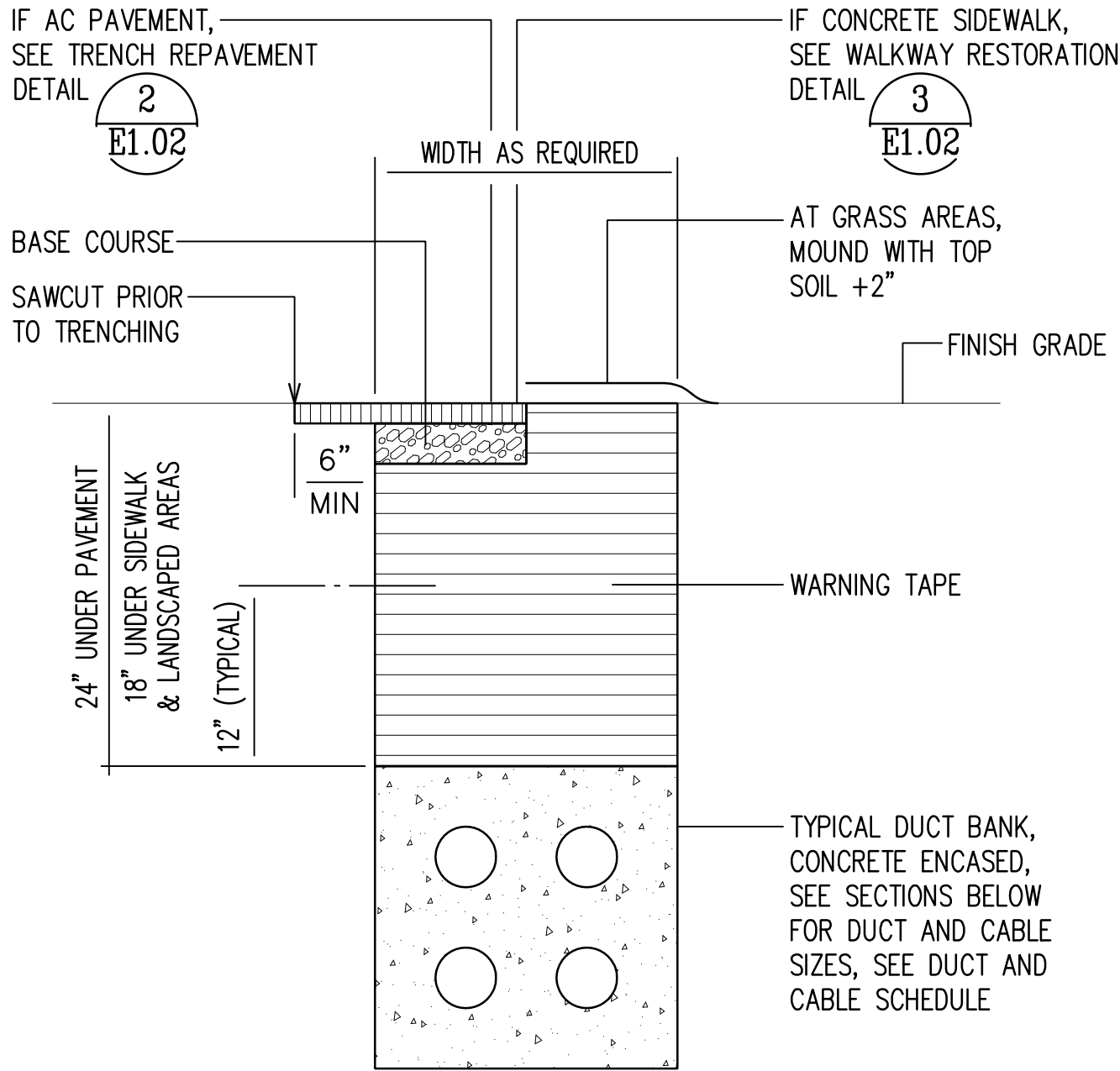
GENERAL CONSTRUCTION NOTES:

- CONTRACTOR SHALL COORDINATE ALL WORK WITH THE HAWAIIAN ELECTRIC COMPANY AND HAWAIIAN TELCOM.
- PROVIDE POLYOLEFIN 200LB TEST PULLCORD IN ALL EMPTY CONDUITS, UNLESS OTHERWISE NOTED.
- ALL ELECTRICAL EQUIPMENT ENCLOSURES AND EQUIPMENT MOUNTING HARDWARE AND FASTENERS FOR OUTDOOR INSTALLATION SHALL BE TYPE 316 STAINLESS STEEL, UNLESS OTHERWISE NOTED.

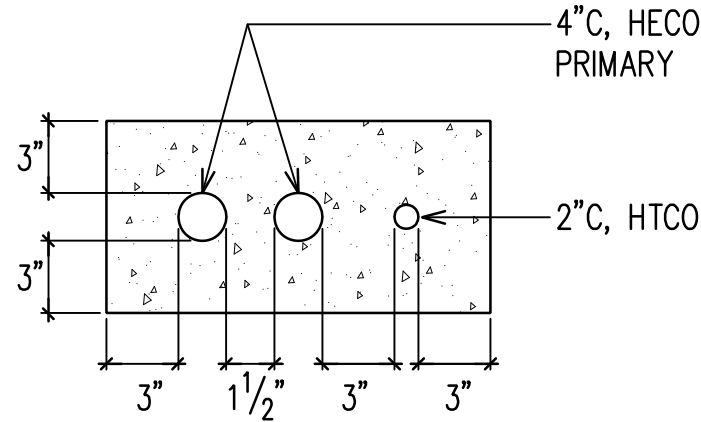
BACKFILL NOTES:

TYPE "A" BACKFILL – EARTH & GRAVEL. ROCK SIZE TO BE 1" MAX. & THE MIXTURE TO CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES. 95% COMPACTION.

CONCRETE – 3" ENCASEMENT, 3000 psi COMPRESSIVE STRENGTH @ 28 DAYS.



1
E1.02 TYPICAL DUCT SECTION DETAIL
NOT TO SCALE



SECTION A

C004

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SIGNATURE Exp: 4/30/22		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: NOVEMBER 2021	
DRAWN BY: CADD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____
FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET E001 OF _____	SHEETS
FILE	POCKET	FOLDER	NO.

HAWAIIAN ELECTRIC COMPANY NOTES

1. LOCATION OF HAWAIIAN ELECTRIC FACILITIES

THE LOCATION OF HAWAIIAN ELECTRIC'S OVERHEAD AND UNDERGROUND FACILITIES SHOWN ON THE PLANS ARE FROM EXISTING RECORDS WITH VARYING DEGREES OF ACCURACY AND ARE NOT GUARANTEED AS SHOWN. THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATIONS OF THE FACILITIES AND SHALL EXERCISE PROPER CARE IN EXCAVATING AND WORKING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES AND UTILITY CROSSINGS ARE SHOWN, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS AND CROSSINGS TO VERIFY THE DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES WHETHER SHOWN OR NOT SHOWN ON THE PLANS.

2. COMPLIANCE WITH HAWAII OCCUPATIONAL SAFETY AND HEALTH LAWS

THE CONTRACTOR SHALL COMPLY WITH THE STATE OF HAWAII'S OCCUPATIONAL SAFETY AND HEALTH LAWS AND REGULATIONS, INCLUDING WITHOUT LIMITATION, THOSE RELATED TO WORKING ON OR NEAR EXPOSED OR ENERGIZED ELECTRICAL LINES AND EQUIPMENT.

3. EXCAVATION CLEARANCE

THE CONTRACTOR SHALL OBTAIN AN EXCAVATION CLEARANCE FROM HAWAIIAN ELECTRIC'S PLANNING AND DESIGN SECTION OF THE TRANSMISSION & DISTRIBUTION ENGINEERING DEPARTMENT (543-5654) LOCATED AT 820 WARD AVENUE, 4TH FLOOR, A MINIMUM OF TEN (10) WORKING DAYS PRIOR TO STARTING CONSTRUCTION.

4. CAUTION!!! ELECTRICAL HAZARD!!!

EXISTING HAWAIIAN ELECTRIC OVERHEAD AND UNDERGROUND LINES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION UNLESS PRIOR SPECIAL ARRANGEMENTS HAVE BEEN MADE WITH HAWAIIAN ELECTRIC. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO HANDLE THESE ENERGIZED LINES AND ERECT TEMPORARY GUARDS TO PROTECT THESE LINES FROM DAMAGE. THE CONTRACTOR SHALL WORK CAUTIOUSLY AT ALL TIMES TO AVOID ACCIDENTS AND DAMAGE TO EXISTING HAWAIIAN ELECTRIC FACILITIES, WHICH CAN RESULT IN ELECTROCUTION.

5. OVERHEAD LINES

STATE LAW (OSHA) REQUIRES THAT A WORKER AND THE LONGEST OBJECT HE OR SHE MAY CONTACT CANNOT COME CLOSER THAN A SPECIFIED MINIMUM RADIAL CLEARANCE WHEN WORKING CLOSE TO OR UNDER ANY OVERHEAD LINES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE INFORMED OF AND COMPLY WITH THE LAW.

AT ANY TIME SHOULD THE CONTRACTOR ANTICIPATE THAT HIS WORK WILL RESULT IN THE NEED TO ENCROACH WITHIN THE MINIMUM REQUIRED CLEARANCE AS STATED IN THE LAW, THE CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC AT LEAST THREE (3) MONTHS PRIOR TO THE PLANNED ENCROACHMENT SO THAT, IF FEASIBLE, THE NECESSARY PROTECTIONS (E.G. RELOCATE OR DE-ENERGIZE HAWAIIAN ELECTRIC LINES) CAN BE INVESTIGATED. HAWAIIAN ELECTRIC MAY ALSO BE ABLE TO BLANKET ITS DISTRIBUTION (12KV AND BELOW) LINES TO PROVIDE A VISUAL AID IN PREVENTING ACCIDENTAL CONTACT. HAWAIIAN ELECTRIC'S COST OF SAFEGUARDING OR IDENTIFYING ITS LINES WILL BE CHARGED TO THE CONTRACTOR. CONTACT HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 FOR ASSISTANCE IN IDENTIFYING AND SAFEGUARDING OVERHEAD POWER LINES.

6. POLE BRACING

- A. CONTRACTOR SHALL NOT EXCAVATE WITHIN 10 FEET OF HAWAIIAN ELECTRIC'S UTILITY POLES OR ANY ANCHOR SYSTEM SUPPORTING THE UTILITY POLE. IF CONTRACTOR MUST EXCAVATE AN AREA MORE THAN 12 INCHES DEEP BY 12 INCHES WIDE, AND CLOSER THAN 10 FEET FROM A UTILITY POLE OR ITS ANCHOR SYSTEM, CONTRACTOR WILL BE RESPONSIBLE FOR PROTECTING, SUPPORTING, SECURING AND TAKING ALL PRECAUTIONS TO PREVENT DAMAGE TO OR LEANING OF EXISTING POLES. BEFORE COMMENCING SUCH EXCAVATION, CONTRACTOR MUST NOTIFY HAWAIIAN ELECTRIC WHICH MAY LEAD TO IMPLEMENTING POLE BRACING REQUIREMENTS. HAWAIIAN ELECTRIC REQUIRES A MINIMUM OF TEN (10) WORKING DAYS TO CONDUCT THE REVIEW OF CONTRACTOR'S SUBMITTAL. CONTRACTOR SHALL SUBMIT ITS BRACING CALCULATIONS AND DRAWINGS, PREPARED AND STAMPED BY A LICENSED STRUCTURAL ENGINEER, TO HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS (543-7070) FOR REVIEW. CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND REMOVAL OF THE TEMPORARY POLE BRACING SYSTEM, AS WELL AS ALL COSTS INCURRED BY HAWAIIAN ELECTRIC TO REVIEW CONTRACTOR'S DRAWINGS AND TO REPAIR OR STRAIGHTEN POLES IMPACTED BY CONTRACTOR'S ACTIVITIES, INCLUDING RESPONSE AND RESTORATION COSTS INCURRED BY HAWAIIAN ELECTRIC ARISING OUT OF OR RELATED TO OUTAGES CAUSED BY CONTRACTOR'S FAILURE TO MEET THE FOREGOING REQUIREMENTS. HAWAIIAN ELECTRIC'S RECEIPT OF POLE BRACING CALCULATION OR DRAWING SUBMITTALS OF ANY CONTRACTOR, INCLUDING WORK PROCEDURE, SHALL NOT RELIEVE CONTRACTOR FROM ANY LIABILITY RESULTING FROM CONTRACTOR'S EXCAVATION NEAR OR AROUND HAWAIIAN ELECTRIC'S UTILITY POLES.
- B. HAWAIIAN ELECTRIC MAY PROVIDE TO THE CUSTOMER INFORMATION RELATED TO POLE BRACING, INCLUDING CALCULATIONS AND OTHER BASIC ENGINEERING. HOWEVER, HAWAIIAN ELECTRIC PROVIDES THIS INFORMATION FOR INFORMATIONAL PURPOSES ONLY AND DOES NOT WARRANT ANY OF THE INFORMATION PROVIDED TO CUSTOMER. HAWAIIAN ELECTRIC HEREBY DISCLAIMS ANY LIABILITY ASSOCIATED WITH THE CUSTOMER'S USE OF INFORMATION PROVIDED TO THE CUSTOMER FROM HAWAIIAN ELECTRIC. IT IS THE CUSTOMER'S DUTY TO OBTAIN ENGINEERING FROM ITS OWN ENGINEER OR CONTRACTOR IN ORDER TO BRACE POLES AND THE USE OF HAWAIIAN ELECTRIC'S INFORMATION DOES NOT EXCUSE THE CUSTOMER FROM PERFORMING ITS OWN EVALUATION OF THE BRACING NEEDS. SHOULD THE CUSTOMER INSTALL BRACING AT ANY POLE LOCATION, CUSTOMER SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS HAWAIIAN ELECTRIC FROM ANY THIRD PARTY CLAIMS ASSOCIATED WITH THE

CUSTOMER'S BRACING OF A POLE. SHOULD THE WORK CUSTOMER PERFORM AT OR NEAR THE POLE LOCATION COMPROMISE THE POLE OR ITS SURROUNDINGS IN ANY WAY, CUSTOMER SHALL RESTORE OR REPLACE THE POLE SO THAT IT IS NO LONGER COMPROMISED.

7. UNDERGROUND LINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF UNDERGROUND LINES. HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL CABLES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO BREAK INTO EXISTING HAWAIIAN ELECTRIC FACILITIES, HANDLE THESE CABLES, AND ERECT TEMPORARY GUARDS TO PROTECT THESE CABLES FROM DAMAGE. THE COST OF HAWAIIAN ELECTRIC'S ASSISTANCE IN PROVIDING PROPER SUPPORT AND PROTECTION OF ITS UNDERGROUND LINES WILL BE CHARGED TO THE CONTRACTOR. FOR ASSISTANCE/COORDINATION IN PROVIDING PROPER SUPPORT AND PROTECTION OF THESE LINES, THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 A MINIMUM OF TEN (10) WORKING DAYS IN ADVANCE.

SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S 138KV OR 46KV UNDERGROUND LINES (SEE HAWAIIAN ELECTRIC INSTRUCTIONS TO CONSULTANTS/CONTRACTORS ON "EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND 138KV AND/OR 46KV LINES" FOR DETAILED REQUIREMENTS).

FOR VERIFICATION OF UNDERGROUND LINES, THE CONTRACTOR SHALL CALL THE HAWAII ONE CALL CENTER AT 866-423-7287 MINIMUM OF FIVE (5) WORKING DAYS IN ADVANCE.

8. UNDERGROUND FUEL PIPELINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES. SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES (SEE HAWAIIAN ELECTRIC'S SPECIFIC FUEL PIPELINE "GUIDELINES" TO CONSULTANTS/CONTRACTORS ON EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL PIPELINES FOR DETAILED REQUIREMENTS).

9. EXCAVATIONS

WHEN TRENCH EXCAVATION IS ADJACENT TO OR BENEATH HAWAIIAN ELECTRIC'S EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR IS RESPONSIBLE FOR:

- A) ARRANGING FOR HAWAIIAN ELECTRIC STANDBY PERSONNEL TO OBSERVE WORK AT CONTRACTOR'S COST.
- B) SHEETING, BRACING, OR OTHERWISE SUPPORTING THE EXCAVATION AND STABILIZING THE EXISTING GROUND TO RENDER IT SAFE AND SECURE AND TO PREVENT POSSIBLE SLIDES, CAVE-INS, AND SETTLEMENTS.
- C) PROPERLY SUPPORTING EXISTING STRUCTURES OR FACILITIES WITH BEAMS, STRUTS, UNDER-PINNINGS, OR OTHER NECESSARY METHODS TO FULLY PROTECT IT FROM DAMAGE.
- D) BACKFILLING WITH PROPER BACKFILL MATERIAL INCLUDING SPECIAL THERMAL BACKFILL WHERE EXISTING (REFER TO ENGINEERING DIVISION FOR THERMAL BACKFILL SPECIFICATIONS).
10. RELOCATION OF HAWAIIAN ELECTRIC FACILITIES

ANY WORK REQUIRED TO RELOCATE OR MODIFY HAWAIIAN ELECTRIC FACILITIES SHALL BE DONE BY HAWAIIAN ELECTRIC, OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION, AND SHALL PROVIDE NECESSARY SUPPORT FOR HAWAIIAN ELECTRIC'S WORK, WHICH MAY INCLUDE, BUT NOT BE LIMITED TO, STAKING OF POLE/ANCHOR LOCATIONS, IDENTIFYING RIGHT OF WAY AND PROPERTY LINES, EXCAVATION AND BACKFILL, PERMITS AND TRAFFIC CONTROL, BARRICADING, AND RESTORATION OF PAVEMENT, SIDEWALKS, AND OTHER FACILITIES.

ALL COSTS ASSOCIATED WITH ANY RELOCATION OR MODIFICATION (EITHER TEMPORARY OR PERMANENT) FOR THE CONVENIENCE OF THE CONTRACTOR, OR TO ENABLE THE CONTRACTOR TO PERFORM HIS WORK IN A SAFE AND EXPEDITIOUS MANNER IN FULFILLING HIS CONTRACT OBLIGATIONS SHALL BE BORNE BY THE CONTRACTOR.

11. CONFLICTS

ANY REDESIGN OR RELOCATION OF HAWAIIAN ELECTRIC'S FACILITIES NOT SHOWN ON THE PLANS MAY BE CAUSE FOR LENGTHY DELAYS. THE CONTRACTOR ACKNOWLEDGES THAT HAWAIIAN ELECTRIC IS NOT RESPONSIBLE FOR ANY DELAY OR DAMAGE THAT MAY ARISE AS A RESULT OF ANY CONFLICTS DISCOVERED OR IDENTIFIED WITH RESPECT TO THE LOCATION OR CONSTRUCTION OF HAWAIIAN ELECTRIC'S ELECTRICAL FACILITIES IN THE FIELD, REGARDLESS OF WHETHER THE CONTRACTOR HAS MET THE REQUESTED MINIMUM ADVANCE NOTICES. IN ORDER TO MINIMIZE ANY DELAY OR IMPACT ARISING FROM SUCH CONFLICTS, HAWAIIAN ELECTRIC SHOULD BE NOTIFIED IMMEDIATELY UPON DISCOVERY OR IDENTIFICATION OF SUCH CONFLICT.

12. DAMAGE TO HAWAIIAN ELECTRIC FACILITIES

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL HAWAIIAN ELECTRIC SURFACE AND SUBSURFACE UTILITIES AND SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES AS A RESULT OF HIS OPERATIONS. THE CONTRACTOR SHALL IMMEDIATELY REPORT SUCH DAMAGES OR ANY HAZARDOUS CONDITIONS RELATED TO HAWAIIAN ELECTRIC'S LINES TO HAWAIIAN ELECTRIC'S TROUBLE DISPATCHER AT 548-7961. REPAIR WORK SHALL BE DONE BY HAWAIIAN ELECTRIC OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. COSTS FOR DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES SHALL BE BORNE BY THE CONTRACTOR.

IN CASE OF DAMAGE OR SUSPECTED DAMAGE TO HAWAIIAN ELECTRIC'S FUEL PIPELINE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY HAWAIIAN ELECTRIC'S SECURITY COMMAND CENTER AT 543-7685 (A 24-HOUR NUMBER) SO HAWAIIAN ELECTRIC PERSONNEL CAN SECURE THE DAMAGED SECTION AND REPORT ANY OIL SPILLS TO THE PROPER AUTHORITIES. ALL COSTS ASSOCIATED WITH THE DAMAGE, REPAIR, AND OIL SPILL CLEANUP SHALL BE BORNE BY THE CONTRACTOR.

13. HAWAIIAN ELECTRIC STAND-BY PERSONNEL

THE CONTRACTOR MAY REQUEST HAWAIIAN ELECTRIC TO PROVIDE AN INSPECTOR TO STAND-BY DURING CONSTRUCTION NEAR HAWAIIAN ELECTRIC'S FACILITIES. THE COST OF SUCH INSPECTION WILL BE CHARGED TO THE CONTRACTOR.

THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER RELATIONS AT 543-7070 A MINIMUM OF THREE (3) MONTHS IN ADVANCE TO ARRANGE FOR HAWAIIAN ELECTRIC STAND-BY PERSONNEL.

14. CLEARANCES

THE FOLLOWING CLEARANCES SHALL BE MAINTAINED BETWEEN HAWAIIAN ELECTRIC'S DUCTLINE AND ALL ADJACENT STRUCTURES (CHARTED AND UNCHARTED) IN THE TRENCH: (SEE TABLE)

THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER & HAWAIIAN ELECTRIC OF ANY HEAT SOURCES (POWER CABLE DUCT BANK, STEAMLINE, ETC.) ENCOUNTERED THAT ARE NOT PROPERLY IDENTIFIED ON THE DRAWING.

15. INDEMNITY

THE CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS HAWAIIAN ELECTRIC FROM AND AGAINST ALL LOSSES, DAMAGES, CLAIMS, AND ACTIONS, INCLUDING BUT NOT LIMITED TO REASONABLE ATTORNEY'S FEES AND COSTS BASED UPON OR ARISING OUT OF DAMAGE TO PROPERTY OR INJURIES TO PERSONS, OR OTHER TORTIOUS ACTS CAUSED OR CONTRIBUTED TO BY CONTRACTOR OR ANYONE ACTING UNDER ITS DIRECTION OR CONTROL OR ON ITS BEHALF; PROVIDED CONTRACTOR'S INDEMNITY SHALL NOT BE APPLICABLE TO ANY LIABILITY BASED UPON THE SOLE NEGLIGENCE OF HAWAIIAN ELECTRIC.

ADDITIONAL NOTES WHEN WORK INVOLVES CONSTRUCTION OF HAWAIIAN ELECTRIC FACILITIES

16. SCHEDULE

CONTRACTOR SHALL FURNISH HIS CONSTRUCTION SCHEDULE SIX (6) MONTHS PRIOR TO STARTING WORK ON HAWAIIAN ELECTRIC FACILITIES. CONTRACTOR SHALL GIVE HAWAIIAN ELECTRIC, IN WRITING, THREE (3) MONTHS NOTICE TO PROCEED WITH HAWAIIAN ELECTRIC'S PORTION OF WORK.

17. AUTHORITY

ALL CONSTRUCTION, RESTORATION WORK, AND INSPECTION SHALL BE SUBJECT TO WHICHEVER GOVERNMENTAL AGENCY HAS AUTHORITY OVER THE WORK.

18. SPECIFICATIONS

CONSTRUCTION OF HAWAIIAN ELECTRIC'S UNDERGROUND FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST REVISIONS OF HAWAIIAN ELECTRIC SPECIFICATIONS CS7001, CS7003, CS7202, CS9301, AND CS9401 AND APPLICABLE HAWAIIAN ELECTRIC STANDARDS.

19. CONSTRUCTION

CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES TO PROPERLY PERFORM AND FULLY COMPLETE ALL WORK SHOWN ON THE CONTRACT, DRAWINGS, AND SPECIFICATIONS. ALL MATERIALS SHALL BE NEW AND MANUFACTURED IN THE UNITED STATES OF AMERICA. ALL MANHOLE, HANDHOLE, AND DUCTLINE INSTALLATIONS SHALL BE INSPECTED AND APPROVED BY HAWAIIAN ELECTRIC PRIOR TO EXCAVATION AND PRIOR TO PLACING CONCRETE. CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST FIVE (5) WORKING DAYS PRIOR TO INSTALLING FACILITIES OR PLACING CONCRETE.

CONTRACTOR TO COORDINATE WORK TO BREAK INTO HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL FACILITIES WITH HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST TEN (10) WORKING DAYS IN ADVANCE.

20. STAKEOUT

THE CONTRACTOR SHALL ARRANGE FOR TONEOUTS OF ALL UNDERGROUND FACILITIES AND SHALL STAKEOUT ALL PROPOSED HAWAIIAN ELECTRIC FACILITIES WITHIN THE PROJECT AREA SO AS TO NOT CONFLICT WITH ANY UTILITY (EXISTING OR PROPOSED) AND ANY PROPOSED CONSTRUCTION OR IMPROVEMENT WORK FOR VERIFICATION BY HAWAIIAN ELECTRIC BEFORE PROCEEDING WITH HAWAIIAN ELECTRIC WORK.

21. DUCTLINES

ALL DUCTLINE INSTALLATIONS SHALL BE PVC SCHEDULE 40 ENCASED IN CONCRETE, UNLESS OTHERWISE NOTED. ALL COMPLETED DUCTLINES SHALL BE MANDREL TESTED BY THE CONTRACTOR IN THE PRESENCE OF HAWAIIAN ELECTRIC'S INSPECTOR USING HAWAIIAN ELECTRIC'S STANDARD PRACTICE. THE CONTRACTOR SHALL INSTALL 1800# TENSILE STRENGTH MULETAPE PULL LINE IN ALL COMPLETED DUCTLINES AFTER MANDREL TESTING IS COMPLETE.

22. JOINT POLE REMOVAL

THE LAST JOINT POLE OCCUPANT OF THE POLES SHALL REMOVE THE POLES.

23. AS-BUILT PLANS

THE CONTRACTOR SHALL PROVIDE HAWAIIAN ELECTRIC WITH A SET OF ELECTRONIC AND HARD COPY PLANS OF EACH SHEET SHOWING THE OFFSETS, STATIONING, AND VERTICAL ELEVATION OF THE DUCT LINE(S) CONSTRUCTED.

DRAWING REVIEW

Reviewed for Hawaiian Electric Company Facilities Only

Req# _____ By _____ Date _____

Customer Installations Department
Hawaiian Electric

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Exp: 4/30/22

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR
MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII
HECO NOTES

APPROVED: _____ DATE: **NOVEMBER 2021**

DRAWN BY: **CADD** ENGINEER: **RY** CHECKED BY: **BJO** FILE NO: _____

FIELD BOOK NO: _____ SCALE: AS INDICATED SHEET **E002** OF _____ SHEETS

FILE	POCKET	FOLDER	NO.

HAWAIIAN ELECTRIC COMPANY NOTES (Continued)

Guidelines for Minimum Horizontal (parallel) Clearances Between Hawaiian Electric and Other Underground Utilities				
Underground Utility	Hawaiian Electric Direct Buried Cable	Hawaiian Electric Direct Buried in Conduit (No Concrete Encasement)	Hawaiian Electric 3" (Minimum) Concrete Encasement	Applicable Notes:
Hawaiian Electric DB Conduits	12"	3"	0"	
Hawaiian Electric 3" Encasement	0"	0"	0"	
Telephone/CATV DB	12"	12"	6"	
Telephone/CATV DB Ducts	12"	12"	6"	
Telephone/CATV 3" Encasement	0"	0"	0"	5
Traffic Signal	12"	12"	12"	
Water DB (BWS Owned)	36"	36"	36"	1, 4
Customer Owned Water Service Laterals	12"	12"	12"	
Water (Concrete Jacketed) (BWS Owned)	36"	36"	36"	1, 4
Gas DB	12"	12"	12"	1
Gas (Concrete Jacketed)	12"	12"	12"	1
Sewer DB	36"	36"	36"	1, 2
Sewer (Concrete Jacketed)	36"	36"	36"	1, 2
Drain	12"	12"	12"	1
Fuel Pipelines				3
<p>Notes:</p> <p>1. Where Space is Available, Parallel Clearance to Other Utilities, or Foreign Structures Other Than Communication or Traffic Signal Shall Be 36"</p> <p>2. If 36" Clearance Cannot Be Met:</p> <p>– If Clearance is Less Than 12", Jacket Sewer Line with Reinforced Concrete (Per HECO's Std. 30–1030) for a Distance of 5' Plus Pipe Diameter.</p> <p>– If Clearance is Between 12" and 36", Jacket Sewer Line with Plain Concrete.</p> <p>3. All Fuel Pipeline Crossings Shall Be Reviewed and Approved by the Company That Owns and Maintains it.</p> <p>4. 5 Feet Clear to Water Mains 16" or Larger.</p> <p>5. For Situations with 0" Minimum Separation, a 6" Separation is Recommended.</p> <p>6. Clearances Measured from Outer Edges or Diameters of Utilities. Whenever Concrete Jackets are Involved, Clearances Shall Be Total Clear Distance Between the Concrete Jacket and Utility Concerned.</p>				

Guidelines for Minimum Vertical (Crossing) Clearances Hawaiian Electric and Other Underground Utilities				
Underground Utility	Hawaiian Electric Direct Buried Cable	Hawaiian Electric Direct Buried In Conduit (No Concrete Encasement)	Hawaiian Electric 3" (Minimum) Concrete Encasement	Applicable Notes:
Hawaiian Electric DB Conduits	6"	3"	0"	
Hawaiian Electric 3" Encasement	0"	0"	0"	
Telephone/CATV DB	12"	12"	6"	
Telephone/CATV DB Ducts	12"	12"	6"	
Telephone/CATV 3" Encasement	0"	0"	0"	3
Traffic Signal	12"	12"	6"	
Water DB (BWS Owned)	12"	12"	12"	5
Customer Owned Water Service Laterals	6"	6"	6"	
Water (Concrete Jacketed) (BWS Owned)	12"	12"	12"	5
Gas DB	12"	12"	12"	
Gas (Concrete Jacketed)	12"	12"	12"	
Sewer DB	24"	24"	24"	1
Sewer (Concrete Jacketed)	24"	24"	24"	1
Drain	12"	12"	6"	
Fuel Pipelines				2
<p>Notes:</p> <p>1. If Clearance Cannot be Met:</p> <p>– If Clearance is Less Than 12", Jacket Sewer Line with Reinforced Concrete (Per HECO's Std. 30–1030) for a Distance of 5' Plus Pipe Diameter.</p> <p>– If Clearance is Between 12" and 24", Jacket Sewer Line with Plain Concrete.</p> <p>2. All Fuel Pipeline Crossings Shall Be Reviewed and Approved by the Company That Owns and Maintains it.</p> <p>3. For Situations with 0" Minimum Separation, a 6" Separation is Recommended.</p> <p>4. Clearances Measured from Outer Edges or Diameters of Utilities. Whenever Concrete Jackets are Involved, Clearances Shall Be Total Clear Distance Between the Concrete Jacket and Utility Concerned.</p> <p>5. 36" Clearance is Required for Trenchless Installation Work.</p>				

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DRAWING REVIEW

Reviewed for Hawaiian Electric Company Facilities Only

Req# _____ By _____ Date _____

Customer Installations Department
Hawaiian Electric

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Exp: 4/30/22

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX

ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR

MAKAHA WELLS II, III, AND IV

MAKAHA, O'AHU, HAWAII

HECO NOTES

APPROVED: _____

MANAGER AND CHIEF ENGINEER, BWS

DATE: NOVEMBER 2021

DRAWN BY: CADD

ENGINEER: RY

CHECKED BY: BJO

FILE NO: _____

FIELD BOOK NO: _____

SCALE: AS INDICATED

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HAWAIIAN TELCOM (HTCO) NOTES:

1. THE CONTRACTOR SHALL PROCURE AND PAY FOR ALL LICENSES AND PERMITS AND SHALL GIVE ALL NOTICES NECESSARY AND INCIDENT TO THE DUE AND LAWFUL PROSECUTION OF THE WORK.

2. THE CONTRACTOR SHALL OBTAIN AN EXCAVATION PERMIT AND TONING REQUEST FROM HAWAIIAN TELCOM'S EXCAVATION PERMIT SECTION, LOCATED AT 1177 BISHOP STREET, TWO WEEKS PRIOR TO THE START OF CONSTRUCTION. HOURS OF BUSINESS ARE 8:00 A.M. TO 11:00 A.M. AND 12:00 P.M. TO 3:00 P.M. MONDAY THROUGH FRIDAY, EXCEPT HOLIDAYS.

3. PRIOR TO THE EXCAVATION OF THE DUCTLINE, THE CONTRACTOR SHALL REQUEST HAWAIIAN TELCOM TO LOCATE EXISTING DUCTLINE WHEREVER REQUIRED. FOR UNDERGROUND CABLE LOCATING AND MARKING, FIVE (5) WORKING DAYS ADVANCE NOTICE IS REQUIRED. THREE (3) WORKING DAYS ADVANCE NOTICE IS REQUIRED FOR ANY INSPECTION BY A DESIGNATED REPRESENTATIVE.

4. THE LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION AND SHALL MAINTAIN PROPER CLEARANCES WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF HAWAIIAN TELCOM FACILITIES. THE CONTRACTOR SHALL VERIFY THEIR LOCATIONS AND SHALL BE LIABLE FOR ANY DAMAGES TO HAWAIIAN TELCOM FACILITIES. ANY DAMAGES SHALL BE REPORTED IMMEDIATELY TO HAWAIIAN TELCOM'S REPAIR SECTION AT #611 (24 HOURS) OR TO THE EXCAVATION PERMIT SECTION AT 546-7746 (NORMAL WORKING HOURS, MONDAY THROUGH FRIDAY, EXCEPT HOLIDAYS). AS A RESULT OF HIS OPERATIONS, ADJUSTMENTS TO THE NEW DUCTLINE ALIGNMENT, IF REQUIRED, SHALL BE MADE TO PROVIDE THE REQUIRED CLEARANCES.

5. THE CONTRACTOR SHALL TAKE NECESSARY PRECAUTION NOT TO DAMAGE EXISTING CABLES OR DUCTS. A HAWAIIAN TELCOM INSPECTOR OR DESIGNATED REPRESENTATIVE IS REQUIRED TO BE AT ANY JOB SITE WHENEVER THERE WILL BE A BREAKAGE INTO OR ENTRY INTO ANY STRUCTURE THAT CONTAIN HAWAIIAN TELCOM FACILITIES. TEMPORARY CABLE AND DUCT SUPPORTS SHALL BE PROVIDED WHEREVER NECESSARY.

6. THE CONTRACTOR SHALL NOTIFY HAWAIIAN TELCOM'S INSPECTOR OR DESIGNATED REPRESENTATIVE A MINIMUM OF 72 HOURS PRIOR TO EXCAVATION, BRACING, OR BACKFILLING OF HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

7. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE "HAWAIIAN TELCOM STANDARD SPECIFICATIONS FOR PLACING TELEPHONE SYSTEMS" DATED JANUARY 2007, ALL SUBSEQUENT AMENDMENTS AND ADDITIONS, AND ALL OTHER PERTINENT STANDARDS FOR TELEPHONE CONSTRUCTION. CONTRACTOR SHALL FAMILIARIZE HIS PERSONNEL BY OBTAINING APPLICABLE SPECIFICATIONS.

8. WHEN EXCAVATION IS ADJACENT TO OR BENEATH HAWAIIAN TELCOM'S EXISTING STRUCTURES R FACILITIES, THE CONTRACTOR SHALL:

A. SHEET AND/OR BRACE THE EXCAVATION TO PREVENT SLIDES, CAVE-INS, OR SETTLEMENTS TO ENSURE NO MOVEMENT TO HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

B. PROTECT EXISTING STRUCTURES AND/OR FACILITIES WITH BEAMS, STRUTS, OR UNDERPINNING WHILE EXCAVATING BENEATH THEM TO ENSURE NO MOVEMENT TO HAWAIIAN TELCOM'S STRUCTURES OR FACILITIES.

9. THE CONTRACTOR SHALL BRACE ALL POLES OR LIGHT STANDARDS NEAR THE NEW DUCTLINE, MANHOLE, OR HANDHOLE DURING HIS OPERATIONS.

10. THE CONTRACTOR SHALL SAW-CUT AC. PAVEMENT AND CONCRETE GUTTER WHEREVER NEW MANHOLES, HANDHOLES, OR DUCTLINES ARE TO BE PLACED AND SHALL RESTORE TO EXISTING CONDITION OR BETTER.

11. THE CONTRACTOR SHALL COMPLY WITH THE POLICY ADOPTED BY THE DEPARTMENT OF PLANNING AND PERMITTING, CITY AND COUNTY OF HONOLULU, CONCERNING THE REPLACEMENT OF CONCRETE SIDEWALKS AFTER EXCAVATION WORK.

12. THE UNDERGROUND PIPES, CABLES, OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.

13. WHEREVER CONNECTIONS TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES PRIOR TO EXCAVATION OF THE MAIN TRENCHES TO VERIFY THEIR LOCATIONS AND DEPTH.

14. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE COST FOR SUPPLEMENTARY MEASURES, WHICH WILL BE REQUIRED BY THE CITY AND COUNTY, SHALL BE BORNE BY THE CONTRACTOR.
15. THE CONTRACTOR SHALL PUMP ALL MANHOLES DRY DURING FINAL INSPECTION.

16. THE CONTRACTOR SHALL NOTIFY HAWAIIAN TELCOM INSPECTOR 24 HOURS PRIOR TO THE POURING OF CONCRETE OR BACKFILLING.

17. WHEN CONNECTING TO MANHOLE WALLS, ALL EXISTING REINFORCING BARS SHALL BE LEFT INTACT. DUCTS SHALL BE ADJUSTED IN THE FIELD IN ORDER TO CLEAR REINFORCING

18. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYING OUT ALL REQUIRED LINES AND GRADES AND SHALL PRESERVE ALL BENCH MARKS AND WORKING POINTS NECESSARY TO LAY OUT THE WORK CORRECTLY. THE NEW DUCTLINE SHALL BE ADJUSTED BY THE CONTRACTOR TO SUIT THE EXISTING CONDITIONS AND THE DETAILS AS DESCRIBED IN THE PLANS.

19. MINIMUM CONCRETE STRENGTH SHALL BE: -FOR DUCTLINE 2500 PSI AT 28 DAYS -FOR MANHOLE 3000 PSI AT 28 DAYS OR AS SPECIFIED IN DESIGN NOTES

20. BENDS IN THE DUCT ALIGNMENT, DUE TO CHANGES IN GRADE SHALL HAVE A MINIMUM RADIUS OF 25 FEET. ALL 90 DEGREE C-BENDS AT A POLE OR AT THE BUILDING FLOOR SLAB PENETRATION, SHALL HAVE A BEND RADIUS OF TEN TIMES THE DIAMETER OF THE DUCT OR GREATER.

21. AFTER DUCTLINE HAS BEEN COMPLETED, A MANDREL WITH A SQUARE FRONT NOT LESS THAN 12" LONG AND HAVING A DIAMETER OF 1/4" LESS THAN THE INSIDE DIAMETER OF THE DUCT, SHALL BE PULLED THROUGH EACH DUCT AFTER WHICH A BRUSH WITH STIFF BRISTLES SHALL BE PULLED THROUGH TO MAKE CERTAIN THAT NO PARTICLES OF EARTH, SAND, OR GRAVEL HAVE BEEN LEFT INSIDE. DUCTS SHALL BE COMPLETELY DRY AND CLEAN.

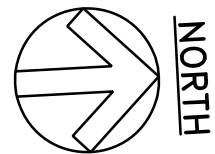
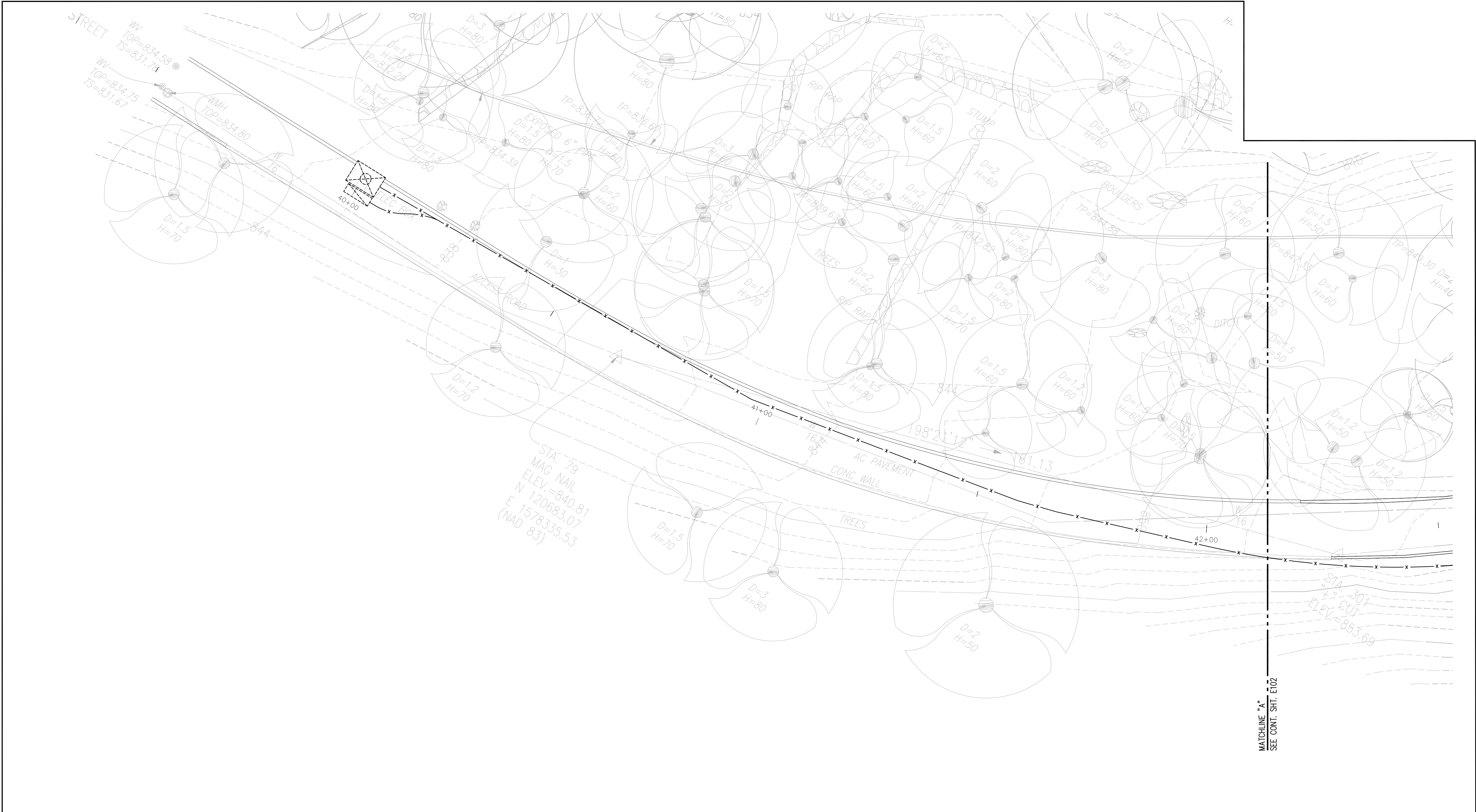
22. ALL DUCTS AND CONDUITS SHALL HAVE AN 1800# POLYESTER MULE-TAPE (NEPTCO, WP1800P, HAWAIIAN TELCOM MATERIAL CODE NO. 571154) INSTALLED THROUGHOUT ITS ENTIRE LENGTH. ALL DUCTS SHALL BE CAPPED TO PREVENT ENTRY OF FOREIGN MATERIAL DURING CONSTRUCTION AND AT THE COMPLETION OF INSTALLATION.

APPROVED BY _____ DATE _____
HAWAIIAN TELCOM

C004

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	JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII HTCO NOTES			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: NOVEMBER 2021
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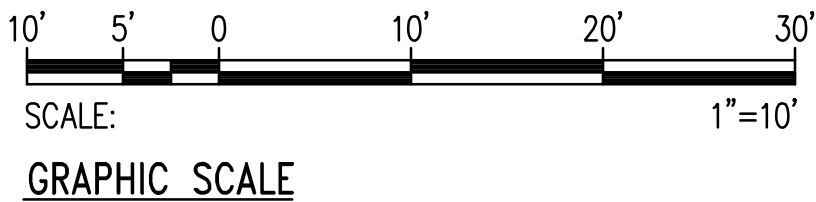
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DEMOLITION ELECTRICAL SITE PLAN 1

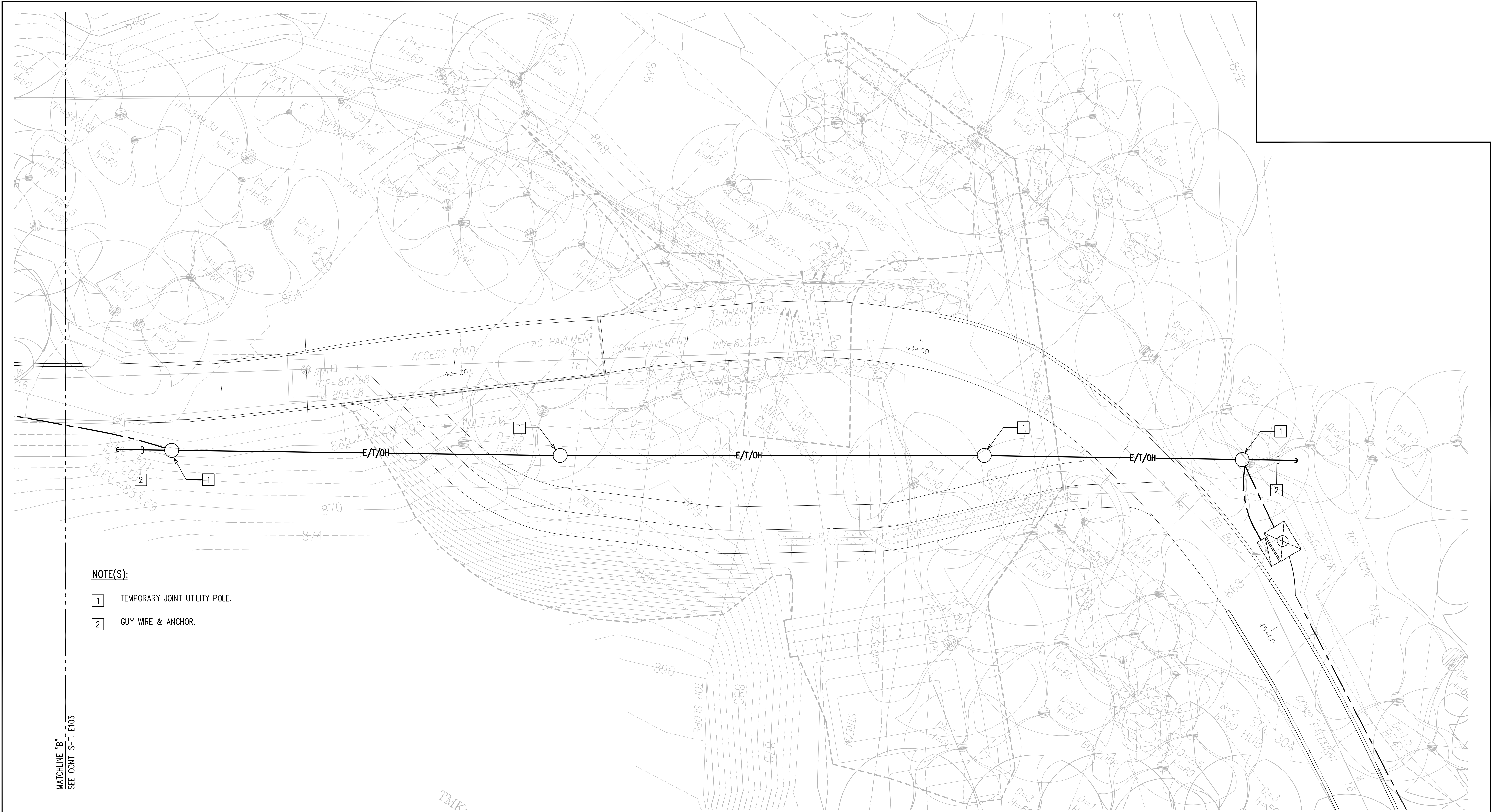
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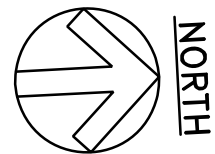
BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR
MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII
TEMPORARY ELECTRICAL SITE PLAN 2

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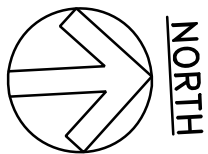
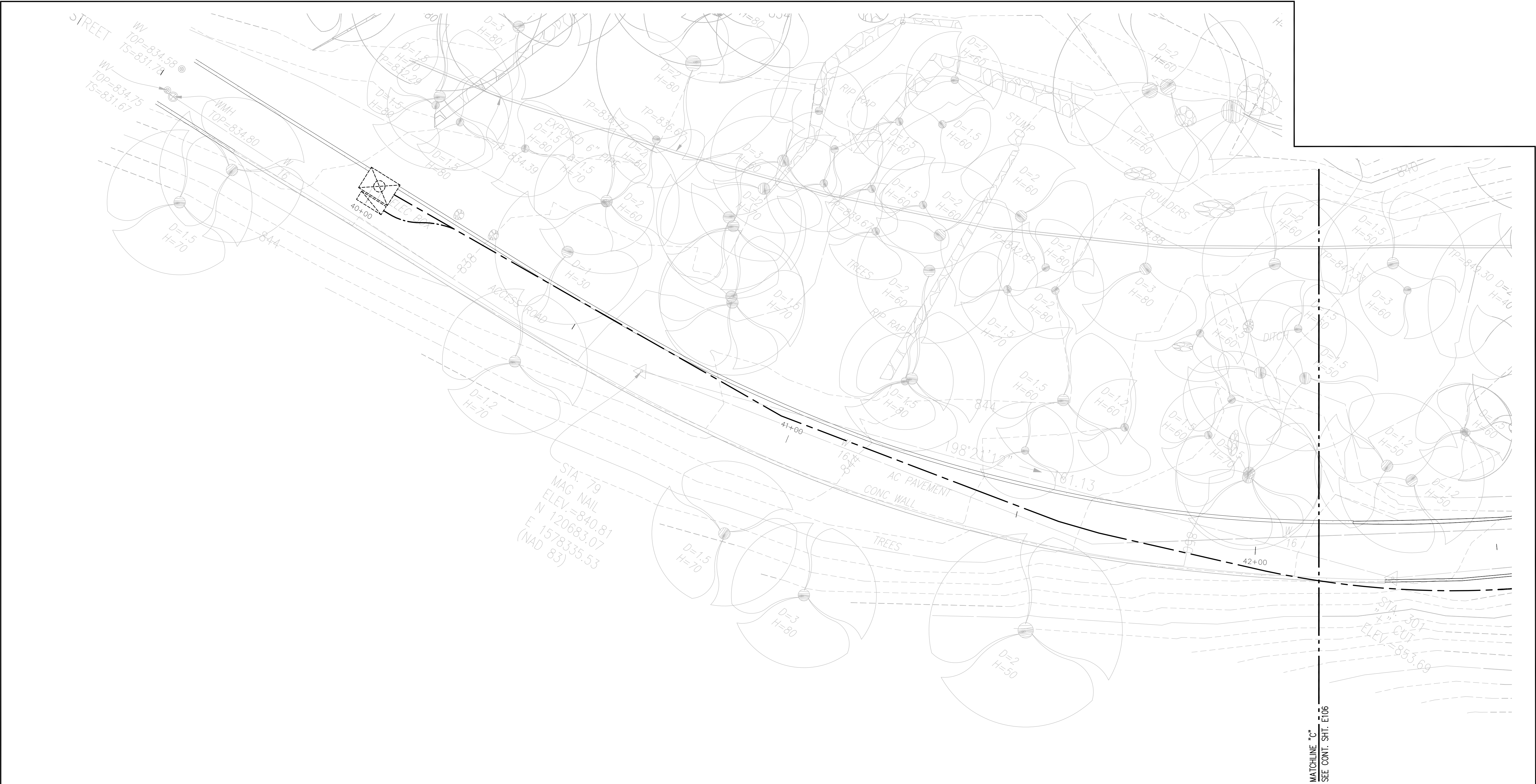
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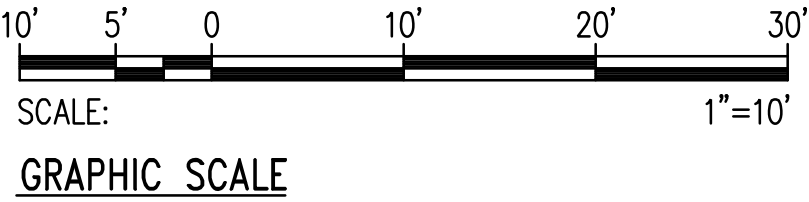
1 TEMPORARY ELECTRICAL SITE PLAN

E104 SCALE: 1"=10'

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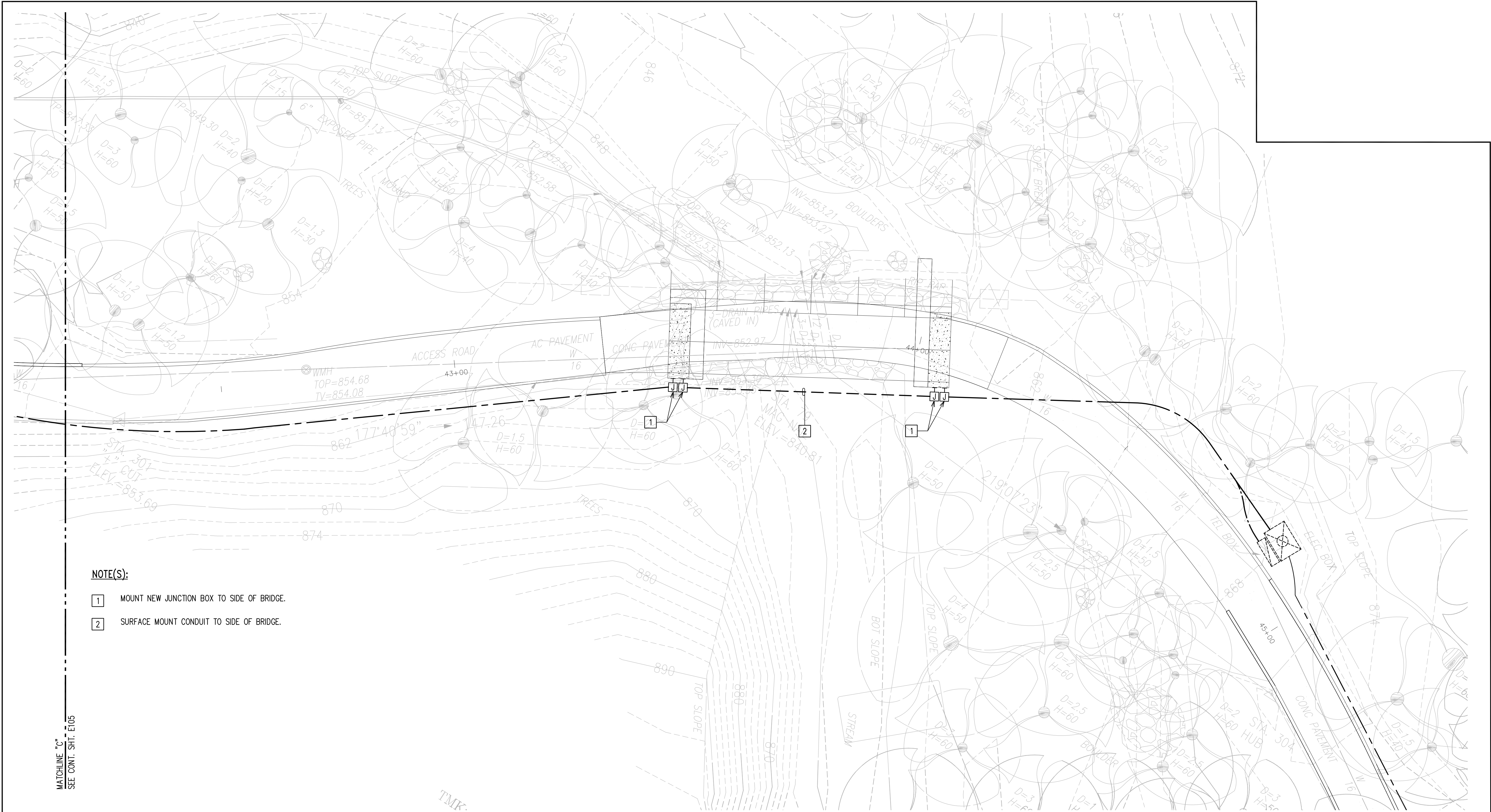
1 ELECTRICAL SITE PLAN 1
E105 SCALE: 1"=10'



C004

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SIGNATURE Exp: 4/30/22		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII ELECTRICAL SITE PLAN 1	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: NOVEMBER 2021	
DRAWN BY: CADD	ENGINEER: RY	CHECKED BY: BJO	FILE NO: _____
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FILE	POCKET	FOLDER	NO.

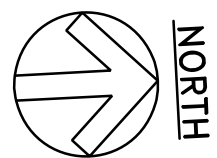
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NOTE(S):

- 1 MOUNT NEW JUNCTION BOX TO SIDE OF BRIDGE.
- 2 SURFACE MOUNT CONDUIT TO SIDE OF BRIDGE.

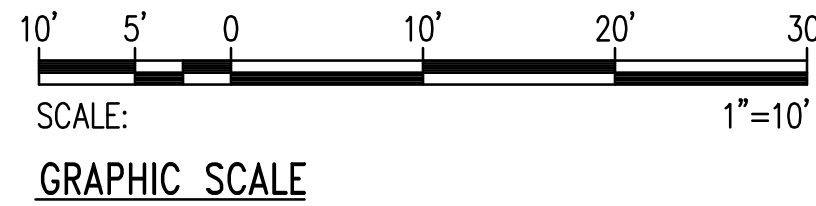
MATCHLINE "C"
SEE CONT. SHT. E105



1
E106

ELECTRICAL SITE PLAN 2

SCALE: 1"=10'



C004

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR
MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII
ELECTRICAL SITE PLAN 2

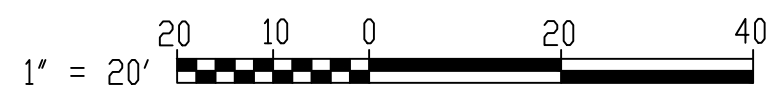
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DRAWN BY:	CADD	ENGINEER:	RY
CHECKED BY:	BJO	FILE NO:	
FIELD BOOK NO:	SCALE: AS INDICATED	SHEET	E106 OF SHEETS

FILE	POCKET	FOLDER	NO.

Thu, 25 Nov 2021 9:54am
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LEGEND:
APPROXIMATE BORING LOCATION



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SIGNATURE Exp: 4/30/22 GERALD Y. SEKI LICENSED PROFESSIONAL ENGINEER No. 6835-C HAWAII, U.S.A.		JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII	
APPROVED: _____ MANAGER AND CHIEF ENGINEER, BWS		DATE: 2021	
DRAWN BY: HC	ENGINEER: GS	CHECKED BY: GS	FILE NO: _____
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FILE	POCKET	FOLDER	NO.

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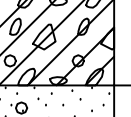
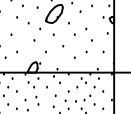


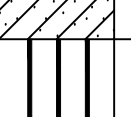
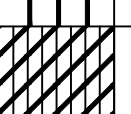

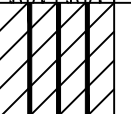
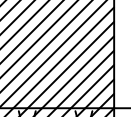
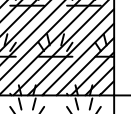


LOG LEGEND FOR SOIL 7956-00.GPJ GEOLABS.GDT 11/23/23



GEOLABS, INC.
Geotechnical Engineering









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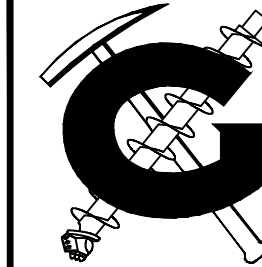
UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS	
COARSE-GRAINED SOILS	GRAVELS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		LESS THAN 5% FINES		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		LESS THAN 5% FINES		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
				MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE		CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
			HIGHLY ORGANIC SOILS		

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

	(2-INCH) O.D. STANDARD PENETRATION TEST	LL	LIQUID LIMIT (NP=NON-PLASTIC)
	(3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE	PI	PLASTICITY INDEX (NP=NON-PLASTIC)
	SHELBY TUBE SAMPLE	TV	TORVANE SHEAR (tsf)
	GRAB SAMPLE	UC	UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH
	CORE SAMPLE	TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)
	WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING		
	WATER LEVEL OBSERVED IN BORING AFTER DRILLING		
	WATER LEVEL OBSERVED IN BORING OVERNIGHT		



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Soil Classification Log Key
(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)	COHESIVE SOIL (- #200 ≥ 50%)
<ul style="list-style-type: none">PRIMARY constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., GRAVEL, SAND)SECONDARY constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (SILTY or CLAYEY); otherwise, a granular constituent is used (GRAVELLY or SANDY) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY GRAVEL, CLAYEY SAND) and precede the primary constituent.accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY GRAVEL with a little sand)	<ul style="list-style-type: none">PRIMARY constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., CLAY, SILT)SECONDARY constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY CLAY, SILTY CLAY, CLAYEY SILT) and precede the primary constituent.accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY CLAY with some sand)
EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: SILTY GRAVEL with some sand	

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

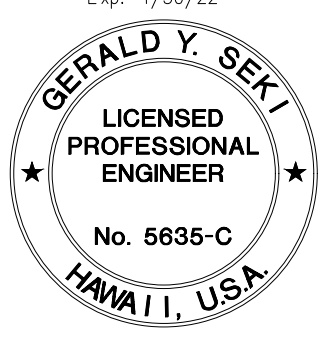
PP: Pocket Penetrometer

*Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).

SOIL CLASS LOG KEY 7956-00.GPJ GEOLABS.GDT 11/23/21

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Exp: 4/30/22



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

BORING LOG LEGENDS

APPROVED: _____
MANAGER AND CHIEF ENGINEER, BWS

DATE: 2021

DRAWN BY: HC

ENGINEER: GS

CHECKED BY: GS

FILE NO: _____


FIELD BOOK NO: _____

SCALE: AS INDICATED

SHEET _____ OF _____ SHEETS

FILE	POCKET	FOLDER	NO.

JOB NO. 641-00

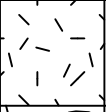

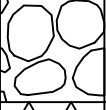
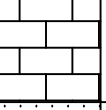
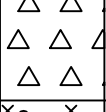
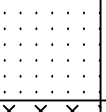
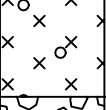
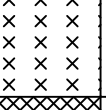

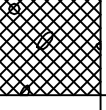
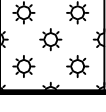



GEOLABS, INC.

Geotechnical Engineering

Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		CONGLOMERATE
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive:

Greater than 24 inches apart

Slightly Fractured:

12 to 24 inches apart

Moderately Fractured:

6 to 12 inches apart

Closely Fractured:

3 to 6 inches apart

Severely Fractured:

Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered:

Rock shows no sign of discoloration or loss of strength.

Slightly Weathered:

Slight discoloration inwards from open fractures.

Moderately Weathered:

Discoloration throughout and noticeably weakened though not able to break by hand.

Highly Weathered:

Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.

Extremely Weathered:

Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard:

Specimen breaks with difficulty after several "pinging" hammer blows.

Example: Dense, fine grain volcanic rock

Hard:

Specimen breaks with some difficulty after several hammer blows.

Example: Vesicular, vugular, coarse-grained rock

Medium Hard:

Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce.

Example: Porous rock such as clinker, cinder, and coral reef

Soft:

Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot.

Example: Weathered rock, chalk-like coral reef

Very Soft:

Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure.

Example: Saprolite

GEOTECHNICAL NOTES:


- A geotechnical engineering report entitled "Geotechnical Engineering Exploration, Makaha Wells II, III and IV Access Road Repairs, Makaha, Oahu, Hawaii" dated November 19, 2021 has been prepared by Geolabs, Inc. A copy of the report is on file at the office of the Engineer for review by the Contractor.
- For boring locations, see Sheet ____.
- The information presented in the logs of borings depict the subsurface conditions encountered at that specified location and at the time of the field exploration only. Variations of subsoil conditions from those depicted in the logs of borings may occur between and beyond the borings.
- The penetration resistance shown on the logs of borings indicate the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.
- The data given is for general information only. Bidders shall examine the site and the boring data and draw their own conclusions therefrom as to the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or conditions other than at the boring locations shown and at the time the borings were taken.

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JOB NO. 641-00

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SIGNATURE
Exp: 4/30/22



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

JOB XX-XXXX
ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS
FOR MAKAHA WELLS II, III, AND IV
MAKAHA, O'AHU, HAWAII

ROCK LOG LEGEND & NOTES

APPROVED: _____
MANAGER AND CHIEF ENGINEER, BWS

DATE: 2021

DRAWN BY: HC

ENGINEER: GS

CHECKED BY: GS

FILE NO: _____





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
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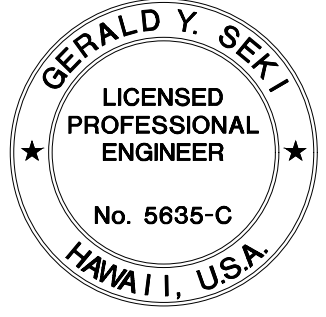
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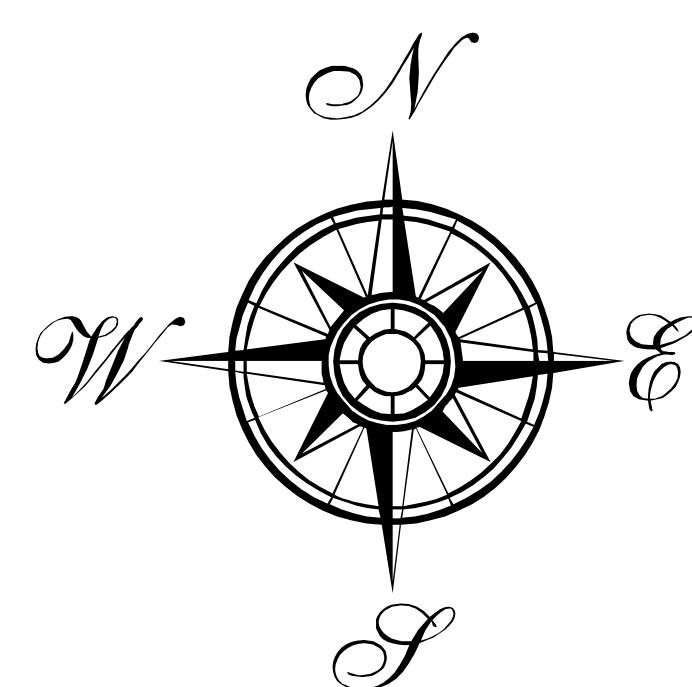
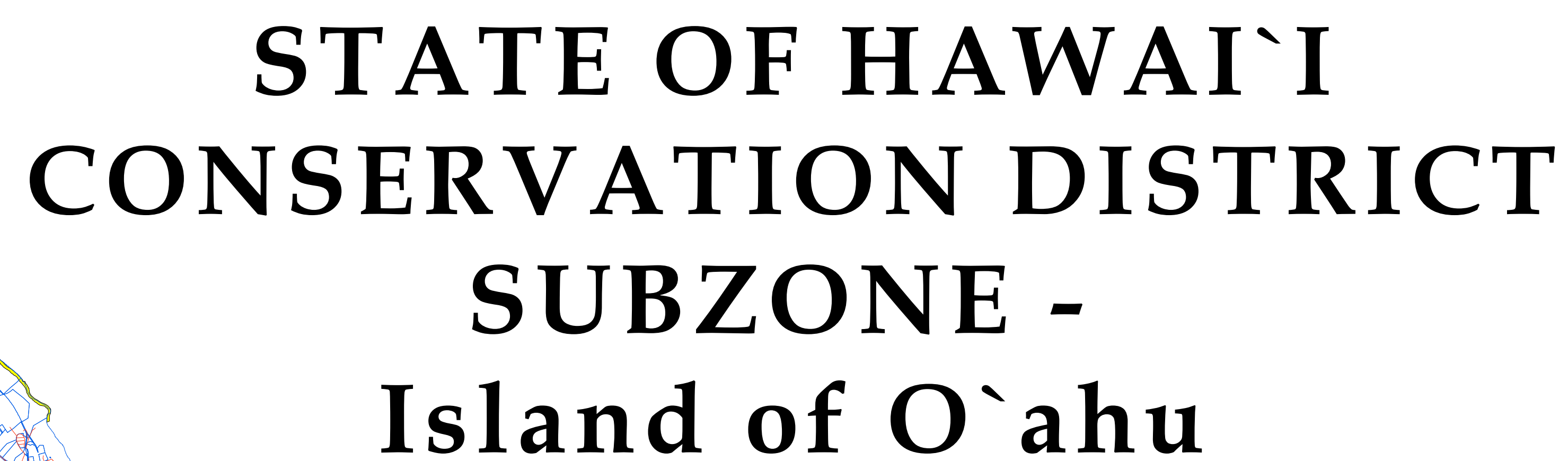
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		GEOLABS, INC. Geotechnical Engineering		MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, OAHU, HAWAII						Log of Boring 1	
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet): 857 *	
										Description	
UC=9.0 ksf	11 37	121	70	25	45 41		5		GW	2-inch ASPHALTIC CONCRETE	
										Brownish gray SANDY GRAVEL (BASALTIC), moist (base course)	
LL=58 PI=29	20 37				12 19		10		CH	Brown with some gray SILTY CLAY with some sand and a little gravel (basaltic), very stiff, moist (older alluvium)	
										Reddish brown with some gray CLAYEY SILT with some sand and a little gravel (basaltic), stiff to very stiff, moist (older alluvium)	
										Brownish gray COBBLES AND BOULDERS (BASALTIC) with a little clay, dense, moist (colluvium)	
										Brown with some gray SILTY CLAY with some gravel and a little cobbles (basaltic), stiff to very stiff, moist (older alluvium)	
						15		Boring terminated at 15 feet			
						20				* Elevations estimated from Topographic Survey Map dated September 19, 2019 prepared by Controlpoint Surveying, Inc.	
						25					
Date Started: December 31, 2019			Date Completed: December 31, 2019			Water Level:  Not Encountered					
Logged By: S. Latronic			Drill Rig: CME-75DR			Drilling Method: 4" Solid-Stem Auger & PQ Coring					
Total Depth: 15 feet			Driving Energy: 140 lb. wt., 30 in. drop								
Work Order: 7956-00											

		GEOLABS, INC. Geotechnical Engineering		MAKAHA WELLS II, III AND IV ACCESS ROAD REPAIRS MAKAHA, OAHU, HAWAII						Log of Boring 2	
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet): 861 *	
										Description	
LL=42 PI=17 UC=2.6 ksf	17 8	106	83		65 56	25/1"	5		ML CL	5-inch CONCRETE	
										Grayish brown CLAYEY SILT with some sand, damp (fill)	
UC=14120 psi			68				10			Brown with some gray SANDY CLAY with some gravel (basaltic) and a little sand, hard, moist (older alluvium) grades more gravelly	
										Gray with traces of brown COBBLES AND BOULDERS (BASALTIC) with a little silt, very dense, moist (river channel deposit) grades with sandy gravel pockets locally	
						15		Boring terminated at 15 feet			
						20					
						25					
Date Started: December 31, 2019			Date Completed: December 31, 2019			Water Level:  Not Encountered					
Logged By: S. Latronic			Drill Rig: CME-75DR			Drilling Method: 4" Solid-Stem Auger & PQ Coring					
Total Depth: 15 feet			Driving Energy: 140 lb. wt., 30 in. drop								
Work Order: 7956-00											

<div>THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION</div> <div>SIGNATURE Exp: 4/30/22</div> <div></div>	BOARD OF WATER SUPPLY <small>CITY AND COUNTY OF HONOLULU</small>			
	JOB XX-XXXX ACCESS ROAD REPAIR & DRAINAGE IMPROVEMENTS FOR MAKAHA WELLS II, III, AND IV MAKAHA, O'AHU, HAWAII			
	BORING LOGS			
	APPROVED: _____ <small>MANAGER AND CHIEF ENGINEER, BWS</small>			DATE: 2021
	DRAWN BY: HC	ENGINEER: GS	CHECKED BY: GS	FILE NO: _____
	FIELD BOOK NO: _____	SCALE: AS INDICATED	SHEET _____ OF _____	SHEET 15
	FILE	POCKET	FOLDER	NO.



This map is intended for visual representation of proposed subzone designation. It should not be used for boundary interpretations or any other use beyond the limits of this data. (Prepared on the State of Hawai'i's GIS - NOVEMBER 2012)

Legend

 Oahu Tax Map Key - 2012

Conservation Subzone

	Conservation
	GENERAL
	LIMITED
	PROTECTED
	RESOURCE
	SPECIAL

EXHIBIT 3

DLNR-OCCL SUBZONE MAP



APPENDIX

NATURAL RESOURCES ASSESSMENT (AECO)



**A natural resources assessment
for a BWS road crossing of Mākaha Stream
Mākaha Valley, west O'ahu**



AECOS Inc.
45-939 Kamehameha Highway
Suite 104
Kāne'ohe, Hawai'i 96744

September 6, 2023

A natural resources assessment for a BWS road crossing of Mākaha Stream Mākaha Valley, west O‘ahu¹

September 6, 2023

DRAFT

AECOS No. 1641B

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Introduction

The City and County of Honolulu, Board of Water Supply (BWS), plans to repair the BWS well access road at “Ford No. 2” crossing of Mākaha Stream in Mākaha Valley, O‘ahu (herein, the “Project”; see Figure 1). The road connects BWS wells II, III, and IV to Alahele Street in upper Mākaha Valley. AECOS Inc. was contracted by Bills Engineering to conduct a natural resources survey and assessment of the Project for the proposed repair work and delineate jurisdictional limits of waters of the U.S. This document reports our findings.²

The Project at Ford No. 2 is located on the BWS access road approximately 1.1 km (0.7 mi) in from the BWS gate at the *mauka* end of Alahele Street. Prior flooding has damaged the structure of Ford No. 2 such that existing pipes beneath the crossing are displaced and no longer convey low-flow stream water beneath the ford. At present, stream sediment is accumulated on the upstream side of the ford, and a large scour-hole has developed at the downstream side, exposing the small diameter pipe culverts (see cover photo and Figure 2).

¹ This report replaces AECOS No. 1641, dated November 23, 2020. This report differs only in the addition of sections on the jurisdictional waters survey methods, results, and conclusions.

² This document is produced for inclusion in an EA for the subject project and will become part of the public record.



Figure 1. Project location (red square) in upper Mākaha Valley, O'ahu.



Figure 2. Downstream scour exposing small diameter pipe culverts beneath Ford No. 2

Climate and Rainfall

Mākaha Valley is located along the leeward (west-facing) slope of Waianae Mountain. The Project area in Mākaha Valley receives an average annual rainfall of about 1590 mm (62.8 in), with rainfall typically highest in January and lowest in June (Giambelluca et al., 2013; see Figure 3).

Stream and Watershed

Mākaha Stream (DAR code 3-5-07) runs from northeast to southwest through Mākaha Valley and enters the Pacific Ocean at Mākaha Beach Park. Mākaha Stream is the only named stream within the approximately 19.4-sq km (7.5-sq mi) watershed, although several unnamed tributaries are also mapped (USFWS, nd-a; HDLNR-DAR, 2008). Mākaha Valley reaches up to 1212 m (3976 ft) in elevation (Parham et. al, 2008) near the top of Mount Ka‘ala, the highest point on O‘ahu Island. The Project area at Ford No. 2 is located at an elevation of approximately 275 m (900 ft) ASL and only approximately 3.9 sq km (2.4 sq mi) of the watershed remain above the Project (River Focus, Inc., 2019). Mākaha

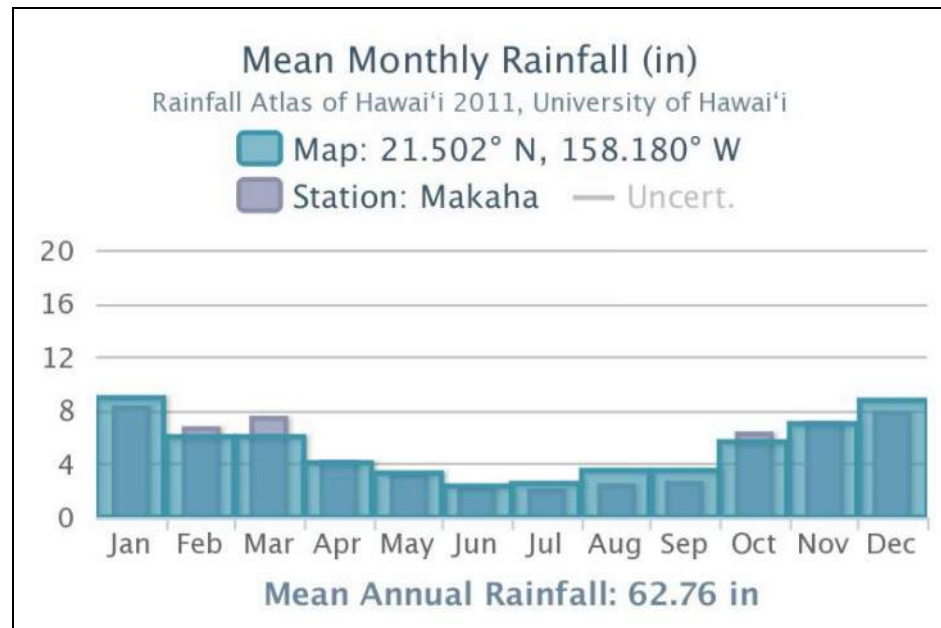


Figure 3. Average rainfall at the Project site (Giambelluca et al., 2013).

Stream is classified as a “perennial³” stream that is interrupted in lower reaches (Parham et. al, 2008; HCPSCU, 1990). Listed recreational resources for Mākaha Stream consist of fishing, parks, hunting and scenic views, and listed natural resources are coastal wetlands (HCPSCU, 1990).

An unnamed tributary, mapped on several federal and state hydrography datasets (USDA, nd.; USFWS, nd-a; HDLNR-DAR, 2008) converges at the right bank of Mākaha Stream just downstream of Ford No. 2 (Fig. 1). The unnamed tributary is classified as an “intermittent” stream on the state hydrography dataset (HDLNR-DAR, 2008).

The U.S. Department of Agriculture, National Resources Conservation Service, *Web Soil Survey* (USDA-NRCS, 2022) maps soils at Ford No. 2 as predominantly Pulehu very stony clay loam series along Mākaha Stream, surrounded by Helemano silty clay series on the right bank and northwest side of Mākaha Valley, and Lolekaa silty clay on the left bank and southeast side of Mākaha Valley. None of these soil series are on the list of hydric soils for Hawai'i (USDA-NRCS, 2020). Ford No. 2 falls under Flood Zone D, meaning that a FEMA flood study has been conducted at this location (HDLNR & FEMA, nd).

³ A perennial stream is one that flows all year round in some part of its bed. An interrupted stream is a perennial stream that is typical dry in the lower portion during the dry season (Timbol & Maciolek, 1978).

Jurisdictional Waters or Waters of the U.S.

Waters of the U.S. (also called “jurisdictional waters,” “federally jurisdictional waters,” or “WOTUS”) are surface waters that come under federal jurisdiction as authorized by the CWA and the Rivers and Harbors Act (RHA). Authority over these waters is granted to various federal agencies, including the U.S. Environmental Protection Agency (USEPA), with the U.S. Army Corps of Engineers (USACE) having permit authority for some actions that impact jurisdictional waters. Jurisdictional waters include all tidal waters and a subset of streams, lakes, reservoirs, and wetlands.

Revised definition of Waters of the U.S.

On March 20, 2023, the final “Revised Definition of Waters of the United States” took effect (USACE and USEPA, 2023). Jurisdictional waters identified in the rule include:

- tidal waters, also known as traditionally navigable waters (TNWs) [(a)(1)(i)]⁴;
- impoundments of jurisdictional waters [(a)(2)];
- tributaries of TNWs that have relatively permanent water (RPW) [(a)(3)(i)] or tributaries of TNWs that have a significant effect on the chemical, physical, or biological integrity of a TNW [(a)(3)(ii)];
- wetlands adjacent to TNWs [(a)(4)(i)] or wetlands adjacent to and with a continuous surface connection to RPW tributaries [(a)(4)(ii)], or wetlands adjacent to tributaries, provided the wetlands significantly affect the chemical, physical, or biological integrity of a TNW [(a)(4)(iii)];
- other waters not identified above that have RPW and a surface connection to a TNW or RPW tributary [(a)(5)(i)] or other waters not identified above that significantly affect the chemical, physical, or biological integrity of a TNW [(a)(5)(i)];

Non-jurisdictional waters identified in the rule include:

- prior converted cropland (PCC) [(b)(2)];
- ditches excavated wholly in and draining only dry land that do not carry RPW [(b)(3)]; and
- artificial lakes or ponds created by excavating or diking dry land to collect and retain water and are used exclusively for irrigation [(b)(5)].

⁴ Numbers and letters given in brackets are from the final rule (USACE and USEPA, 2023). Waterbody types are referred to by these designations.

U.S. Supreme Court Ruling

On May 25, 2023, a US Supreme Court ruling (SCOTUS, 2023) rejected the *significant nexus* standard, effectively eliminating jurisdiction over (a)(3)(ii), (a)(4)(iii), and (a)(5)(ii) waters as listed above. The ruling concludes that waters of the U.S. in the CWA encompass “only those relatively permanent, standing or continuously flowing bodies of water ‘forming geographic[al] features’ that are described in ordinary parlance as ‘streams, oceans, rivers, and lakes.’” In light of the US Supreme Court decision, USEPA and USACE are developing a rule to amend the final “Revised Definition of ‘Waters of the United States’” rule. The agencies intend to issue a final rule by September 1, 2023 (USEPA, 2023).

Methods

AECOS conducted two site visits to the Project site at Mākaha Stream. The initial survey on October 1, 2020 covered natural resources (flora and fauna). A second survey on August 1, 2023 covered the determination of state and federal jurisdictional waters and delineated the federal boundary.

Jurisdictional Waters Survey

AECOS scientists assessed extent of federal jurisdiction of Mākaha Stream in August 2023. Prior to the field surveys, we reviewed literature and GIS data, including: results of previous surveys conducted by AECOS for projects in the project vicinity (AECOS, 2012); streamflow data (USGS, 2023); climate data, including recent rainfall (NOAA-NWS, 2023); mapped soil types (USDA-NRCS, 2022); surface waters and wetlands identified in NWI (USFWS, nd-a); and mapped flood zones (HDLNR, 2023). We confirmed Mākaha Stream has a surface connection to the ocean.

Tributaries

AECOS scientists delineated OHWM on the banks of Mākaha Stream by marking paired locations along the stream channel with colored flagging tape and by recording the geospatial position of each flag using a handheld global navigation satellite system (GNSS) instrument (Trimble Geo7X), capable of sub-meter accuracy. We marked additional smaller tributaries and drainage features by walking the centerline of these features, recording a line on the Trimble Geo7X, and noting the respective channel width.

The resulting shapefile was processed with GPS Pathfinder, including differential correction, and exported as ArcMap shapefiles using a projected coordinate system of NAD 1983 UTM Zone 4N. We took photographs at each location to document the OHWM characteristics and illustrate the environment.

Wetlands

Wetland determinations followed the methods described in the *Corps of Engineers Wetland Delineation Manual* (“Manual”; USACE, 1987) and *Regional Supplement for Hawai‘i and Pacific Islands* (USACE, 2012). Wetland determination sampling points (SPs) are used to evaluate the presence of either wetland or upland characteristics at selected points. The approach for wetland delineation requires finding positive evidence of hydric soil, wetland hydrology, and hydrophytic vegetation at a SP. All three indicators must be present for a positive wetland determination. The boundary between wetland and upland (non-wetland) is established as a line outside of which at least one of the three wetland indicators is absent.

At each SP, we completed a wetland data determination form and recorded the geospatial position of the SP using the Trimble Geo 7X. We processed the geospatial data, as described above.

Water Quality

No surface water flow was occurring at the Project site at the time of either of our surveys in 2020 or 2023 (see cover photo). Consequently, no water samples could be obtained. A dry streambed in this reach is presumably normal during the dry season (May 1 to October 31).

Botanical Survey

The natural resources survey of flora in the Project area was undertaken by Bryson Luke on October 1, 2020 using a wandering (pedestrian) transect methodology. Plant species were identified as they were encountered. Species names follow *Manual of the Flowering Plants of Hawai‘i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow the 2019 *Hawaiian Native and Naturalized Vascular Plants Checklist* (Imada, 2019).

Aquatic Flora and Fauna Survey

No water (flowing or otherwise) was present anywhere in the Project vicinity at the time of our survey on October 1, 2020. Consequently, no aquatic biota were observed.

Terrestrial Vertebrates Survey

A survey of extant birds was conducted by Reginald David and Bryson Luke on the morning of October 1, 2020, including a single, 8-minute avian point-count station at Ford No. 2 at the Project site. The survey was conducted in the early morning hours when birds are most active. Birds were identified to species by visual observation, aided by Leica 8 X 42 binoculars, and by listening for vocalizations. Avian species observed in the Project area outside of timed-duration counts were noted as incidental observations. The avian phylogenetic order and nomenclature used in this report follows the AOU *Check-List of North and Middle American Birds* 2019, and the Sixtieth Supplement to the American Ornithological Society’s *Check-List of North American Birds* (Chesser et al., 2019, 2020).

We compiled a list of mammals encountered during the surveys. Indicators of mammalian presence, such as tracks, scat, and other sign were noted. Mammalian phylogenetic order and nomenclature follow *Mammal Species of the World* (Wilson and Reeder, 2005).

No survey was conducted for Hawaiian hoary bat (*‘ōpe‘ape‘a*; *Lasiurus cinereus semotus*), the only native land mammal in the Hawaiian Islands. The population of this bat is sparse on O‘ahu and detection requires multi-night surveys and deployment of special detection equipment. Negative results from one or even several such surveys cannot be taken as evidence of absence of this bat from a Project area. Rather, trees that could potentially serve as roost-sites for the species were noted, if present.

Results

Jurisdictional Waters

The nearest National Oceanographic and Atmospheric Administration–National Weather Service (NOAA–NWS) rain gage—Mākaha Stream (MKHH1)—recorded a total of 904 mm (35.57 in) of rainfall in the six months preceding our jurisdictional waters survey on August 1, 2023 (NOAA–NWS, 2023). Total

rainfall in that six-month period (February through July 2023) was 111% of the moving 30-year average rainfall for that gage. Climate conditions can be considered ‘typical’ for a determination of jurisdictional waters.

Mākaha Stream and tributaries were dry during both surveys (October 1, 2020, August 1, 2023). The U.S. Geological Survey (USGS) stream gage at Mākaha Stream (ID 16211600) upstream of the Project area indicates that Mākaha Stream was dry from August 5 to December 18, 2022 and again from July 7 to August 1, 2023 but had flowing water somewhat permanently from December 19, 2022 to July 6, 2023. This suggests that Mākaha Stream has seasonal (intermittent) flow during the wet season at the Project site, and relatively permanent waters are likely to be found in Mākaha Stream headwaters upstream of the Project area.

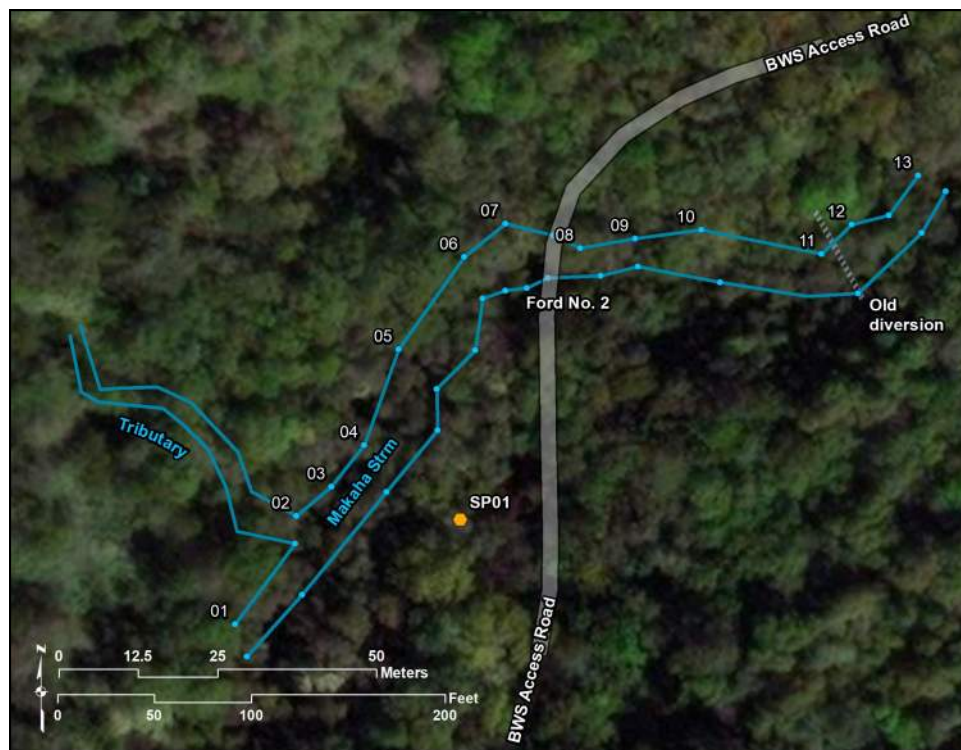


Figure 4. Marked OCHWM locations in Project area.

Tributaries

We marked a 150-m (490-ft) long segment of OCHWM at the Mākaha Stream Ford No. 2 crossing using 13 paired points (Figure 4). This delineation spans approximately 45 m (150 ft) upstream and 105 m (340 ft) downstream of the BWS Access Road crossing at Ford No. 2. We also marked 45 m (150 ft) of

OHWM of an additional unnamed tributary that runs north to southeast from the east-facing wall of Mākaha Valley using a centerline method. The unnamed tributary enters Mākaha Stream at the right bank near OHWM point 02 (Fig. 4). A photolog of our delineation is provided in Attachment A.



Figure 5. Old diversion spanning OHWM point 11, upstream of Ford No. 2.

Physical indicators used to delineate the OHWM are break in bank slope, destruction of terrestrial vegetation, changes in vegetative community, debris wracking, sediment sorting, polished boulders on streambed, natural line impressed on bank. Clumps of dried green macroalgae on the streambed suggests that streamflow occurs over a duration of time sufficient for algal growth during the wet season.

Mākaha Stream is well-defined throughout the course, with an average channel width of 7.6 m (25 ft) and mostly natural bed and bank near the Project crossing. The stream descends a moderate slope. During the wet season, the stream is likely to flow as a series of pools and runs. Human modifications to the channel are especially evident in two areas—the BWS access road crossing at Ford No. 2 and an obsolete ditch diversion that spans the stream channel at OHWM point 11 (Figure 5). Pieces of damaged pipe culvert and concrete-rock masonry (CRM) wall from Ford No. 2 crossing are scattered through the channel in the downstream direction. A very small pool at the base of the ditch diversion

(at OHWM 11) had remnant wet-season surface waters, but the remaining channel was dry. The streambed consists of well-worn basalt boulders and cobble. Very little of the underlying bedrock is visible.

The channel is lined with Java plum (*Syzygium cumini*), African tulip tree (*Spathodea campanulata*), and bumelia (*Sideroxylon persimile*). Basketgrass (*Oplismenus hirtellus*) and coral berry (*Rivina humilis*) grow on the banks above the OHWM, where seasonal streamflow has not stripped the surface soil. Guinea grass (*Megathyrsus maximus*) grows opportunistically throughout the understory, both above and partly below the delineated OHWM line.

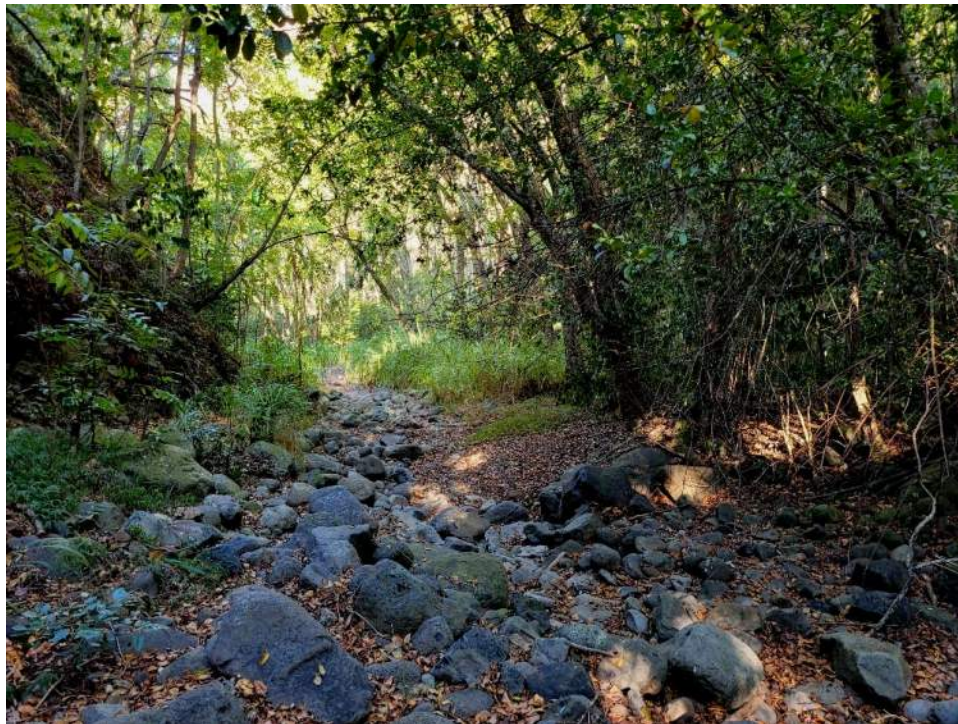


Figure 6. Dry stream bed aspect of Mākaha Stream just upstream of the Project site.

Wetlands

Our survey used one wetland determination point (SP-01) and found no wetlands at the Project area (see Fig. 4). The wetland determination datasheet for SP-01 is provided in Attachment B.

We located SP-01 in a low point above the left bank, proposed for use as a Project staging area. The site is in a low geomorphic position and may receive both floodwaters from Mākaha Stream and runoff from the BWS Access Road.

Aside from geomorphic position, we found no other primary or secondary indicators of wetland hydrology. The area is dominated by mostly upland plant species, consisting of African tulip tree (FACU), bumelia (UPL), coffee (*Coffea arabica*; FACU), and Java plum (FAC). The understory is filled with shoots and tree saplings of those species, along with Christella fern (*Christella parasitica*; FAC). The plant community does not meet the criteria for hydrophytic (wetland) plants. The soil is a non-hydric loam.

Vegetation

The BWS Access Road runs along the floor of Mākaha Valley, from around 165 m (550 ft) ASL off Alahele Street to 300 m (1000 ft) ASL at the BWS Well Site IV (see Figure 1). Vegetation along the access road is primarily mesic forest comprising primarily non-native trees and shrubs growing on former pastureland. Non-native forest covers slopes above left and right banks of Mākaha Stream at the Project site. Figure 6 shows the typical view of extant vegetation in the Project area, viewed from the Project site looking downstream.

Flora

Table 1 is a listing of ferns and flowering plants (angiosperms) observed during the survey with 33 taxa identified. The majority (94%) are naturalized (non-native) species. The only native plant is *Cyperus polystachios*, an indigenous sedge seen growing in the stream channel. One early Polynesian introduction, *kukui* (*Aleurites moluccana*), is also present along the valley floor.

Aquatic Biota

No aquatic biota was observed from Mākaha Stream during our survey on October 1, 2020 nor on August 1, 2023. The streambed in the Project area was dry during both surveys (see Fig. 6), which appears to be the typical condition for this stream segment in the dry season.

State of Hawai‘i, Division of Land and Natural Resources (HDLNR), Dept. of Aquatic Resources (DAR) survey data for aquatic species in Mākaha Watershed are recorded in the *Atlas of Hawaiian Watersheds* (Parham et al., 2008). The DAR survey results are summarized in Table 2, compiled from surveys conducted between 1956 and 2001.

The results of DAR aquatic surveys indicate the presence of native stream fauna within Mākaha Stream. ‘O‘opu nākea (*Awaous stamineus*), a native stream goby, occur in the middle-reach of Mākaha Stream, and Hawaiian mountain shrimp or

Table 1. Plant species observed along Mākaha Stream at Ford No. 2.

Species listed by family	Common name	STATUS	ABUNDANCE	NOTES
FERNS AND FERN ALLIES				
BLECHNACEAE				
<i>Blechnum appendiculatum</i> Willd.	---	Nat	C	
PTERIDACEAE				
<i>Adiantum hispidulum</i> Sw.	rough maidenhair	Nat	A	
THELYPTERIDACEAE				
<i>Christella parasitica</i> (L.) Farw	downy woodfern	Nat	C	
FLOWERING PLANTS				
MAGNOLIIDS				
LAURACEAE				
<i>Persea americana</i> Mill.	avocado	Nat	R	
FLOWERING PLANTS				
MONOCOTS				
CYPERACEAE				
<i>Cyperus involucratus</i> Rottb.	umbrella sedge	Nat	R	
<i>Cyperus polystachyos</i> Rottb.	---	Ind	R	
LILIACEAE				
<i>Asparagus plumosus</i> J. G. Baker	climbing asparagus-fern	Nat	R	
POACEAE				
<i>Eleusine indica</i> (L.) Gaertn	wiregrass	Nat	R	
<i>Megathyrsus maximus</i> (Jacq.) B. K. Simon & W. L. Jacobs	Guinea grass	Nat	A	
<i>Oplismenus hirtellus</i> (L.) P. Beauv.	basketgrass	Nat	C	
FLOWERING PLANTS				
EUDICOTS				
ANACARDIACEAE				
<i>Schinus terebinthefolius</i> Raddi	Christmas berry	Nat	C	
ARALIACEAE				
<i>Heptapleurum actinophyllum</i> (Endl.) Lowry & G. M. Plunkett	octopus tree	Nat	R	
ASTERACEAE (COMPOSITAE)				
<i>Sphagnetica trilobata</i> (L.) Pruski	wedelia	Nat	O	
<i>Synedrella nodiflora</i> (L.) Gaertn.	nodeweed	Nat	R	

Table 1 (continued).

Species listed by family	Common name	STATUS	ABUNDANCE	NOTES
BIGNONIACEAE				
<i>Spathodea campanulata</i> P.Beauv.	African tulip tree	Nat	C	
CLUSIACEAE				
<i>Clusia rosea</i> Jacq.	autograph tree	Nat	R	
CONVOLVULACEAE				
<i>Ipomoea obscura</i> (L.) Ker-Gawl.	---	Nat	R	
EUPHORBIACEAE				
<i>Aleurites moluccana</i> (L.) Wild.	kukui	Pol	O	
FABACEAE				
<i>Acacia confusa</i> Merr.	Formosan koa	Nat	R	
<i>Leucaena leucocephala</i> (Lam.) deWit	koa haole	Nat	A	
<i>Mimosa pudica</i> L.	sleeping “grass”	Nat	R	
FABACEAE (cont.)				
<i>Senna surattensis</i> (Burm. F.) H. S. Irwin & Barneby	scrambled egg plant	Nat	R	
LAMIACEAE				
<i>Leonotis nepetifolia</i> (L.) R. Br.	lion’s ear	Nat	R	
MELASTOMATACEAE				
<i>Miconia crenata</i> (Vahl) Mich.	Koster’s curse	Nat	C	
MYRTACEAE				
<i>Psidium cattleianum</i> Sabine	strawberry guava	Nat	C	
<i>Syzygium cumini</i> (L.) Skeels	Java plum	Nat	C	
PHYTOLACCACEAE				
<i>Rivina humilis</i> L.	coral berry	Nat	C	
PROTEACEAE				
<i>Grevillea robusta</i> A. Cunn. ex R. Br.	silk oak	Nat	R	
RUBIACEAE				
<i>Coffea arabica</i> L.	Arabian coffee	Nat	R	
<i>Spermacoce assurgens</i> Ruiz & Pav.	buttonweed	Nat	R	
SAPOTACEAE				
<i>Chrysophyllum oliviforme</i> L.	satin leaf	Nat	A	
<i>Sideroxylon persimile</i> (Hemsl.) T.D. Penn	bumelia	Nat	C	
ULMACEAE				
<i>Trema orientalis</i> (L.) Blume	gunpowder tree	Nat	O	
VERBENACEAE				
<i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Jamaica vervain	Nat	R	

Table 1 (continued).

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.**Nat** = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.**Pol** = An early Polynesian introduction; introduced before 1778.

ABUNDANCE = occurrence ratings for plant species:

R - Rare seen in only one or perhaps two locations.

U - Uncommon seen at most in several locations

O - Occasional seen with some regularity

C - Common observed numerous times during the survey

A - Abundant found in large numbers; may be locally dominant.

AA - Very abundant abundant and dominant; defining vegetation type.

**Table 2. DAR aquatic biota survey results from
Mākaha Stream (Parham et. al, 2008).**

Species	Common name	Status
INVERTEBRATES		
Insects		
<i>Megalagrion hawaiiense</i> McLachlan	Hawaiian upland damselfly	End
<i>Megalagrion nigrohamatum</i> <i>nigrolineatum</i> Blackburn	blackline damselfly	End
<i>Megalagrion oceanicum</i> McLachlan	oceanic damselfly	End
Crustaceans		
<i>Atyoida bisulcata</i> Randall	'opae kala'ole, Hawaiian mountain shrimp	Ind
Vertebrates		
Fishes		
GOBIIDAE		
<i>Awaous stamineus</i> Eydoux & Souleyet	'o'opu nākea	End
POECILIIDAE		
<i>Gambusia affinis</i> S.F. Baird	mosquitofish	Nat

Table 2 (continued).

Legend to Table 2

STATUS = distributional status for the Hawaiian Islands:

End = endemic; native and unique to the Hawaiian Islands.**Ind** = indigenous; native but not uniquely so in the Hawaiian Islands**Nat** = introduced, non-native (alien) species naturalized in the Hawaiian Islands.

‘ōpae kala’ole (*Atyoida bisulcata*) occur in the upper-reaches of Mākaha Stream, along with the endemic and endangered blackline damselfly (*Megalagrion nigrohamatum nigrolineatum*) and oceanic damselfly (*M. oceanicum*). Hawaiian upland damselfly (*M. hawaiiense*) was recorded in the stream headwaters.

Birds

A total of 41 individual birds of 8 species was recorded by the point-count survey at Ford No. 2 (Table 3). Six additional bird species were observed at or near the Project area outside the timed-count and are listed as incidental species in Table 3. Of fourteen total bird species identified, none is native (indigenous or endemic) to the Hawaiian Islands. Most are common non-native (alien) species naturalized to the Hawaiian Islands, while two species, Indian Peafowl (*Pavo cristatus*) and Kalij Pheasant (*Lophura leucomelanos*) are non-native introductions with limited geographical distributions: a population of Indian Peafowl is known from Mākaha Valley Towers condominium south of the Project area; and Kalij Pheasant were purposefully introduced into DLNR game bird hunting areas on Waianae Mountain.

Table 3. Avian species detected on October 1, 2020 from the Project area along Mākaha Stream.

ORDER			
FAMILY	Common Name	Status	Count
Species			
GALLIFORMES			
PHASIANIDAE			
<i>Lophura leucomelanos</i>	Kalij Pheasant	NN	†
<i>Pavo cristatus</i>	Indian Peafowl	NN	1
<i>Gallus gallus</i>	Domestic Chicken	NN	†
<i>Francolinus erckelii</i>	Erckel’s Francolin	NN	†

Table 3 (continued).

ORDER				
FAMILY		Common Name	Status	Count
<i>Species</i>				
COLUMBIFORMES				
COLUMBIDAE				
<i>Streptopelia chinensis</i>		Spotted Dove	NN	8
<i>Geopelia striata</i>		Zebra Dove	NN	2
PASSERIFORMES				
PYCNONOTIDAE				
<i>Pycnonotus cafer</i>		Red-vented Bulbul	NN	3
ZOSTEROPIDAE				
<i>Zosterops japonicus</i>		Warbling White-eye	NN	8
LEIOTHRICHIDAE				
<i>Leiothrix lutea</i>		Red-billed Leiothrix	NN	14
MUSICAPIDAE				
<i>Copsychus malabaricus</i>		White-rumped Shama	NN	3
STURNIDAE				
<i>Acridotheres tristis</i>		Common Myna	NN	†
THRAUPIDAE				
<i>Paroaria coronata</i>		Red-crested Cardinal	NN	2
ESTRILDIDAE				
<i>Estrilda astrild</i>		Common Waxbill	NN	†

† = Incidental observation; observed outside the timed count.

Key to Table 3.

Status: NN = Naturalized, non-native species (introduced).

Avian diversity and densities observed in this survey are consistent with disturbed mesic forest on West O'ahu. Red-billed Leiothrix (*Leiothrix lutea*) was the most common bird species counted and was abundant in the trees along the stream. Red-billed Leiothrix, Warbling White-eye (*Zosterops japonicus*), and Spotted Dove (*Streptopelia chinensis*) cumulatively accounted for nearly three-quarters (73%) of the total birds counted.

Mammals

Small Indian mongoose (*Herpestes javanicus*) was the only mammalian species encountered during our survey of the Project area. Domestic dog (*Canis lupus*

familiaris) was noted in the Alahele Street neighborhood downslope of the Project.

Trees of suitable height for Hawaiian hoary bat roosting (trees taller than 15 ft) are present and abundant along the banks of Mākaha Stream and along the BWS access road at the Project area.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, 2020). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to protected species to the maximum extent practicable.

Jurisdictional Waters

Mākaha Stream is an interrupted perennial stream that stretches from Mount Ka'ala to the Pacific Ocean as a tributary, potentially making it a water of the U.S. We found no wetlands to occur adjacent to Mākaha Stream in the Project area. If jurisdictional, the limit of federal jurisdiction within the Project area is drawn at the OHWM of the stream, as delineated and depicted in Fig. 4.

Federal jurisdiction is solely determined by the USACE and is based upon the USACE accepting our findings. Acceptance may require a field visit by a USACE representative from the Regulatory Office to confirm our delineation. Our delineation is not official until an acceptance letter from the USACE is received by the applicant.

Floral Resources

No plants of conservation concern or enjoying statutory protection (that is, listed as threatened or endangered; HDLNR, 1998; USFWS, nd-b) were noted in the survey area. No plants suggestive of wetlands (hydrophytes) were observed growing on ground adjacent to the stream bed.

Aquatic Resources

No aquatic species protected by state or federal statutes (HDLNR, 2015; USFWS, nd-b) were observed in Mākaha Stream at the Project site during the course of our surveys. Streamflow data (USGS, 2023) and observations of stream

macroalgae suggest that streamflow in the Project segment of Mākaha Stream is seasonal, typically extending several months through the wet season. While not observed, Hawaiian freshwater streams are habitat for many Hawaiian endemic and indigenous life, including several species of damselfly, freshwater gobies, shrimp, and snails. Many native freshwater species have an amphidromous life cycle—eggs are laid in freshwater stream reaches, and hatched larvae drift downstream and out into the ocean where they develop for a time before migrating back into freshwater streams to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). Project activities must not impede the migratory pathways of native amphidromous species. Maintaining good water quality in the stream should be a priority.

Several species of Hawaiian damselfly are protected under state and federal statutes. On O'ahu, these are crimson damselfly (*Megalagrion leptodemas*), blackline damselfly (*M. nigrohamatum nigrolineatum*), oceanic damselfly (*M. oceanicum*), and orange-black damselfly (*M. xanthomelas*; USFWS-PIFWO, 2020). Of these, blackline damselfly and oceanic damselfly have been reported from the middle to upper reaches of Mākaha Stream. Predatory non-native fishes, amphibians, and invertebrates, along with habitat degradation and loss, are major threats to Hawaiian damselfly populations. Habitat for Hawaiian damselflies was not observed at the immediate Project site but could occur up or downstream of the Project area.

- If in-water work is required, BMPs for work in aquatic environments should be incorporated into the project plan to minimize the degradation of water quality and impacts to biological resources.
- Instream migration pathways should be maintained at all times.

Avian Resources

All avian species recorded at the Project site from this survey are non-native species naturalized to the Hawaiian Islands. None of the species recorded from this survey receive special protections under state or federal endangered species statutes.

Protected night-flying seabirds in Hawai'i include Hawaiian Petrel (*Pterodroma sandwichensis*), Wedge-tailed Shearwater (*Ardenna pacifica*), Newell's Shearwater (*Puffinus newelli*), and Band-rumped Storm-Petrel (*Hydrobates castro*). Hawaiian Petrel and Newell's Shearwater nest in upland mountainous habitat and have been detected on the Island of O'ahu (Young et al. 2019). In the summer and fall, protected night-flying seabirds (especially fledglings) transiting to the sea from inland locations can become disoriented by exterior

lighting. When disoriented, seabirds may collide with man-made structures or the ground. If not killed outright, dazed or injured birds are targets of opportunity for feral mammals (Podolsky et al., 1998; Ainley et al., 2001; Day et al., 2003). The primary cause of mortality in both Hawaiian Petrel and Newell’s Shearwater is predation by alien mammalian species at the nesting colonies (USFWS, 1983; Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabirds in Hawai‘i. No suitable nesting habitat for seabird species occurs in the Project area.

White Tern (*Gygis alba*), or *manu o Kū*, is an indigenous seabird listed as threatened under State of Hawai‘i endangered species statute, HRS 195D (HDLNR, 2015). In the main Hawaiian Islands, the majority of White Tern population is restricted to central urban and suburban Honolulu, with a known nesting and breeding range extending from Aloha Tower to Niu Valley (VanderWerf and Downs, 2018). The Project area in Mākaha Valley is well outside this range and there is little chance White Tern would occur at the Project site.

No O‘ahu ‘*Elepaio* were visually detected and no calls were heard during our time at the Project site. Federally designated critical habitat for the endangered O‘ahu ‘*Elepaio* (*Chasiempis ibidis*) begins approximately 90 m (300 ft) upslope from Ford No. 2 (see Figure 7). The Wai‘anae subpopulation of O‘ahu ‘*Elepaio* forms a fragmented breeding range throughout Wai‘anae Mountain. Five pairs and 13 individual male O‘ahu ‘*Elepaio* were counted from Mākaha Valley in 2009 (VanderWerf et al., 2011). The Waianae population of O‘ahu ‘*Elepaio* is typically observed over an elevation range of 500 to 850 m (1,625 to 2,775 ft; Mitchell et al., 2005). Ford No. 2 is slightly below this range, at around 275 m (900 ft) ASL, and thus O‘ahu ‘*Elepaio* are unlikely to occur there on a regular-basis. However, elevation would not necessarily preclude potential presence of O‘ahu ‘*Elepaio*, and aquatic insects during periods of streamflow at Ford No. 2 may present a temporary or seasonal forage opportunity for O‘ahu ‘*Elepaio*.

The following minimization measures and construction BMPs are recommended to minimize potential impacts to listed avian species to the maximum extent practicable (USFWS-PIFWO, 2020):

- If Project work will result in night-time lighting sources, including lights from night-time construction, then risk of incidentally downing nocturnally-flying seabirds will increase. To avoid and minimize potential impacts to seabirds, USFWS recommends the following applicable measures: fully shield all outdoor lights so the bulb can only be seen from below bulb height and only use when necessary; install

automatic motion sensor switches and timer controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area; and avoid all night-time construction during the seabird fledging period from September 15 through December 15 (USFWS-PIFWO, 2020). All external lighting structures should be fully “dark sky compliant” (HDLNR-DOFAW, 2016).

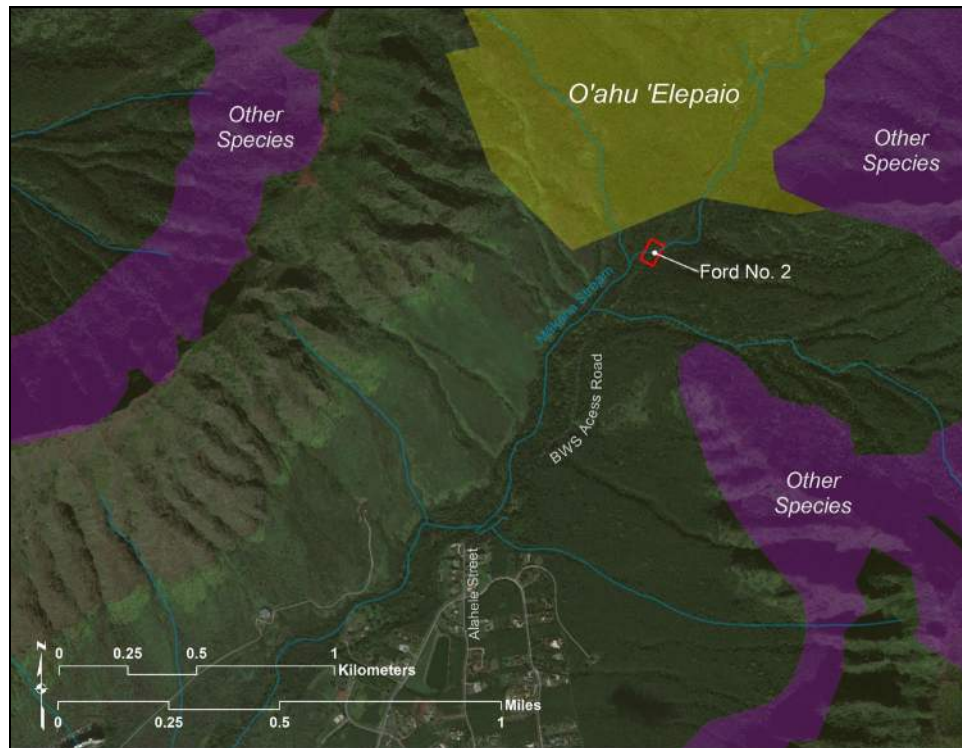


Figure 7. Critical habitat areas relative to the Project site at Ford No. 2.

Forest birds are sensitive to mosquito-borne disease. Avoid increasing mosquito populations by creating stagnant water habitat at project sites. As this Project will improve drainage through Ford No 2, Project activities would appear to reduce the presence of stagnant water and have a positive impact on forest birds.

Mammals

Our survey identified only one mammal, Small Indian mongoose, though it is probable that domestic dog (*Canis lupis familiaris*), domestic cat (*Felis catus*), wild boar (*Sus scrofa*), and one or more of the four alien Muridae (rats and mice) currently established on the Island of O‘ahu utilize this area to some extent. Goat (*Capra hircus*) are also known from Wai‘anae Mountain. All of the

aforementioned mammalian species are introduced mammals deleterious to native ecosystems and native fauna.

It is possible that the Hawaiian hoary bat uses resources within the Project vicinity. This species is solitary and rare but with a potentially widespread distribution on O‘ahu (USFWS, 1998). Many potential roost trees (trees over 15 ft tall) exist within the Project area along Mākaha Stream and the Access Road. However, Hawaiian hoary bats use multiple roosts within a home territory (Bonaccorso, 2015), so the disturbance associated with removal of any particular tree would be minimal. An exception might be during the pupping season, if a female bat carrying a pup is unable to rapidly vacate a roost tree that is being felled, or if an unattended pup is unable to flee a tree that is being felled.

- Potential adverse impacts to Hawaiian hoary bat can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the bat pupping season.

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Attachment A

OHWM photolog



OHWM Location 1 Upstream



OHWM Location 1 Right bank



OHWM Location 1 Downstream



OHWM Location 1 Left bank



OHWM Location 2 Upstream



OHWM Location 2 Right bank



OHWM Location 2 Downstream



OHWM Location 2 Left bank



OHWM Location 4 Upstream



OHWM Location 4 Right bank



OHWM Location 4 Downstream



OHWM Location 4 Left bank



OHWM Location 5 Upstream



OHWM Location 5 Right bank



OHWM Location 5 Downstream



OHWM Location 5 Left bank



OHWM Location 6 Upstream



OHWM Location 6 Right bank



OHWM Location 6 Downstream



OHWM Location 6 Right bank



OHWM Location 7 Upstream



OHWM Location 7 Right bank



OHWM Location 7 Downstream



OHWM Location 7 Left bank



OHWM Location 8 Upstream



OHWM Location 8 Right bank



OHWM Location 8 Downstream



OHWM Location 8 Left bank



OHWM Location 9 Upstream



OHWM Location 9 Right bank



OHWM Location 9 Downstream



OHWM Location 9 Left bank



OHWM Location 10 Upstream



OHWM Location 10 Right bank



OHWM Location 10 Downstream



OHWM Location 10 Left bank



OHWM Location 11 Upstream



OHWM Location 11 Right bank



OHWM Location 11 Downstream



OHWM Location 11 Left bank



OHWM Location 12 Upstream



OHWM Location 12 Right bank



OHWM Location 12 Downstream



OHWM Location 12 Left bank



OHWM Location 13 Upstream



OHWM Location 13 Right bank



OHWM Location 13 Downstream



OHWM Location 13 Left bank

Attachment B

Wetland Determination Datasheets

SOIL

Sampling Point: SP-01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0 - 14	10YR 2/2	100					Loamy/Clayey	loam

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

Hydric Soil Indicators: <input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Muck Presence (A8) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) (Guam, CNMI, and American Samoa) <input type="checkbox"/> Dark Surface (S7) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)	Indicators for Problematic Hydric Soils³: <input type="checkbox"/> Stratified Layers (A5) <input type="checkbox"/> Red Parent Material (F21) <input type="checkbox"/> Very Shallow Dark Surface (F22) <input type="checkbox"/> Other (Explain in Remarks)
---	--	---

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

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
---	---

Remarks:

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u>				<u>Secondary Indicators (minimum of two required)</u>			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Aquatic Fauna (B13)	<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Tilapia Nests (B17)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)		<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Salt Deposits (C5)		<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Thin Muck Surface (C7)	<input checked="" type="checkbox"/> Geomorphic Position (D2)		<input type="checkbox"/> Iron Deposits (B5)	<input type="checkbox"/> Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)	<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)		<input type="checkbox"/> Water-Stained Leaves (B9)			

Field Observations: Surface Water Present? Yes _____ No <u>x</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>x</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>x</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
---	---

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

Remarks:
Negative alpha, alpha dipyrindyl test . This area may be in the floodplain of Makaha Stream and also receives runoff from the road.



APPENDIX

Makaha Wells Access Road & Makaha Stream
H&H Report (2021-12-06)



Access Road Repair Mākaha Wells II, III, and IV

Mākaha Stream Hydraulic Analysis



December
2021

Final Report

Prepared for:



Prepared by:



In association with:



Access Road Repairs Mākaha Wells II, III, and IV Mākaha Stream Hydraulic Analysis

Final Report

December 2021

Prepared for

Board of Water Supply
City and County of Honolulu

In association with

Bills Engineering, Inc.

Prepared by

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Signature

April 30, 2022

Expiration Date

Table of Contents

1	INTRODUCTION.....	1
1.1	Watershed and Stream Characteristics.....	1
2	HYDROLOGY	6
2.1	Previous Studies	6
2.2	Flood-Frequency Analysis	6
2.3	Peak 100-Year Design Discharge Comparison.....	8
2.4	Peak 2-Year Design Discharge.....	9
3	HYDRAULIC MODELING	10
3.1	Hydraulic Model Data/Parameters.....	10
3.2	HEC-RAS Model Results – Existing Conditions.....	13
3.3	Proposed Conditions	1
3.4	HEC-RAS Model Results – Proposed Conditions	1
4	REFERENCES.....	33
5	ACKNOWLEDGMENTS	33

List of Tables

Table 2-1.	Mākaha Stream Flood-Frequency Analysis – Computed Peak Discharges	7
Table 2-2.	Mākaha Stream Flood-Frequency Analysis – Adjusted Peak Discharges	8
Table 2-3.	Mākaha Stream Flood-Frequency Analysis – Exponent Values in USGS Regression Equation for Adjusted Peak Discharges	8
Table 2-4.	Mākaha Stream 100-year Peak Discharge Comparison.....	9
Table 2-5.	Mākaha Stream 2-Year Peak Discharge for Diversion.....	9
Table 3-1.	Manning’s Roughness Values.....	13

List of Figures

Figure 1-1.	Mākaha Stream Watershed – Project Location (USGS StreamStats, 2019)	1
Figure 1-2.	Makai Side of Access Road showing Erosion Damage.....	3
Figure 1-3.	Mākaha Stream – Makai of the Access Road (Facing in the Mauka Direction).....	3
Figure 1-4.	Mākaha Stream – From the Access Road (Facing in the Makai Direction).....	4
Figure 1-5.	Mākaha Stream – Pool formed on Mauka Side of Access Road due to Blocked Pipe Culverts (photo provided by Bills Engineering).....	4
Figure 1-6.	Water flowing over Access Road due to Blocked Pipe Culverts (photo provided by Bills Engineering)	5
Figure 2-1.	Mākaha Stream Watershed and USGS Streamgage #16211600.....	6
Figure 2-2.	Mākaha Stream – Flood-Frequency Curve	7
Figure 3-1.	Initial Existing Conditions HEC-RAS 2-D Model Results.....	10
Figure 3-2.	Final 2-D Model Area with Proposed Condition Terrain and Land Cover.....	11
Figure 3-3.	Input Hydrograph.....	12

Figure 3-4. Existing Conditions 100-year Flow Trace	15
Figure 3-5. Existing Conditions 100-year Flood Depth with 1-ft Contours	16
Figure 3-6. Existing Conditions 100-year Water Surface Elevation with 1-ft Contours	17
Figure 3-7. Existing Conditions 100-year Water Surface Profile Plot	18
Figure 3-8. Existing Conditions 100-year Velocity (ft/sec) with 2-ft/s contours	19
Figure 3-9. Existing Conditions 100-year Shear Stress (lb/ft ²)	20
Figure 3-10. Proposed Acrow Bridge Crossing Layout with Diversion Ditch and Temporary Access Road	20
Figure 3-11. Proposed Bridge Section (Mauka Face)	21
Figure 3-11. Sectional Profile of the Proposed Bridge	22
Figure 3-12. Proposed Conditions 100-year Flow Trace and Flood Depth (ft)	23
Figure 3-13. Proposed Conditions 100-year Flood Depth with 1-ft Contour	24
Figure 3-14. Proposed Conditions 100-year Water Surface Elevation with 1-ft Contours	25
Figure 3-15. Proposed Conditions 100-year Water Surface Profile Plot	26
Figure 3-16. Proposed Conditions 100-year Water Surface Elevation – Cross Section View at Bridge Centerline	27
Figure 3-17. Proposed Conditions 100-year Water Surface Elevation – Cross Section View at Mauka Face of Bridge	28
Figure 3-18. Proposed Conditions 100-year Velocity (ft/sec) with 2-ft/s contours	29
Figure 3-19. Proposed Conditions 100-year Shear Stress (lb/ft ²)	30
Figure 3-20. Mākaha Stream Thalweg Profile	31
Figure 3-21. Makaha Stream Profile	32

1 INTRODUCTION

The Mākaha Stream crossing at the Honolulu Board of Water Supply (BWS) Access Road for Mākaha Wells II, III, and IV is located in the upper Mākaha Stream watershed on the leeward side of O‘ahu. The concrete ford crossing has small diameter pipe culverts that are completely clogged, forcing the stream to go over the road. Heavy accumulation of stream sediment to the top of the cement rubble masonry (CRM) shoulder has occurred on the mauka side of the crossing. On the makai side, a large scour hole has developed below the grouted rubble paving (GRP) shoulder and vertical wall. During heavy stream flows, water also flows down the road more than 50 feet from the crossing, causing further erosion along the side of the road.

The purpose of this study is to perform a hydrologic and hydraulic analysis for the Mākaha Stream crossing to determine the expected flows, evaluate scour potential, and support the design of a new bridge crossing.

1.1 Watershed and Stream Characteristics

Watershed Summary

The watershed area above the project location is approximately 2.4 square miles (see Figure 1-1) based on U.S. Geological Survey (USGS) StreamStats (2019). It is located mauka of the Mākaha Valley, one of the 9 major valleys formed along the western side of the Wai‘anae Range, the remnants of an ancient highly eroded shield volcano that comprises the western half of the island of Oahu. The Mākaha Valley is surrounded by pali (steep slopes and cliffs) formed on the eroded volcano.



Figure 1-1. Mākaha Stream Watershed – Project Location (USGS StreamStats, 2019)

Land Cover / Vegetation

The entire watershed upstream of the project location is undeveloped. The majority of the vegetation in the upper valley walls consists of non-native grasses, shrubs, and trees. Invasive species such as coffee and strawberry guava are also found throughout the forested areas.

Precipitation

The average annual precipitation varies with topography within Mākaha Stream watershed, averaging 20 inches in the lower reaches to over 75 inches in the headwaters. Mean annual precipitation in the project watershed is approximately 67 inches. The maximum 100-year, 48-hour rainfall depth in the watershed is approximately 19.3 inches (Ries et al., 2017).

Mākaha Stream

Mākaha Stream is perennial (i.e., it flows year-round). The mean annual flow is less than 5 cfs at the USGS streamflow gage (#16211600) located just upstream of the study reach. Mākaha Stream is fed by water that falls on Mount Ka‘ala and from numerous tributaries along the pali.

Flood History

In the 58 years that the Mākaha streamgage has been in operation, the average annual peak flow during any given year is approximately 400 cfs with a relatively high degree of variability (1 standard deviation is approximately 425 cfs). The peak streamflow has exceeded 1,000 cfs on four occasions within the period of record, most recently in 1996 (2,680 cfs) and 2008 (1,100 cfs).

Major flooding and infrastructure damage occurred in the Mākaha Valley during 1996 and 2008. Flood damage also occurs at lower flow rates as well. In 2011, a storm that generated a peak flow of 539 cfs at this streamgage caused damage in Mākaha Valley along Kili Drive (USGS National Water Information System: <https://nwis.waterdata.usgs.gov/nwis>).

Field Visit & Site Photos

River Focus personnel (Jake Gusman and Darren Bertrand) performed a field reconnaissance visit on July 15, 2019, to evaluate hydraulic model parameters and examine existing scour conditions. A selection of field photos is provided in Figure 1-2 through Figure 1-6.



Figure 1-2. Makai Side of Access Road showing Erosion Damage



Figure 1-3. Mākaha Stream – Makai of the Access Road (Facing in the Mauka Direction)



Figure 1-4. Mākaha Stream – From the Access Road (Facing in the Makai Direction)



Figure 1-5. Mākaha Stream – Pool formed on Mauka Side of Access Road due to Blocked Pipe Culverts
(photo provided by Bills Engineering)



Figure 1-6. Water flowing over Access Road due to Blocked Pipe Culverts (photo provided by Bills Engineering)

2 HYDROLOGY

2.1 Previous Studies

In 2014-15, Okahara and Associates, Inc.—as subconsultant to Townscape, Inc.—prepared a hydrologic and hydraulic study for Mākaha Stream; however, the study focus was on Mākaha Valley and they did not compute a peak discharge (or hydrograph) for the current study reach.

2.2 Flood-Frequency Analysis

USGS Streamgage Data

If a stream has a streamflow gage with a long period of record (e.g., more than 15 to 20 years), a flood-frequency analysis based on the observed gage data is typically the most reliable method of estimating peak flows. In the case of Mākaha Stream, a gage with 58 years of data (USGS #16211600) is located just a quarter of a mile upstream of the access road crossing—an ideal gage location for this project. Data from the Mākaha Stream gage is available from 1960 to the present. The gage location compared to the overall watershed topography is provided in Figure 2-1.

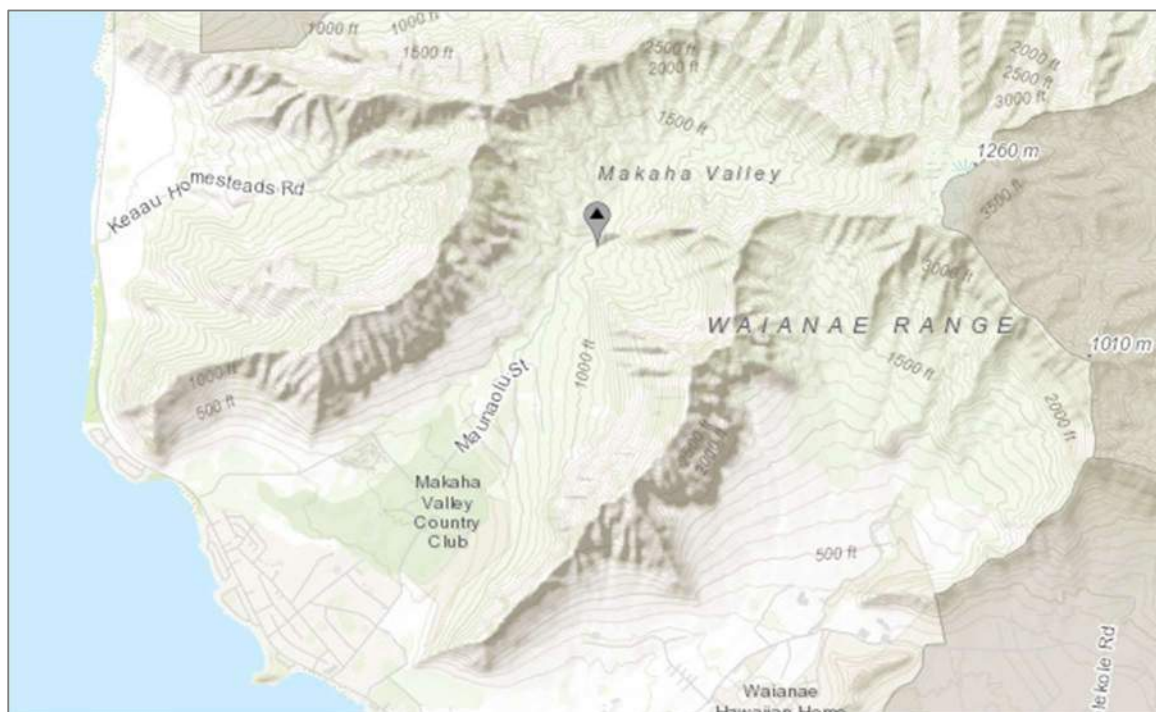


Figure 2-1. Mākaha Stream Watershed and USGS Streamgage #16211600

Bulletin 17C Flood-Frequency Analysis

A flood-frequency analysis (Log Pearson Type III – Bulletin 17C) was performed to estimate the 100-year peak flow for the hydraulic modeling and to develop additional return interval flows for the long-term channel degradation and scour analysis. A flood-frequency curve is shown in Figure 2-2 and the computed discharges are summarized in Table 2-1.

Table 2-1. Mākaha Stream Flood-Frequency Analysis – Computed Peak Discharges

Location	Computed Peak Discharge (cfs) at Gage				
	10-yr	25-yr	50-yr	100-yr	500-yr
Mākaha Stream	900	1,385	1,820	2,305	3,670

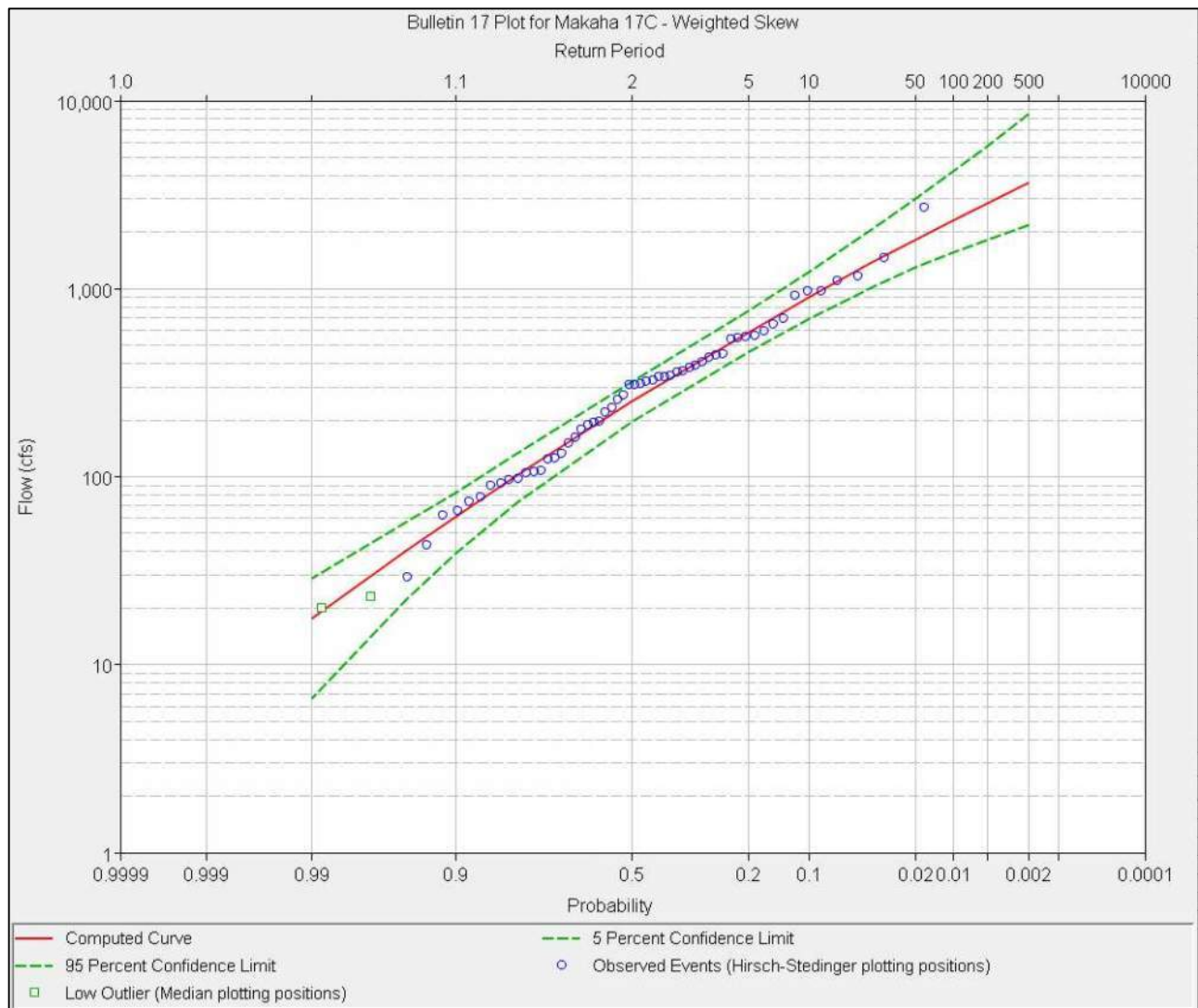


Figure 2-2. Mākaha Stream – Flood-Frequency Curve

Peak Discharges at Access Road

The drainage area at the access road is 2.43 mi², which is slightly larger than the drainage area at the streamgage (2.117 mi²). To obtain the peak flow at the access road (Table 2-2), the following equation was used, which is based on the standard USGS Regression equation for leeward O'ahu (Oki et al., 2010):

$$Q_{ungaged} = Q_{gaged} \left(\frac{A_{ungaged}}{A_{gaged}} \right)^b \left(\frac{P_{ungaged}}{P_{gaged}} \right)^c$$

where $Q_{ungaged}$, Q_{gaged} , $P_{ungaged}$, P_{gaged} , and $A_{ungaged}$, A_{gaged} are the peak discharges, mean annual precipitation, and the drainage areas for the ungaged and gaged basins, respectively. The exponents b and c are region and event-specific and are listed in Table 2-3.

Table 2-2. Mākaha Stream Flood-Frequency Analysis – Adjusted Peak Discharges

Location	Adjusted Peak Discharge (cfs) at Access Road					
	2-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Mākaha Stream	270	980	1,510	1,980	2,510	3,995

Table 2-3. Mākaha Stream Flood-Frequency Analysis – Exponent Values in USGS Regression Equation for Adjusted Peak Discharges

Location	Exponent Values in USGS Regression Equation					
	2-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Exponent b	0.678	0.664	0.657	0.652	0.646	0.633
Exponent c	1.106	0.674	0.520	0.422	0.335	0.162

2.3 Peak 100-Year Design Discharge Comparison

A comparison of computed peak discharges for Mākaha Stream is provided in Table 2-4. The 100-year flood-frequency peak flow of 2,510 cfs is based on an analysis of nearly 60 years of observed streamgage data near the project site; therefore, it is considered the most reliable of the flow estimates and is recommended for design purposes. For comparison, the City and County of Honolulu Plate 6 (Group C) design discharge is approximately 3,200 cfs.

Table 2-4. Mākaha Stream 100-year Peak Discharge Comparison

Location	Computed 100-year Peak Discharge (cfs)	
	Flood-Frequency Analysis¹ (for Design)	City/County Plate 6 (for Comparison)
Mākaha Stream	2,510	3,200

1. Flood-frequency analysis is based on 58 years of observed streamgage data.

2.4 Peak 2-Year Design Discharge

During the construction of the new bridge, a temporary access road will be used as a crossing over the stream. A diversion ditch will take low flows from the stream around the construction area. The peak 2-year discharge will be used for the diversion ditch crossing design (Table 2-5).

Table 2-5. Mākaha Stream 2-Year Peak Discharge for Diversion

Location	2-Year Peak Discharge (cfs)
Mākaha Stream	270

3 HYDRAULIC MODELING

Hydraulic modeling was performed using HEC-RAS (Hydrologic Engineering Center-River Analysis System), Version 6.0 (HEC, 2021). A two-dimensional (2-D) hydraulic model was used to compute water surface elevations, flood depths, and velocities for the 100-year discharge within the study area. This section describes the HEC-RAS model development and results.

3.1 Hydraulic Model Data/Parameters

Preliminary 2-D Model Area

A preliminary existing conditions 2-D hydraulic model was constructed to analyze overall flow patterns. This model included Mākaha Stream and overbanks and an unnamed tributary approximately 250 feet makai of the access road crossing (Figure 3-1). The model included approximately 2,000 feet of Mākaha Stream and approximately 800 feet of the unnamed tributary. The makai limit of the model was approximately 700 feet below the access road crossing.

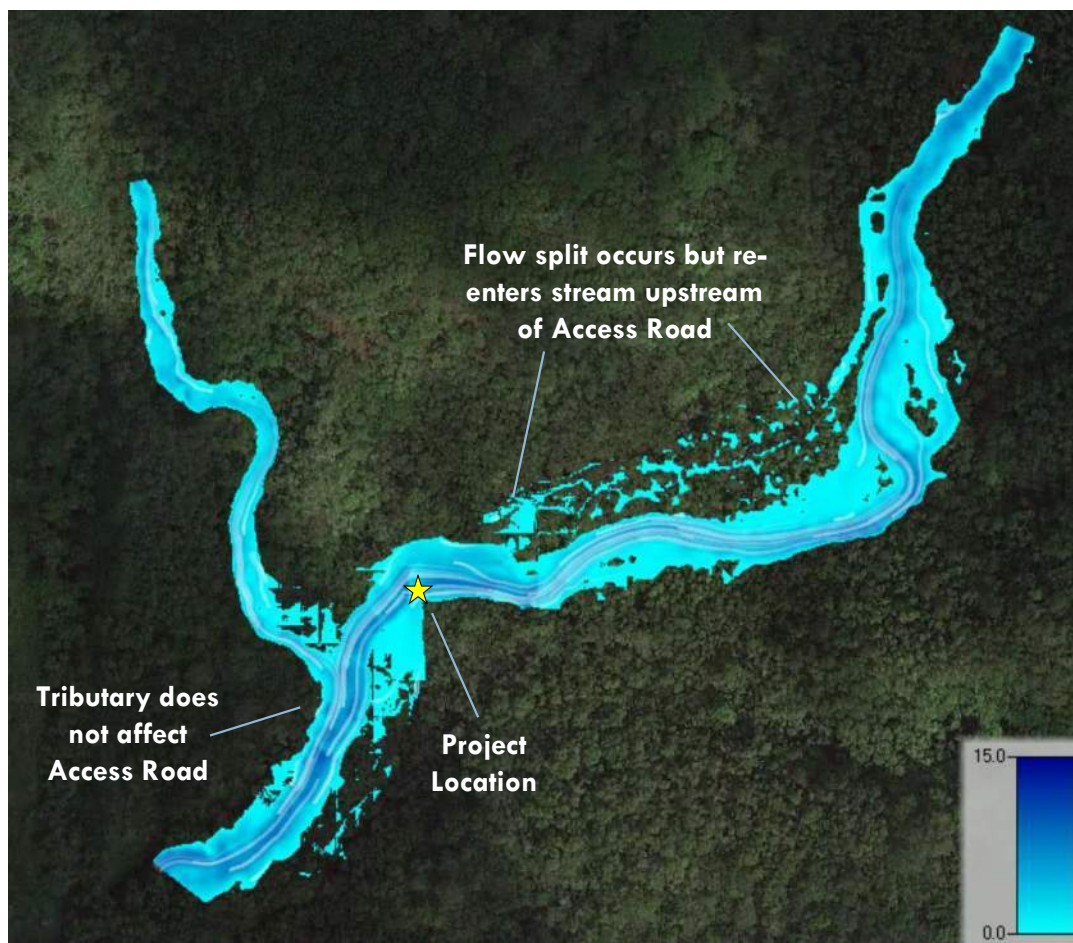


Figure 3-1. Initial Existing Conditions HEC-RAS 2-D Model Results

Final 2-D Model Area

Following a detailed review of the preliminary model results (Figure 3-1), the final 2-D model area was determined. The tributary makai of the access road did not affect the flow patterns (i.e., through backwater effects) because the terrain is quite steep in the area. A separate flow path branches off upstream of the access road at the bend in Mākaha Stream but returns to the mainstem prior to crossing the access road.

The final 2-D geometry is focused on the area closer to the access road crossing (Figure 3-2). A breakline was added to the geometry along the access road. A 5-foot nominal grid cell spacing was used for the overall model mesh, with 2.5-foot spacing used along the access road.

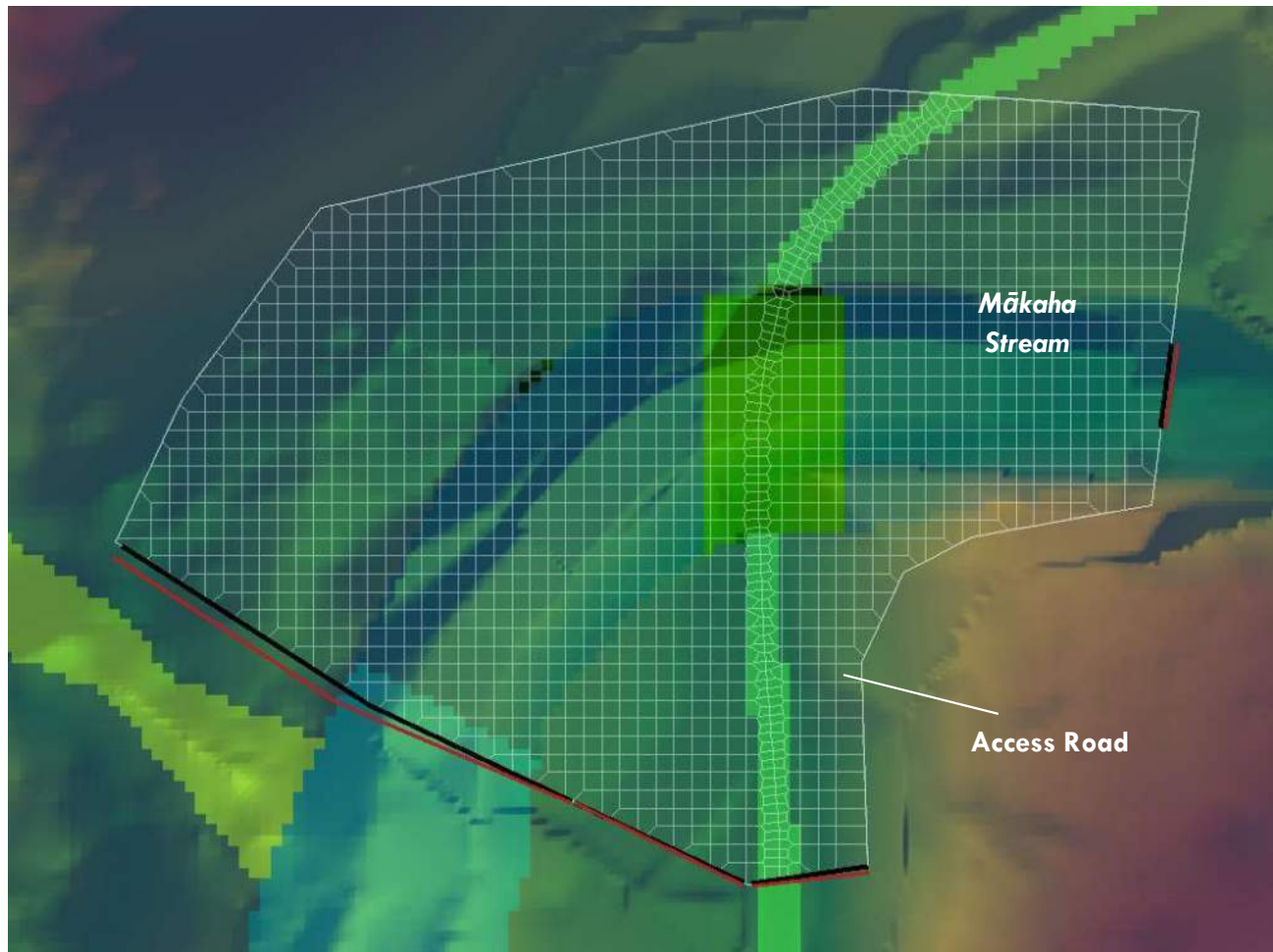


Figure 3-2. Final 2-D Model Area with Proposed Condition Terrain and Land Cover

Topographic Data

Topographic data used for the hydraulic model was developed by ControlPoint Surveying and provided by Bills Engineering. The ground survey was performed during July 2019. Elevation data for areas not included in the ground survey were obtained from the NOAA Coastal Topographic LiDAR dataset and merged with the survey data to create a combined terrain for hydraulic modeling.

The projection/coordinate system used for this study is NAD 1983 State Plane Hawaii Zone III, US feet, and the vertical datum is LMSL (Local Mean Sea Level).

Boundary Conditions

For the downstream boundary conditions, a normal depth slope was used, varying from 0.069 to 0.087 across the boundary. A flow hydrograph was used as the upstream boundary condition as shown in Figure 3-3. The hydrograph was developed by scaling the December 11, 2008, flood event hydrograph from the Mākaha Gage (USGS #16211600) to the computed Mākaha Stream peak flow.

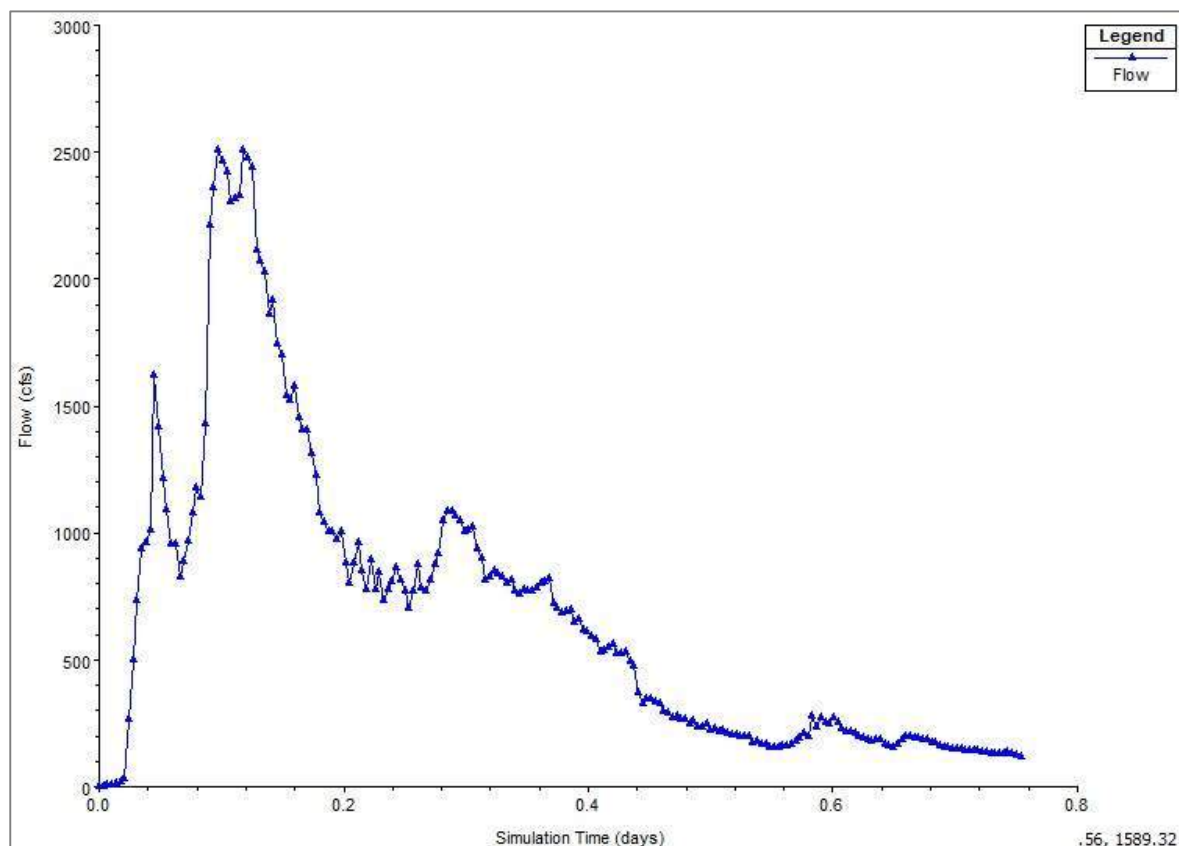


Figure 3-3. Input Hydrograph

Manning's Roughness

The channel and overbank roughness (Manning's n) values used in the hydraulic simulations are summarized in Table 3-1. The selected n values were based on field observations, standard engineering references (e.g., Chow, 1959), and engineering judgment.

Table 3-1. Manning's Roughness Values

Manning's <i>n</i> Value	Description
0.015	Access Road
0.025	Cement Rubble Masonry (CRM)
0.060	Mākaha Stream – Proposed Channel
0.060	Mākaha Stream – Upstream Channel
0.130	Mākaha Stream – Downstream Channel
0.180	Mākaha Stream – Tributary Channel
0.150	Overbank – Evergreen Forest

Sensitivity Analyses of 2-D Model Parameters

A sensitivity analysis was performed on two model parameters: mesh cell size and computational time step. This was done to determine the most stable solution and to ensure that cell size was not affecting the final results. The time step was set to change based on the Courant condition.

3.2 HEC-RAS Model Results – Existing Conditions

Flow Trace and Flood Depth

The flow trace and flood depth plots from the existing conditions 2-D model are provided in

Figure 3-4 and Figure 3-5, respectively. These plots are based on the 100-year flood-frequency flow (2,510 cfs). The 100-year maximum flow depth in the channel ranges from 6 to 7 feet through most of the study reach, except for the almost 9-foot depth at the scour hole on the makai side of the crossing.

Water Surface Elevation

The 100-year water surface elevations for existing conditions are provided in

Figure 3-6 and a profile plot is provided in Figure 3-7.

Velocity

The computed velocities for the 100-year flood event are shown in Figure 3-8. The maximum channel velocity is 12 to 16 feet per second through most of the study reach, and greater than 30 feet per second on the makai face of the access road crossing.

Shear Stress

Computed shear stresses for the 100-year flood event are shown in Figure 3-9. Maximum shear stress in the channel generally ranges from 16-30 lb/ft². Higher values are observed makai of the access road crossing.

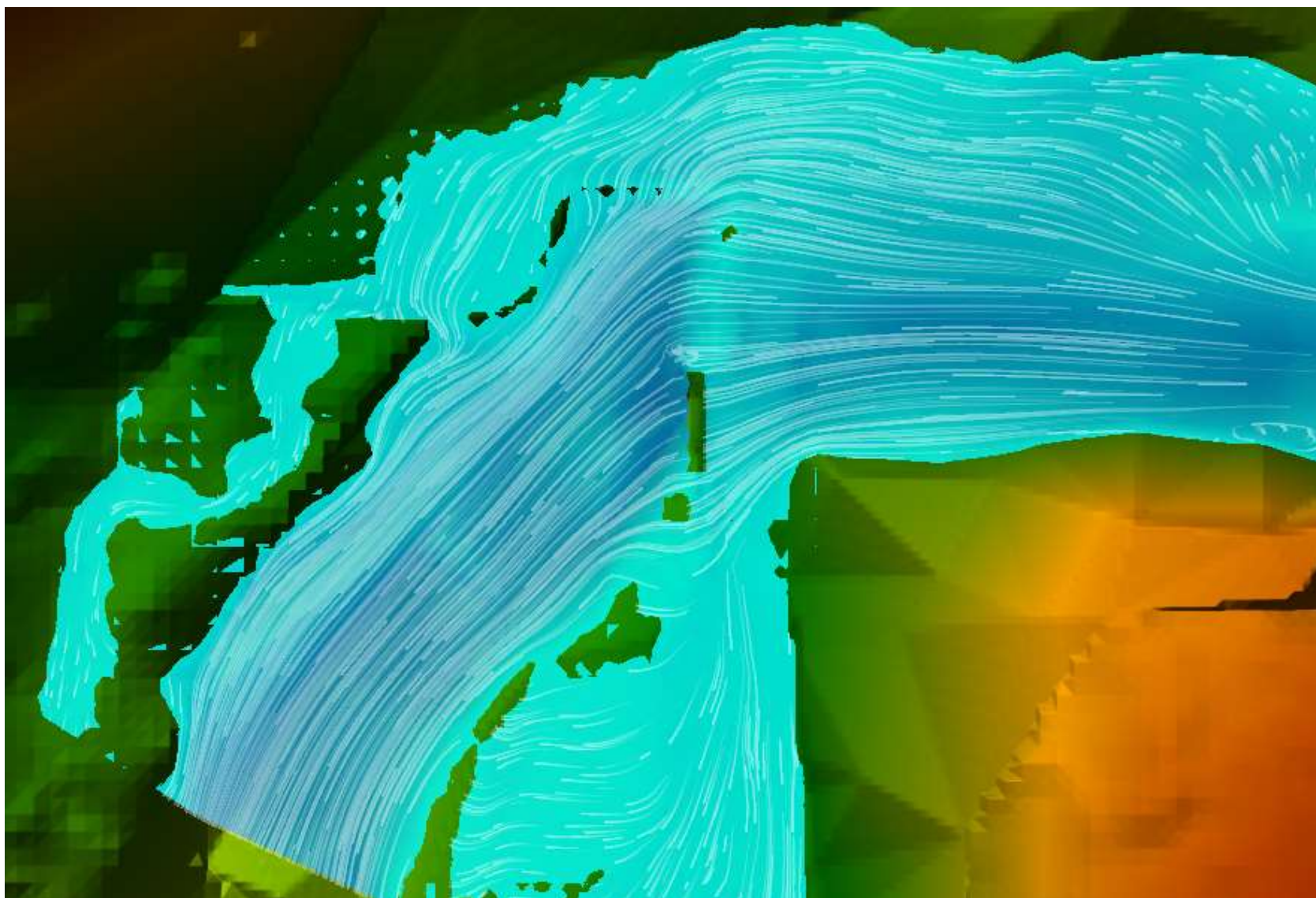


Figure 3-4. Existing Conditions 100-year Flow Trace

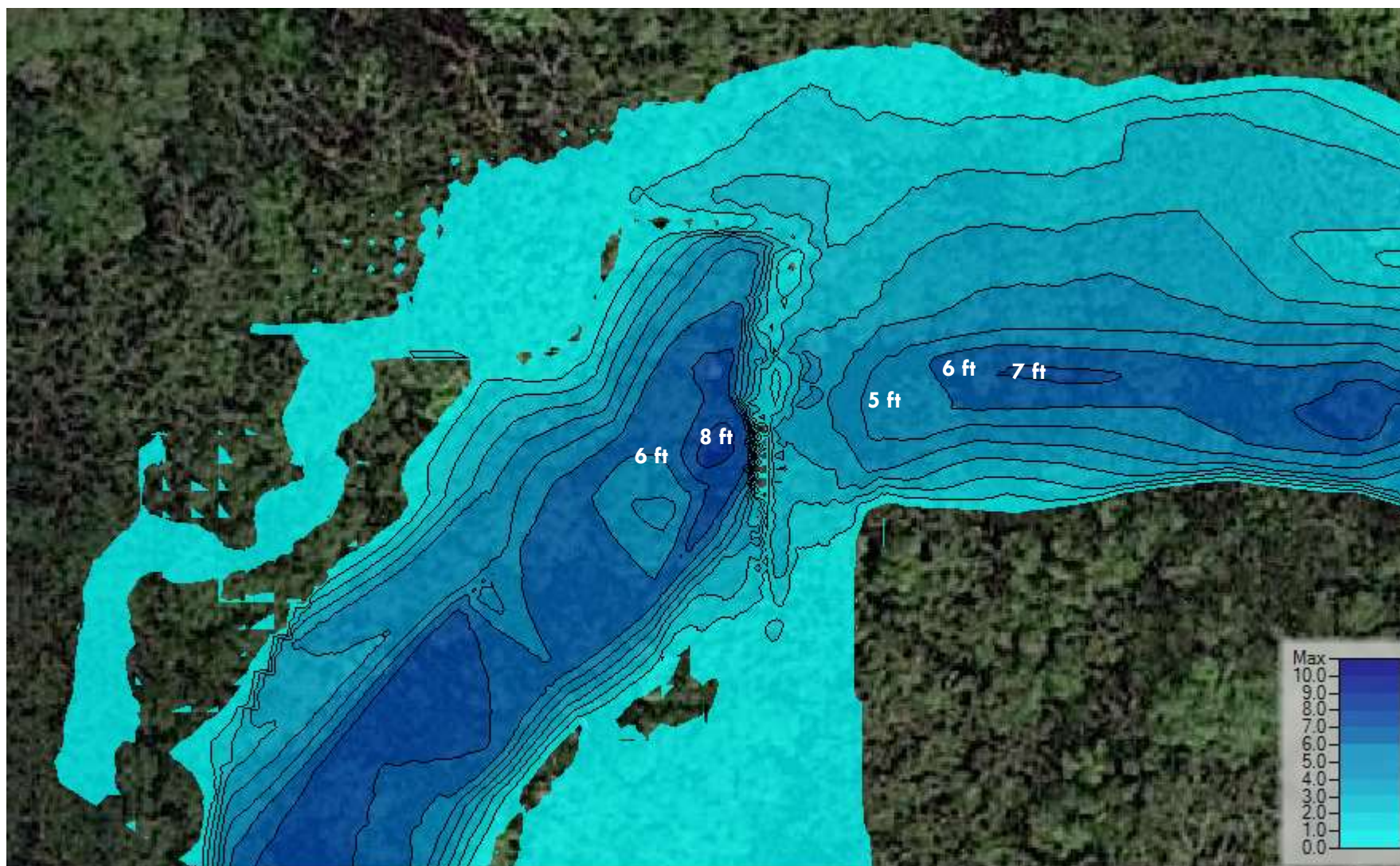


Figure 3-5. Existing Conditions 100-year Flood Depth with 1-ft Contours

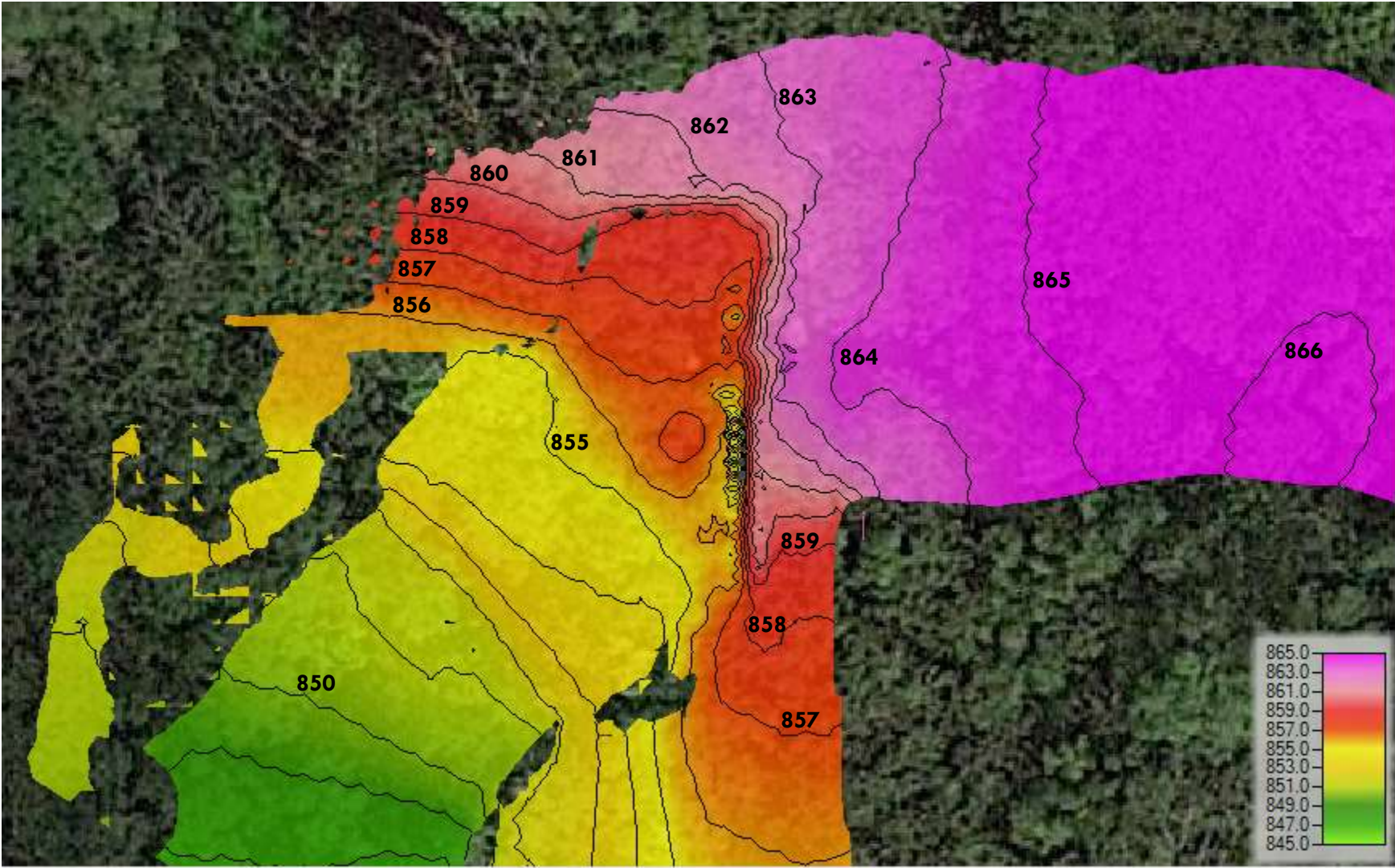


Figure 3-6. Existing Conditions 100-year Water Surface Elevation with 1-ft Contours

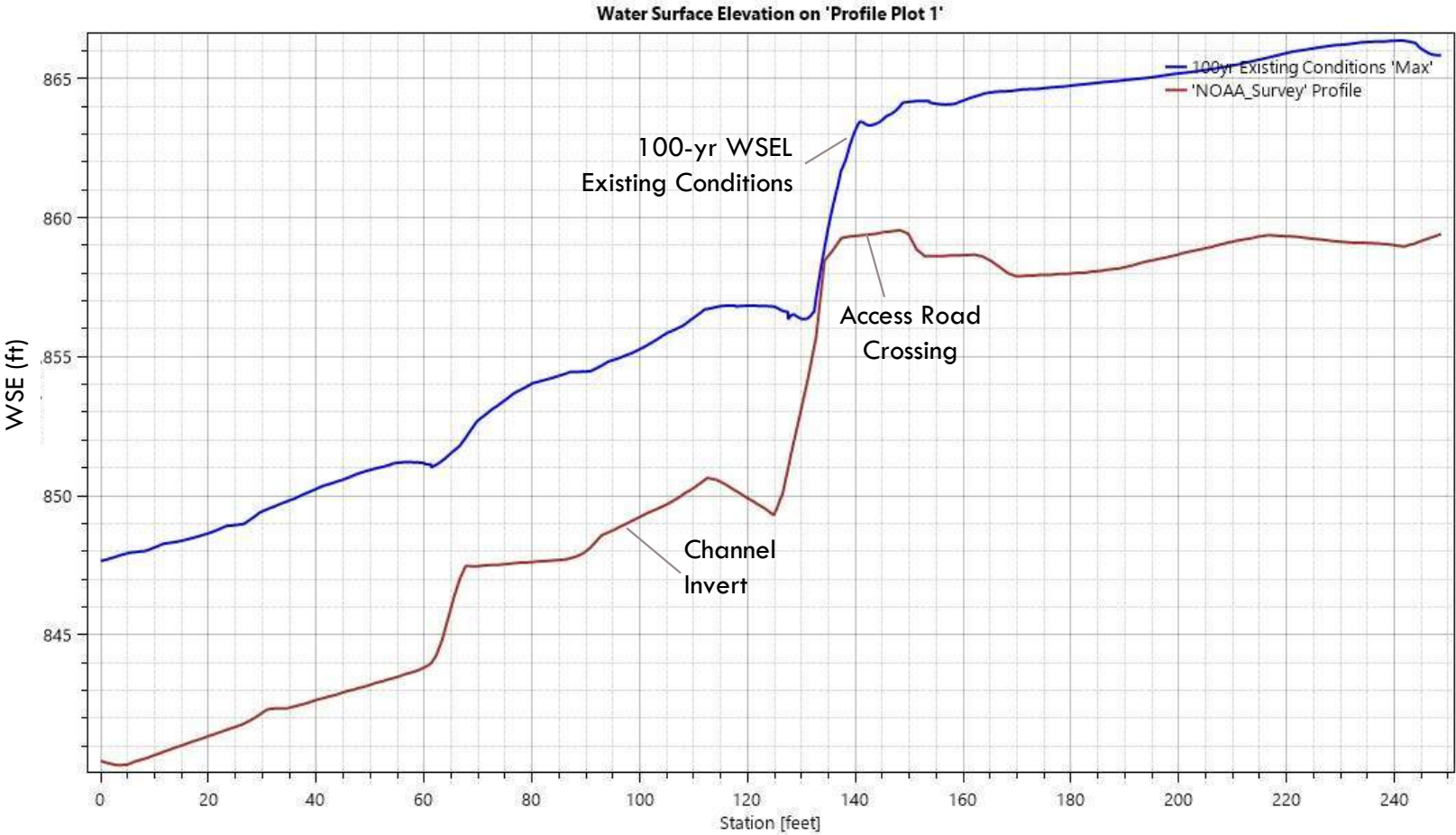


Figure 3-7. Existing Conditions 100-year Water Surface Profile Plot

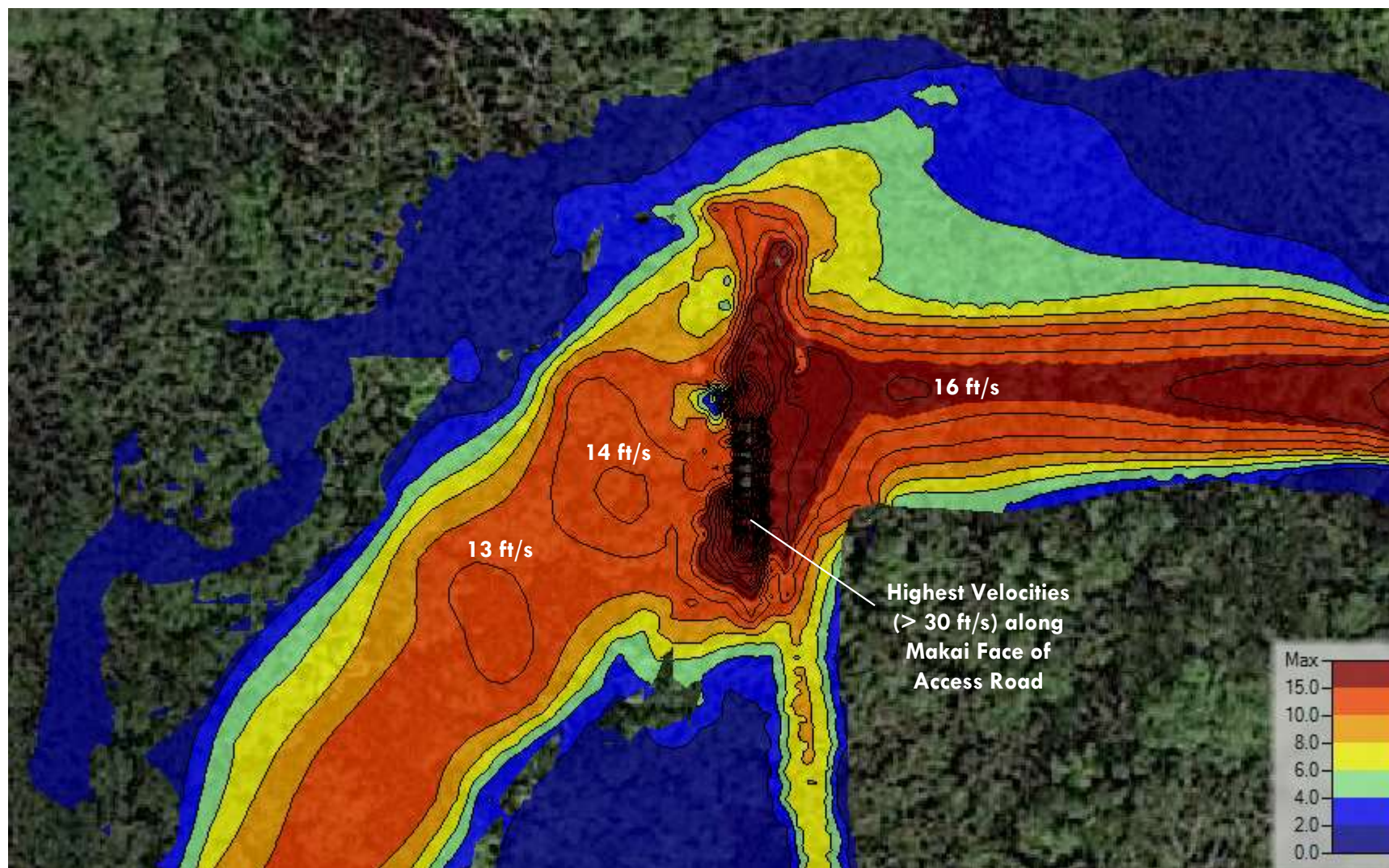


Figure 3-8. Existing Conditions 100-year Velocity (ft/sec) with 2-ft/s contours

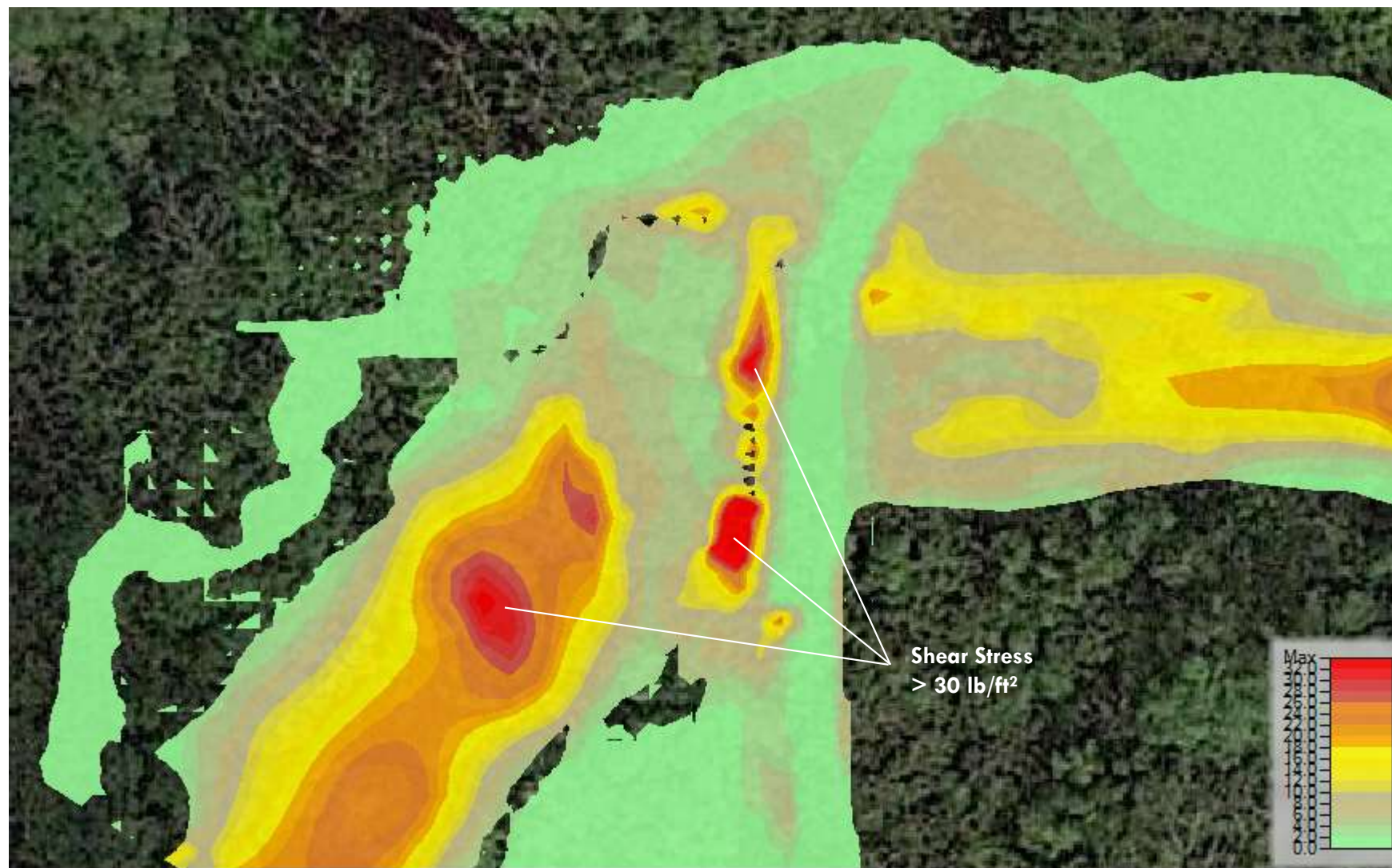


Figure 3-9. Existing Conditions 100-year Shear Stress (lb/ft²)

3.3 Proposed Conditions

Sediment that has accumulated at the access road crossing will be removed in the proposed condition terrain, and a proposed channel will be excavated. The proposed channel is trapezoidal in shape, with a channel bottom width of approximately 21 ft and 1.5H:1V side slopes.

A proposed Acrow bridge (60 feet long and 21.6 feet wide) will be installed within the channel crossing. A temporary access road crossing the diversion ditch will be used during the bridge installation process. Plans for the proposed Acrow bridge crossing with the access road are shown in Figure 3-10. A cross section view at the upstream face of the bridge is shown in Figure 3-11. A profile of the proposed bridge looking along the roadway is shown in Figure 3-12. The channel bed and banks through the bridge are protected by grouted rubble paving (GRP).

3.4 HEC-RAS Model Results – Proposed Conditions

Flow Trace and Flood Depth

The flow trace and flood depth plots from the proposed conditions 2-D model are provided in Figure 3-13 and Figure 3-14, respectively. These plots are based on the 100-year flood-frequency flow (2,510 cfs). The simulated 100-year maximum flow depth in the channel ranges from 1 to 6 feet through most of the study reach.

Water Surface Elevation

The 100-year water surface elevations for the proposed conditions are provided in Figure 3-15. The simulated water surface elevation (WSE) range is 847 feet to 864 feet throughout the study reach. A WSE plot through the proposed bridge is provided in Figure 3-16. The maximum WSE through the proposed bridge is 856.2 ft. The computed freeboard required based on the City/County of Honolulu drainage design standard is 2.42 ft at that location within the bridge.

Cross-sectional WSE profiles through the proposed bridge centerline and at the upstream face of the bridge are provided in Figure 3-17 and Figure 3-18, respectively. Due to superelevation resulting from the curved channel, the WSE is sloped laterally at the bridge location the maximum elevation on the right side (facing in the downstream direction) and the minimum elevation on the left side. The sloping WSE matches the slope of the bridge deck, providing freeboard throughout the bridge.

Velocity

The computed velocities for the 100-year flood event are shown in Figure 3-19. The maximum channel velocities are 12 to 20 feet per second through most of the study reach.

Shear Stress

Computed shear stresses for the 100-year flood event are shown in Figure 3-20. Maximum shear stress in the channel generally ranges from 15-30 lb/ft². Higher values are observed mauka of the access road crossing.

Mākaha Stream Thalweg Profile

The Mākaha Stream thalweg profile with existing crossing, projected channel elevation after crossing removal, and the profile for proposed conditions are shown in Figure 3-21. The stream profile is shown in Figure 3-22.

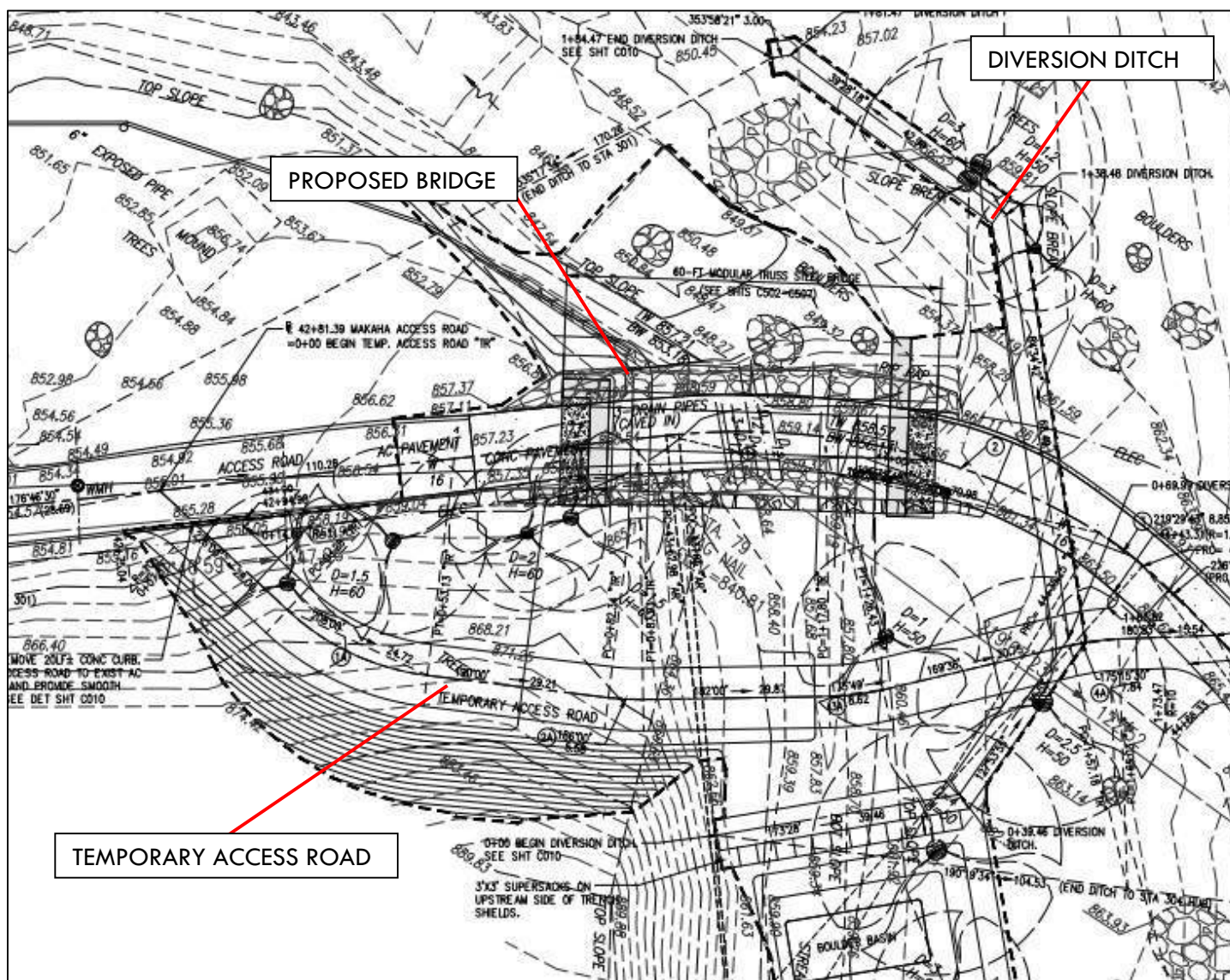


Figure 3-10. Proposed Acrow Bridge Crossing Layout with Diversion Ditch and Temporary Access Road

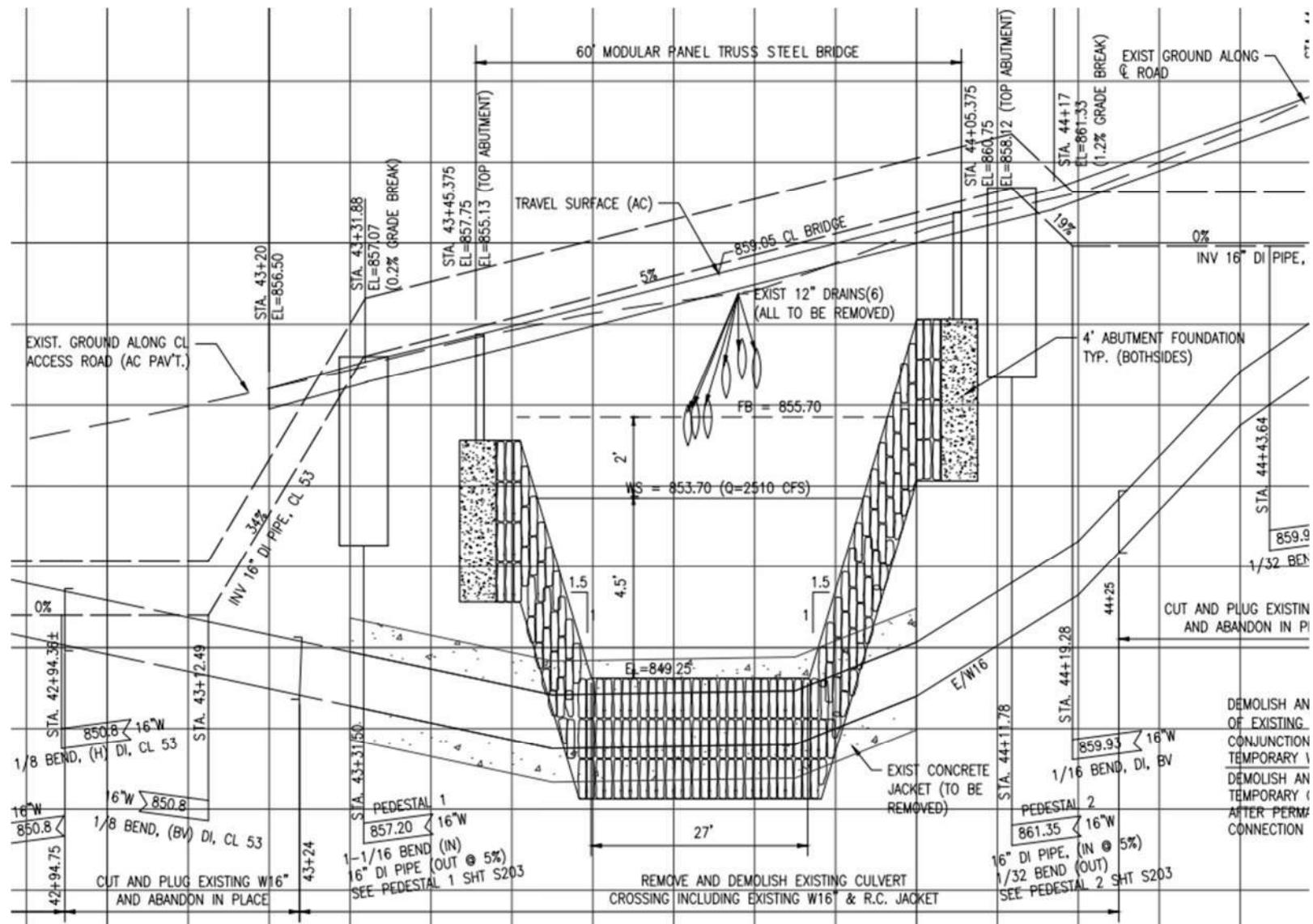


Figure 3-11. Proposed Bridge Section (Mauka Face)

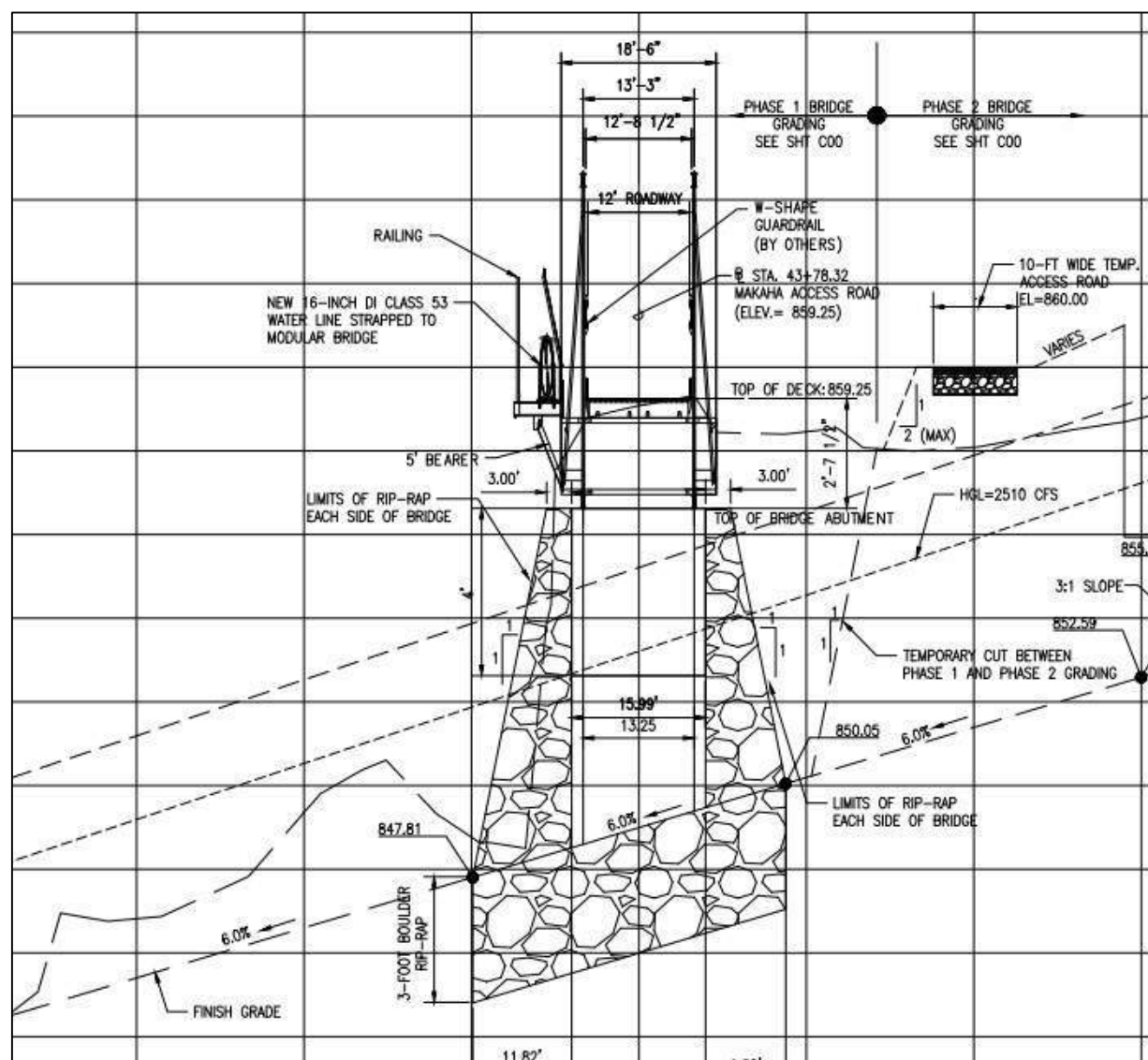


Figure 3-12. Sectional Profile of the Proposed Bridge

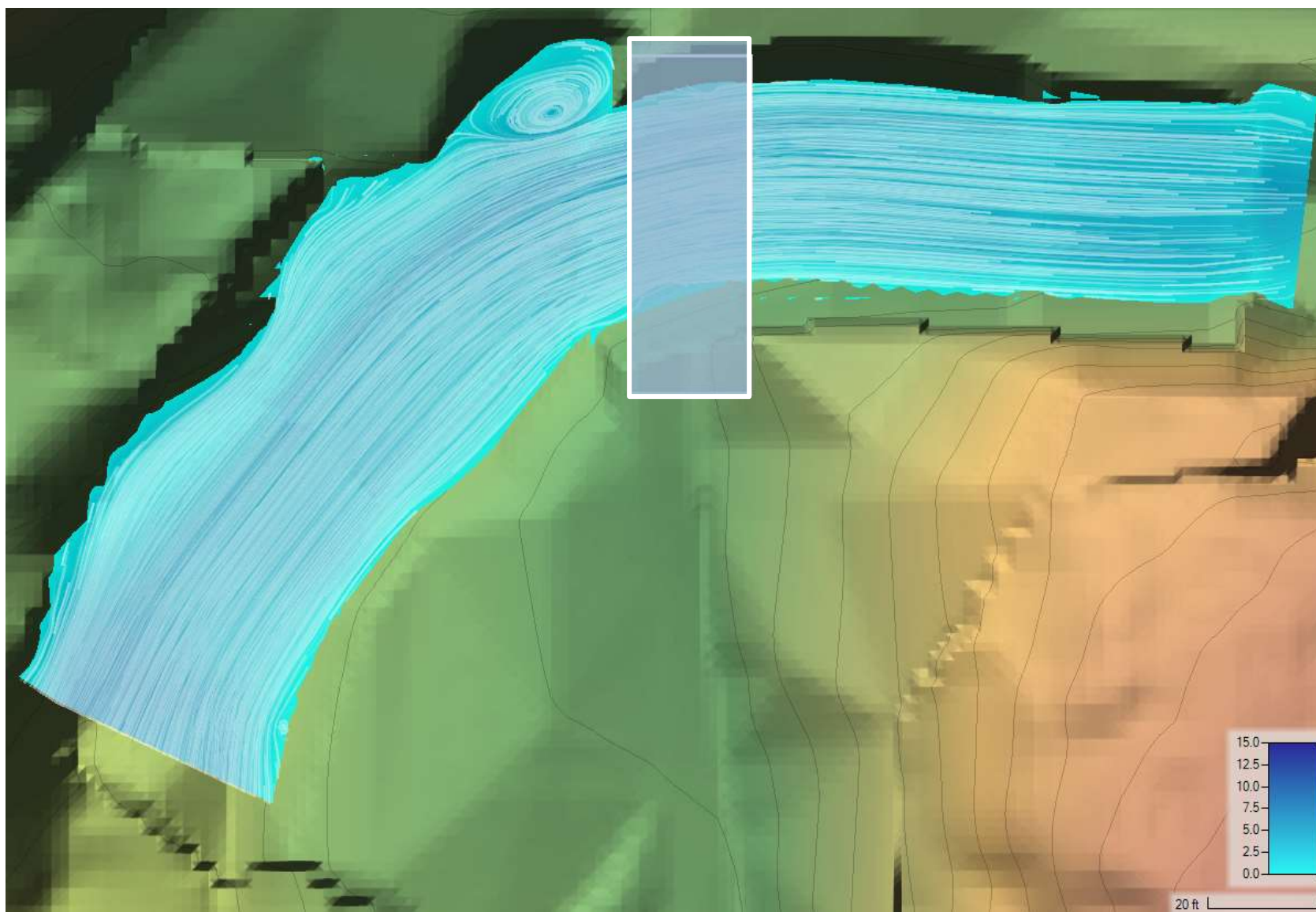


Figure 3-13. Proposed Conditions 100-year Flow Trace and Flood Depth (ft)

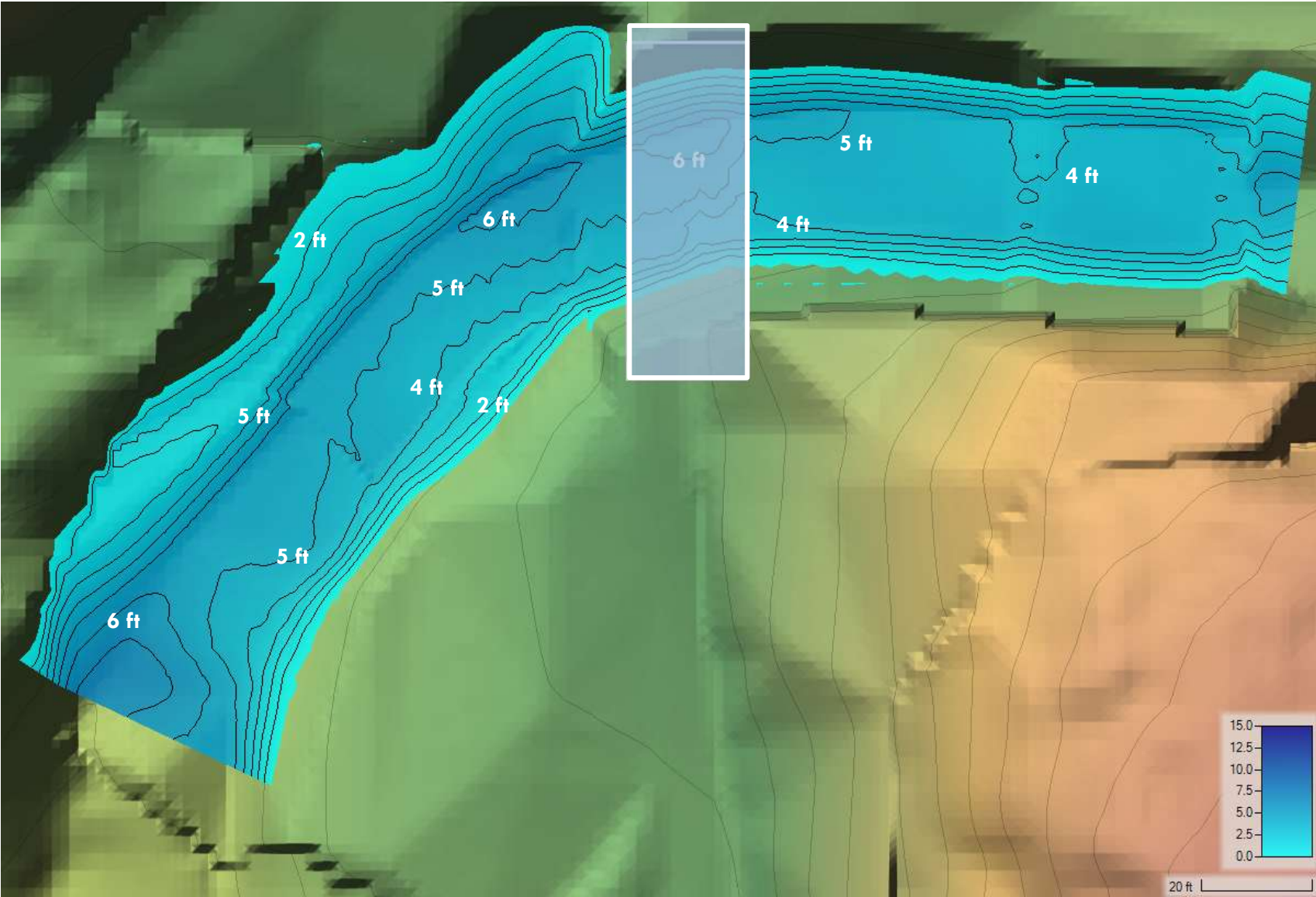


Figure 3-14. Proposed Conditions 100-year Flood Depth with 1-ft Contour

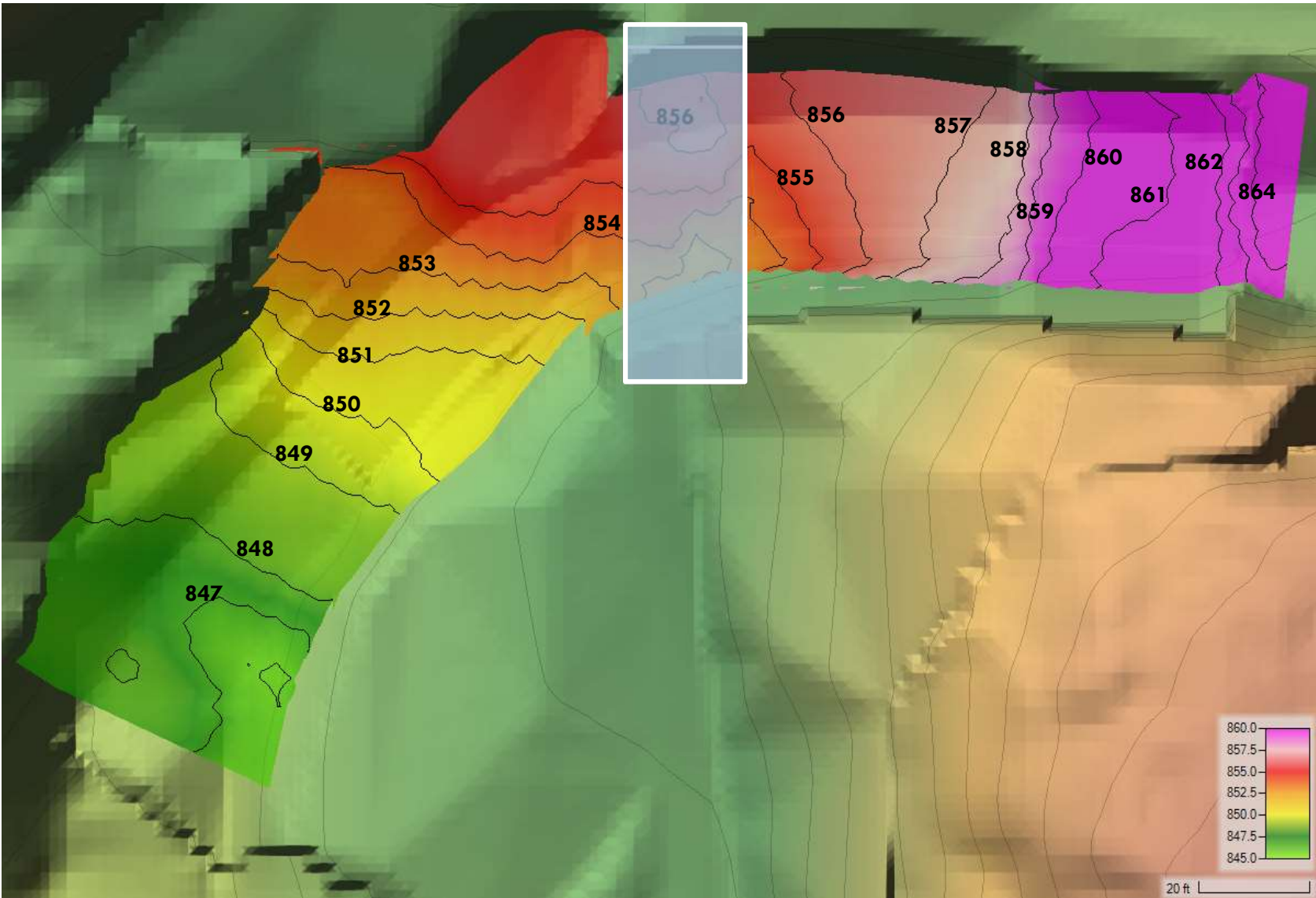


Figure 3-15. Proposed Conditions 100-year Water Surface Elevation with 1-ft Contours

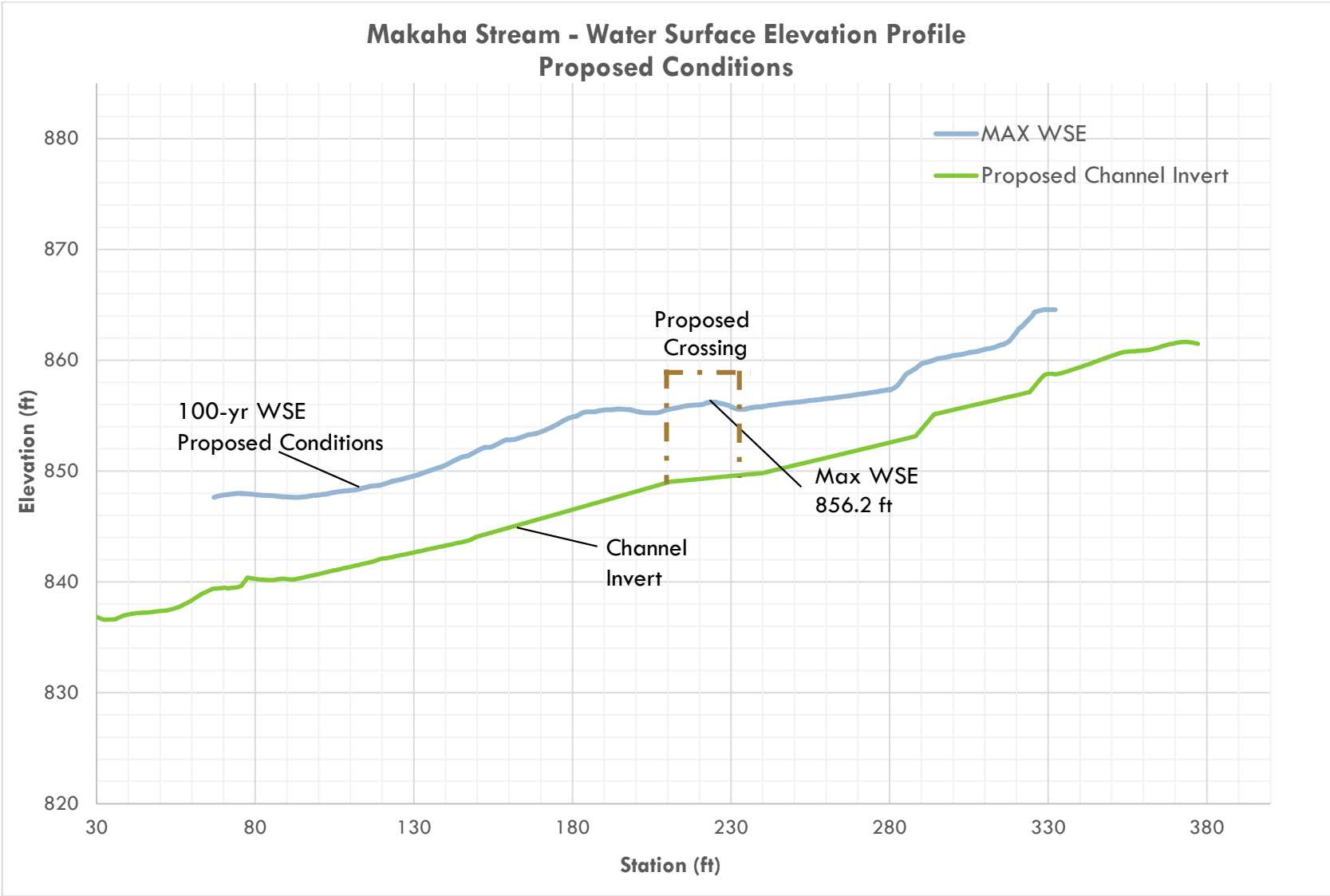


Figure 3-16. Proposed Conditions 100-year Water Surface Profile Plot

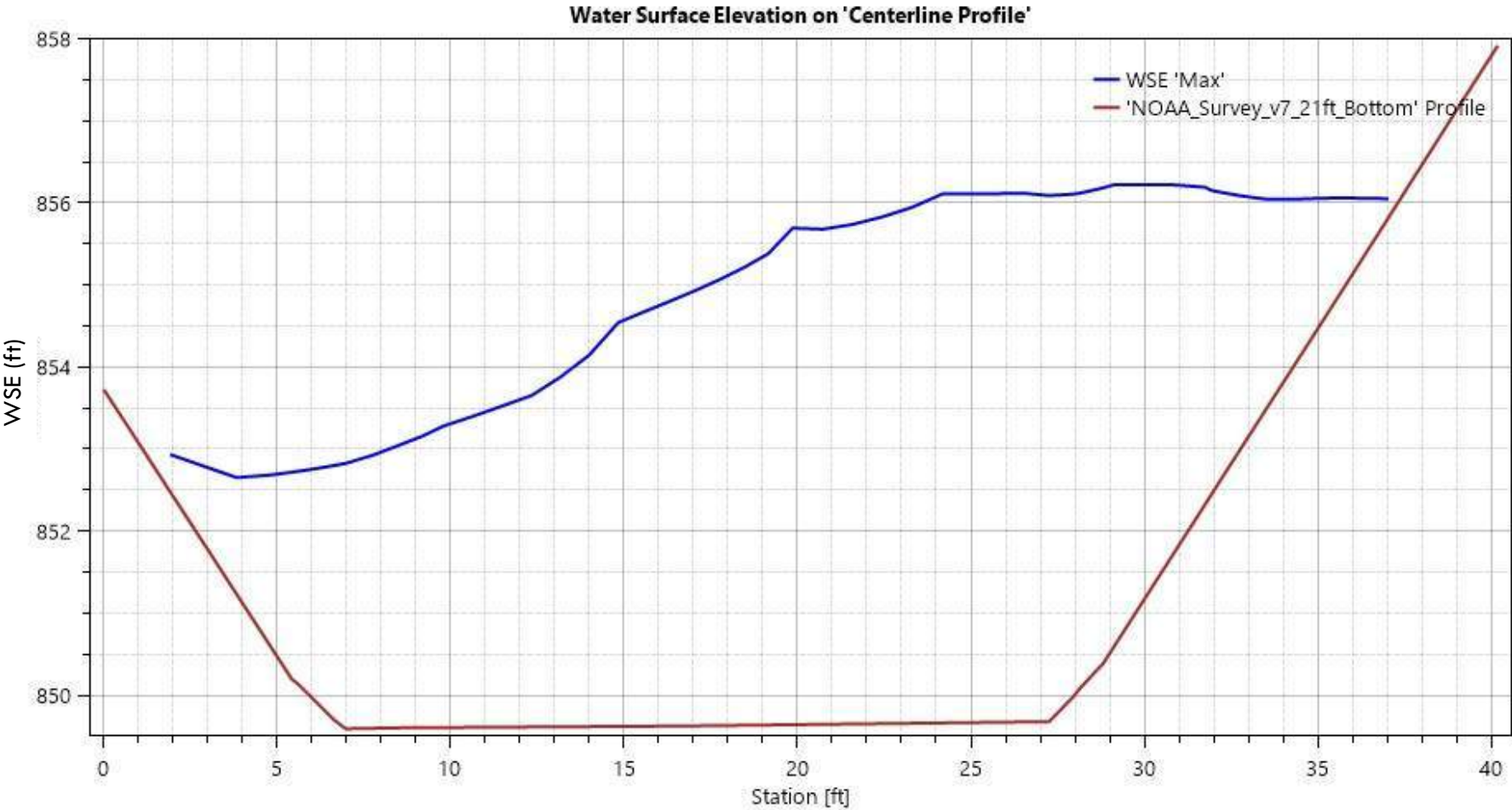


Figure 3-17. Proposed Conditions 100-year Water Surface Elevation – Cross Section View at Bridge Centerline

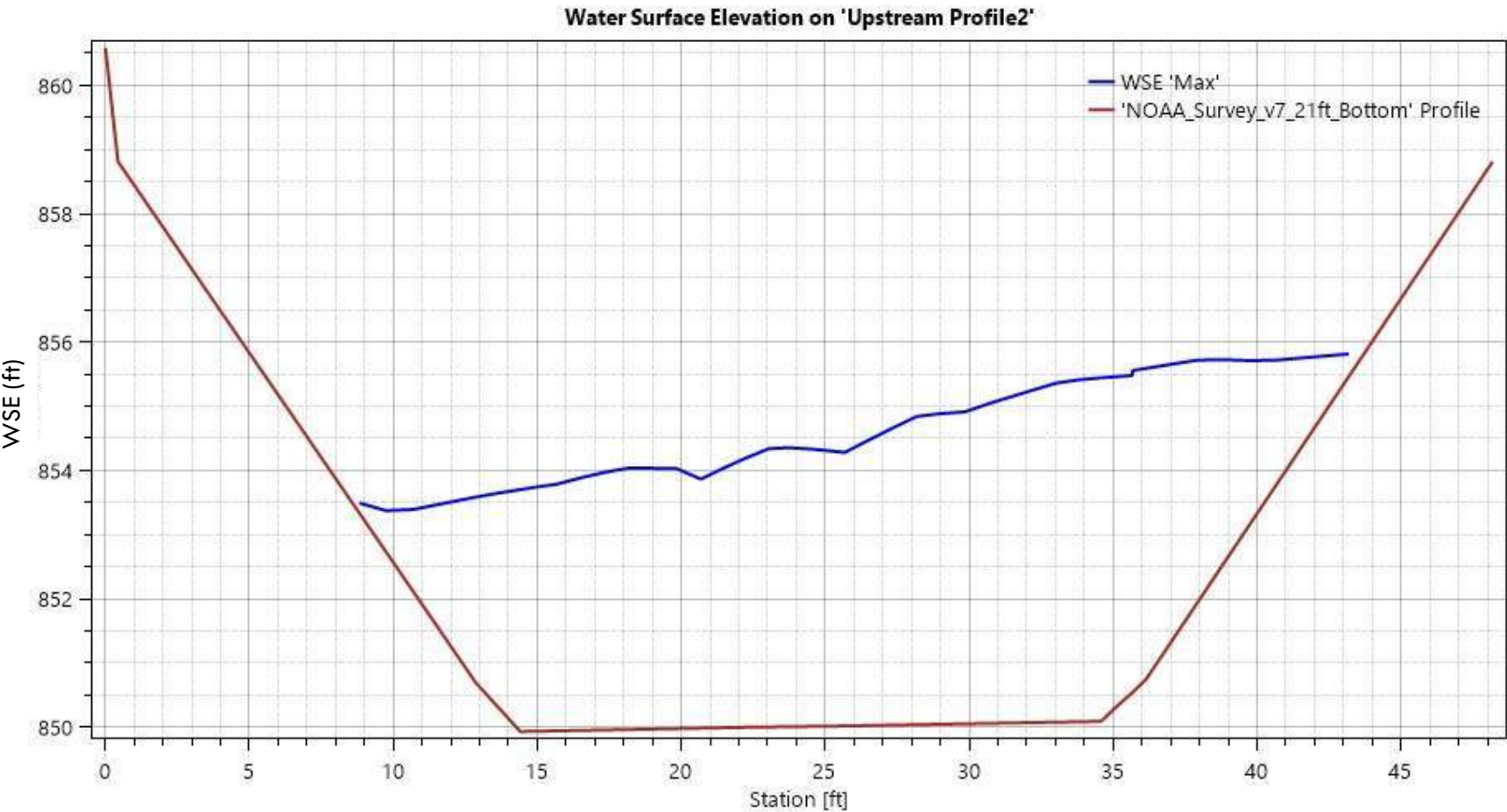


Figure 3-18. Proposed Conditions 100-year Water Surface Elevation – Cross Section View at Mauka Face of Bridge

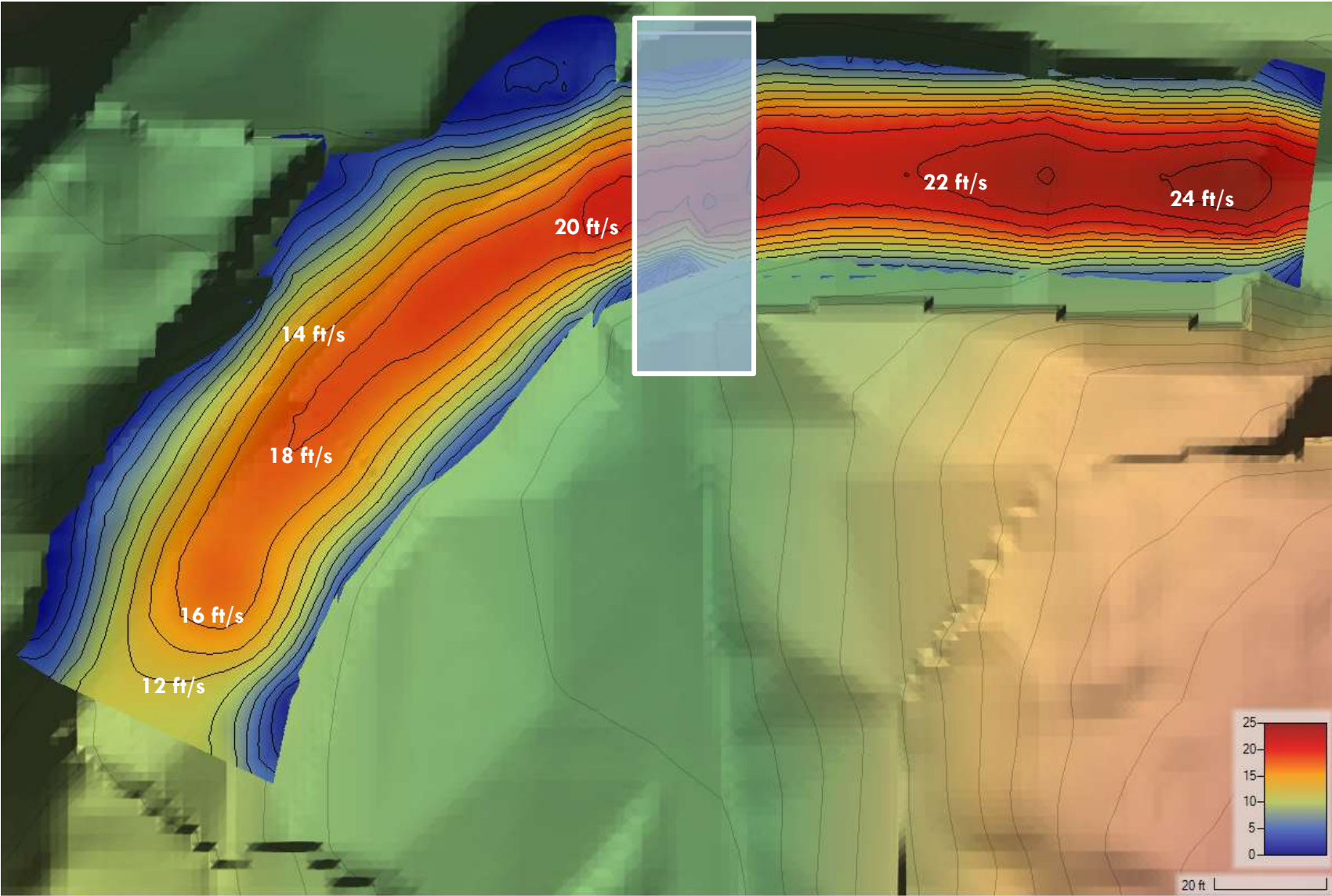


Figure 3-19. Proposed Conditions 100-year Velocity (ft/sec) with 2-ft/s contours

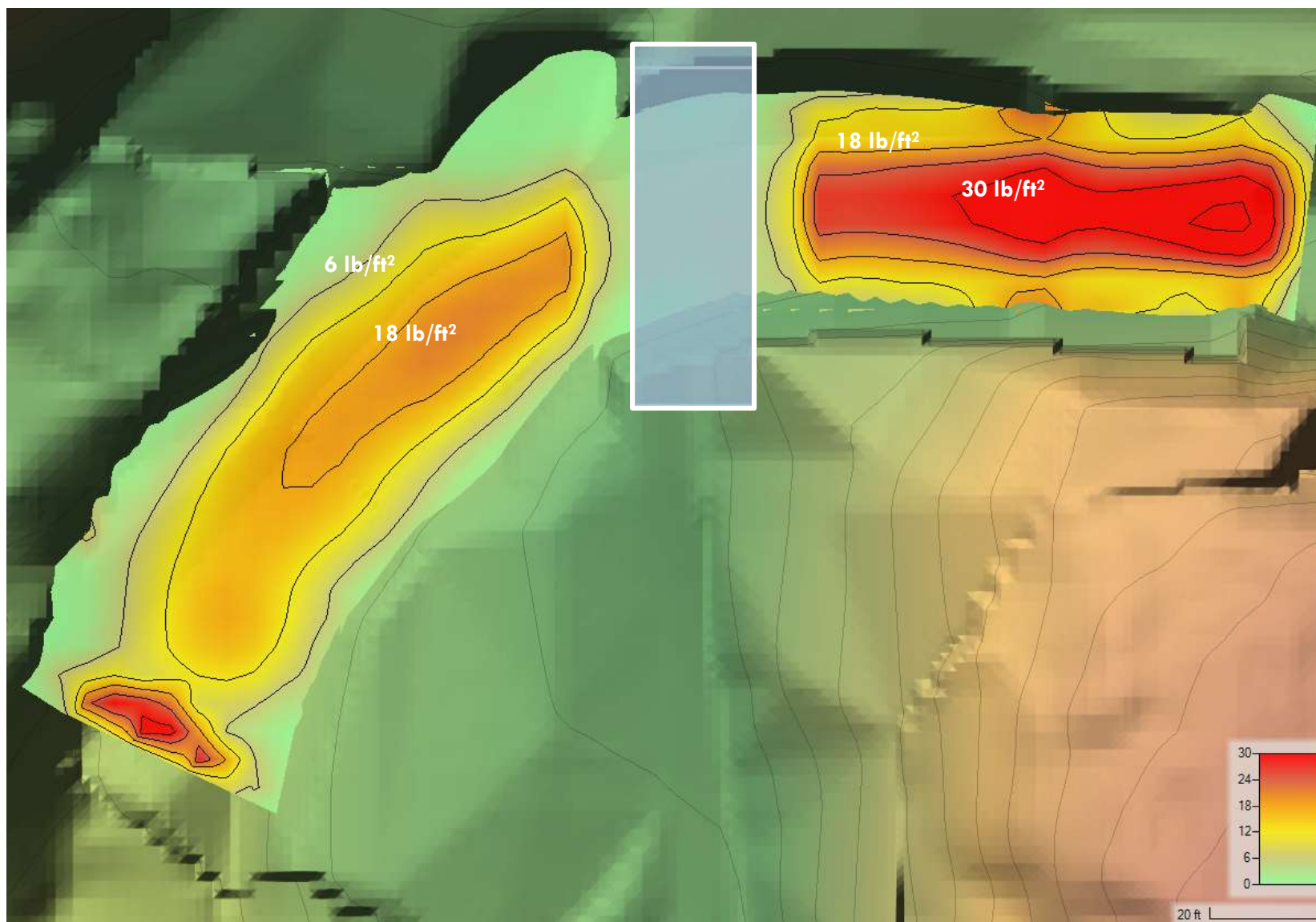


Figure 3-20. Proposed Conditions 100-year Shear Stress (lb/ft²)

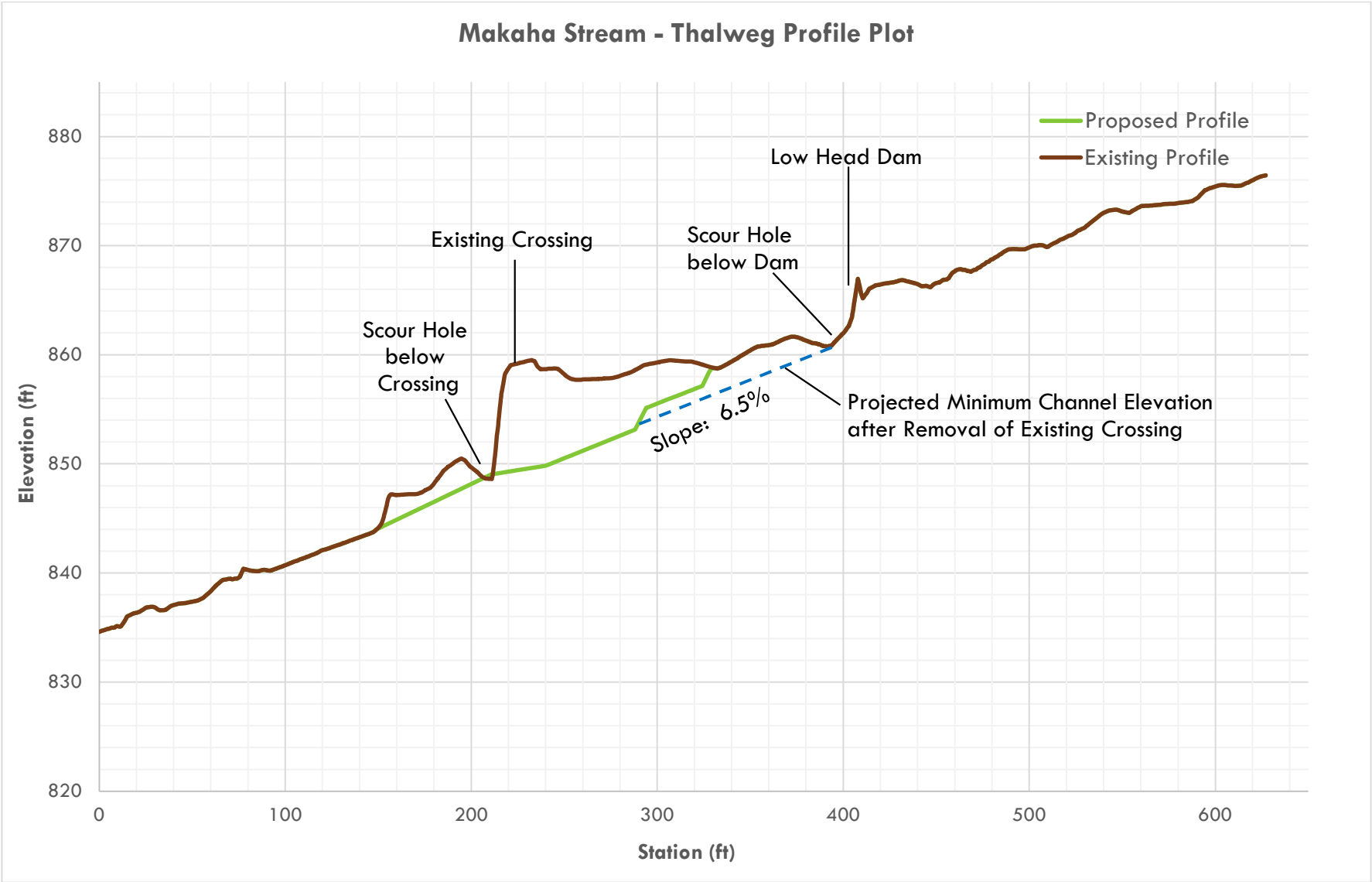


Figure 3-21. Mākaha Stream Thalweg Profile

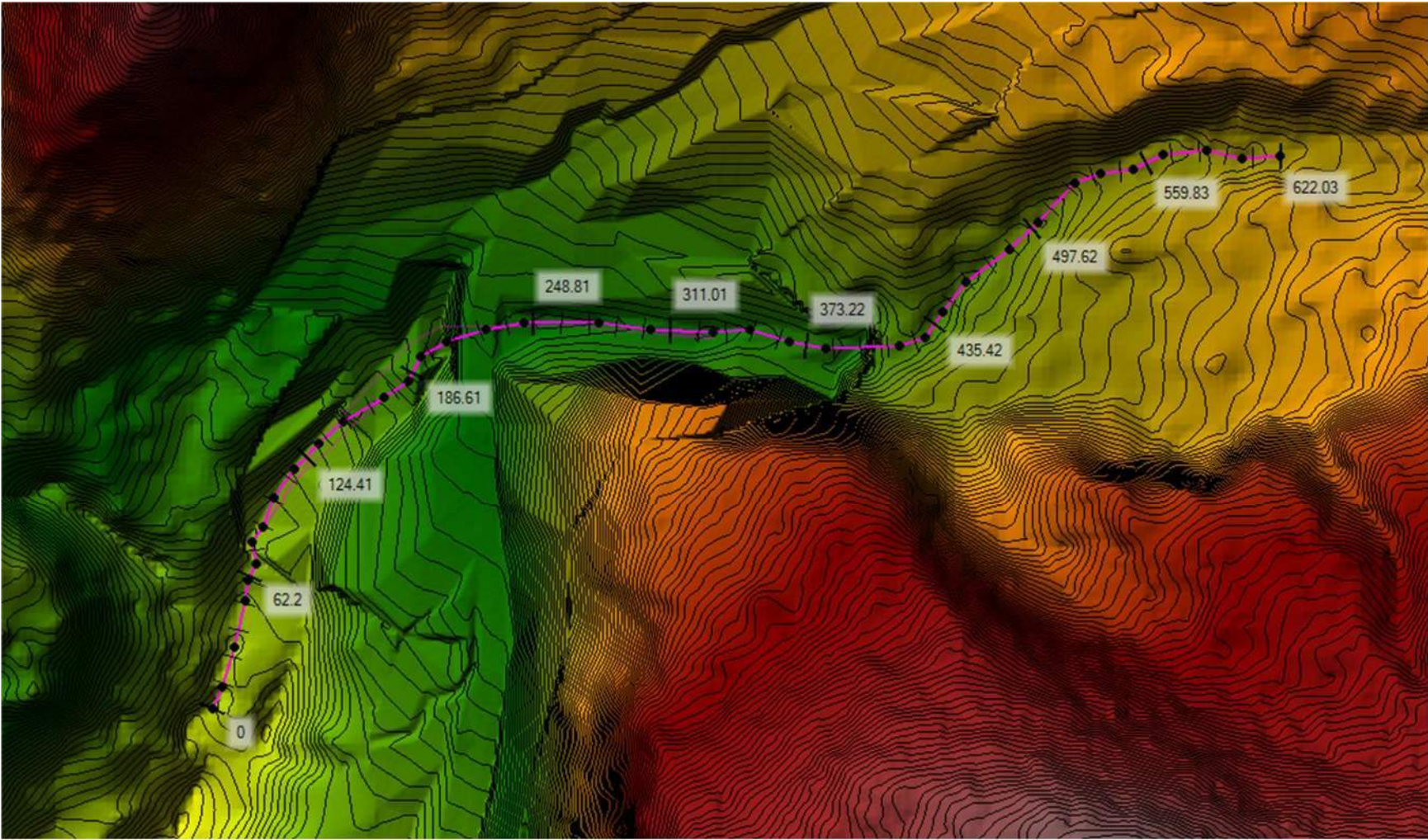


Figure 3-22. Makaha Stream Profile

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5 ACKNOWLEDGMENTS

This study was performed for the Board of Water Supply (City and County of Honolulu) by River Focus, Inc., as subconsultant to Bills Engineering, Inc., led by David Bills, P.E. The River Focus study team included Jake Gusman, P.E. (Project Manager), Darren Bertrand, CFM, Mikell Warms, EIT, and Rumana Reaz Arifin, PhD.