## APPENDIX I
### DESIGN DRAWINGS

| I1 | Design Drawings                          |
| I2 | Design GIS                               |
| I3 | Subsurface Utility Report                |
| I4 | Design Documentation                     |
This page is intentionally left blank.
1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-401 FOR THE HAUSTEN DITCH BRIDGE NEW CONCRETE WALL PLAN.
3. SEE SHEET C-316 FOR THE HAUSTEN DITCH DETENTION FLOODWALLS AND BERM, PROFILE AND SECTIONS.

NOTES:

HAUSTEN DITCH DETENTION PLAN

SCALE: 1"=50'
1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
KALAKUA AVE AND ALA WAI BLVD PLAN

SCALE: 1"=20'

ALAE WA CANAL MIDDLE
RIGHT BANK FLOODWALL

ALAE WA CANAL MIDDLE
LEFT BANK FLOODWALL

EXISTING SIDEWALK

CONSTRUCTION LIMITS

ALAE WA CANAL LOWER
RIGHT BANK FLOODWALL

ALAE WA CANAL LOWER
LEFT BANK FLOODWALL

ROAD EDGE

KALAKUA AVE AND ALA WAI BLVD PLAN

SCALE: 1"=20'
NOTE:
1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. THE FLOOD GATES ARE PASSIVE AUTOMATIC BARRIERS.
SECTION C-C

SECTION A-A

SECTION B-B

NOTES:
1. THE ACCESS ROAD WILL ALSO BE USED FOR MAINTENANCE.
WAIAKEKUA DEBRIS AND DETENTION BASIN
SECTION C-C
SCALE: 1"=10'

SLOTTED CONCRETE FOOTING
WAIAKEKUA DEBRIS AND DETENTION BASIN
SECTION D-D
SCALE: 1"=10'

WAIAKEKUA DEBRIS AND DETENTION BASIN
SECTION A-A
SCALE: 1"=10'

WAIAKEKUA DEBRIS AND DETENTION BASIN
SECTION B-B
SCALE: 1"=10'

NOTES:
1. ALUMINUM ARCH CULVERT METAL THICKNESS IS 1.50" WITH A NATURAL BOTTOM.
2. THE APPROXIMATE AREA UNDER THE ARCH CULVERT IS 35.3 SQ FT.
3. THE ACCESS ROAD WILL ALSO BE USED FOR MAINTENANCE.
SLOTTED CONCRETE FOOTING
WOODLAWN DITCH DETENTION BASIN
SECTION D-D
SCALE: NTS

SCALE: 1" = 60'

WOODLAWN DITCH DETENTION BASIN
SECTION B-B
SCALE: 1" = 60'

WOODLAWN DITCH DETENTION BASIN
SECTION C-C
SCALE: 1" = 60'

1. ALUMINUM ARCH CULVERT METAL THICKNESS IS 1.50".  WITH A
   NATURAL BOTTOM.
2. THE APPROXIMATE AREA UNDER THE ARCH CULVERT IS 35.3 SQ FT.
WAIOMAO DEBRIS AND DETENTION BASIN
SECTION C-C
SCALE: 1"=50'

WAIOMAO DEBRIS AND DETENTION BASIN
SECTION A-A
SCALE: 1"=50'

WAIOMAO DEBRIS AND DETENTION BASIN
SECTION B-B
SCALE: 1"=50'

RIPRAP DISSIPATION & SCOUR PROTECTION DETAIL
C-308
SCALE: 1"=20'

NOTES:
1. THE ACCESS ROAD WILL ALSO BE USED FOR MAINTENANCE.

GROUTED RIP RAP
8" DIA. PIPE
CONCRETE
CONCRETE
GROUTED RIP RAP
CONCRETE ANCHOR COLLAR
CONCRETE SPILLWAY EL. 386.6'
GROUND EL. 178.0'
EXISTING GROUND
100'
EL. 398.6'
CONCRETE SPILLWAY EL. 386.6'
GROUND EL. 178.0'
EXISTING GROUND
EL. 398.6'
CONCRETE SPILLWAY EL. 386.6'
GROUND EL. 178.0'
EXISTING GROUND
EL. 398.6'
CONCRETE SPILLWAY EL. 386.6'
GROUND EL. 178.0'
EXISTING GROUND

SCALE: 1"=20'
SECTION B-B
WAIOMAO DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SCALE: 1"=10'
SECTION C-C
WAIOMAO DEBRIS AND DETENTION BASIN

1. ELEVATIONS ARE FOOT MSL.

Note: All elevations are feet MSL.
PUKELE DEBRIS AND DETENTION BASIN

SECTION A-A

SHEET OF

PLAN AND SECTIONS

SCALE: 1"=5'

SECTION B-B

SCALE: 1"=5'

SECTION C-C

SCALE: 1"=5'

NOTE:
1. THE ACCESS ROAD WILL ALSO BE USED FOR MAINTENANCE.
MAKIki DEBRiS AND DETEnTION BASiN
SECTiON A-A
SCALE 1"=15'

SLOTTED CONCRETEx FOOTiNG
MAKIki DEBRiS AND DETEnTION
SECTiON D-D
SCALE 1"=15'
HAUSTEN BRIDGE PLAN & SECTIONS

NOTES:

1. SEE SHEET C-501 FOR THE SLIDE GATE DETAIL.

2. THE NEW CONCRETE WALL SHALL CONFORM TO THE 2012 INTERNATIONAL BUILDING CODE (IBC) AND EM 1110-2-2502 WITH A FACTOR OF SAFETY OF AT LEAST 1.5.

3. ALL WORK SHALL CONFORM TO THE BEST PRACTICE PREVAILING IN THE VARIOUS TRADES COMPRISING THE WORK.
1. The contractor shall verify all dimensions and conditions and report any discrepancies in writing to the contracting officer before commencing work.
2. Details shown on the drawings shall be typical for all similar conditions.

**CONSTRUCTION NOTES:**
1. The contractor shall be fully responsible for methods of construction, workmanship, and job safety including falsework, bracing, and other temporary items used for the construction of this project.
2. The contractor shall notify the contracting officer at least 48 hours in advance for inspection of excavations and all concrete pours.
3. Chamfer all exposed edges 1/2" unless otherwise noted.
4. The location of embedded items shall be coordinated with other trades before concrete pours.

**CONCRETE NOTES:**
1. Unless otherwise shown, construction joints shall be located by the contractor subject to approval by the contracting officer. They shall be so located as to least impair the strength of the structure and to minimize shrinkage stresses.
2. Provide dowels as directed and thoroughly clean and roughen surfaces before proceeding with the next pour.

**REINFORCING STEEL NOTES:**
1. Dowels shall be the same size and spacing and shall be in the same plane as the bars to which they are spliced unless otherwise shown.
2. Minimum concrete cover:
   - Concrete deposited on or against earth: 3"
   - All others: 2"

---

**TYPICAL SLIDE GATE DETAIL**

1. TYPICAL SLIDE GATE DETAIL
2. TYPICAL FLAP GATE DETAIL
3. HAUSTEN BRIDGE SLIDE GATE DETAIL

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**DRAWING NUMBER:**

**DISTRIBUTION:**

**SHEET:** C-601

**DRAWN BY:**

**CHECKED BY:**

**APPROVED:**

**DATE:** 8/30/2016

**TIME:** 10:08:32 AM

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**FILE:**

**PLotted DRIVER:**

**PEN TABLE:**

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**MARK A P P R .**

**DAT E :** 8/30/2016

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**US ARMY CORPS**

**OF ENGINEERS**

**HONOLULU DISTRICT**

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**SOLICIT./CONTRACT NO.:**

**DRAWING NUMBER:**

**REVISION:**

**LOCATION CODE:**

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**DESCRIPTION:**

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**FILE:**

**PRINTED BY:**

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**LAST SAVED BY:**

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**DESIGN 35%**

**SUBMITTED BY:**

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**SIZE:**

**SUBMITTEE:**

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**MATERIALS AND MISCELLANEOUS DETAILS**

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**SCALE: 1/4"=1'**

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**FLOW**
### RIGHT BANK FLOOD WALL

**Location**

<table>
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<th>H max</th>
<th>d key</th>
<th>Wt</th>
<th>Wh</th>
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<td>1.5</td>
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<td>2</td>
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<td>7.4</td>
<td>3</td>
<td>1.5</td>
<td>3.5</td>
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**Scale:** 3/8" = 1'

**Details:**

- **EXISTING WALL**
- **EXISTING GROUND** 3' Min
- **SIDEWALK**
- **EXISTING CURB**
- **FILTER DIAPHRAGM**
- **LOW PERMEABILITY CLSM**
- **FLOOD WALL OVER BOX CULVERT (TYP)**

### LEFT BANK FLOOD WALL

**Location**

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<td>1.5</td>
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<tr>
<td>04+00 to 31+00 left</td>
<td>4</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
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<tr>
<td>31+00 to 42+00 left</td>
<td>6</td>
<td>2</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>42+00 to 67+00 left</td>
<td>7.6</td>
<td>3</td>
<td>1.5</td>
<td>3.5</td>
</tr>
<tr>
<td>67+00 to 84+00 left</td>
<td>7</td>
<td>3</td>
<td>1.5</td>
<td>3.5</td>
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</table>

**Scale:** 1/2" = 1'

**Details:**

- **EXISTING WALL**
- **EXISTING GROUND** 3' Min
- **SIDEWALK**
- **EXISTING CURB**
- **FILTER DIAPHRAGM**
- **LOW PERMEABILITY CLSM**
- **FLOOD WALL OVER PIPE CULVERT (TYP)**

**NOTE:**

1. FILTER DIAPHRAGM consists of trench with imported sand to prevent piping at utility penetrations.
CONCEPTUAL DEWATERING REQUIREMENTS FOR LEFT BANK FLOOD WALL

NOTES:

1. Native soil is subject to caving, and groundwater table must be lowered below the excavation to allow dry construction.

2. Dewatering to construct a concrete key will likely require a positive groundwater cutoff system in addition to pumping from wells or well points installed inside the positive groundwater cutoff limits.

3. At culvert penetrations, dewatering with more closely spaced deep well systems will be required, because sheet piles cannot be used.
<table>
<thead>
<tr>
<th>CULVERT NAME</th>
<th>STATION</th>
<th>SIZE (WIDTH x HEIGHT) AND TYPE</th>
<th>H</th>
<th>G</th>
</tr>
</thead>
</table>
| DIAMOND 2, GOLF COURSE | 102+45.5 | 108"x72" RECTANGULAR OPENING SLIDE GATE     | 15'-0"| 11'-6"
| ALA WAI BLVD       | 101+75  | 144"x96" RECTANGULAR OPENING SLIDE GATE     | 19'-0"| 15'-0"
| DIAMOND 3, GOLF COURSE | 96+67   | 3 - 120"x96" RECTANGULAR OPENING SLIDE GATE | 17'-0"| 25'-2"
| 94+19               | 94+19   | 84"x48" RECTANGULAR OPENING SLIDE GATE      | 15'-6"| 12'-6"
| 87+89               | 81+89   | 108"x60" RECTANGULAR OPENING SLIDE GATE     | 19'-0"| 15'-0"
| 50+67               | 50+67   | 24"x24" SQUARE OPENING SLIDE GATE           | 6'-0" | 4'-0"
| 49+65, RB           | 49+65   | 144"x96" RECTANGULAR OPENING SLIDE GATE     | 19'-0"| 15'-0"
| 49+65               | 49+65   | 72"x48" RECTANGULAR OPENING SLIDE GATE      | 11'-3"| 7'-6"
| 36+81, RB           | 36+81   | 72"x48" RECTANGULAR OPENING SLIDE GATE      | 11'-3"| 7'-6"
| HAUSSEN             | 42+10   | 4-120"x96" SLIDE GATE                       | 10'-3"| 7'-0"

**GENERAL NOTES:**

1. SEE SHEET C-501 FOR THE SLIDE GATE DETAIL.
TYPICAL NOTES FOR ALL PUMP STATIONS:

1. The contractor shall comply with all applicable codes and building regulations having jurisdiction over this project.


3. All work shall conform to the best practice prevailing in the various trades comprising the work.
NOTES:
1. SEE TYPICAL PUMP STATION NOTES ON SHEET A-101.
A-302

PUMP STATION 2 - SECTION

MINIMUM CLEARANCE BETWEEN PUMP AND SEAM CRANE: 2'-8"

5'-0"
33'-4"
33'-4"
5'-0"

PUMP APPARATUS

BEAM CRANE

CORBEL AND RUNWAY SEAM

6'-0"
36'-8"
10'-0"

TOP OF WALL

MINIMUM CLEARANCE BETWEEN PUMP AND SEAM CRANE: 2'-8"

CONCRETE WALL

16" THICK

CONCRETE SLAB

8" THICK

FINISH FLOOR ELEVATION: 5.8'

SPACING BETWEEN PUMP INTAKES

WATER LEVEL: (TYP)

TOP OF WALL

EXISTING GROUND

EXISTING GROUND

GROUND EXISTING (TYP)

4' OVERHANG (TYP)

500 KW GENERATOR

(MAX 4" CLEARANCE FROM CEILING)

PUMP APPARATUS

PUMP INTAKE

PUMP SUMP PIT SECTION

WATER LEVEL

FOR ACTIVATION

SPACING TO ACCOUNT FOR POTENTIAL SEDIMENT

8" THICK CONCRETE SLAB

100' FOR ACTIVATION

6'-0"

5'-0"

8'-0"

12'-0"

14'-5"

31'-5"

39'-1"

2'-3"

PUMP SUMP PIT SECTION

BEAM CRANE

BETWEEN PUMP AND MINIMUM CLEARANCE

4' OVERHANG (TYP)

16" CONCRETE WALL

8" CONCRETE SLAB

TOP OF WALL

TOP OF WALL

ELEVATION 5.8'

FINISH FLOOR

ELEVATION 5.8'

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FINISH FLOOR

ELEVATION 5.8'
FIGURE 11
Compensatory Mitigation Measures
Ala Wai Canal Project
O'ahu, Hawai'i
NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SITE PHOTO

NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SECTION

POOL DEPTH - FIELD VERIFIED

WATER SURFACE ELEVATION

NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

PLAN

EDGE OF WATER EXTENDS UPSTREAM

POOL

STREAM BYPASS PITS

FIRSTING CONSTRUCTION LIMIT, TYP

FLUSH DIRECTION

COPPERHEAD, TYP

GROUTED ROCK FALLS

GROUTED ROCK FALLS

EXISTING ROCK FALLS, TYP

GROUTED ROCK FALLS

NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SITE PHOTO

NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SECTION

POOL DEPTH - FIELD VERIFIED

WATER SURFACE ELEVATION

NOTE:
DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.
Ala Wai Golf Course Multi-purpose Detention

- Ala Wai Golf Course Levees (5,037 ft)
- Golf Course Sedimentation Basin (541,300 sq ft)
- Golf Course Cross Sections
- Ala Wai Golf Course Staging Area (25,730 sq ft)
- 2011 TMK (Parcels)

Brief Description of Measure:
Earthen berm around entire outside perimeter of existing golf course property; passive drainage back into Canal.
Hausten Ditch Detention

- Hausten Floodwalls (920 ft)
- Hausten Ditch Construction Limits
- Hausten Berm (705 ft)
- Hausten Staging Area (5,950 sq ft)
- 2011 TMK (Parcels)

Brief Description of Measure
Need to determine how the water from the ditch gets into the golf course
NOTES:
1. STAGING AREA WILL HAVE 2' OF TEXTILE AND 3' OF SURGE MATERIAL.
2. SEE SHEET C-401 FOR THE HAUSTEN DITCH BRIDGE NEW CONCRETE WALL PLAN.
Legend
- Stream
- Footprint (17,165 sq ft)
- Excavation Area (14,040 sq ft)
- Construction Limit (65,360 sq ft)
- Staging Area (2,500 sq ft)
- 20’ Wide Access Road (720 ft long)
- 100-yr Pool (21,245 sq ft)
- TMK Parcel
- NWI Wetland (4,240 sq ft w/in Footprint)

Ala Wai Watershed Project  Makiki Debris and Detention Basin
Island of Oahu, Hawaii

\poh-netapp2\gis\Projects\C0046\arcgismaps\Makiki_Debris_and_Detention_Basin_Alt3_20160627.mxd
Brief Description of Measure
Concrete pad; 8' wide, 2' thick, 140' across; steel posts (4" - 7' high), spaced every 4' along concrete pad.
Legend
- Damselfly
- Stream
- Footprint (41,620 sq ft)
- Construction Limit (72,800 sq ft)
- 20' Wide Access Road (1,080 ft long)
- Staging Area (2,320 sq ft)
- 100-yr Pool (139,740 sq ft)
- TMK Parcel
- NWI Wetland (8,650 sq ft w/in Footprint)

Ala Wai Watershed Project
Waiakeakua Debris and Detention Basin
Island of Oahu, Hawaii

\poh-netapp2\gis\Projects\Civil_Works\C0046\arcgis\Waiakeakua_Debris_and_Detention_Basin_Alt3_20160627.mxd
Brief Description of Measure
Three-sided berm; 20’ high and 840’ across; 5’x5’ box culvert; concrete spillway (3’x80’) above culvert; 18’ of rip rap on downstream edge of spillway; 20-foot-wide perimeter to be maintained as cleared around around perimeter of berm; **NOTE: does NOT include diversion of flows via buried pipe along Woodlawn Drive (Measure #9 in Manoa Technical Report)

Woodlawn Ditch Detention Basin
- Woodlawn Dam (37,520 sq ft)
- Woodlawn Access Road (550 ft)
- Woodlawn Construction Limits (79,315 sq ft)
- Woodlawn Staging Area (25,000 sq ft)
- Woodlawn Detention 100-yr Pool (75,830 sq ft)
- 2011 TMK (Parcels)
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   1.2 Purpose and Scope .............................................................................................................................. 2

2.0 Methodology ............................................................................................................................................ 3

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4.0 Summary and Recommendations ........................................................................................................... 9

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2. Categories of Potential Conflicts and Recommendations for Resolution
3. Summary of Key Utilities Requiring Relocation and/or Design Modifications

## Attachments

1. Project Location Figure
2. Information Request Letters and Responses
3. Detailed Listing of Utilities with in the Project Construction Limits
4. Existing Utility Plan Drawings
5. Waikiki Buffer Zone Map
1.0 Introduction

The Ala Wai Canal Project is a flood risk management feasibility study being conducted by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962. The non-Federal sponsor is the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division.

The project is currently in the feasibility phase of the USACE planning process, which consists of a study to investigate and determine the extent of Federal interest in a plan to reduce flood risk within the Ala Wai Canal watershed. Specifically, the study includes (1) an assessment of the risk of flooding, (2) analysis of a range of alternatives formulated to reduce flood risk, and (3) identification of a tentatively selected plan for implementation (with design drawings developed to a 35% level of design). The results of the feasibility study are presented in a report with an integrated Environmental Impact Statement (EIS), as needed to comply with the National Environmental Policy Act (NEPA) and Hawai’i Revised Statutes (HRS) Chapter 343.

The Draft Feasibility Report/EIS for the Ala Wai Canal Project was released for public review in the fall of 2015, and underwent concurrent public review, Agency Technical Review (ATR), USACE Headquarters Policy Review, and Independent External Peer Review (IEPR). The USACE is currently working to address comments received on the Draft Feasibility Report/EIS in preparation for the Final Feasibility Report/EIS. The Final Feasibility Report/EIS will be submitted to USACE Headquarters for review and approval; if approved, a Chief of Engineers Report would be sent to Congress recommending authorization of the Ala Wai Canal Project for construction.

In response to comments received on the Draft Feasibility Report/EIS and in support of the USACE’s effort to prepare the Final Feasibility Report/EIS, CH2M has been contracted to collect and depict existing utility and subsurface drainage information to assess potential utility conflicts within the project construction limits. This report summarizes the approach and results of this task.

1.1 Background

The Ala Wai Canal watershed is located on the southeastern side of the island of Oahu, and includes Makiki, Manoa, and Palolo streams, all of which drain to the Ala Wai Canal. The Canal is a 2-mile-long waterway constructed during the 1920s to drain extensive coastal wetlands, thus allowing development of the Waikiki District. A large portion of the watershed, including most of Waikiki, is highly susceptible to flooding.

As presented in the Draft Feasibility Report/EIS, the USACE’s tentatively selected plan to address flood risk in the Ala Wai Canal watershed consists of the following measures:

- Six in-stream debris and detention basins in the upper reaches of the watershed
- One standalone debris catchment feature
- Three multi-purpose detention basins in open space areas within the developed watershed
- Floodwalls along the Ala Wai Canal (including three associated pump stations)
- Improvements to the flood warning system (non-structural)
- Compensatory mitigation features

The location of each of the flood risk management measures in the tentatively selected plan is shown in Figure 1 (Attachment 1); a detailed description of each measure is provided in the Feasibility Report/EIS.
1.2 Purpose and Scope

The purpose of this assessment is to identify and depict the existing utilities and subsurface drainage structures within the project construction limits in order to better define the extent of potential conflicts and the need for utility and drainage relocations as part of project implementation. For the purposes of this report, all references to underground “utility” or “utilities” will be considered to include drainage facilities and associated pipelines, as applicable. The results of this assessment will be used to inform the USACE’s cost engineering and feasibility analysis. The tasks included in the scope of work (dated March 15, 2016; revised April 7, 2016) are summarized below.

- **Records Research**: Conduct appropriate investigations (e.g., utility owner records, USACE records, State records, County records, personal interviews, visual inspections, etc.) to help identify utility owners that may have facilities within the project construction limits or that may be affected by construction of the project.

- **Records Collection**: Collect applicable records (e.g., utility owner maps, "as built" or record drawings, permit records, field notes, geographic information system [GIS] data, oral histories, etc.) on the existence and approximate location of existing involved utilities.

- **Records Review**: Review records for evidence or indication of additional available records; duplicate or conflicting information; and/or need for clarification. Exercise professional judgment to correlate data from different sources, and to resolve conflicting information.

- **Conflict Assessment**: Determine conflict points between planned construction and existing or planned utility facilities.

- **Utility Depiction**: Incorporate utility information into project plans (drawings) and furnish documentation to USACE and/or utility owners as needed.

- **Conflict Resolution**: Develop and make recommendations on relocation alternatives, with emphasis on cost effectiveness and on minimizing conflicts.

Based on project schedule and budget limitations, and consistent with the principles of the USACE’s SMART planning process, this effort was based solely on a review and assessment of readily available documentation. A detailed utility mapping survey is beyond the current scope for this task, but a complete project survey including and identifying utilities should be a standard part of the future design process.

Although this approach is expected to yield sufficient information for feasibility planning purposes, it is important to note that it carries an inherent degree of uncertainty and will not necessarily result in complete and/or entirely accurate data. For example, the existing documentation does not provide continuous coverage nor consistent level of detail throughout the project construction limits. There are also instances of inconsistent or conflicting information. Missing information was identified and conflicts were resolved to the extent possible based on the accuracy and reliability of the source information. However, the future utility mapping survey will be critical to achieve the level of accuracy and confidence needed to support the detailed design process. It is recommended that this assessment report and supporting documentation be made available to the project survey team so they may better understand the locations that will require detailed validation and specific confirmation.
2.0 Methodology

As detailed above, the basis for this task was research, compilation and review of publically available documents and other information to support the assessment of utilities within the project area. The potential for utilities was considered within the construction limits for all of the proposed flood risk management measures included in the USACE’s tentatively selected plan, but particular focus was given to the urbanized portions of the project area. Specifically, this included the area along the Ala Wai Canal (both for the Ala Wai Canal floodwalls, and the Hausten Ditch and Ala Wai golf course detention measures) because of the density of urban development within the Waikiki district. Utilities in areas immediately adjacent to the construction limits were also noted, where identified.

Information regarding existing and future/planned utilities within the project area was obtained using the following methods:

- **Information Request Letters**: A comprehensive list of utility owners that could potentially have infrastructure within the project area was identified based on the providers included in the Hawaii “One-Call” Utility Notification Center “Call Before You Dig” service. An information request letter, including maps of the flood risk management measure locations was sent to each of the utility owners requesting information about any existing and/or future utilities in the project area. Given the aggressive timeline for completing the task, the letter requested a response within approximately 10 days. In cases where a response was not received from a utility owner, telephone calls were made to follow-up with the point of contact. Copies of the letters and responses received are contained in Attachment 2.

- **Document Research**: A thorough search was conducted for publically-available documents, with sources including repositories of hard-copy documents and online for electronic information. Specifically, this search included the following:
  - Asbuilt drawings on file at the City & County of Honolulu
  - State of Hawaii Office of Environmental Quality Control (OEQC) online library and map viewer for Environmental Assessments and Environmental Impact Statements
  - Utility distribution maps and relevant project documents stored in CH2M office library

- **GIS Database**: The City & County of Honolulu Department of Planning & Permitting (DPP) maintains the Honolulu Land Information System (HOLIS) Interactive GIS Web Map and Data Services (http://gis.hicentral.com/). This online tool includes a mapping tool as well as access to the geographic information system (GIS) database for a variety of information, including the City & County of Honolulu’s sewer and storm water system. The mapping tool was used to review the type and extent of sewer and storm water facilities in the project area, and the GIS database was used to download the detailed GIS data for inclusion in the plan drawings.

- **Visual Inspection**: CH2M staff conducted multi-day site visits to the proposed flood risk management measure locations where construction is proposed. Only areas that are publically-accessible were visited. Photographs were taken and observations were recorded on a copy of the 35% design drawings.

The various documents obtained from these sources were compiled and reviewed for relevant utility information. This effort involved a systematic review of each document, with cross-checking between documents as needed. Priority was assigned to documents with verified and reputable source information, as well as an adequate level of detail and resolution. Documents with unknown source information were considered, but were generally only used as supporting (rather than primary)
TABLE 1
Documentation Used for Identification of Existing Utilities

<table>
<thead>
<tr>
<th>Source</th>
<th>Citation</th>
<th>Quick Reference a</th>
</tr>
</thead>
<tbody>
<tr>
<td>On file at the City &amp; County of Honolulu</td>
<td>City &amp; County of Honolulu, Department of Design and Construction (DDC) Wastewater Division, Asbuilt Drawings, Job No. W18-07, Plan and Profile Sheets, 2/9/2009.</td>
<td>DDC Asbuilt, Job No. W18-07</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>Board of Water Supply. Distribution Map for Waikiki Area (electronic), provided May 2016.</td>
<td>BWS Dist. Map (2016)</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>Board of Water Supply. Asbuilt Drawings for the Replacement of 12&quot; Water Main Along Ala Wai Boulevard, Job No. 78-100. February 7, 1978.</td>
<td>BWS Asbuilt, Job No. 78-100</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>City &amp; County of Honolulu, Department of Public Works (DPW). Asbuilt Drawings for Ala Wai Boulevard from Kalakaua Ave. to Ala Moana, Job No. 24-50. July 25, 1950.</td>
<td>DPW Asbuilt, Job No. 24-50</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>Board of Water Supply. Asbuilt Drawings for Ala Wai Blvd: 16-Inch Water Main, Kaiulani Avenue to Kapahulu Avenue, Job No. 92-016, March 1991.</td>
<td>BWS Asbuilt, Job No. 92-016</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>Asbuilt Drawings for Improvements of Kalakaua Ave. Fronting the Allure Waikiki Condo, CP Job# 2006/CP-278, Sheet C-4.2, 2010</td>
<td>Asbuilt for Allure Waikiki</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>City &amp; County of Honolulu, Department of Parks and Recreation (DPR), Site and Utility Plan for New Clubhouse at the Ala Wai Golf Course (Addendum No. 1), Job No. 89-009c, October 1988.</td>
<td>DPR Utility Plan, Job No. 89-009c</td>
</tr>
<tr>
<td>Provided by Board of Water Supply</td>
<td>City &amp; County of Honolulu, Department of Parks and Recreation (DPR), Asbuilt Drawings for Ala Wai Golf Course Maintenance Facility, Job No. 96-011C, November 1996.</td>
<td>DPR Asbuilt, Job No. 96-011C</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Design and Construction. Waikiki Buffer Zone Map. 2009.</td>
<td>Waikiki Buffer Zone Map</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Design and Construction. Future Projects (Nos. 08-0107, 08-0108, 13-0062), Provided May 20, 2016.</td>
<td>DDC Future Projects</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Design and Construction. Hillside Terrace at Palolo, Provided May 20, 2016.</td>
<td>Hillside Terrace at Palolo</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Design and Construction (DDC) Division of Wastewater Management. Asbuilt Drawings for Relocation of Sewer for Hillside Terrace Subdivision. Job No. 3-04-19. May 1989.</td>
<td>DDC Asbuilt for Hillside Terrace Subdivision Sewer Relocation</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Public Works (DPW) Division of Sewers. Asbuilt Drawings for Waiohau Sewers Improvement District No. 238, Job No. 47-72, December 1972.</td>
<td>DPW Asbuilt, Job No. 47-72</td>
</tr>
<tr>
<td>Provided by City and County of Honolulu, Department of Design and Construction</td>
<td>City &amp; County of Honolulu, Department of Environmental Services (DES) Division of Collection System Maintenance. Asbuilt Drawings for Moliiili Area 3. June 2013.</td>
<td>DES Asbuilt, Moiiili Area 3</td>
</tr>
</tbody>
</table>
TABLE 1
Documentation Used for Identification of Existing Utilities

<table>
<thead>
<tr>
<th>Source</th>
<th>Citation</th>
<th>Quick Reference a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided by City and County</td>
<td>City &amp; County of Honolulu, Department of Environmental Services (DES)</td>
<td>DES Asbuilt, Palolo Area 3.1</td>
</tr>
<tr>
<td>Provided by Hawaii Gas</td>
<td>Hawaii Gas. Distribution Map for project area (electronic), provided May 2016.</td>
<td>Hawaii Gas distribution map</td>
</tr>
<tr>
<td>Provided by HECO</td>
<td>Documentation for Ala Wai 46kV Underground Cable Relocation Project (schematic figure), provided May 2016.</td>
<td>46kV Relocation Project documentation</td>
</tr>
<tr>
<td>City &amp; County of Honolulu GIS Database</td>
<td>City &amp; County of Honolulu, Department of Planning &amp; Permitting, Honolulu Land Information System (HOLIS), Interactive GIS Web Map and Data Services.</td>
<td>C&amp;C GIS database</td>
</tr>
<tr>
<td>N/A</td>
<td>Visual Inspection by CH2M staff, May 2016.</td>
<td>Visual inspection</td>
</tr>
</tbody>
</table>

NOTES:

a The quick reference for each piece of documentation was used to track the source of information for each utility listed in the detailed spreadsheets contained in Attachment 3.

The utility information derived from the source documents was then transferred to Microstation and depicted together with the USACE’s 35% design information in a set of plan drawings. Data showing the sewer and storm water system were imported from the City & County of Honolulu’s GIS database. The locations of other utilities were identified based on the range of asbuilt drawings, which were scanned and imported as raster images in Microstation, allowing the utility locations to be traced. Based on some of the source information, the presence of a utility was determined, but detailed location information was not obtained. In some cases, these were shown schematically in the plan drawings. In other cases, the utility was noted as being present, but was not displayed in the plan drawings. These instances are noted in the tabular listing of utilities present in the project area.

The plan drawings were then reviewed, in parallel with visual observations of the proposed measure locations to identify potential conflicts between the planned construction and utility infrastructure. Categories were assigned based on the type and degree of potential conflict, to allow the results to be more easily interpreted. For each category of potential conflict, a recommended approach to resolve the conflict was also identified. The categories of the anticipated degree of conflict and recommendation for conflict resolution are listed in Table 2.

TABLE 2
Categories of Potential Conflicts and Recommendations for Resolution

<table>
<thead>
<tr>
<th>Category</th>
<th>Anticipated Degree of Conflict</th>
<th>Recommendations for Conflict Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proposed design conflicts with utility; it is likely that utility will require relocation</td>
<td>Recommend utility relocation (or make design adjustments to accommodate utility, where possible)</td>
</tr>
<tr>
<td></td>
<td>Proposed design conflicts with utility; it is likely that design can be (or will need to be)</td>
<td>Recommend design adjustments be made as part of detailed design process to accommodate utility (or avoid utility, where possible)</td>
</tr>
<tr>
<td></td>
<td>adjusted to avoid utility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed design may conflict with utility; need for design modifications and/or avoidance</td>
<td>Recommend design adjustments and/or utility relocation be considered, if needed, once more detailed information is available</td>
</tr>
<tr>
<td></td>
<td>measures to be determined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed design does not appear to conflict with utility, but utility may affect construction</td>
<td>Recommend detailed design drawings/specifications address temporary utility relocation for construction access and/or measures to avoid/protect utility</td>
</tr>
<tr>
<td></td>
<td>access and/or may require avoidance/protection measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed measure design does not appear to conflict with utility; information provided for</td>
<td>None (but utility should be tracked in case future design refinements may lead to a potential conflict)</td>
</tr>
<tr>
<td></td>
<td>reference</td>
<td></td>
</tr>
</tbody>
</table>
3.0 Results

A detailed listing of all utilities identified within the project construction limits is included in Attachment 3, and the plan drawings depicting the utility locations is included in Attachment 4. Table 4 summarizes those utilities that are expected to require relocation and/or design modifications; this is not intended to replace the complete list in Attachment 3, but rather to provide a high-level summary of the extent to which relocation and/or design modifications may be required for each of the proposed measure location.

TABLE 3
Summary of Key Utilities Requiring Relocation and/or Design Modifications

<table>
<thead>
<tr>
<th>Location</th>
<th>Utility Conflicts</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>Underground 46kV electrical line along Ala Wai Boulevard between Kapiolani Street and McCully Street may be located within or near floodwall footprint; exact location is not known</td>
<td>Determine whether floodwall conflicts with electrical line once detailed information is obtained; microsite floodwalls or relocate utility, as needed</td>
</tr>
<tr>
<td>(Left Bank)</td>
<td>Miscellaneous electrical distribution lines along entire length of Ala Wai Blvd (transitioning between roadway and landscaped area) are partially located within or near floodwall footprint</td>
<td>Relocate within landscaped area, as needed</td>
</tr>
<tr>
<td></td>
<td>16-inch and 30-inch diameter water lines located alongside McCully Street Bridge; bridge tie-in could impact water lines</td>
<td>Design bridge tie-in to accommodate water lines</td>
</tr>
<tr>
<td></td>
<td>Wide variety of storm drains would be crossed by floodwall</td>
<td>Design floodwall to accommodate storm drain crossings</td>
</tr>
<tr>
<td></td>
<td>Multiple force mains and sewer tunnel located in close proximity and crossed by floodwalls</td>
<td>Waikiki Buffer Zone requires mitigation and monitoring measures to avoid damage to the Beachwalk WWPS force mains; consider loads imposed on sewer lines and manhole access</td>
</tr>
<tr>
<td></td>
<td>Power feeds and lines for walkway and street lighting located within or near floodwall footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td></td>
<td>Power feeds and lines for traffic signals (and traffic signal boxes) located within or near floodwall footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td></td>
<td>Irrigation lines located within or near floodwall footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td></td>
<td>Water line running along Ala Wai Promenade located within floodwall footprint</td>
<td>Relocate within promenade area as needed</td>
</tr>
<tr>
<td></td>
<td>Parallel 3-inch diameter and 8-inch diameter water lines cross location where floodwall and/or flood gate would join with golf course detention berm</td>
<td>Design floodwall and/or flood gate to accommodate water lines</td>
</tr>
<tr>
<td></td>
<td>Wide variety of storm drains would be crossed by floodwall</td>
<td>Design floodwall to accommodate storm drain crossings</td>
</tr>
<tr>
<td></td>
<td>Multiple force mains and sewer tunnel located in close proximity and would be crossed by floodwalls</td>
<td>Waikiki Buffer Zone requires mitigation and monitoring measures to avoid damage to the Beachwalk WWPS force mains; consider loads imposed on sewer lines and manhole access</td>
</tr>
<tr>
<td></td>
<td>Power feeds and park lights for Ala Wai Community Park located within or near floodwall footprint</td>
<td>Design floodwall to avoid lights or relocate closer to interior of park</td>
</tr>
<tr>
<td></td>
<td>Power feeds for walkway lighting located within or near floodwall footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td></td>
<td>Irrigation lines located within or near floodwall footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td>Location</td>
<td>Utility Conflicts</td>
<td>Recommendations</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pump Station 1 (Kapahulu)</td>
<td>No utilities identified that require design modifications and/or relocation</td>
<td>N/A</td>
</tr>
<tr>
<td>Pump Station 2 (Golf Course)</td>
<td>Storm drain located within footprint of pump station</td>
<td>Design pump station to accommodate drain line</td>
</tr>
<tr>
<td>Pump Station 2 (Golf Course)</td>
<td>Lighting for driving range located near pump station footprint (currently under construction)</td>
<td>Relocate lighting (or design pump station to avoid lighting) as needed</td>
</tr>
<tr>
<td>Pump Station 3 (University)</td>
<td>Proposed 46kv line to be installed in horizontal directional drill casing under Canal (est. 2018-2020) could conflict with pump station (sump)</td>
<td>Design pump station to avoid proposed 46kv line</td>
</tr>
<tr>
<td>Pump Station 3 (University)</td>
<td>Transformers and electrical boxes located in (or near) pump station footprint</td>
<td>Design pump station to avoid transformers and electrical boxes</td>
</tr>
<tr>
<td>Pump Station 3 (University)</td>
<td>Pump station would be located in close proximity to 72-inch diameter sewer tunnel; sump pump could conflict with sewer tunnel</td>
<td>Design pump station to avoid sewer tunnel</td>
</tr>
<tr>
<td>Pump Station 3 (University)</td>
<td>Power feeds for lighting generally located within or near pump station footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Overhead electrical and telecommunications lines located along entrance road to golf course clubhouse could affect construction access</td>
<td>May require temporary relocation for construction</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Detention berm would cross water line that runs from Kapahulu Street to drainage channel</td>
<td>Design berm to accommodate waterline</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Detention berm would cross water line near maintenance facility in at least 2 locations; water line may also conflict with sediment basin</td>
<td>Relocate water line (or design berm and sediment basin to accommodate water line) as necessary</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Detention berm would cross large drain lines that run from Kapahulu Avenue through golf course, daylighting into drainage channel</td>
<td>Design berm to accommodate drain lines</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Storm drains running along edge of Ala Wai golf course property near Date Street would be in close proximity to detention berm</td>
<td>Confirm final design for berm does not conflict with storm drain; modify berm design and/or relocate storm drain as needed</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Detention berm would cross 6-inch and 8-inch diameter sewer lines near maintenance facility; sediment basin would also conflict with 8-inch sewer line</td>
<td>Relocate sewer lines (or design berm and sediment basin to accommodate sewer lines) as necessary</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Detention berm would cross 12-inch and 24-inch diameter sewer lines in eastern portion of golf course</td>
<td>Design berm to accommodate sewer lines and manholes</td>
</tr>
<tr>
<td>Ala Wai Golf Course Detention</td>
<td>Irrigation lines and equipment located within or near detention footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td>Hausten Ditch Detention</td>
<td>72-inch diameter sewer tunnel and associated manholes located in close proximity to detention basin; detention berm may cross sewer tunnel</td>
<td>Identify measures to avoid/protect sewer; specifically need to consider loads imposed on sewer line and manhole access</td>
</tr>
<tr>
<td>Hausten Ditch Detention</td>
<td>Power feeds for lighting may extend into detention footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td>Hausten Ditch Detention</td>
<td>Irrigation lines and equipment located within detention footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td>Location</td>
<td>Utility Conflicts</td>
<td>Recommendations</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kanewai Detention</td>
<td>Overhead electrical line located along Manoa Stream, with pole at edge of construction limits</td>
<td>Relocate pole (or design detention berm to accommodate pole) as appropriate</td>
</tr>
<tr>
<td></td>
<td>Overhead electrical and telecommunication lines along Dole Street may affect construction access</td>
<td>May require temporary relocation for construction</td>
</tr>
<tr>
<td></td>
<td>Box culvert draining to Manoa Stream near baseball diamond is expected to conflict with excavation for detention basin</td>
<td>Design detention basin to avoid or accommodate feature (e.g., lower box culvert, replace box culvert with pipes or shallower box culvert)</td>
</tr>
<tr>
<td></td>
<td>Irrigation lines may be located within or near detention footprint</td>
<td>Relocate as needed during construction</td>
</tr>
<tr>
<td></td>
<td>Gaging station located near edge of construction limits; may be within footprint of detention basin</td>
<td>Design detention basin to avoid gaging station or relocate as necessary</td>
</tr>
<tr>
<td>Manoa In-Stream</td>
<td>Overhead electrical and telecommunication lines along Kahaloa Drive may affect construction access</td>
<td>May require temporary relocation</td>
</tr>
<tr>
<td>Woodlawn Detention</td>
<td>No utilities identified that require design modifications and/or relocation</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Overhead electrical and telecommunication lines traverse along and across proposed construction access route and detention berm</td>
<td>Relocate poles and overhead lines (or design detention berm to accommodate utility) as appropriate</td>
</tr>
<tr>
<td></td>
<td>Water lines/valves located within footprint of construction access road; water line and valves could be impacted by construction equipment and/or potential bridge reinforcement</td>
<td>Design access road and bridge reinforcement to accommodate water line and valves</td>
</tr>
<tr>
<td></td>
<td>Storm drain located directly adjacent to access road at bridge crossing at end of Waaloa Way (near proposed staging area); storm drain could be impacted by potential bridge reinforcement</td>
<td>Design access road and bridge reinforcement to accommodate drainage feature</td>
</tr>
<tr>
<td>Waikeakua Debris and Detention Basin</td>
<td>No utilities identified</td>
<td>N/A</td>
</tr>
<tr>
<td>Makiki Debris and Detention Basin</td>
<td>Utility poles with overhead electrical and telecommunication lines located near perimeter of construction limits; may conflict with detention berm and/or affect construction access</td>
<td>Design detention berm as needed to avoid utility poles and lines and/or temporarily relocate for construction access</td>
</tr>
<tr>
<td>Pukele Debris and Detention Basin</td>
<td>Overhead electrical and telecommunication lines along La‘i Road may affect construction access</td>
<td>May require temporary relocation for construction</td>
</tr>
<tr>
<td></td>
<td>Storm drain extending from Ipulei Place with outfall near stream; storm drain could be impacted by detention berm</td>
<td>Confirm final design for berm does not conflict with storm drain; modify design and/or relocate storm drain as needed</td>
</tr>
<tr>
<td></td>
<td>Sewer line and manholes located within (or near) construction limits along Pukele Stream and could be impacted by detention berm</td>
<td>Design detention berm to accommodate sewer line and manholes to extent possible; some degree of reinforcement may be necessary</td>
</tr>
<tr>
<td>Waiomao Debris and Detention Basin</td>
<td>Overhead electrical and telecommunication lines along Waiomao Road may affect construction access</td>
<td>May require temporary relocation for construction</td>
</tr>
<tr>
<td></td>
<td>Sewer line and manholes located within (or near) construction limits along Waiomao Stream and may conflict with detention berm and/or access road</td>
<td>Design berm and access road to accommodate sewer line and manholes to extent possible; some degree of reinforcement may be necessary</td>
</tr>
<tr>
<td>Mitigation Sites (Falls 7 and 8)</td>
<td>No utilities identified that require design modifications and/or relocation</td>
<td>N/A</td>
</tr>
</tbody>
</table>
4.0 Summary and Next Steps

The information in this report summarizes the utilities that are known to occur within the project construction limits, based on information obtained as of June 15, 2016. As summarized in Table 3 (and detailed in Attachments 3 and 4), there are existing utilities within the construction limits of nearly every proposed measure, generally with increasing occurrence in the urbanized areas. As expected, the greatest number of utility conflicts would result from those measures located in the Waikiki District, particularly the Ala Wai Canal floodwalls and the Ala Wai golf course detention measure. With a few exceptions (as documented in Table 3 and Attachment 3), it is expected that most of the permanent utility conflicts can or should be resolved through design modifications.

Given the schedule requirements for the feasibility study, the timing for completing this existing utilities review and assessment was necessarily abbreviated, with this assessment completed approximately 30 days after the information request letters were mailed out. This short response period exceeded the ability of some utility owners to provide documentation of their utility infrastructure. In particular, Hawaiian Electric Company indicated that they would require up to 90 days to provide documentation of their electrical transmission and distribution system. To the extent possible, the occurrence of electric utilities was identified based on other documentation; however, it should be recognized that documentation from Hawaiian Electric Company may yield important information regarding the electrical utility system (particularly regarding the location of underground 46kV sub-transmission lines along Ala Wai Boulevard).

As detailed throughout this report, the occurrence and location of utilities were assessed based on publically-available documentation. This effort was as comprehensive as possible, and is believed to have captured the vast majority of utilities that occur within the construction limits for the project; however, the list may not be exhaustive and the locations (where shown) may not be exact. Nonetheless, the information presented in this report is expected to be adequate for feasibility planning purposes, with the understanding that a detailed utility mapping survey will be conducted in the future to support the detailed design effort. Other issues and recommendations that should be considered as the project progresses through the current feasibility planning and future design phases are listed below:

- Although most of the documentation was consistent, in some cases, the City & County of Honolulu’s GIS data and/or the asbuilt drawings showed conflicting information with that shown for the location of storm drains on the USACE 35% design drawings. It is understood that the source information used for the 35% design drawings was from the City & County of Honolulu, but the specific details and level of accuracy of this documentation is unknown. Therefore, where discrepancies were identified, the information from the City & County of Honolulu’s GIS database was assumed to be more accurate (and the discrepancy was noted in the detailed list of utilities in Attachment 3). It is not anticipated that any of these discrepancies will have a significant bearing on the outcome of the feasibility study as they generally fall within the range of conditions addressed in this assessment (and the exact locations would be verified as part of the future utility mapping survey), but it is recommended that the USACE confirm this conclusion.

- In many cases, utilities were identified that would not be in direct conflict, but would be close to a proposed flood risk management measure. In cases where the utility is expected to be immediately proximate to the construction limits or where the utility could be susceptible to damage, it is recommended that measures be implemented to avoid and protect the utility, as appropriate. In any case, these utility locations should be confirmed as part of the future utilities survey mapping effort to ensure that no conflict exists.
• For the proposed Waiomao Debris and Detention Basin, it was observed that in addition to the utilities that were identified, the proposed staging area and access road would be located in very steep terrain in the vicinity of various driveways and dwellings. It is recommended that the proximity of these features relative to the construction limits be reconsidered.

• It is understood that the USACE is conducting additional analyses, based upon which they may consider an extension of the Ala Wai Canal floodwalls along the right bank of the Manoa Palolo Drainage Canal up to the Date Street bridge. As these floodwalls were not previously included in the tentatively selected plan, they were not considered throughout the utility assessment. However, based on a review of the documentation obtained to date, the utilities that are known to occur in this area have been included in the detailed listing (Attachment 3) and are shown on Sheet C-210 (Attachment 4), to the extent possible.

• At the current time, it is assumed that there are not any utility agreements in place and all financial obligations for relocation would be the responsibility of the project sponsors. The specific requirements for compensability should be reviewed with USACE legal counsel.

• It is important to note that portions of the project (primarily the Ala Wai Canal floodwalls and Hausten Ditch Detention Basin) are within the Waikiki Buffer Zone (see Attachment 5), which was established to protect the Beachwalk Wastewater Pump Station (WWPS). Any work within the Waikiki Buffer Zone will require mitigation and/or monitoring measures to avoid damage to the Beachwalk WWPS force mains due to ground vibration or soil liquefaction. It is recommended that this information be considered in the detailed design process and included in the detailed design and specification documents.

• In addition to a survey for utilities during the early stages of the final design phase, it is recommended that USACE conduct early and close coordination with the utility owners as needed to confirm utility information and reach mutual agreement on requirements for avoidance/protection measures and relocation plans, where required.

• This assessment is limited to utilities that would be impacted by construction of the proposed flood risk management features. It does not consider utility impacts associated with flooding or related conditions (e.g., inundation of sewer lines). It is assumed that these impacts will be considered and addressed as needed through the detailed design process.
Attachment 1

Location of Tentatively Selected Plan
Tentatively Selected Plan
Upper Watershed
Ailau Canal Project
O'ahu, Hawai'i
Tentatively Selected Plan
Lower Watershed
Ala Wai Canal Project
O'ahu, Hawai'i

LEGEND
Stream
Watershed Boundary
5 Percent Annual Chance Exceedance Floodplain
(with Implementation of Tentatively Selected Plan)
Flood Risk Management Measure

DISCLAIMER: This map was created by USACE using the best available data at the time (July 2010). It may or may not accurately reflect existing conditions.
Attachment 2

Information Request Letters and Responses
Attachment 2a

Correspondence with Hawaiian Electric Company
May 10, 2016

Mr. Kenneth Jen, EFT Researcher
Hawaiian Electric Company, Inc.
820 Ward Avenue
Honolulu, Hawaii 96814

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Jen:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

- Ala Wai Canal Floodwalls (Sheet C-101): Makai side of Ala Wai Canal, along Ala Wai Boulevard between Ala Moana Boulevard and Ainakea Way
- Ala Wai Golf Course Detention Basin (Sheet C-103): Makai side of Date Street from Manoa Palolo Drainage Canal to Kapahulu Avenue (adjacent to Ala Wai Golf Course) and ewa side of Kapahulu Avenue, between Date Street and Ala Wai Boulevard
- Hausten Ditch Detention (Sheet C-102)
- Kanewai Field Multi-Purpose Detention (Sheet C-306)
- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-buils of your existing infrastructure around the proposed project areas, as well as any future planning which may occur at these locations. This information will assist in evaluation of the proposed project.
The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
Attachment 2b
Correspondence with City and County of Honolulu Board of Water Supply
May 10, 2016

Mr. Ernest Y.W. Lau, P.E., Manager and Chief Engineer
Board of Water Supply
Plans Review Section
City and County of Honolulu
630 South Beretania Street, 1st Floor
Honolulu, Hawaii 96813

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Lau:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

- Ala Wai Canal Floodwalls (Sheet C-101): Makai side of Ala Wai Canal, along Ala Wai Boulevard between Ala Moana Boulevard and Ainakea Way
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- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-builds of your existing infrastructure
around the proposed project areas, as well as any future planning which may occur at these locations. This information will assist in evaluation of the proposed project.

The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
Hi Jeff,

The request for as-builts and distribution map is on a CD and ready for pick up. The CD will be with the Engineering Bldg Security Guard. Please bring a blank CD to exchange. Feel free to contact me if you have any questions.

Thanks,

Guy Masagatani
Board of Water Supply
Capital Projects – Support Branch
630 S. Beretania Street
Honolulu, HI 96843
Ph. (808) 748-5748
Fax (808) 550-5549
Email: gmasagatani@hbws.org

From: MICHAEL DOMION
Sent: Thursday, May 12, 2016 1:39 PM
To: GUY MASAGATANI <GMASAGATANI@hbws.org>
Subject: FW: Request for As-builts/Distribution maps (Ala Wai)

Guy,

Please take care of this.

Thanks,
Mike D.

From: Jeff.Onaga@ch2m.com [mailto:Jeff.Onaga@ch2m.com]
Sent: Thursday, May 12, 2016 1:20 PM
To: MICHAEL DOMION
Cc: Jason.Kage@ch2m.com
Subject: Request for As-builts/Distribution maps (Ala Wai)

Hi Mike,

As Jason mentioned in his call previously, we are requesting as-builts and distribution maps for the highlighted areas in the attached map. The main focus is the area along Ala Wai Blvd from Ala Moana Blvd to Kapahulu Ave. Along with this area we would also like information on the Date Street
area along the golf course. We hope that you can provide us with this information as soon as possible, to allow for us to meet our client’s fast approaching deadlines.

Thank you,
Jeff Onaga
Water Engineer
O: (808) 440-0207
CH2M
www.ch2m.com | LinkedIn | Twitter | Facebook
Attachment 2c

Correspondence with City and County of Honolulu
Department of Environmental Services
May 10, 2016

Ms. Lori M.K. Kahikina, P.E, Director
Department of Environmental Services
City and County of Honolulu
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707

Subject:  Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Ms. Kahikina:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

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- Hausten Ditch Detention (Sheet C-102)
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- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information regarding any future sewer projects around the proposed project areas. This information will assist in evaluation of the proposed project.
The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
Yes we should be able to get that to you by Friday. Jack Pobuk is already compiling the information.

Sent from my iPhone

> On May 17, 2016, at 8:10 AM, "Jeff.Onaga@ch2m.com" <Jeff.Onaga@ch2m.com> wrote:
> >
> > Okay, thank you! I will contact Randall for his help, but any information from ENV for those sewer projects will be extremely helpful to us.
> >
> > Thanks,
> > Jeff
> >
> > -----Original Message-----
> > From: Kahikina, Lori M K [mailto:lkahikina@honolulu.gov]
> > Sent: Tuesday, May 17, 2016 8:00 AM
> > To: Onaga, Jeff/HNL <Jeff.Onaga@ch2m.com>
> > Subject: Re: Info Request
> >
> > Ah, the joys of working with the government. Ha! Thank you for indulging me.
> >
> > Yes, the Stormwater group moved over last July to DFM and Randall Wakumoto would be a good POC. His email address is rwakumoto@honolulu.gov.
> >
> > However, ENV will be able to provide to you the sewer projects.
> >
> > Mahalo
> > Lori
> >
> > Sent from my iPhone
> >
> > >> On May 16, 2016, at 3:59 PM, "Jeff.Onaga@ch2m.com" <Jeff.Onaga@ch2m.com> wrote:
> > >> Hi Lori,
> > >>
> > >> I apologize for the rush on this request. I am aware that this project has been in the planning stages for years, but we have just got approval to work on our part of the study from USACE last week. Since they have not altered their work schedule, our work deadlines have been approaching even faster now. I have also sent a similar request letter to DFM, but was not aware the storm water group had moved completely. I was under the impression that your department would be able to help us with any future sewer projects in the area. Would I have to contact DFM's storm water group for that information too? If so, would you be able to provide me with contact information for that branch?
> > >>
> > >> Thank you,
> > >> Jeff
> > >>
> > >> -----Original Message-----
> > >> From: Kahikina, Lori M K [mailto:lkahikina@honolulu.gov]
> > >> Sent: Monday, May 16, 2016 3:45 PM
> > >> To: Onaga, Jeff/HNL <Jeff.Onaga@ch2m.com>
> > >> Subject: Info Request
>> Aloha Jeff
>> I know this project has been studied and planned for years. I'm just curious why this request is a rush now.
>>
>> Also, just want to confirm with you that the storm water group has moved completely to our sister department, Facilities Maintenance. Just want to make sure you're also checking with them.
>>
>> Mahalo
>> Lori
>>
>> Sent from my iPhone
>
CH2M,

We reviewed the locations for the various flood control improvements proposed. Our comments:

We have major sewer trunk lines running parallel to, and across, the Ala Wai Canal. One of these is the recently completed Beachwalk WWPS Force Main back-up pipe. This approx 72-inch sewer line, which is currently a force main, but scheduled to be converted to gravity flow in approx 10 years, runs parallel with the Ala Wai Canal, and may be under the proposed flood wall improvements. There are several manholes for this sewer line that may be in conflict with the flood walls. Also, we may have future projects to connect new gravity sewers to these manholes, after the conversion to gravity flow, and we need the area around these manholes to be clear in anticipation of the future sewer connection work.

Also, we have tentative plans for a new sewer trunk line parallel to the Ala Wai Canal, mauka side, to connect from the existing 48-inch (upstream of the inverted siphon crossing the Ala Wai) to the new 72-inch sewer (at or near the “mauka pit”).

We also have existing sewers in the vicinity of the following project areas:
Hausten Ditch Detention basin facilities
Ala Wai Golf Course Multi-purpose Detention basin facilities
Kanewai Field Multi-purpose Detention basin facilities
Pukele Debris and Detention basin facilities
Waiomao Debris and Detention basin facilities (this location may be affected by a planned sewer rehab project.)
Manoa In-Stream Debris Catchment facilities

The existing sewers in these areas will need to be protected from damage during construction. Also, if any sewers or manholes are located in areas that could be impacted by flooding, detention basin water, or debris accumulation, then this needs to be addressed.

Please let me know if any questions. You can call me at 768-3464, or call Marisol of my staff at 768-3467.

Thanks,
Jack
On May 16, 2016, at 3:40 PM, Pobuk, Jack <jpobuk@honolulu.gov> wrote:

Lori,
Seems all they need is information on our CIP projects, and it should not be that difficult to do. It is basically just our planned wastewater projects. We can provide response by Fri.
Hope CH2M realizes that all CIP projects for storm water quality are entirely under DDC/CD or DFM now.
Thanks,
Jack

---

From: Kahikina, Lori M K
Sent: Monday, May 16, 2016 3:35 PM
To: Pobuk, Jack
Cc: Tanimoto, Ross; Houghton, Tim
Subject: Fwd: Request for Information Letter (Utilities)

Hi Jack
Will you be able to provide the information by this Friday? If not, let me know and I'll contact Ross Kaneko. This project has been studied for years and now it's a one-week rush to get our response???
Thanks

---

Sent from my iPhone

Begin forwarded message:

From: "Fukumoto, Diane S" <dfukumoto@honolulu.gov>
Date: May 16, 2016 at 2:47:14 PM HST
To: "Kahikina, Lori M K" <lkahikina@honolulu.gov>
Subject: FW: Request for Information Letter (Utilities)

Hi, Lori. Jeff Onaga wanted to speak to you on the attached. I printed out the attached and gave it to Jack. He said he has seen things on this Ala Wai Canal Project.

Jeff can be reached at 440-0207.

Thank you,
Diane

---

From: Jeff.Onaga@ch2m.com [mailto:Jeff.Onaga@ch2m.com]
Hi Diane,

Thank you so much for assisting us with this request. Attached is our request letter and the supporting pdf files. If any questions about these documents may arise, feel free to contact me by phone or email. My project manager, Jason Kage can also be reached through his contact information, which is available on the request letter.

Once again thank you very much,

Jeff Onaga
Water Engineer
O: (808) 440-0207
CH2M

www.ch2m.com | LinkedIn | Twitter | Facebook
Attachment 2d
Correspondence with City and County of Honolulu
Department of Design and Construction
Wastewater Division
May 10, 2016

Mr. Guy Inouye, Chief of Wastewater Division
Wastewater Division
650 South King Street, 14th Floor
Honolulu, Hawaii 96813
Department of Design and Construction, Wastewater Division
City and County of Honolulu

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Inouye:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

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- Kanewai Field Multi-Purpose Detention (Sheet C-306)
The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
May 19, 2016

Mr. Jason Y. Kage  
Project Manager  
CH2M Hill  
1132 Bishop Street, Suite 1100  
Honolulu, Hawaii 96813

Dear Mr. Kage:

SUBJECT: Feasibility Study of Ala Wai Canal Project  
U.S. Army Corps of Engineers, Honolulu District  
Response to Utility Verification and Request for Information

The enclosed CD contains the information requested in your letter dated May 10, 2016, regarding the subject project. The information provided includes both As-Built drawings of our sewers and location maps of future sewer projects currently in the design phase.

If there are any questions, please contact Tina Ono of our Wastewater Division at (808) 768-8766.

Very truly yours,

[Signature]

Robert J. Kroning, P.E.  
Director

Enclosure
Attachment 2e

Correspondence with City and County of Honolulu
Department of Facility Maintenance
May 10, 2016

Mr. Ross S. Sasamura, P.E., Director and Chief Engineer
Department of Facility Maintenance
City and County of Honolulu
1000 Uluohia Street, Suite 215
Kapolei, Hawaii 96707

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Sasamura:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

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• Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-builts of your existing infrastructure for traffic signals and street lights around the proposed project areas. This information will assist in evaluation of the proposed project.

The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
Attachment 2f

Correspondence with Hawaii Gas
May 10, 2016

Mr. Charles Calvet, P.E., Manager, Engineering
Hawaii Gas
515 Kamakee Street
Honolulu, Hawaii 96814

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Calvet:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

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The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

[Signature]
Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
May 23, 2016

Mr. Jason Y. Kage, P.E.
CH2M Hill, Inc.
1132 Bishop Street, Suite 1100
Honolulu, Hawaii 96813

Dear Mr. Kage:

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

In response to your letter dated May 10, 2016, we are sending gas maps for Ala Wai Boulevard, Kapahulu Avenue, Date Street, Puakele and Kanewai Field. Also enclosed is a copy of our construction notes for gas facilities which should be included as part of the final plans and our gas line symbols for your information.

All information provided by Hawaii Gas, including but not limited to maps, prints, stakeouts, toning, and site indications are approximations only of the location of its facilities and pipelines. Hawaii Gas makes no representation or warranty, either expressed or implied, of their accuracy; and the party receiving such information shall have the sole responsibility for field verification for determining the exact location of said facilities and pipelines. The presence of or assistance provided by any Hawaii Gas employee shall not relieve said party of its responsibility for verification. Hawaii Gas shall not be liable for any claims or damages arising from the use of the information provided.

The recipient shall not assign, loan, sell copy or otherwise transfer data to any other party.

Should there be any questions, or if additional information is desired, please call Colin Chikamoto at 596-1430.

Sincerely,

Hawaii Gas

[Signature]

Keith K. Yamamoto
Manager, Engineering

KKY krs

Attached: CD
Attachment 2g
Correspondence with Oceanic – Time Warner Cable
May 10, 2016

Ms. Allyson Ebert
Oceanic- Time Warner Cable
Engineering Department
200 Akamainui Street
Mililani, Hawaii 96789

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Ms. Ebert,

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

- Ala Wai Canal Floodwalls (Sheet C-101): Makai side of Ala Wai Canal, along Ala Moana Boulevard between Ala Moana Boulevard and Ainakea Way
- Ala Wai Golf Course Detention Basin (Sheet C-103): Makai side of Date Street from Manoa Palolo Drainage Canal to Kapahulu Avenue (adjacent to Ala Wai Golf Course) and ewa side of Kapahulu Avenue, between Date Street and Ala Wai Boulevard
- Hausten Ditch Detention (Sheet C-102)
- Kanewai Field Multi-Purpose Detention (Sheet C-306)
- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-builds of your existing infrastructure
around the proposed project areas, as well as any future planning which may occur at these locations. This information will assist in evaluation of the proposed project.

The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
May 12, 2016

CH2M
1132 Bishop Street, Suite 1100
Honolulu, Hawaii 96813

Attention: Jason Y. Kage

Project: Feasibility Study of Ala Wai Canal Project

Subject: Impacted to CATV

Dear Mr. Kage,

At this time Oceanic Time Warner Cable sees No impact to our facilities in and around the project areas. If you have any questions, contact me at #625-8576.

Sincerely,

[Signature]
Lionel Aguilar
OSP Engineer
Oceanic Time Warner Cable
Attachment 2h

Correspondence with Hawaiian Telcom, Inc.
May 10, 2016

Mr. Leslie Loo
Hawaiian Telcom, Inc.
1177 Bishop Street (A10)
Honolulu, Hawaii 96813

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

Dear Mr. Loo:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

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- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-builds of your existing infrastructure around the proposed project areas, as well as any future planning which may occur at these locations. This information will assist in evaluation of the proposed project.
The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
June 1, 2016

CH2M HILL
1132 Bishop Street
Suite 1100
Honolulu, Hawaii 96813
Attention: Mr. Jason Y. Kage, Project Manager

Dear Mr. Kage:

Subject: Feasibility Study of Ala Wai Canal Project
U.S. Army Corps of Engineers, Honolulu District
Utility Verification and Request for Information

In response to your letter dated May 10, 2016, we have determined that Hawaiian Telcom has aerial and underground facilities within the area of your proposed project sites. The locations of the support structures are indicated on the attached drawings.

Please be aware that these locations are only approximate and that field locating should be done prior to any excavation work commencing. Also, underground service drop connections to individual lots may or may not be identified on the maps.

Hawaiian Telcom does not foresee any future projects at these locations.

If you have any questions or require assistance in the future on this project, please call me at 546-7761.

Sincerely,

[Signature]

Les Loo
Network Engineer – Outside Plant Engineering
Network Engineering & Planning

Attachments

cc: File
Attachment 2i

Correspondence with Sandwich Isles Communications, Inc.
May 10, 2016

Kalani Andrade, Network Engineering and I.T. Manager  
Sandwich Isles Communications, Inc.  
77-808 Kamehameha Highway  
Mililani, Hawaii 96789

Subject: Feasibility Study of Ala Wai Canal Project  
U.S. Army Corps of Engineers, Honolulu District  
Utility Verification and Request for Information

Dear Kalani Andrade:

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division, the Ala Wai Canal Project is a flood risk management feasibility study being investigated by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962.

The objective of the project is to reduce riverine flood risks in the Ala Wai Watershed. In response to identified flood-related problems and opportunities, a range of alternatives were evaluated, resulting in identification of a tentatively selected plan. The plan includes (1) in-stream debris catchment and detention basins in the upper reaches of Makiki, Manoa and Palolo streams, (2) multi-purpose detention basins in open space areas in the urbanized portions of the watershed, and (3) floodwalls (and associated pump stations) along the Ala Wai Canal.

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- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

Enclosed are site plans of all the proposed project areas, with the areas of particular interest highlighted in yellow. We are requesting information and as-builds of your existing infrastructure around the proposed project areas, as well as any future planning which may occur at these locations. This information will assist in evaluation of the proposed project.
The project is under an accelerated schedule and to assist us in meeting our client’s expectations, we respectfully request that this information be returned by May 20, 2016. Should you have any questions, please do not hesitate to contact me at (808) 943-1133. Thank you in advance for your assistance.

Sincerely,

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE
Attachment 3

Detailed Listing of Utilities within the Project Construction Limits
<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Ala Wai Canal Floodwalls (Left Bank)</th>
<th>Ala Wai Canal Floodwalls (Right Bank)</th>
<th>Ala Wai Canal Floodwalls (Manoa Palolo Canal)</th>
<th>Pump Station 1 (Palolo)</th>
<th>Pump Station 2 (Golf Course)</th>
<th>Pump Station 3 (University)</th>
<th>Ala Wai Golf Course Detention</th>
<th>Hausten Ditch Detention</th>
<th>Kanewai Detention</th>
<th>Manoa In-Stream</th>
<th>Waiakea Debris / Detention Basin</th>
<th>Waihi Debris / Detention Basin</th>
<th>Pukaheko Debris / Detention Basin</th>
<th>Mitigation Sites (Falls 7 and 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>●</td>
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<tr>
<td>Water</td>
<td>Board of Water Supply</td>
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<td>Storm Drain</td>
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<td>Sanitary Sewer</td>
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<td>Gas</td>
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<td>Telecommunications</td>
<td>Oceanic Time Warner</td>
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<td>Hawaiian Telcom</td>
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<td></td>
<td>Sandwich Isles Communications</td>
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<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
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<tr>
<td>Traffic Signals</td>
<td>City &amp; County of Honolulu</td>
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<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
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</tr>
</tbody>
</table>
## Ala Wai Canal Floodwalls (Left Bank)

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-13</td>
<td>Conduit; size unknown</td>
<td>Crosses Canal at Ala Moana Blvd Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Conduit encased in bridge structure</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on asbuilt</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-17</td>
<td>Conduit; size unknown</td>
<td>Crosses Canal at McCully St Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Conduit encased in bridge structure</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on asbuilt</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>No detailed source documents identified</td>
<td>46kV underground sub-transmission line</td>
<td>Along Ala Wai Blvd between Kaiolu St and McCully St</td>
<td>Active</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Assumed to be within Ala Wai Blvd roadway, but specific information has not been obtained</td>
<td>Determine whether floodwall conflicts with electrical line once detailed information is obtained; microsite floodwalls or relocate utility, as needed</td>
<td>Detailed information not obtained; locations not shown on plan drawings</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA 46kV Relocation Project documentation</td>
<td>Two 46kV lines within 200' wide easement crossing Canal; to be replaced by new line (see future project)</td>
<td>Extending across Canal between Kaiolu St and Ala Wai Neighborhood Park; manholes at intersection of Kaiolu St and Ala Wai Blvd</td>
<td>Active (to be replaced in future)</td>
<td>yes</td>
<td>Approx. 20 feet below grade (per 46kV relocation project info)</td>
<td>Floodwall would cross existing 46kV lines, but these are expected to be removed in 2018</td>
<td>N/A</td>
<td>Schematically shown on plan drawings based on 46kV Relocation Project documentation</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>46kV Relocation Project documentation</td>
<td>Proposed 46kV line to be installed in horizontal directional drill casing under Canal</td>
<td>Crossing Canal between Kalaimoku St and University Ave, with associated trenching in Ala Wai Blvd roadway between Kaiolu St and Kalaimoku St</td>
<td>Future (planned to start in 2018)</td>
<td>yes</td>
<td>40-50' deep (at edge of Canal)</td>
<td>46kV line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station</td>
<td>Track utility information; confirm there would be no conflict once detailed utility information and location is available</td>
<td>Schematically shown on plan drawings based on 46kV Relocation Project documentation; would also involve trenching between Kaiolu St and Kalaimoku St (expected to occur in Ala Wai Blvd. roadway, but design is not yet complete)</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16</td>
<td>Miscellaneous electrical distribution lines and other electrical infrastructure</td>
<td>Along entire length of Ala Wai Blvd, transitioning back and forth between roadway and landscaped area</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Partially located within or near floodwall footprint</td>
<td>Relocate within landscaped area, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map [2016]</td>
<td>Underground distribution line; 12' diameter</td>
<td>Crosses Wai Canal at Ala Moana Blvd.; [attached to bridge]</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map [2016] DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>Underground distribution line; 12' diameter</td>
<td>Within Ala Wai Blvd roadway; crosses Canal at Kalakaua Ave (attached to bridge)</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map [2016] DDC Asbuilt, Job No. W18-07, Sheet C-17</td>
<td>Underground distribution line; 16' diameter</td>
<td>Crosses Canal at McCully St. (attached to bridge)</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not likely to be affected by floodwall, depending on design for bridge tie-in</td>
<td>Confirm final design for bridge tie-in does not conflict with existing water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
<td>General Location</td>
<td>Status</td>
<td>Within Const. Limits</td>
<td>Est. Depth Within Construction Limits</td>
<td>Potential Conflict with Proposed Feature</td>
<td>Recommended Resolution</td>
<td>Notes</td>
</tr>
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</tr>
<tr>
<td>Water (con't)</td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-17</td>
<td>Underground distribution line; 30” diameter</td>
<td>Crosses Ala Wai Blvd. near McCully St.; in concrete encasement alongside upstream side of bridge</td>
<td>Active</td>
<td>yes</td>
<td>Alongside upstream side of bridge</td>
<td>Bridge structure (and existing water line) not likely to be affected by floodwall, depending on design for bridge tie-in</td>
<td>Confirm final design for bridge tie-in does not conflict with existing water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on visual observation</td>
</tr>
<tr>
<td>Water (con't)</td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016) DDC Asbuilt, Job No. 92-016</td>
<td>Underground distribution line (transitions between 12” and 16” diameter); an abandoned line runs parallel to this active line</td>
<td>Entire length of Ala Wai Blvd, within roadway</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Project is not expected to affect utilities within Ala Wai Blvd roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility, depending on final design</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td>Water (con't)</td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-14</td>
<td>Lateral lines feeding approx. 40 fire hydrant along Ala Wai Blvd</td>
<td>Various locations within Ala Wai Blvd roadway. Most are on makai side of roadway; 4 are located within landscaped area (between Kalakaua Ave and Ala Moana Blvd)</td>
<td>Active</td>
<td>yes</td>
<td>Typically 3’ cover</td>
<td>Project is not expected to affect utilities within Ala Wai Blvd roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect laterals and hydrants (particularly those in landscaped area between Kalakaua Blvd and Ala Moana Blvd)</td>
<td>Plan drawings only show fire hydrants on makai side of Ala Wai Blvd, west of Kalakaua Ave (not total)</td>
</tr>
<tr>
<td>Private</td>
<td>Ala Wai Canal Dredging FEA BWS Asbuilt, Job No. 78-300, Sheet 6</td>
<td>Private line for Sheraton Hotel; emergency replacement for original line was abandoned; replacement status unknown</td>
<td>Crossing Ala Wai Blvd. at Nahua St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert + 0.2’ (approx.)</td>
<td>Floodwall would cross abandoned water line; status of replacement line is unknown</td>
<td>Verify status of replacement line and design floodwall to accommodate water line as needed</td>
<td>Location of abandoned line shown on plan drawings based on Asbuilt, status of replacement line to be verified during design phase</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DPW Asbuilt, Job No. 24-50, Sheet 3</td>
<td>4”x4” culvert</td>
<td>Crossing Ala Wai Blvd at western terminus</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Shown as proposed on asbuilt; not in C&amp;C GIS database</td>
<td>Current City &amp; County GIS records do not identify storm drain in this location; no conflict expected</td>
<td>Verify status of proposed storm drain and design floodwall to accommodate line if needed</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DPW Asbuilt, Job No. 24-50, Sheet 3</td>
<td>Reinforced concrete drain box, 12” diameter</td>
<td>Crossing Ala Wai Blvd. between Ala Moana Blvd. and Lipepele St.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Shown on asbuilt; not in C&amp;C GIS records</td>
<td>Current City &amp; County GIS records do not identify storm drain in this location; no conflict expected</td>
<td>Verify status of drainage box and design floodwall to accommodate line if needed</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-13</td>
<td>8” diameter reinforced concrete pipe (RCP)</td>
<td>Crossing Ala Wai Blvd between Ala Moana Blvd and Lipepele St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td></td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-14</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd between Ala Moana Blvd and Lipepele St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td></td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-14</td>
<td>8” RCP</td>
<td>Crossing Ala Wai Blvd between Ala Moana Blvd and Lipepele St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td></td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-14</td>
<td>18” RCP</td>
<td>Crossing Ala Wai Blvd between Ala Moana Blvd and Lipepele St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td></td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-15</td>
<td>48” RCP</td>
<td>Crossing Ala Wai Blvd at Lipepele St</td>
<td>Active</td>
<td>yes</td>
<td>Invert + approx. -14’ (Asbuilt)</td>
<td></td>
<td>Floodwall would cross storm drain, but no conflict expected based on storm drain elevation</td>
<td>Confirm elevation of storm drain and design floodwall to accommodate line if needed</td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
<td>General Location</td>
<td>Status</td>
<td>Within Const. Limits</td>
<td>Est. Depth Within Construction Limits</td>
<td>Potential Conflict with Proposed Feature</td>
<td>Recommended Resolution</td>
<td>Notes</td>
</tr>
<tr>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-15</td>
<td>24” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Iwippeepe St</td>
<td>Active</td>
<td>yes</td>
<td>-0.2’</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-15</td>
<td>24” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Makaoe Ln.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd between Makakei Ln and Kalakaua Ave</td>
<td>Active</td>
<td>yes</td>
<td>Invert = approx. -0.8’</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>Asbuilt for Allure Waikiki, Sheet C-4.2</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>18” diameter RCP</td>
<td>Running up middle of McCully Street Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>18” diameter RCP</td>
<td>Running up middle of McCully Street Bridge</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Floodwall would not cross storm drain</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>24” diameter RCP</td>
<td>Running up middle of McCully Street Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.1’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Neu Street</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.4’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Neu Street</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.7’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Neu Street</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.8’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Kalakaua Ave</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -1.1’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.3’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>24” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.2’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.5’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Olohalo St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.1’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>USACE 35% design drawings</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd at Waikehe St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.8’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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</table>

**Storm Drain (con’t)**

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>BWS Asbuilt, Job No. 70-100, Sheet 3</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Kuamoo St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -1.1’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>BWS Asbuilt, Job No. 70-100, Sheet 4</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.3’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>BWS Asbuilt, Job No. 70-100, Sheet 4</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.2’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>BWS Asbuilt, Job No. 70-100, Sheet 4</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Namahana St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = -0.5’ (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>RCP, unknown diameter</td>
<td>16” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Olohi St.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>BWS Asbuilt, Job No. 70-100, Sheet 4</td>
<td>18” diameter RCP</td>
<td>Crossing Ala Wai Blvd west of Kalamoku St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = = approx. -0.8’</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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### Ala Wai Canal Floodwalls (Left Bank)

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Ext. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>72&quot; x 30&quot; box culvert</td>
<td>Crossing Ala Wai Blvd. at Kalamak St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.9' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database BWS Asbuilt, Job No. 78-100, Sheet 4</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Kalamak St.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Shown as 18&quot; diameter RCP in GIS database, 24&quot; culvert on USACE 35% design drawings</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Kalamak St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.7' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Kaimoku St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 1.0' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Shown as 24&quot; diameter in GIS database, 18&quot; diameter in USACE 35% design drawings</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Kaimoku St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 1.6' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5</td>
<td>42&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Lewers St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 5.9' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Lewers St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 2.2' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>66&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Seaside Ave.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 6.0' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Seaside Ave.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.8' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>USACE design drawings show the 66&quot; RCP and 24&quot; RCP in reverse locations</td>
<td></td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Nohonani St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.80' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>USACE design drawings show the 66&quot; RCP and 24&quot; RCP in reverse locations; Shown as 24&quot; diameter in GIS database, and 18&quot; diameter in USACE 35% design drawings</td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Nahua St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.47' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Wallia St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 1.5' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Wallia St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.40' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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</tbody>
</table>

**Storm Drain (con't)**

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Ext. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>66&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Seaside Ave.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 6.0' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Seaside Ave.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.8' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
<td></td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Nohonani St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.80' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>USACE 35% design drawings show two 18&quot; diameter lines</td>
<td></td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7</td>
<td>24&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Nohonani St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.47' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Shown as 24&quot; diameter in GIS database, 18&quot; diameter in USACE 35% design drawings</td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Wallia St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 1.5' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Wallia St.</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 0.40' (Asbuilt)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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</tr>
<tr>
<td>Utility Type</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Kamehameha St.</td>
<td>Active</td>
<td>yes</td>
<td>inv = 0.00</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Kamehameha St.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -1.9' and -2.9' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>USACE 35% design drawings show two 18&quot; diameter lines</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>60&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Kailua Ave.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -3.04'</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Liliuokalani Ave.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -0.3'</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Ohua Ave.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -0.3' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Ohua Ave.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -0.8' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>7'x4' box drain (USACE 35% design drawings show 10' x 4')</td>
<td>Crossing Ala Wai Blvd. west of Pasakaini Ave.</td>
<td>Active</td>
<td>yes</td>
<td>inv = -2.2' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Shown as 7'x4' box culvert in GIS database and as 10'x4' culvert in USACE 35% design drawings</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Pasakaini Ave</td>
<td>Active</td>
<td>yes</td>
<td>inv = 0.3' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Wai Nani Way</td>
<td>Active</td>
<td>yes</td>
<td>inv = -0.3' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. at Wai Nani Way</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. west of Alainakea Way</td>
<td>Active</td>
<td>yes</td>
<td>inv = 0.6' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database USACE 35% design drawings</td>
<td>18&quot; diameter RCP</td>
<td>Crossing Ala Wai Blvd. east of Alainakea Way</td>
<td>Active</td>
<td>yes</td>
<td>inv = 0.7' (USACE drawings)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td>Utility Type</td>
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<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Force main; 42” diameter</td>
<td>Within Ala Wai Blvd roadway between Kaiolou St and Ala Moana Blvd.; crosses Canal near Ala Moana Blvd</td>
<td>Active</td>
<td>Yes</td>
<td>Top of concrete pipe jacket at about -20 feet MSL (Ala Wai Canal Dredging FEA)</td>
<td>Force main is in roadway for most of its length, but floodwall would cross it near Ala Moana Blvd; however, no conflict is expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Force main, Hobas pipe; 27” diameter</td>
<td>Crossing Ala Wai Canal at Kaiolou Street</td>
<td>Active</td>
<td>Yes</td>
<td>Inv = between -19 and -34’ (GIS database)</td>
<td>Floodwall would cross force main near Kaiolu St; however, no conflict is expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Sewer tunnel, Hobas pipe; 72” diameter</td>
<td>Within Ala Wai Blvd between Kalakaua Ave and Ala Moana Blvd; crosses Canal between MCCully St and Kalakaua Ave, and near Ala Moana Blvd</td>
<td>Active</td>
<td>No</td>
<td>Inv = approx. -13’ (GIS database)</td>
<td>Project is not expected to affect utilities within Ala Wai Blvd roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>Waikiki Buffer Zone Map BWS Asbuilt, Job No. 78-100, Sheet G-3</td>
<td>Gravity line; 27” diameter</td>
<td>Within Ala Wai Blvd ROW between Lewers St. and Kaneakapolei St.</td>
<td>Active</td>
<td>No</td>
<td>Estimated to have 6’ cover</td>
<td>Floodwall would cross utility; however, no conflict is expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer and accommodate existing manhole, as needed</td>
<td>C&amp;C GIS database shows three 12” diameter lines crossing Kalakaua Bridge</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database Waikiki Buffer Zone Map Ala Wai Canal Dredging FEA</td>
<td>Three gravity siphon lines; 21”, 24” and 27” diameter</td>
<td>Crossing Canal at Lewers St.</td>
<td>Active</td>
<td>Yes</td>
<td>Top of concrete block at 15.75’ MSL (FEA); Inv = approx. -14 to -15.75’ (GIS)</td>
<td>Bridge structure (and existing sewer) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing sewer line; more detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database Ala Wai Canal Dredging FEA Waikiki Buffer Zone Map DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>Force main; 20” diameter</td>
<td>Along Kalakaua Ave, crossing Ala Wai Blvd and Ala Wai Promenade</td>
<td>Active</td>
<td>Yes</td>
<td>TBD</td>
<td>No conflict identified based on current level of detail; no manholes associated with 72” force main located within construction limits on makai side of Canal</td>
<td>Track additional detail and development of future plans</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Information provided by Jack Pobuk, ENV (email dated May 29, 2016)</td>
<td>Information provided by Jack Pobuk, ENV (email dated May 29, 2016)</td>
<td>Future plans to convert 72” force main to gravity line; and connect new gravity sewers to existing manholes along 72” force main</td>
<td>Existing 72” diameter force main line corridor</td>
<td>Future (dates TBD)</td>
<td>Yes</td>
<td>TBD</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Gas</td>
<td>Hawaii Gas</td>
<td>Hawaii Gas distribution map DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>Underground distribution line; 8” diameter transitioning to 6” diameter</td>
<td>Crossing Ala Wai Canal in conduit on Kalakaua Bridge</td>
<td>Active</td>
<td>Yes</td>
<td>Approx. 4’ cover near Ala Wai Blvd (Asbuilt)</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td></td>
<td>Hawaii Gas</td>
<td>Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-13</td>
<td>4” diameter</td>
<td>Crossing Ala Wai Canal in conduit on Ala Moana Bridge</td>
<td>Active</td>
<td>Yes</td>
<td>Inv = approx. 3.8’ (Asbuilt)</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
<tr>
<td></td>
<td>Hawaii Gas</td>
<td>Hawaii Gas distribution map Various</td>
<td>Various distribution lines within Ala Wai Blvd roadway (discontinuous)</td>
<td>Active and Abandoned</td>
<td>No Unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Project is not expected to affect utilities within Ala Wai Blvd roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect gas lines, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
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<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Cable</td>
<td>Conduit in Kalakaua Ave. Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Cable and telephone lines</td>
<td>Conduit in Ala Moana Blvd Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Telephone lines</td>
<td>Conduit in McCully St Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with utility conduit once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16</td>
<td>Unknown telecommunication line</td>
<td>Within Ala Wai Blvd between Kalakaua Ave and Ala Moana Blvd</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Project is not expected to affect utilities within Ala Wai Blvd roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect gas lines, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16</td>
<td>Multiple power feeds and lines; details not shown on asbuilt drawings</td>
<td>Between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Multiple power feeds and lines, as well as traffic signal boxes; details not shown on asbuilt drawings</td>
<td>Between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16</td>
<td>Various line (inc. 2-1/2&quot; and 3-1/4&quot; diameter); details not shown on asbuilt drawings</td>
<td>Generally between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Partial location shown on plan drawings based on Asbuilt</td>
</tr>
</tbody>
</table>

**NOTE:** A description of the color coding shown for the potential conflict and recommended resolution is provided in Section 3 of the Utility Assessment report.

Attachment 3, Page 8
<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
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<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA DDC Asbult, Job No. W18-07, Sheet C-13</td>
<td>Electrical line; size unknown</td>
<td>Crosses Canal at Ala Moana Blvd Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Conduit encased in bridge structure</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on asbuilt</td>
</tr>
<tr>
<td></td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA DDC Asbult, Job No. W18-07, Sheet C-17</td>
<td>Electrical conduit; size unknown</td>
<td>Crosses Canal at McCully St Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Conduit encased in bridge structure</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on asbuilt</td>
</tr>
<tr>
<td></td>
<td>Hawaiian Electric Company</td>
<td>Ala Wai Canal Dredging FEA 46kV Relocation Project documentation</td>
<td>Two 46kV lines within 200’ wide easement crossing Canal; to be replaced by new line (use future project)</td>
<td>Extending across Canal between Ala Wai Neighborhood Park and Kalolu St</td>
<td>Active</td>
<td>(to be replaced by future project)</td>
<td>yes</td>
<td>Approx. 20 feet below grade (per 46kV relocation project info)</td>
<td>Floodwall would cross existing 46kV lines, but these are expected to be removed in 2018</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Hawaiian Electric Company</td>
<td>46kV Relocation Project documentation</td>
<td>Proposed 46kV line to be installed in horizontal directional drill casing under Canal</td>
<td>Crossing Ala Wai Canal, between Kalaimoku St and University Ave</td>
<td>Future (planned to start in 2018)</td>
<td>yes</td>
<td>40-50’ deep (at edge of Canal)</td>
<td>46kV line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station</td>
<td>Track utility information; confirm there would be no conflict once detailed utility information and location is available</td>
<td>Schematically shown on plan drawings based on 46kV Relocation Project documentation</td>
</tr>
<tr>
<td></td>
<td>Hawaiian Electric Company</td>
<td>Visual inspection</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheet C3</td>
<td>Overhead electrical line</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Floodwall and/or flood gate not expected to conflict with overhead electrical line</td>
<td>Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map (2016)</td>
<td>Underground distribution line; 12” diameter</td>
<td>Crosses Wai Canal at Ala Moana Blvd; attached to bridge</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map (2016)</td>
<td>Underground distribution line; 12” diameter</td>
<td>Crosses Canal at Kalakaua Ave; attached to bridge</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map (2016)</td>
<td>Underground distribution line; 14” diameter</td>
<td>Crosses Canal at McCully St. (attached to bridge)</td>
<td>Active</td>
<td>yes</td>
<td>Attached to bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>Ala Wai Canal Dredging FEA BWS Dist Map (2016)</td>
<td>Underground distribution line; 30” diameter</td>
<td>Crosses Ala Wai Blvd. near McCully St.; in concrete encasement alongside upstream side of bridge</td>
<td>Active</td>
<td>yes</td>
<td>Alongside upstream side of bridge</td>
<td>Bridge structure (and existing water line) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with water line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>Partial location shown on plan drawings based on visual observation</td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheet C3</td>
<td>3” diameter</td>
<td>Runs along entrance road to Ala Wai Golf Course clubhouse</td>
<td>Active</td>
<td>yes</td>
<td>Approx. 2-3’ below ground</td>
<td>Water line crosses location where floodwall and/or flood gate would join with golf course detention berm</td>
<td>Design floodwall and/or flood gate to accommodate water line crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheet C3</td>
<td>8” diameter</td>
<td>Runs along entrance road to Ala Wai Golf Course clubhouse</td>
<td>Active</td>
<td>yes</td>
<td>Approx. 2-3’ below ground</td>
<td>Water line crosses location where floodwall and/or flood gate would join with golf course detention berm</td>
<td>Design floodwall and/or flood gate to accommodate water line crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>BWS Dist Maps (1988), Sheet 45</td>
<td>BWS Dist Map (2016)</td>
<td>4” transitioning to 3” diameter</td>
<td>Along Ala Wai Promenade, west of Kalakaua Ave.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate within promenade area as needed during construction</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
<td>General Location</td>
<td>Status</td>
<td>Within Const. Limits</td>
<td>Est. Depth Within Construction Limits</td>
<td>Potential Conflict with Proposed Feature</td>
<td>Recommended Resolution</td>
<td>Notes</td>
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<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Just east of Ala Moana Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>24&quot; diameter RCP</td>
<td>Between Ala Moana Blvd and Kalakaua Ave</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>6&quot; x 7' box culvert</td>
<td>Between Ala Moana Blvd and Kalakaua Ave</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>RCP, diameter unknown</td>
<td>Between Ala Moana Blvd and Kalakaua Ave; near convention center</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Just west of Kalakaua Ave</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>24&quot; diameter RCP</td>
<td>Between Kalakaua Ave and McCully St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Along McCully St. sidewalk (east side)</td>
<td>Active</td>
<td>yes</td>
<td>Inv = -.01' (USACE)</td>
<td>Storm drain is located within McCully St roadway, but exact location is unknown floodwall may conflict with storm drain depending on final design location</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-17</td>
<td>8&quot; diameter RCP</td>
<td>At the Ala Wai Recreation Center east of McCully St., outfall to Ala Wai Canal</td>
<td>Shown on Asbuilt; not in C&amp;C GIS records</td>
<td>yes</td>
<td>Inv = approx 0.0' (Asbuilt)</td>
<td>Floodwall would cross storm drain (if verified to be present)</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A</td>
<td>24&quot; diameter RCP</td>
<td>At the Ala Wai Recreation Center east of McCully St., outfall to Ala Wai Canal</td>
<td>Shown on Asbuilt; not in C&amp;C GIS records</td>
<td>yes</td>
<td>Inv = approx 0.0' (Asbuilt)</td>
<td>Floodwall would cross storm drain (if verified to be present)</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A</td>
<td>18&quot; diameter RCP</td>
<td>Within the parking area for Ala Wai Recreation Center</td>
<td>Shown on Asbuilt; not in C&amp;C GIS records</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain (if verified to be present)</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A</td>
<td>6&quot; diameter RCP</td>
<td>At the Ala Wai Recreation Center by McCully St., outfall to Ala Wai Canal</td>
<td>Shown on Asbuilt; not in C&amp;C GIS records</td>
<td>yes</td>
<td>Inv = approx 0.0' (Asbuilt)</td>
<td>Floodwall would cross storm drain (if verified to be present)</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A</td>
<td>6&quot; diameter RCP</td>
<td>At the Ala Wai Recreation Center by McCully St., outfall to Ala Wai Canal</td>
<td>Shown on Asbuilt; not in C&amp;C GIS records</td>
<td>yes</td>
<td>Inv = approx 0.0' (Asbuilt)</td>
<td>Floodwall would cross storm drain (if verified to be present)</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A</td>
<td>24&quot; diameter RCP</td>
<td>Running through Ala Wai Community Park, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = approx -.175' (Asbuilt)</td>
<td>Storm drain pipe and design floodwall to accommodate line if needed</td>
<td>Storm drain is not shown on C&amp;C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present.</td>
<td></td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
<td>General Location</td>
<td>Status</td>
<td>Within Const. Limits</td>
<td>Est. Depth Within Construction Limits</td>
<td>Potential Conflict with Proposed Feature</td>
<td>Recommended Resolution</td>
<td>Notes</td>
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</tr>
<tr>
<td>Storm Drain (cont')</td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18</td>
<td>6'x4' box drain</td>
<td>Running through Ala Wai Community Park, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = -3.1' (USACE)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database USACE 35% design drawings</td>
<td>15' x 3' box culvert Hausten Ditch</td>
<td>Active</td>
<td>yes</td>
<td>N/A</td>
<td>New slide gates proposed as part of project</td>
<td>Design floodwall to accommodate existing flood drain crossing once detailed information is obtained</td>
<td>Shown on plans as Hausten Ditch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18</td>
<td>10'x8' box drain</td>
<td>Running mauka to makai at University Ave, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = 0.0' (USACE)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-22</td>
<td>24' diameter RCP</td>
<td>Near Ala Wai Community Garden, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = -1.3' (USACE)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
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<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-12</td>
<td>36' diameter RCP</td>
<td>Near Moana-Palolo Drainage Canal, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = -2.7' (USACE)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Force main; 42' diameter</td>
<td>Crosses Canal just east of Ala Moana Blvd</td>
<td>Active</td>
<td>yes</td>
<td>Top of concrete pipe jacket at about -20 feet MSL (Ala Wai Canal Dredging FEA)</td>
<td>Floodwall may cross force main at terminus near Ala Moana Blvd Bridge; however, no conflict expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer lines, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Force main, Hobas pipe; 2 3/8' diameter</td>
<td>Crosses Ala Wai Canal near Ala Wai Neighborhood Park (connecting to Mauka Pit)</td>
<td>Active</td>
<td>yes</td>
<td>Inv = between -19 and -34' (GIS)</td>
<td>Floodwall would cross force main near Kailoa St; however, no conflict expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer line, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Sewer tunnel, Hobas pipe; 72' diameter</td>
<td>Runs parallel to Canal (near walkway) from Mauka Pit (near Ala Wai Neighborhood Park), crossing under McCully St Bridge and across Ala Wai Canal; crosses back to makua side of Canal just east of Ala Moana Blvd Bridge</td>
<td>Active</td>
<td>yes</td>
<td>30' + below grade</td>
<td>Floodwall located in close proximity to sewer tunnel (and associated manholes); at a minimum the flood wall would cross the tunnel in multiple locations (e.g., near McCully St Bridge and Ala Moana Blvd Bridge); however, no conflict expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer line and accommodate manholes, as needed</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database Waikiki Buffer Zone Map Ala Wai Canal Dredging FEA</td>
<td>Three gravity siphon lines; 21', 24' and 27' diameter</td>
<td>Crosses Canal near Ala Wai Neighborhood Park, just west of Manno Palolo Drainage Canal; continues as 48' diameter line toward Ala Wai Elementary School</td>
<td>Active</td>
<td>yes</td>
<td>Top of concrete pipe jacket at -15.75' MSL (Ala Wai Canal Dredging FEA); Inv = approx. -14 to -15.75' (GIS)</td>
<td>Floodwall would cross sewer lines; however, no conflict expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer line and accommodate manholes, as needed</td>
<td></td>
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<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C &amp; GIS database Waikiki Buffer Zone Map Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-16</td>
<td>20' diameter force main</td>
<td>Along Kalakaua Ave. crossing Ala Wai Blvd. and Ala Wai Promenade</td>
<td>Active</td>
<td>yes</td>
<td>Estimated to have 6' cover</td>
<td>Bridge structure (and existing sewer) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with sewer line once detailed utility information is obtained; include measures to avoid/protect, as needed</td>
<td>C &amp; GIS database shows three 12' diameter lines crossing Kalakaua Bridge</td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
<td>General Location</td>
<td>Status</td>
<td>Within Const Limits</td>
<td>Est. Depth Within Construction Limits</td>
<td>Potential Conflict with Proposed Feature</td>
<td>Recommended Resolution</td>
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<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Cable and telephone lines</td>
<td>Conduit in Ala Moana Blvd Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit. May require further review.</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Cable</td>
<td>Conduit in Kalakaua Ave Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit. May require further review.</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>Ala Wai Canal Dredging FEA</td>
<td>Telephone lines</td>
<td>Conduit in McCully St Bridge</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Bridge structure (and existing conduit) not expected to be affected by floodwall</td>
<td>Confirm final design for bridge tie-in does not conflict with existing utility conduit. May require further review.</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Park Lights</td>
<td>City &amp; County of Honolulu</td>
<td>Visual inspection</td>
<td>Park lights</td>
<td>Surrounding baseball field at Ala Wai Community Park</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Design floodwall to avoid lights or relocate closer to interior of park</td>
<td>Shown schematically on plan drawings based on visual observation</td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual inspection</td>
<td>Multiple power feeds and lines; complete details not shown on asbuilt drawings</td>
<td>Along edge of existing walkway from Manoa Palolo Drainage Canal to Kalakaua Ave (discontinuous)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Partially shown on plan drawings near Ala Wai Neighborhood Park; specific location and full extent to be verified during design phase</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt, Job No. W18-07, Sheet C-18 and up</td>
<td>Multiple power feeds and lines; complete details not shown on asbuilt drawings</td>
<td>Parking area for Ala Wai Community Park (end of University Ave)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Location not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Various lines and valves</td>
<td>Generally along walkway and within Ala Wai Community Park</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Other</td>
<td>State Civil Defense</td>
<td>Visual Inspection</td>
<td>Warning siren (and associated power feed and lines)</td>
<td>Located within parking lot for Ala Wai Community Park (near intersection of McCully Street and Kapioiki Blvd)</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Along west side of Lualu Street, parallel to Manoa Palolo Drainage Canal</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016)</td>
<td>30&quot; diameter water line</td>
<td>Within Date St roadway/bridge</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Project is not expected to affect utilities within Date St roadway/bridge</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility, depending on final design</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016)</td>
<td>12&quot; diameter water line</td>
<td>Within Date St roadway/bridge</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Project is not expected to affect utilities within Date St roadway/bridge</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility, depending on final design</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Along Lualu St, crossing Iolani School driveway and draining to Manoa Palolo Drainage Canal</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>36&quot; diameter RCP</td>
<td>Outfall to Ala Wai Canal near Moana-Palolo Drainage Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = -2.7&quot; (USACE)</td>
<td>Floodwall would cross storm drain</td>
<td>Design floodwall to accommodate existing storm drain crossing once detailed information is obtained</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>30&quot; diameter sewer line</td>
<td>Located within Date St roadway, but transitions to cross below Manoa Palolo Drainage Canal on makai side of Date St bridge; manholes located on either side of bridge</td>
<td>Active</td>
<td>yes</td>
<td>Inv = approx. -9&quot; (GIS)</td>
<td>Floodwall would cross sewer line; however, no conflict is expected based on sewer depth</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer and accommodate existing manholes, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Co-located with electrical lines</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Electrical lines for street lighting</td>
<td>Located along makai side of Date Street</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located near potential floodwall location but not expected to be within construction limits; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Power feeds and lines</td>
<td>Located along makai side of Date Street</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located near potential floodwall location but not expected to be within construction limits; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Various lines and valves</td>
<td>Located along pathway parallel to Manoa Palolo Drainage Canal</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near floodwall footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td><strong>PUMP STATION 1 (KAPAHULU)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database, Visual Inspection, USACE 35% design drawings</td>
<td>12' x 7' box culvert</td>
<td>At head of Ala Wai Canal in makai corner</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 4.1' (USACE drawings)</td>
<td>Drainage feature to be incorporated into pump station design</td>
<td>Design drawings and specifications should identify measures to avoid/protect drainage feature</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection, USACE 35% design drawings</td>
<td>4' x 3' box culvert, outfall has been covered</td>
<td>At head of Ala Wai Canal near center of channel</td>
<td>Abandoned (based on visual inspection)</td>
<td>yes</td>
<td>Invert = 3.5' (USACE drawings)</td>
<td>Drainage feature to be incorporated into pump station design</td>
<td>Design drawings and specifications should identify measures to avoid/protect drainage feature</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection, DDC Wastewater Div. Asbuilt</td>
<td>Multiple power feeds and lines; details not shown on asbuilt drawings</td>
<td>Along Ala Wai Blvd within/near existing sidewalk; specific locations not shown on asbuilt drawings</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Located near pump station but not within construction limits; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Multiple power feeds and lines; details not shown on asbuilt drawings</td>
<td>Along Ala Wai Blvd within/near existing sidewalk; specific location not shown on asbuilt drawings</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Located near pump station but not within construction limits; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td><strong>PUMP STATION 2 (GOLF COURSE)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection, C&amp;C GIS database, USACE 35% design drawings</td>
<td>3' - 9.5'x7' RCP, 48&quot; diameter pipe</td>
<td>Running through golf course, daylighting into drainage that flows to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Invert = 4.7' (USACE drawings)</td>
<td>Drainage feature to be incorporated into pump station design</td>
<td>Design drawings and specifications should identify measures to avoid/protect drainage feature</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; RCP</td>
<td>Running through driving range, daylighting into drainage that flows to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Storm drain located within footprint of pump station</td>
<td>Design pump station to accommodate existing storm drain once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Lighting for driving range</td>
<td>Within interior portion of golf course, east of club house. Driving range is currently under renovation, so lighting location may be in flux</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Located near pump station footprint</td>
<td>Relocate lighting (or design pump station to avoid utility) as appropriate once detailed information is obtained</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>DPR Asbuilt for Ala Wai Golf Course, Sheet C3</td>
<td>2&quot; diameter</td>
<td>Running through golf course, from Kapahulu Ave across drainage channel</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Located near pump station but not within construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
# Pump Stations

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>46kV Relocation Project documentation</td>
<td>Proposed 46kV line to be installed in horizontal directional drill casing under Canal</td>
<td>Crossing Ala Wai Canal, between Kalaimoku St and University Ave</td>
<td>Future (planned to start in 2018)</td>
<td>yes</td>
<td>40-50' deep (at edge of Canal)</td>
<td>46kv line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station (sumps)</td>
<td>Design pump station to avoid proposed 46kv line once crossing design information is obtained</td>
<td>Schematically shown on plan drawings based on 46kV Relocation Project documentation</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>CBC GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18</td>
<td>Transformer and electrical boxes</td>
<td>Near walkway, east of canoe club-longhouse</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Transformers and electrical boxes are generally located in (or near) pump station footprint</td>
<td>Design pump station to avoid transformers and electrical boxes once detailed utility information is obtained</td>
<td>Schematically shown on plan drawings based on visual observation</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>CBC GIS database DDC Asbuilt, Job No. W18-07, Sheet C-18</td>
<td>10x8' box drain</td>
<td>Running mauka to makai along University Ave, outfall to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Inv = 0.0' (USACE drawings)</td>
<td>Drainage feature to be incorporated into pump station design</td>
<td>Design drawings and specifications should identify measures to avoid/protect drainage feature</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection DDC Asbuilt, Job No. W18-07, Sheet C-25A</td>
<td>Multiple power feeds and lines; complete details not shown on asbuilt drawings</td>
<td>Parking area for Ala Wai Community Park (end of University Ave)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Pump station would be located in close proximity to sewer tunnel; pump pump could conflict with sewer tunnel</td>
<td>Design pump station to avoid sewer tunnel once detailed utility information is obtained</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
</tbody>
</table>

## NOTES

- A description of the color coding shown for the potential conflict and recommended resolution is provided in Section 3 of the Utility Assessment Report.

- **Attachment 3, Page 15**
<table>
<thead>
<tr>
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<th>Recommended Resolution</th>
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<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheets C-2 and C-3</td>
<td>Overhead electrical line</td>
<td>Makai side of entrance road to Ala Wai Golf Course clubhouse</td>
<td>Active</td>
<td>Yes</td>
<td>Aboveground</td>
<td>Overhead electrical line not expected to conflict with detention berm, but may affect construction access</td>
<td>Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016)</td>
<td>24&quot; diameter water line</td>
<td>Located near edge of golf course property along Kapahulu Ave</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Detention berm is not expected to conflict with water line</td>
<td>Confirm that detention berm does not conflict with water line once detailed information is obtained; adjust berm design as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016)</td>
<td>8&quot; diameter waterline service</td>
<td>Connecting from Date St at Palani Ave to golf course</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Detention berm is not expected to conflict with service line, but extent and location of service use is unknown</td>
<td>Determine whether detention berm conflicts with service line or other golf course features once detailed information is obtained; adjust berm design or relocate utility as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>BWS Dist Map (2016)</td>
<td>4&quot; diameter waterline service</td>
<td>Connecting from Date St at Kapahulu Ave to golf course</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Detention berm is not expected to conflict with service line, but extent and location of service use is unknown</td>
<td>Determine whether detention berm conflicts with service line or other golf course features once detailed information is obtained; adjust berm design or relocate utility as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheets C-2 &amp; C-3</td>
<td>8&quot; diameter fire line feeding fire hydrant and golf course clubhouse</td>
<td>Runs along entrance road to golf course clubhouse</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Fire line runs along entrance road; flood gate would be installed across road</td>
<td>Confirm final design for flood gate does not conflict with fire line once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheets C-2 &amp; C-3</td>
<td>3&quot; diameter waterline connecting to golf course clubhouse</td>
<td>Located parallel to 8&quot; fire line</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Fire line runs along entrance road; flood gate would be installed across road</td>
<td>Confirm final design for flood gate does not conflict with fire line once detailed information is obtained; include measures to avoid/protect, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheets C-2 &amp; C-3</td>
<td>2&quot; diameter waterline</td>
<td>Runs from Kapahulu St. to drainage channel</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Detention berm would cross water line</td>
<td>Design berm to accommodate waterline once detailed information is obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>DPR Utility Plan, Job No. 89-009c, Sheets C-4</td>
<td>6&quot; diameter waterline</td>
<td>Located near southwest side of maintenance building on Date Street, and runs through golf course</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown</td>
<td>Detention berm would cross water line in at least 2 locations; sediment basin would also conflict with water line</td>
<td>Relocate water line (or design berm and sediment basin to accommodate water line) as necessary, once detailed utility information is obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>DPR Asbuilt, Job No. 96-011C, Sheets C-4</td>
<td>Abandoned 6&quot; diameter water line; line has been cut &amp; plugged</td>
<td>Located near southwest side of maintenance building on Date Street (parallel to active 6&quot; waterline)</td>
<td>Abandoned</td>
<td>Yes</td>
<td>Unknown</td>
<td>Water line located within footprint of detention berm, but is no longer in use; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>DPR Asbuilt, Job No. 96-011C, Sheets C-4</td>
<td>Abandoned 8&quot; diameter water line; may have been removed</td>
<td>Located near southeast side of maintenance building on Date Street</td>
<td>Abandoned</td>
<td>Yes</td>
<td>Unknown</td>
<td>Water line located within footprint of detention berm, but is no longer in use; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>DPR Asbuilt, Job No. 96-011C, Sheets C-4</td>
<td>2&quot; and 8&quot; diameter waterlines (parallel)</td>
<td>Located near west side of maintenance building on Date Street</td>
<td>Active</td>
<td>No</td>
<td>Unknown</td>
<td>Located near detention berm but not within construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Utility Type</td>
<td>Utility Owner</td>
<td>Source of Information</td>
<td>Description</td>
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</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual inspection &amp; GIS database</td>
<td>Runs through golf course and daylights into drainage channel that flows to Ala Wai Canal</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Detention berm would cross drain lines</td>
<td>Design berm to accommodate existing drain lines; once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual inspection &amp; GIS database</td>
<td>Runs along edge of Ala Wai golf course property between maintenance building and Palani St</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Storm drain located near foot of staging area</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line, as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual inspection &amp; GIS database</td>
<td>Runs along edge of Ala Wai golf course property between Palani St and Kapahulu Ave</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Storm drain located in close proximity to detention berm; may conflict depending on final design and exact location/depth of storm drain</td>
<td>Confirm final design for berm does not conflict with existing storm drain; once detailed utility information is obtained; modify design and/or relocate storm drain, as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>Located within Date St roadway; transitions to cross below Manoa Palolo Drainage Canal on makai side of Date St bridge; manholes located on either side of bridge</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Sewer line is located within Date St roadway, but approaches construction limits near northwest corner of golf course (near Manoa-Palolo Drainage Canal)</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer and accommodate manholes, as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>DPR Asbuilt, Job No. 96-011C, Sheets C-4</td>
<td>Located between west side of maintenance facility; connects to a 8&quot; diameter sewer line that exits the property at Date-Kapahulu Sewer</td>
<td>Active</td>
<td>yes</td>
<td>Inv = approx. 4.1' (Asbuilt)</td>
<td>Detention berm would cross sewer line</td>
<td>Design berm to accommodate existing sewer line; once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>DPR Asbuilt, Job No. 96-011C, Sheets C-4</td>
<td>Runs from golf course clubhouse to Date-Kapahulu Sewer (connects at sewer manhole (SMH #1))</td>
<td>Active</td>
<td>yes</td>
<td>Inv = approx. -5.38' (Asbuilt)</td>
<td>Detention berm would cross sewer line; sediment basin would also conflict with sewer line</td>
<td>Relocate sewer line (or design berm and sediment basin to accommodate sewer line) as necessary, once detailed utility information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>Runs north to south through eastern portion of golf course (roughly from vicinity of Ekela St to Castle St)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Detention berm would cross sewer line</td>
<td>Design berm to accommodate existing sewer line and manholes once detailed information is obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>Runs east to west through eastern portion of golf course (roughly from vicinity of Kamuela St to 24&quot; sewer line)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Detention berm would cross sewer line</td>
<td>Design berm to accommodate existing sewer line and manholes once detailed information is obtained</td>
<td></td>
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### Ala Wai Golf Course Multi-Purpose Detention

<table>
<thead>
<tr>
<th>Utility Type</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>Hawaii Gas</td>
<td>Hawaii Gas distribution map</td>
<td>Various distribution lines within Kapahulu Ave</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td></td>
<td>Project is not expected to affect utilities within Kapahulu Ave roadway</td>
<td>Design drawings and specifications should identify measures to avoid/protect gas lines, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Hawaiian Telcom</td>
<td>Hawaiian Telcom maps</td>
<td>Overhead telecommunication lines</td>
<td>Co-located with electrical lines on makai side of entrance road to Ala Wai Golf Course Clubhouse</td>
<td>Active</td>
<td>Yes</td>
<td>Overhead</td>
<td>Detention berm not expected to conflict with overhead telecommunication line</td>
<td>Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Various lines and valves</td>
<td>Generally located within Ala Wai golf course; specific locations unknown</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near detention berm</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
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<tbody>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist Maps (2016)</td>
<td>8&quot; diameter waterline</td>
<td>Within University Ave and Hihiwai St roadways</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>15'x3' box culvert</td>
<td>Hausten Ditch</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Drainage feature located within footprint of detention basin; new slide gates proposed as part of project</td>
<td>Design drawings and specifications should identify measures to avoid/protect drainage feature</td>
<td>Shown on plans as Hausten Ditch</td>
</tr>
<tr>
<td>Sanitary sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database, DDC Asbuilt, Job No. W18-07, Sheet G-3</td>
<td>Sewer tunnel, Hobas pipe; 72&quot; diameter</td>
<td>Runs parallel to Canal (near walkway)</td>
<td>Active</td>
<td>yes</td>
<td>30'+ below grade</td>
<td>Detention basin would be located in close proximity to sewer tunnel and associated manholes; detention berm may cross tunnel near Canal</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer and accommodate manholes; specifically need to consider loads imposed on sewer line and manhole access</td>
<td>Project is within the Waikiki Buffer Zone, which requires mitigation/monitoring measures to avoid damage to the Beachwalk WWPS force mains from ground vibration or soil liquefaction</td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Multiple power feeds and lines; details not shown on as-built drawings</td>
<td>Along walkway</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within floodwall footprint, but may also extend into detention footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Unknown; details not shown on as-built drawings</td>
<td>Throughout Ala Wai Community Park</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Generally located within or near detention basin footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection</td>
<td>Backflow preventer</td>
<td>Within Ala Wai Community Park, just west of the sports courts</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Generally located within or near detention basin footprint</td>
<td>Relocate backflow preventer (or design detention berm to avoid backflow preventer) as appropriate</td>
<td>Not shown on plan drawings</td>
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<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Running adjacent to Manoa Stream from Dole St. to Koali Rd.</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Overhead electrical line and pole located at edge of construction limits for detention basin</td>
<td>Relocate pole (or design detention basin to accommodate pole) as appropriate once detailed information is obtained</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Running along Dole St., crossing between makau and makai sides of road</td>
<td>Active</td>
<td>no</td>
<td>Aboveground</td>
<td>Overhead electrical line not expected to conflict with detention basin, but could affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Not shown on plan drawings</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet SO</td>
<td>20” diameter</td>
<td>Along Dole St</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet SO</td>
<td>8” diameter</td>
<td>Along Kanewai St</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City and County of Honolulu</td>
<td>Visual Inspection C&amp;C GIS database</td>
<td>6’ x 4’ box culvert (with manhole located within park)</td>
<td>Runs from Dole St. to Manoa Stream; crosses near home plate (manhole located just east of baseball diamond)</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Unknown (but appears to be relatively shallow based on visual inspection)</td>
<td>Design detention basin to avoid or accommodate features (e.g., lower box culvert, replace box culvert with pipes or shallower box culvert)</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line</td>
</tr>
<tr>
<td>City and County of Honolulu</td>
<td>Visual Inspection C&amp;C GIS database</td>
<td>Inlet to 24” diameter RCP</td>
<td>At southern edge of park along row of houses on Koali Rd.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Drain inlet located within footprint of detention basin, project is designed to utilize drain inlet and drain line</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City and County of Honolulu</td>
<td>DES Asbuilt, Moilili Area 3 C&amp;C GIS database</td>
<td>6” diameter sewer main</td>
<td>Within park, running parallel to Dole St.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Sewer line is not within construction limits for detention basin, but would be crossed by access road</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
</tr>
<tr>
<td>City and County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>4’ diameter sewer line</td>
<td>Along eastern edge of tennis courts, parallel to 6” diameter sewer line</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Sewer line is not within construction limits for detention basin, but would be crossed by access road</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Overhead lines, co-located with electrical lines</td>
<td>Running along Dole Street, crossing between makau and makai sides of road</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Telecommunication lines not expected to conflict with detention basin, but could affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Lighting</td>
<td>City and County of Honolulu</td>
<td>Visual Inspection</td>
<td>Electrical lines for park lighting</td>
<td>Exact locations are unknown</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Electrical lines are generally expected to be near park infrastructure and not within detention footprint</td>
<td>Determine whether detention basin conflicts with electrical lines once detailed information is obtained; relocate utility during construction, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Irrigation</td>
<td>City and County of Honolulu</td>
<td>Visual Inspection</td>
<td>Backflow preventer, valves and other miscellaneous irrigation features</td>
<td>Throughout park area, backflow preventer located near to wall between swimming pool and maintenance building</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>May be located within or near detention footprint</td>
<td>Relocate as needed during construction (assuming locations may not be obtainable as part of future survey effort)</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Other</td>
<td>U.S. Geological Survey</td>
<td>Visual Inspection</td>
<td>Stream gaging station</td>
<td>Located next to Manoa Stream, approximately midway between baseball diamond fencing and housing next to school</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Gaging station located near edge of construction limits; may be within footprint of detention basin</td>
<td>Design detention basin to accommodate gaging station (or relocate as necessary) once detailed information is obtained</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility room, as needed</td>
</tr>
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<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Located along mauka side of Kahaloa Dr. at entrance to park, with feeder lines crossing Kahaloa Dr.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict with in-stream debris catchment, but overhead lines may affect construction access</td>
<td>Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>36&quot; RCP</td>
<td>Runs through park and drains to Manoa Stream, just south of Kahaloa Dr</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Drain line is not within construction limits for in-stream debris catchment, but may be crossed as part of construction access</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>24&quot; RCP</td>
<td>Run through park and drains to Manoa Stream, just north of baseball diamond</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Drain line is not within construction limits for in-stream debris catchment, but may be crossed as part of construction access</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>30&quot; x 48&quot; box culvert</td>
<td>Series of ditches around baseball diamond lead to box culvert that drains to Manoa Stream at southern tip of park</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Drainage feature is not within construction limits; no conflict expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>15&quot; diameter gravity-fed sewer line</td>
<td>Runs through park near walkway parallel to Manoa Stream</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Sewer line is near construction limits for in-stream debris catchment; may be crossed by construction access</td>
<td>Design drawings and specifications should identify measures to avoid/protect sewer, as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>Overhead lines</td>
<td>Co-located with electrical lines</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict with in-stream debris catchment, but overhead lines may affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Street lights located along makai side of Kahaloa Drive at entrance to park; location of electrical lines is unknown</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Exact location of electrical lines is unknown, but not expected to conflict with in-stream debris catchment</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
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<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Along north side of Lower Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Utility poles are located near detention berm, but are not within construction limits; no conflict expected</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility, depending on final design</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Visual observation BWS Dist. Maps [1988], Sheet 56</td>
<td>6&quot; diameter water line and fire hydrant</td>
<td>Along Lower Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway outside of construction limits; no conflict expected</td>
<td>N/A</td>
<td>Water line not shown on plan drawings</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Along Lower Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway outside of construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP</td>
<td>Crossing intersection of Old E Manoa Rd and E Manoa Road</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP, with manhole</td>
<td>Running along Pakanu Street, draining into Woodlawn Ditch</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>10&quot; diameter sewer line</td>
<td>Within E. Manoa Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>8&quot; diameter sewer line</td>
<td>Within Lower Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located in roadway at a distance from construction limits; no conflict expected</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Hawaiian Telcom</td>
<td>Hawaiian Telcom maps</td>
<td>Overhead</td>
<td>Co-located with electrical lines along Lower Rd</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Utility poles are located near detention berm, but are not within construction limits; no conflict expected</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line, as needed</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

**NOTE:** A description of the color coding shown for the potential conflict and recommended resolution is provided in Section 3 of the Utility Assessment Report.
## Waiakeakua Debris and Detention Basin

### Table of Potential Conflicts

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Along BWS dirt access road</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Traverses along and across proposed construction access route and detention berm</td>
<td>Relocate poles and overhead lines (or design detention berm to accommodate utility) as appropriate once detailed utility information is obtained</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Visual Inspection BWS Dist. Maps (1988), Sheet 54</td>
<td>12&quot; diameter water line</td>
<td>Runs from Manoa Tunnel #3 to Waaloa Way. Located along dirt access road; two valves located just east of bridge over Waiakeakua Stream</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Located within footprint of construction access road; water line and valves could be impacted by construction equipment and/or potential bridge reinforcement</td>
<td>Design access road and bridge reinforcement to accommodate existing water line and valves once detailed information is obtained</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Board of Water Supply</td>
<td>Visual Inspection BWS Dist. Maps (1988), Sheet 54</td>
<td>8&quot; diameter water line</td>
<td>Runs north to south, connecting to 12&quot; waterline east of bridge over Waiakeakua Stream</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Located within footprint of construction access road; water line could be impacted by construction equipment and/or potential bridge reinforcement</td>
<td>Design access road and bridge reinforcement to accommodate existing water line once detailed information is obtained</td>
<td>-------</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection C&amp;C GIS database</td>
<td>48&quot; diameter RCP</td>
<td>Located along Waaloa Way, draining to stream at first bridge crossing</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Located directly adjacent to access road at bridge crossing at end of Waaloa Way (near proposed staging area); storm drain could be impacted by potential bridge reinforcement</td>
<td>Design access road and bridge reinforcement to accommodate existing drainage feature once detailed information is obtained</td>
<td>-------</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Hawaiian Telcom</td>
<td>Visual Inspection (2/19/2016) Hawaiian Telcom maps</td>
<td>Overhead telecommunication lines, co-located with electrical lines</td>
<td>Co-located with electrical lines</td>
<td>Active</td>
<td>yes</td>
<td>Aboveground</td>
<td>Traverses along and across proposed construction access route and detention berm</td>
<td>Relocate overhead lines (or design detention berm to accommodate utility) as needed once detailed utility information is obtained</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

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## Makiki Debris and Detention Basin

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Along west side of Makiki Heights Dr., crossing to east side of Makiki Heights Dr. in vicinity of proposed detention berm</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Utility poles are located near perimeter of construction limits; may conflict with detention berm</td>
<td>Confirm location relative to proposed measure once detailed utility information is obtained; microsite design as needed to avoid utility impacts</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead electrical lines</td>
<td>Along west side of Round Top Dr.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Utility poles are located near perimeter of construction limits; may conflict with detention berm and/or affect construction access</td>
<td>Confirm location relative to proposed measure once detailed utility information is obtained; microsite design as needed to avoid utility impacts and/or temporarily relocate for construction access</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet 54</td>
<td>8&quot; diameter distribution line</td>
<td>Within Round Top Dr</td>
<td>Active</td>
<td>No</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet 54</td>
<td>8&quot; diameter distribution line</td>
<td>Within Makiki Heights Dr</td>
<td>Active</td>
<td>No</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>Visual Inspection</td>
<td>Pump station and reservoir</td>
<td>Between Makiki Heights Dr. and Round Top Dr., just south of proposed staging area</td>
<td>Active</td>
<td>No</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Overhead telecommunication lines, co-located with electrical lines</td>
<td>Along west side of Makiki Heights Dr., crossing to east side of Makiki Heights Dr. in vicinity of proposed detention berm</td>
<td>Active</td>
<td>Yes</td>
<td>N/A</td>
<td>Utility poles are located near perimeter of construction limits; may conflict with detention berm</td>
<td>Confirm location relative to proposed measure once detailed utility information is obtained; microsite design as needed to avoid utility impacts</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Overhead telecommunication lines, co-located with electrical lines</td>
<td>Along west side of Round Top Dr.</td>
<td>Active</td>
<td>Yes</td>
<td>N/A</td>
<td>Utility poles are located near perimeter of construction limits; may conflict with detention berm and/or affect construction access</td>
<td>Confirm location relative to proposed measure once detailed utility information is obtained; microsite design as needed to avoid utility impacts and/or temporarily relocate for construction access</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Other</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Former well?</td>
<td>Adjacent to Makiki Heights Dr., in vicinity of proposed staging area</td>
<td>Abandoned?</td>
<td>No</td>
<td>N/A</td>
<td>Located near access road; may conflict with access road if not abandoned</td>
<td>Confirm location relative to access road once detailed utility information is obtained; microsite design as needed to avoid utility</td>
<td>Yellow background</td>
</tr>
<tr>
<td>Other</td>
<td>Unknown</td>
<td>Visual Inspection</td>
<td>Former utility house?</td>
<td>Adjacent to right bank of stream, in vicinity of proposed staging area</td>
<td>Abandoned?</td>
<td>No</td>
<td>N/A</td>
<td>Near staging area, but conflict expected; included for reference</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** A description of the color coding shown for the potential conflict and recommended resolution is provided in Section 9 of the Utility Assessment Report.
## Pukele Debris and Detention Basin

### Utility Type

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Along east side of Ipulei Pl., with service lines crossing street</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Along east side of La‘i Road, with guy wires crossing road</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict with proposed detention basin, but electrical lines may affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet 62</td>
<td>8&quot; diameter distribution line</td>
<td>Within La‘i Rd.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet 62</td>
<td>8&quot; diameter distribution line</td>
<td>Within Ipulei Pl.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt for Hillside Terrace Subdivision Sewer</td>
<td>18&quot; concrete pipe</td>
<td>Extending from Ipulei Pl. to Pukele Stream</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Drainage outfall is located near perimeter of construction limits; may conflict with detention berm</td>
<td>Confirm location relative to proposed measure once detailed utility information is obtained; adjust design as needed to avoid drain line and outfall</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>DDC Asbuilt for Hillside Terrace Subdivision Sewer Relocation C&amp;G GIS database</td>
<td>8&quot; diameter sewer line, with shallow manholes</td>
<td>Along Pukele stream</td>
<td>Active</td>
<td>Yes</td>
<td>Unknown, but appears to be relatively shallow</td>
<td>Sewer line and manholes are located within (or near) construction limits along Pukele Stream</td>
<td>Design detention berm to accommodate existing sewer line and manholes; some degree of reinforcement may be necessary</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Overhead lines</td>
<td>Along east side of Ipulei Pl., co-located on electrical poles</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Unknown</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Overhead lines</td>
<td>Along east side of La‘i Road, co-located with electrical lines</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict with proposed detention basin, but telecommunication lines may affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Not shown on plan drawings</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Street lights</td>
<td>Along east side of Ipulei Pl., co-located on electrical poles</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Street lights</td>
<td>Along east side of La‘i Road, co-located with electrical lines</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict identified; included for reference</td>
<td>N/A</td>
<td>Not shown on plan drawings</td>
<td></td>
</tr>
</tbody>
</table>

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## Waiomao Debris and Detention Basin

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
<th>Status</th>
<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Along west side of Waiomao Rd., crossing road in various locations</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>No conflict with proposed detention basin, but electrical lines may affect construction access</td>
<td>Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Water</td>
<td>Board of Water Supply</td>
<td>BWS Dist. Maps (1988), Sheet 62</td>
<td>Parallel 6&quot; and 8&quot; diameter distribution lines</td>
<td>Along Waiomao Rd., Waiomao Rd.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Not located within construction limits; no conflict identified</td>
<td>None</td>
<td>In addition to utilities, there are various driveways and dwellings in the vicinity of the staging area and access road</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City and County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>18&quot; diameter RCP transitioning to 24&quot; diameter RCP</td>
<td>Extending west from Waiomao Rd.</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Located within or near to staging area</td>
<td>Design drawings and specifications should identify measures to avoid/protect drain line, as needed</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>RCP; diameter unknown</td>
<td>Within Waiomao Rd</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Not located within construction limits; no conflict identified</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City and County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>8&quot; diameter sewer main with 6' wide easement</td>
<td>Perpendicular to Haleipua Pl. through project area.</td>
<td>Active</td>
<td>yes</td>
<td>Unknown</td>
<td>Sewer line and manholes are located within (or near) construction limits along Waiomao Stream; may conflict with detention berm and/or access road. Design detention berm and associated access road to accommodate existing sewer line and manholes; some degree of reinforcement may be necessary</td>
<td>No conflict identified</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City and County of Honolulu</td>
<td>C&amp;C GIS Asbuilt, Job No. 47-72</td>
<td>8&quot; diameter sewer main</td>
<td>Within Waiomao Rd</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Not located within construction limits; no conflict identified</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Unknown</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Overhead lines</td>
<td>Along west side of Waiomao Rd., co-located with electrical lines</td>
<td>Active</td>
<td>No</td>
<td>N/A</td>
<td>No conflict with proposed detention basin, but telecommunication lines may affect construction access</td>
<td>Address utility avoidance and/or temporary relocation as part of detailed design process and/or defer to contractor</td>
<td>Not shown on plan drawings</td>
</tr>
<tr>
<td>Lighting</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Street lights</td>
<td>Along west side of Waiomao Rd., co-located with electrical lines</td>
<td>Active</td>
<td>No</td>
<td>N/A</td>
<td>Not located within construction limits; no conflict identified</td>
<td>None</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Utility Owner</th>
<th>Source of Information</th>
<th>Description</th>
<th>General Location</th>
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<th>Within Const. Limits</th>
<th>Est. Depth Within Construction Limits</th>
<th>Potential Conflict with Proposed Feature</th>
<th>Recommended Resolution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Hawaiian Electric Company</td>
<td>Visual Inspection</td>
<td>Overhead lines</td>
<td>Mauka side of Pawaina St.</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Electric lines are outside construction limits; no conflict identified</td>
<td>None</td>
<td>Schematically shown on plan drawings based on visual inspection</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>24&quot; diameter RCP</td>
<td>Draining to stream from intersection of Pinao St and Pinao Pl</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Storm drain is at outer edge of construction limits; no conflict identified</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>12&quot; diameter concrete encased sewer line</td>
<td>Crossing Manoa Stream at Falls 7</td>
<td>Active</td>
<td>yes</td>
<td>Above grade</td>
<td>Measure is intended to address erosion and undercutting beneath sewer line crossing, but is not expected to impact sewer line</td>
<td>Design drawings and specifications should identify measures to avoid/protect utility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City &amp; County of Honolulu</td>
<td>C&amp;C GIS database</td>
<td>8&quot; diameter sewer line</td>
<td>Parallel to west side of Manoa Stream</td>
<td>Active</td>
<td>no</td>
<td>Unknown</td>
<td>Sewer line is outside construction limits; no conflict identified</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>City &amp; County of Honolulu</td>
<td>Visual Inspection (5/19/2016)</td>
<td>Overhead lines</td>
<td>Mauka side of Pawaina Street, co-located with electrical lines</td>
<td>Active</td>
<td>no</td>
<td>N/A</td>
<td>Telecommunication lines are outside construction limits; no conflict identified</td>
<td>None</td>
<td>Not shown on plan drawings</td>
</tr>
</tbody>
</table>

NOTE: A description of the color coding shown for the potential conflict and recommended resolution is provided in Section 3 of the Utility Assessment Report.
Attachment 4

Existing Utility Plan Drawings
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH, THOSE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING ALA MONA BRIDGE (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD (PARTIALLY SHOWN)
   c. 4" AND 1" STORM DRAINS CROSSING ALA WAI BLVD BETWEEN ALA MONA BLVD AND LIPPEE STREET
   d. 4" GAS LINE CROSSING ALA MONA BRIDGE (PARTIALLY SHOWN)
   e. IRRIGATION LINES ALONG ALA WAI BLVD (PARTIALLY SHOWN)
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD
   g. CABLE AND TELEPHONE CONDUIT IN ALA MONA BLVD/BIDGE
   h. STREET LIGHT AND TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD

SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. 4" GAS LINE CROSSING ALA WAI BLVD BETWEEN ALA MONA BLVD AND LIPPEE STREET
   b. IRRIGATION LINES ALONG ALA WAI BLVD (PARTIALLY SHOWN)
   c. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD
   d. CABLE AND TELEPHONE CONDUIT IN ALA MONA BLVD/BIDGE
   e. STREET LIGHT AND TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD

LIMITED TO THE FOLLOWING:
   a. 4" GAS LINE CROSSING ALA WAI BLVD BETWEEN ALA MONA BLVD AND LIPPEE STREET
   b. IRRIGATION LINES ALONG ALA WAI BLVD (PARTIALLY SHOWN)
   c. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD
   d. CABLE AND TELEPHONE CONDUIT IN ALA MONA BLVD/BIDGE
   e. STREET LIGHT AND TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD

ALA WAI CANAL FLOOD WALLS - 1
1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES CANNOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. REINFORCED CONCRETE DRAIN BOX CROSSING ALA WAI BLVD.
   b. IRRIGATION LINES ALONG ALA WAI BLVD. (PARTIALLY SHOWN)
   c. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   d. STREET LIGHTS AND TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.
   e. CABLE CONDUIT IN KALAKAUA AVE. BRIDGE

1. 4" WATER DISTRIBUTION LINE TRANSITIONS TO 3" ALONG ALA WAI PROMENADE.

NOTES:
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

   SEARCH. THESE ADDITIONAL UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT CROSSING McCULLY STREET (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   c. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. FLOOD GATE LATERALS
   f. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   g. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE.
   h. STREET LIGHT AND TRAFFIC SIGNAL CONVEYS ALONG ALA WAI BLVD.
   i. IRRIGATION LINES ALONG ALA WAI BLVD.
   j. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES.
   REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD. (PARTIALLY SHOWN)
   b. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND MUSICK STREET
   c. FIRE-HYDRANT LATERALS
   d. IRRIGATION LINES ALONG ALA WAI BLVD.
   e. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   f. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
   g. TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.

   1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES.

   2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
      a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD. (PARTIALLY SHOWN)
      b. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND MUSICK STREET
      c. FIRE-HYDRANT LATERALS
      d. IRRIGATION LINES ALONG ALA WAI BLVD.
      e. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
      f. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
      g. TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.
**NOTES:**

1. **LOCATION OF EXISTING UTILITIES:**
   - Estimated based on as-builts and other available sources. Refer to the utility assessment report for written description and source information.

2. **ADDITIONAL UTILITIES:**
   - Known to exist beyond those shown on these drawings. Specific locations of these utilities could not be identified in the preliminary search. These additional utilities include, but are not limited to the following:
   - Fire hydrant laterals
   - Irrigation lines along Ala Wai Blvd.
   - Various gas distribution lines within Ala Wai Blvd.
   - Street light conduits on both sides of Ala Wai Canal
   - Traffic signal conduits along Ala Wai Blvd.

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**LEGEND:**

- Property Line
- Flood Wall
- Drain Line
- Sewer Line
- Water Line
- Gas Line
- Telephone Line
- Catch Basin
- Sewer Manhole
- Sewer Cleanout
- Electric Manhole
- Water Manhole
- Electrical Box
- Existing HH (2'x4' Handhole)
- Existing PB (17" x 30" Pullbox)
- Existing HH (5'x7' Vault)
- Flood Wall (proposed)
- Electrical Line (Underground)
- Electrical Line (Overhead)
- Existing Electrical Box
- Fire Hydrant

**SCALE IN FEET:**

1" = 50'
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES WERE NOT SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THEY INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD (PARTIALLY SHOWN)

b. FIRE HYDRANT LATERALS

c. IRRIGATION LINES ALONG ALA WAI BLVD

d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD

e. STREET LIGHT CONDUITS ALONG ALA WAI CANAL

f. TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD.

g. WATER MANHOLE

h. SEWER MANHOLE

i. ELECTRIC MANHOLE

j. FIRE HYDRANT

k. ELECTRICAL BOX

l. CATCH BASIN

m. DRAIN MANHOLE

n. SEWER CLEANOUT

o. TELEPHONE LINE

p. GAS LINE

q. WATER LINE

r. DRAIN LINE

s. PROPERTY LINE

ALOHA WATER SHED PROJECT

FLOOD WALL (PROPOSED)

EXISTING HH (2’x4’ HANDHOLE)

EXISTING PB (17” x30” PULLBOX)

ALA WAI CANAL FLOOD WALLS - 7

Scale In Feet

1"=50'
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   b. FIRE HYDRANT LATERALS
   c. IRRIGATION LINES ALONG ALA WAI BLVD
   d. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
   e. TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD

LEGEND:
- PROPERTY LINE
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- TELEPHONE LINE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- FIRE HYDRANT
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- ELECTRICAL BOX
- WATER MANHOLE
- CAIR
- VSAM
- LB
- 3 fet
- 8 fet
- 16 fet
- 12 fet
- MH
- CB
- W
- D
- T/UG
- E/OH
- SS
- E/UG
- FG
- E/OH
- HH (2'x4' HANDHOLE)
- PB (17" x30" PULLBOX)
1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILT AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SURVEY; THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH ELECTRICAL LINES
   b. LIGHTING AND CONSULTS FOR THE DRIVING RANGE
   c. 6" WATER LINE LOCATED NEAR MAINTENANCE BUILDING ON DATE STREET AND RUNS THROUGHOUT THE GOLF COURSE (PARTIALLY SHOWN)
   d. 8" WATER LINE SERVICES CONNECTING FROM DATE STREET AT PALANI AVE.

   TO GOLF COURSE
   e. 4" AND 6" WATER LINES SERVICE CONNECTING FROM DATE STREET NEAR KAPAHULU AVE.

   TO GOLF COURSE
   f. 24" WATER LINE LOCATED NEAR EDGE OF GOLF COURSE PROPERTY ALONG KAPAHULU AVE
   g. WATER LINES WITHIN DATE STREET ROADWAY
   h. VARIOUS GAS DISTRIBUTION LINES ALONG KAPAHULU AVE. WITHIN ROADWAY
   i. IRRIGATION AND PATHWAY LIGHTING ALONG PATHWAY PARALLEL TO MANOA/PAOLU CANAL.
LEGEND:
- PROPERTY LINE
- ELEVATIONAL PREFERENCES
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- TELEPHONE LINE
- CATCH BASIN
- DRAIN MANHOLE
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- T/UG
- W
- G
- SS
- D/E/UG
- FIRE HYDRANT
- FLOOD WALL (PROPOSED)
- ELECTRIC LINE (UNDERGROUND)
- E/OH
- ELECTRIC LINE (OVERHEAD)
- ELECTRICAL BOX
- EXISTING PB (17" x 30" PULLBOX)

NOTES:
1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON-AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.
2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. 8" WATER LINE WITHIN UNIVERSITY AVE. AND HIHIWAI ST.
   b. LIGHTING AND CONDUITS ALONG WALKWAY WITHIN THE PARK AND AT SPORT COURTS.
   c. IRRIGATION LINES THROUGHOUT THE PARK AND THE BACKFLOW PREVENTER JUST WEST OF THE SPORTS COURTS.

HAUSTEN DITCH DETENTION
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

   a. OVERHEAD ELECTRICAL AND TELECOMMUNICATION LINES CO-LOCATED RUNNING ALONG DOLE STREET, CROSSING BETWEEN MAUKA AND MAKAI SIDES OF ROAD.
   b. ELECTRONIC LINES FOR PARK LIGHTING.
   c. BACKFLOW PREVENTER VALVE AND OTHER MISC. IRRIGATION FEATURES THROUGHOUT THE PARK.
   d. POSSIBLE UTILITY ROOM LOCATED UNDER TENNIS COURTS AT FIELD ELEVATION.

KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN
1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.
   b. ELECTRICAL LINES FOR STREET LIGHTING LOCATED ALONG MAKAI SIDE OF KAHALOA DR. AT ENTRANCE TO PARK.

NOTES:

MANOA IN-STREAM DEBRIS CATCHMENT
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILT PLANS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES
   b. WATER LINES WITHIN ROADWAYS

    WOODLAWN DITCH DETENTION
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES; REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH; THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

- OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.

WAIAKEAKUA DEBRIS AND DETENTION BASIN PLAN

SCALE:

1"=30'
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THOSE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   - OVERHEAD TELECOMMUNICATIONS LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.
NOTES:

1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFERR TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.
   b. STREET LIGHTING CO-LOCATED WITH ELECTRICAL POLES.

PUKELE DEBRIS AND DETENTION BASIN
1. LOCATION OF EXISTING UTILITIES ESTIMATED BASED ON AS-BUILTS AND OTHER AVAILABLE SOURCES. REFER TO THE UTILITY ASSESSMENT REPORT FOR WRITTEN DESCRIPTION AND SOURCE INFORMATION.

2. ADDITIONAL UTILITIES ARE KNOWN TO EXIST BEYOND THOSE SHOWN ON THESE DRAWINGS. SPECIFIC LOCATIONS OF THESE UTILITIES COULD NOT BE IDENTIFIED IN THE PRELIMINARY SEARCH. THESE ADDITIONAL UTILITIES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES ALONG WEST SIDE OF WAIOMAO ROAD.

b. STREET LIGHTING COLLOCATED WITH OVERHEAD ELECTRICAL LINES ALONG WEST SIDE OF WAIOMAO ROAD.

NOTES:

WAIOMAO DEBRIS AND DETENTION BASIN
AL Ahawai Watershed Project

Mitigation Measures

Notes:
1. Location of existing utilities estimated based on as-built and other available sources. Refer to the utility assessment report for written description and source information.
2. Additional utilities are known to exist beyond those shown on these drawings. Specific locations of these utilities could not be identified in the preliminary survey. These additional utilities include, but are not limited to the following:
   a. Overhead telecommunication lines co-located with overhead electrical lines on side of Pawaina Street.

Manoa Stream Falls 7 and 8 Rehabilitation
Attachment 5
Waikiki Buffer Zone Map
Note: Construction activity may cause damage to the Beachwalk WWIPS force main from ground vibration or soil liquefaction. Prevention, mitigation, and/or monitoring measures may need to be taken by the responsibility of the owner/contractor to prevent any impacts or potential damage to the force main.
The Ala Wai Canal Project is a flood risk management feasibility study being conducted by the U.S. Army Corps of Engineers, Honolulu District (USACE) under the authority of Section 209 of the Flood Control Act of 1962. The non-Federal sponsor is the State of Hawaii Department of Land and Natural Resources (DLNR) Engineering Division.

The project is currently in the feasibility phase of the USACE planning process, which consists of a study to investigate and determine the extent of Federal interest in a plan to reduce flood risk within the Ala Wai Canal watershed. Specifically, the study includes (1) an assessment of the risk of flooding, (2) analysis of a range of alternatives formulated to reduce flood risk, and (3) identification of a tentatively selected plan for implementation (with design drawings developed to a 35% level of design). The results of the feasibility study are presented with an integrated Environmental Impact Statement (EIS), as needed to comply with the National Environmental Policy Act (NEPA) and Hawaii Revised Statutes (HRS) Chapter 343.

The Draft Feasibility Report/EIS for the Ala Wai Canal Project was released for public review in the fall of 2015, and underwent concurrent public review, Agency Technical Review (ATR), USACE Headquarters Policy Review, and Independent External Peer Review (IEPR). The USACE is currently working to address comments received on the Draft Feasibility Report/EIS in preparation for the Final Feasibility Report/EIS. The Final Feasibility Report/EIS will be submitted to USACE Headquarters for review and approval; if approved, a Chief of Engineers Report would be sent to Congress recommending authorization of the Ala Wai Canal Project.

In support of this effort, CH2M HILL (CH2M) has been contracted to update the 35% design drawings for the left bank of the Ala Wai Canal floodwalls based on a review comment received on the Draft Feasibility Report/EIS. Specifically, CH2M’s scope of work (SOW) states that the purpose of the task is to “update the civil designs for… the left bank Ala Wai Canal floodwall to ensure a consistent level of detail with USACE designs on the right bank and address comments received from the Independent External Peer Review. The Contractor shall validate the current dimensions of the left bank foundation to ensure sufficient construction space and, if appropriate, designs shall be adjusted to accommodate space constraints (e.g. cantilevered wall).”

This technical memorandum summarizes the approach and results of this task.
BACKGROUND

The Ala Wai Canal watershed is located on the southeastern side of the island of Oahu, and includes Makiki, Manoa, and Palolo streams, all of which drain to the Ala Wai Canal. The Canal is a 2-mile-long waterway constructed during the 1920s to drain extensive coastal wetlands, thus allowing development of the Waikiki District. A large portion of the watershed, including most of Waikiki, is highly susceptible to flooding.

The USACE’s tentatively selected plan to address flood risk in the Ala Wai Canal watershed, as presented in the Draft Feasibility Report/EIS, consists of the following measures:

- Six in-stream debris and detention basins in the upper reaches of the watershed
- One standalone debris catchment feature
- Three multi-purpose detention basins in open-space areas within the developed watershed
- Floodwalls along the Ala Wai Canal (including three associated pump stations)
- Improvements to the flood warning system (non-structural)
- Compensatory mitigation features

Based on the 35% design drawings developed by the USACE, the Ala Wai Canal floodwalls would be constructed along approximately 1.7 miles of the left bank (from near Kapahulu Avenue to Ala Moana Bridge) and approximately 0.9 mile of the right bank (from the Manoa Palolo Drainage Canal to Ala Moana Bridge). The reinforced-concrete floodwalls would be an average of approximately 4 feet high, offset from the existing canal retaining walls; they would be as much as 6 feet high at the upstream end and would taper to the existing grade near Ala Moana Bridge. Three pump stations would be constructed to address storm flows associated with several large existing drainage features that flow into the canal, and gates would be installed for other smaller drainage pipes to prevent backflow from the Ala Wai Canal during a flood event. A copy of the relevant pages of the 35% design drawings are contained in Attachment 1.

Based on their review of the Draft Feasibility Report/EIS, the IEPR team provided the following comment regarding the Ala Wai Canal floodwalls:

*The “L” shaped left bank floodwall includes a foundation equal to only 2/3 the wall height, with all foundation in the toe and no foundation heel. Therefore, the Panel is concerned that the “L” shaped left bank floodwall foundations may not have sufficient factor of safety to resist sliding and overturning.*

Ordinarily, this matter would be corrected during the Preconstruction Engineering & Design (PED) phase and increased incremental cost would be covered by the project contingency. However, the left bank site conditions may not provide adequate available space for construction of either the floodwall design indicated in Detail C of Sheet C-311 or any other cantilever design resulting from a reevaluation of foundation conditions. The already narrow available left bank work area is complicated by existing, possibly historic, canal wall stone work, existing utilities (street lighting and hydrants observed on Google Earth) and trees (indicated on plan drawings and artist renderings), and proximity of heavy vehicular and pedestrian traffic. If a left bank flood wall foundation designed with an adequate factor of safety against sliding and overturning cannot be constructed within the available site without impacts to site constraints, then a significant change in the TSP 35% design may be required. This change may be so major as to change the design concept and cause more environmental impacts to existing canal stone walls, utilities and trees, and traffic. Furthermore, the design is not aligned with the currently assessed level of risk assigned at this stage in the SMART Planning process.
Recommendations:
1. Validate foundation design assumptions used for both left and right bank floodwalls.
2. Correlate left and right bank designs and adjust foundation dimensions accordingly.
3. Ensure that the dimension of correlated and adjusted left bank floodwall foundations allow sufficient construction space within existing left bank physical project constraints.
4. Revise the project constraints and impacts stated in the report if sufficient construction space within existing project constraints is not available, or consider revising design concepts away from a cantilever wall.

A copy of the complete IEPR comment is provided in Attachment 2.

APPROACH AND RESULTS

Consistent with the SOW requirements, the objective of the task is to update the left bank floodwall design pursuant to the relevant IEPR review comment. As such, the approach used for the design update mirrored the recommendations numbered in the IEPR comment. The specific methodology and results for these steps is presented below.

Floodwall Design Validation and Evaluation

In accordance with USACE design guidelines for stability analysis of gravity structures, floodwalls must meet minimum requirements for various loading conditions, including water levels for the design flood and to the top of the wall, earthquake loads, and temporary construction loads. Consistent with the IEPR recommendation, the stability of the existing canal floodwall design (as shown in Attachment 1) was checked for overturning, sliding, and bearing capacity failure modes in accordance with the USACE Engineer Manual (EM) 1110-2-2100 (USACE, 2005) and EM 1110-2-2502 (USACE, 1989), with clarifications provided in Engineering and Construction Bulletin (ECB) No. 2014-24 (USACE, 2014). Details of the methodology, design criteria, and results of the analysis are presented in Attachment 3.

Based on the results of the stability analysis, the following conclusions were reached for the right bank floodwall:

- The wall section as shown on the 35% design drawings (Sheet C-309, Attachment 1) is sufficient to retain the design flood.
- The width of the wall and the depth of its footing can be decreased and still meet minimum stability requirements. However, the cutoff should extend more than 1.5 feet below the footing, if the depth of the footing is decreased.

Based on the results of the stability analysis, the following conclusions were reached for the left bank floodwall:

- The wall as shown on the 35% design drawings (Sheet C-310, Attachment 1) is inadequate to retain the maximum design flood.
- Based on inspection, the left bank wall section could be similar to the right bank floodwall section, if the loading and foundation conditions are very similar.

In response to these findings, a wall section configuration similar to the right bank floodwall detail shown on Sheet C-309 was evaluated for the various loading requirements and wall heights. The required foundation size for the wall was adjusted to correspond to the specific wall heights for each reach of floodwall. The required floodwall dimensions for reaches along both the left and right banks are summarized in the tables on Sheet C-312 (Attachment 4).

Key design issues considered as part of this effort include the following:
• Based on preliminary utility information, it is estimated that the proposed left bank floodwall would cross over approximately 49 storm drains at varying depths. Approximately 30 culverts on the left bank and 1 on the right bank would penetrate the proposed wall key below the footing. The invert elevation of approximately 13 culverts is unknown. At least two culverts would intersect the floodwall footings on both the left and right banks, and require the footing to be raised such that it would bridge over the culvert. Special structural details will be required where the wall crosses over these features. Full development of structural details for these crossings are beyond the current scope, but general concepts for construction requirements at typical culvert crossings are shown in Details C and D on Sheet C-312A (Attachment 4). Encasement with lean concrete or controlled low-strength material would be required to both limit under-seepage along the culvert and to transfer wall loads around the existing culverts. A filter diaphragm, consisting of sand material, should be installed at the downgradient side of the floodwall to limit the risk of internal erosion and piping.

• Two box culverts located at the upstream end of the Ala Wai Canal are located at grade, and have little to no soil cover. It is understood that the proposed pump station would be designed to incorporate these culverts, such that the floodwall would not tie directly into these structures. However, in the event that the pump stations are removed from the design (or the floodwall is otherwise required to tie directly into these structures), the proposed floodwall foundation would not have sufficient embedment in these locations. In this case, it may be necessary to design a new headwall structure with a 7-foot extension above the culvert outlet, and tie the floodwall into the headwall structure. If needed, the design of these parapet wall-type special structural details (or other special details) will need to be performed during the PED phase.

• Existing information about the subsurface conditions beneath the proposed floodwalls is limited, consisting of descriptions of material types observed at various borings and test pits performed as part of a 1999 study of the existing canal retaining walls (Geolabs, 1999). The soil descriptions contain information useful for selecting preliminary soil properties, but should be refined through additional investigation as part of the PED phase. Specifically, a soil investigation must be performed to provide a high level of confidence in the foundation strength and permeability for final design of the Ala Wai Canal floodwalls, in accordance with EM 1110-2-2100, Section 3-4 (USACE, 2005).

• The existing Ala Wai Canal retaining walls vary in shape, size, and materials. They are at risk of becoming unstable in many locations, as concluded in the 1999 study. To limit impacts to the existing retaining walls from new loading imposed by the proposed floodwall and its construction, the floodwalls should be set back outside the influence zone of the existing retaining walls. For preliminary design purposes, it was assumed that the floodwall foundation should bear below an imaginary plane inclined at 45 degrees up from the base of the existing retaining walls. This assumption will need to be validated based on a detailed geotechnical investigation and analysis.

Construction Issues
The existing canal retaining walls are not watertight and the soil behind them appears to consist of loose sand fill materials with potentially high permeability. In the 1999 study of the existing canal retaining walls, the groundwater level was observed to be equal to the water level in the canal, which was as high as approximately 2 feet below the ground surface. High groundwater would likely cause caving of loose sand fill materials into the excavation for the floodwall key below the foundation during construction. In addition, with high groundwater, compaction of the foundation subgrade would be problematic.

Construction of the proposed floodwall section with a reinforced-concrete key below the wall foundation would require dewatering. To accomplish dewatering of any permeable fill materials, a positive groundwater cutoff system would likely be required in combination with wells or well points to maintain water levels below the required excavation, which has the potential to add significant additional costs during construction. The positive groundwater cutoff system may consist of deep
temporary sheet pile walls on both sides of the excavation footprint. Pumping would be required between the cutoff system to remove water seeping through and beneath the cutoff system. A typical dewatering system that could be used to construct the wall with a concrete key beneath the footing is shown as Option 1 on Sheet C-313 (Attachment 4).

An option that could be used in lieu of the deep dewatering scheme would be to use permanent steel sheet piles in place of a concrete key beneath the footing. The installation of the sheet piles would reduce the uplift pressures, reduce the risk of piping beneath the foundation, and provide lateral resistance against sliding of the wall, similar to the reinforced concrete key. The preliminary required depth of the sheet piles is approximately 6 feet below the bottom of the floodwall foundation. The required construction dewatering for this option could be significantly simplified, consisting of pumping from sumps along the alignment to draw water down below the bottom of the relatively shallow wall foundation, as needed. This concept is shown as Option 2 on Sheet C-313A (Attachment 4).

One drawback of using the sheet piles in place of the concrete key is the potential for corrosion. Although not in direct contact with seawater, the sheet piles would be in contact with groundwater and would be subject to some level of corrosion. Corrosion can be mitigated by using a sheet pile with larger thickness than is structurally required. For example, an AZ-12 sheet pile would likely be sufficient for the proposed floodwall. Using an AZ-14 sheet pile instead would provide approximately 0.1 inch of sacrificial thickness to allow for corrosion over a finite design life for the floodwall.

It is estimated that sheet piles can be driven easily through the sand fill materials. However, a layer of cemented coral rubble was identified below the sand fill in the 1999 study of the existing retaining walls, which could cause difficulty in driving piles. If the depth of the coral rubble is found to be deeper than the 6-foot depth of the sheet piles in the PED geotechnical investigation, this would be a non-issue. Otherwise, the driveability of sheet piles should be evaluated during final design if sheet piles are proposed for either temporary dewatering or as a permanent cutoff below the floodwalls.

Space Availability and Utility Conflicts
Using the updated floodwall design, the team then considered whether there would be sufficient space for floodwall construction, given the limited space and potential utility conflicts along the left bank of the canal. As part of a separate task, CH2M assessed the existing and planned/future utilities within the construction limits for the proposed project. The utilities identified along the left bank of the canal and the approach to addressing those utilities as part of the proposed floodwall design are summarized below.

- Utilities running parallel to the canal within the existing sidewalk and greenspace include electrical distribution lines; power feeds and lines for lighting, street lights, and traffic signals; and water for irrigation. It is assumed that these would be protected in place or temporarily relocated during construction (and replaced within the existing sidewalk/greenspace corridor).

- Utilities running parallel to the canal within the Ala Wai Boulevard roadway include electrical and water distribution lines, as well as a 42-inch sewer force main and 72-inch sewer tunnel. It is assumed that the utilities located within the roadway can be avoided, but would need to be protected in place.

- Utilities running perpendicular to the canal include multiple storm drain pipes and culverts, as well as conduits for other utilities within the bridge alignments. It is assumed that these would need to be protected and incorporated into the floodwall design. In addition, the 42-inch sewer force main and a 72-inch sewer tunnel cross the canal in several locations, but in general, are expected to be deep enough such that the floodwall is not expected to directly conflict with this infrastructure (recognizing the need to consider loads imposed on the sewer lines and manhole access).
Based on these assumptions, the space availability for floodwall construction was assessed as follows. The required permanent width required for the floodwall is a maximum of approximately 11 feet, including the required setback and minimum wall foundation width. An additional 3 feet would be required for a temporary excavation slope, although this could be decreased through the use of vertical shoring. In general, the space available for the left floodwall on the Ala Wai Canal between the existing canal retaining wall and the edge of pavement alternates from approximately 17 feet (where there is parallel parking along Ala Wai Boulevard), to approximately 25 feet (where there is no parking). Based on a preliminary assessment of the available space and the average width needed for floodwall construction, there is approximately 6 feet of width remaining (in the narrow sections) for existing utilities running parallel to the canal between the existing canal retaining wall and Ala Wai Boulevard. It should be noted that the trees along Ala Wai Boulevard would most likely need to be removed to construct the wall, and with the limited space available for utilities, there may not be sufficient width for trees post-construction.

Field investigations to determine foundation conditions, along with a utilities survey during the PED phase will provide the information needed to verify the actual wall dimensions and utility locations. This information will be critical to confirm that the horizontal space for utilities along Ala Wai Boulevard is sufficient, and to mitigate and plan for any unanticipated encroachments. If it is determined that relocation of utilities cannot be accommodated within the available space, some of the utility relocations could be moved within the Ala Wai Boulevard roadway. A second option would be to modify the design concept for the floodwall to incorporate a deeper, narrower, foundation type (e.g. I-type wall, pilaster-supported wall panels, or narrow foundation supported by micro-piles or piers). Another option that would allow significantly more space for the existing utilities (and vegetation) on the left bank of Ala Wai Canal would be to reconstruct the existing left bank retaining wall, incorporating a cantilever wall stem above the canal bank retaining wall. This option would require a temporary cofferdam along the length of the project to allow construction in the dry. One benefit of this option would be that the failing portions of the existing wall would no longer be a concern.

It is understood that the USACE has identified a preliminary approach to transition the floodwall to the existing bridges; these transitions were not considered as part of this task. In any case, near the bridge approaches (particularly McCully Street bridge), the width of the corridor between Ala Wai Boulevard and the canal becomes very narrow. At McCully Street bridge, the space between the roadway and the canal is only as wide as the existing sidewalk. The proposed floodwall design shown on Sheet C-312A would not fit within these areas where the available corridor width diminishes near the bridges; instead, the floodwall design would need to incorporate a deep foundation in order to eliminate the footing. However, it is important to note that the addition of a floodwall setback from the existing retaining walls in these areas would displacement the existing sidewalk. In these locations, it may be necessary to demolish the existing retaining walls and reconstruct a new combined retaining wall/floodwall. In addition to the space constraints described above, approximately 350 feet of the left bank on the downstream side of McCully Street bridge also extends over the water in the form of a deck that is supported on square concrete piles. As such, a floodwall structure with an embedded concrete foundation is not feasible at this location. It is understood that the USACE is currently planning for the floodwall to be supported using the existing piles/piers along this reach. Based on visual observation, there is concern that the existing piles/piers may not be adequate to support the proposed floodwall; a detailed analysis will be needed to verify this approach. Another concern is that flood water would pass directly beneath a pile-supported wall and create high uplift pressures on the existing deck or roadway. It is likely that a properly designed sheet pile wall that is embedded deep enough to withstand flood loading will be required in this area. These issues should be considered as part of the effort to design the transition of the floodwall to the bridges during the PED phase.
Issues related to storm drains and other utilities that intersect the alignment of the floodwall and either penetrate the key or encroach on the foundation were discussed in the preceding section. Where the utilities are below the concrete key, no change in the design may be necessary. Conceptual details of utility crossings that penetrate the concrete key are shown on Sheet C-312 (Attachment 4). For utilities that encroach on the floodwall’s foundation base, additional details may be required; it is assumed that these will be developed in the PED phase, as necessary.

As also discussed previously, construction dewatering would be required at the utility crossing locations regardless of whether a concrete key or sheet pile cutoff is incorporated below the floodwall foundation. Multiple dewatering wells and/or well-points would likely be required because it would be difficult to install a positive groundwater cutoff at the crossing locations without leaving potential seepage windows.

In addition to the design and construction issues associated with the proposed floodwall design, it is also important to note specific conditions that require compliance in this area. In particular, the recently constructed Beachwalk Waste Water Pump Station (WWPS) resulted in the designation of the Waikiki Buffer Zone (Attachment 5). Any work within the Waikiki Buffer Zone would require mitigation and/or monitoring measures to avoid damage to the Beachwalk WWPS force mains caused by ground vibration or soil liquefaction. Additional information regarding the specific vibratory conditions that could result in impacts to the force mains (such as particle velocity and displacement magnitude), as well as a detailed geotechnical investigation is needed to clearly identify the construction risks due to vibrations or excavation within the buffer zone. However, at a minimum, it is expected that monitoring and mitigation (e.g., limits on the equipment and installation methods) will be required for project construction, particularly for any activities requiring installation of sheet piles.

**SUMMARY AND CONCLUSIONS**

In response to an IEPR comment on the 35% floodwall design presented in the Draft Feasibility Report/EIS, USACE tasked CH2M with updating the floodwall design pursuant to USACE design guidelines. The specific methodology, consistent with a 35% level of design, culminated from the professional judgement of CH2M staff, with discussion and input by USACE. The design update was based on information derived from site observations and photographs, the 1999 study of the Canal retaining walls, and relevant USACE engineering manuals (listed in the References section of this document). Recommendations for an updated design of the floodwall key are driven by space availability between the edge of the Ala Wai Boulevard roadway and the existing canal retaining walls, constructability issues, and perceived site conditions related to the groundwater. The following investigations and information gathering are recommended to validate the design of the floodwall and the applicable foundation, confirm site conditions, and support analyses necessary for development of the final floodwall and constructions details:

- Conduct a soil investigation to develop information regarding the foundation strength and permeability, as well as information necessary to analyze soil liquefaction and/or vibration within the Waikiki Buffer Zone.
- Conduct a detailed topographic survey (including utility identification) to further refine floodwall foundation design and utilities conflicts.
- Confirm setback criteria for floodwalls and available space based on detailed survey and geotechnical investigation.
- Perform finite element seepage analyses to verify the simplified uplift pressures used in accordance with the USACE design method.
- Perform detailed structural analysis or computations.
- Assess sheet pile penetration or driveability in cemented coral rubble.
- Develop details for utility encroachments.
- Develop details for transitioning the floodwalls into the existing bridges and incorporating the piles/piers adjacent to the McCully Street bridge.

REFERENCES


ATTACHMENTS

1 USACE 35% Design Drawings (Excerpts)
2 Independent External Peer Review Comment #4
3 Stability Evaluation of Proposed Ala Wai Canal Floodwalls
4 Details for Updated Ala Wai Canal Floodwalls
Attachment 1

USACE 35% Design Drawings
(Sheets C-101 through C-107, and C-309 through C-311)
NOTES:
1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" CORROSION MATERIAL.
2. SEE SHEET C-410 FOR THE HAUSTEN DITCH BRIDGE NEW CONCRETE WALL PLAN.
3. SEE SHEET C-516 FOR THE HAUSTEN DITCH DETENTION FLOODWALLS AND BERM, PROFILE AND SECTIONS.

HAUSTEN DITCH DETENTION PLAN
SCALE: 1"=50'
NOTES:
1. STAGING AREA WILL HAVE GEOTEXTILE AND 3' OF SURGE MATERIAL.
NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.

2. THE FLOOD GATES ARE PASSIVE AUTOMATIC BARRIERS.

ALA WAI CANAL AND MCCULLY ST PLAN

SCALE: 1"=25'
AL A WA I CANAL MIDDLE (ALA2) AND LOWER (ALA1) LEFT BANK FLOODWALLS

1. PROFILE
2. ALA WAI CANAL MIDDLE & LOWER LEFT BANK FLOODWALLS

NOTE
1. SECTION "C" OF DETAIL 2 (C-311) FOR ALA WAI CANAL MIDDLE & LOWER LEFT BANK CONCRETE FLOODWALLS
2. ALA WAI CANAL MIDDLE & LOWER LEFT BANK CONCRETE FLOODWALLS

C-310
Attachment 2

Independent External Peer Review Comment #4
Final Panel Comment 4

Site conditions for the Ala Wai Canal left bank floodwall may not have sufficient space to design an adequate factor of safety against sliding and overturning.

Basis for Comment

Ala Wai Canal FS/EIS Draft Report Appendix A2, Plate 11, TSP 35% Design sheets C-103, C-309 and C-316 indicate construction of “inverted T” shaped floodwalls for Hausten Ditch Detention Basin and the right bank (mountain side) Ala Wai Canal with foundations 3 feet below grade and 9.5 feet wide, with a key to resist sliding an additional 3 feet deep. Report Appendix A2, Plate 11, TSP 35% Design sheets C-310 and C-311 indicate construction of “L” shaped floodwalls for the left bank (ocean side) of the Ala Wai Canal with no foundation heel, no key, and the toe foundation 1 foot below grade.

The report does not include specific geotechnical data or floodwall design calculations. The Panel expects that geotechnical data and design loading for floodwalls on both sides of the canal would be similar; thus, the floodwall foundations would also be similar. However, as indicated above, the foundations are very dissimilar.

USACE Engineer Manual (EM) 110-2-2502 Retaining and Flood Walls does not provide guidance for the use of “L” shaped floodwalls, though the same general design process for “inverted T” shaped walls can be applied to “L” shaped walls. While EM 110-2-2502 addresses only specific design methodologies, conservative rule-of-thumb professional judgment would begin with a floodwall foundation width equal to wall height, with the foundation heel equal to approximately 2/3 the foundation width and the foundation toe equal to approximately 1/3 the foundation width (Federal Emergency Management Agency [FEMA] Engineering Principles and Practice Chapter 5F). The “L” shaped left bank floodwall includes a foundation equal to only 2/3 the wall height, with all foundation in the toe and no foundation heel. Therefore, the Panel is concerned that the “L” shaped left bank floodwall foundations may not have sufficient factor of safety to resist sliding and overturning.

Ordinarily, this matter would be corrected during the Preconstruction Engineering & Design (PED) phase and increased incremental cost would be covered by the project contingency. However, the left bank site conditions may not provide adequate available space for construction of either the floodwall design indicated in Detail C of Sheet C-311 or any other cantilever design resulting from a re-evaluation of foundation conditions. The already narrow available left bank work area is complicated by existing, possibly historic, canal wall stone work, existing utilities (street lighting and hydrants observed on Google Earth) and trees (indicated on plan drawings and artist renderings), and proximity of heavy vehicular and pedestrian traffic. If a left bank flood wall foundation designed with an adequate factor of safety against sliding and overturning cannot be constructed within the available site without impacts to site constraints, then a significant change in the TSP 35% design may be required. This change may be so major as to change the design concept and cause more environmental impacts to existing canal stone walls, utilities and trees, and traffic. Furthermore, the design is not aligned with the currently assessed level of risk assigned at this stage in the SMART Planning process.

Significance – Medium
Final Panel Comment 4

A significant design change may be required during PED to construct the floodwalls, which is not aligned with the currently assessed level of risk assigned at this stage in the SMART Planning process.

Recommendation for Resolution

1. Validate foundation design assumptions used for both left and right bank floodwalls.
2. Correlate left and right bank designs and adjust foundation dimensions accordingly.
3. Ensure that the dimension of correlated and adjusted left bank floodwall foundations allow sufficient construction space within existing left bank physical project constraints.
4. Revise the project constraints and impacts stated in the report if sufficient construction space within existing project constraints is not available, or consider revising design concepts away from a cantilever wall.

PDT Final Evaluator Response (FPC#4):

Non-Concur. The Team will re-visit the floodwall typical shown on the drawings during the Design Phase of the study. As presented on the drawings, the wall sizes are variable and will depend on the final height and location for the thickness and wall footing requirements. Risk-informed contingency estimates are intended to address cost uncertainties with the Feasibility-level design. The cost estimates that were used for the various floodwall heights in the optimization analysis assumed contingency costs to address uncertainties related to the height and footing requirements. The contingency would cover the utility site constraints you have mentioned. Thus, no significant changes in cost would occur with the more refined detail recommended. You are correct in that these details would be determined during the Preconstruction Engineering & Design (PED) phase as this was the Team's plan. There is a low risk that the left bank floodwall foundation designed with an adequate factor of safety against sliding and overturning cannot be constructed within the available site constraints. It was included in the construction cost estimate that trees will be removed, existing sidewalk will be reconstructed, and light pole utilities will be realigned. More than likely the footing will be merged with the new sidewalk in some fashion to provide resiliency in case of overtopping.

Recommendation #1: Not adopt
Explanation: The team further develop the typical sections and provide new typical sections on the drawings during the Design Phase of the study.

Recommendation #2: Not adopt
Explanation: Correlation between the left and right bank floodwalls and development of new typical sections on the drawings will occur during the Design Phase of the study.

Recommendation #3: Adopt
Explanation: The team will re-look at the space constraints of the left bank floodwall. It is not expected that these constraints will prohibit the floodwall construction.

Recommendation #4: Adopt
### Final Panel Comment 4

**Explanation:** The team will revise if needed based on the concerns expressed in this comment.

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<th>Panel Final BackCheck Response (FPC#4):</th>
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| **Non-concur.** The Panel agrees that floodwall designs will be refined during PED. However, the Panel remains concerned that a cantilever floodwall will not fit into the available left bank footprint. If this lack of space bears out, then this matter becomes not one of design refinement that is captured in the cost and schedule contingency, but of needing a new floodwall concept.  

The PDT response to Recommendation #3 to ‘re-look at the space constraints of the left bank floodwall’ is not in accordance with the actual recommendations that were to revisit those space constraints only after correlating the footing dimensions of the right and left bank typical floodwalls. The Panel is concerned that in re-looking at left bank space constraints without first correlating left and right bank design gross foundation dimensions could lead to checking the space constraints for the wrong sized foundation. The differences as shown in the 35% drawing for these two designs are significant enough (9.5 foot footing vs. 3.5 foot footings) to potentially overwhelm the allowed contingency. The potential historic nature of the existing Ala Wai Canal stonework should also be considered as a left bank floodwall space constraint. |
Attachment 3

Stability Evaluation of Proposed Ala Wai Canal Floodwalls
1.0 Purpose and Background

The purpose of this technical memorandum is to summarize stability analyses of proposed floodwalls along the Ala Wai Canal in Honolulu, Hawaii. The preliminary floodwalls were designed by the U.S. Army Corps of Engineers (USACE) to a designated 35 percent design level. The design is presented on drawings dated October 9, 2014; these include the proposed concrete shape and dimensions for the floodwalls.

To assist with addressing a comment received from the Independent External Peer Review (IEPR), USACE contracted CH2M HILL (CH2M) to conduct the following tasks:

- Validate foundation design assumptions used for both left and right bank floodwalls. The left and Right banks are referenced looking downstream.
- Correlate left and right bank designs and adjust foundation dimensions accordingly.
- Ensure that the dimensions of correlated and adjusted left bank floodwall foundations allow sufficient construction space, given the existing left bank space constraints.

This technical memo documents the methodology, design criteria, and results of the stability analysis conducted in support of these tasks.

2.0 Description of Proposed Floodwalls

Reinforced-concrete cantilevered floodwalls are proposed for both the left and right flood defenses along the Ala Wai Canal. The left wall extends from the head of the canal near Kapahulu Avenue to near the ocean outflow at the Ala Moana Boulevard bridge crossing. The right wall begins at the confluence of the Manoa Palolo Drainage Canal and the Ala Wai Canal, and ends near the bridge crossing at Ala Moana Boulevard. The floodwalls are tallest at the upstream end, and decrease in height moving downstream to a height of zero near the Ala Moana Boulevard bridge crossing. Table 1 summarizes the proposed wall height above existing grade and the associated freeboard above the 100-year flood for various reaches of the floodwall.
Gravity retaining walls of various shapes and sizes were previously constructed along most of the canal. The floodwalls will be set back from the existing structures to prevent loading on the existing retaining walls. Numerous pipe and culverts cross the proposed floodwall alignment; crossings will require structural details for the floodwalls to bridge over the existing pipes or culverts.

Penetrations (conduits) through floodwall foundations represent a risk of uncontrolled seepage, internal erosion, and piping. Defects or joints in the conduits can facilitate seepage into the conduit, transporting soil particles with the leakage. Even if the conduit is intact, water may flow along the contact between the conduit and surrounding soil and erode this soil. Where the soil is highly erodible, such as is the case for low-plasticity silt and fine sands, this internal erosion can lead to piping and eventually a breaching failure. Filter diaphragms are typically used as a standard defensive design measure to mitigate the potential for seepage and internal erosion in the foundation soils surrounding a conduit. The Natural Resources Conservation Service (NRCS) defined a filter diaphragm as “a designed zone of filter material (usually well-graded, clean sand) constructed around a conduit” (NRCS, 2007).

Structural and filter diaphragm details will need to be designed as part of the Preconstruction Engineering & Design (PED) phase, and are not considered as part of this stability analysis.

### 3.0 Method of Stability Analysis

The stability of the floodwall design was checked for overturning, sliding, and bearing capacity failure modes in accordance with USACE guidance documents. Many of the applicable sections for inland floodwalls in Engineer Manual (EM) 1110-2-2502, Retaining and Flood Walls (USACE, 1989) have been superseded by parts of EM 1110-2-2100, Stability Analysis of Concrete Structures (USACE, 2005). Further guidance is provided in USACE Engineering and Construction Bulletin (ECB) No. 2014-24 (USACE, 2014), which contains some revisions and clarifications regarding the relationship between EM 1110-2-2100 and EM 1110-2-2502. In accordance with these guidance documents, evaluation of wall stability is required for four different scenarios, as follows:

- **Case 1**, Infrequent Flood, or design flood loading corresponding to 100-year flood. The water level is at the design flood level (top of wall less freeboard) on the unprotected side; uplift is acting.
• Case I2, Maximum Design Flood, or water to top of wall corresponding to a return period greater than 750 years. This is the same as Case I1 except the water level is at the top of the unprotected side of the wall. Lower factors of safety are allowed for this condition.

• Case I3A and I3B, Earthquake Loading. The water is at the coincident level, or temporal average; uplift, if applicable, is acting; earthquake-induced lateral and vertical loads from the operational basis (Case I3a) and maximum credible earthquakes (Case I3b) are evaluated.

• Case I4, Construction Short-Duration Loading. The floodwall is in place with the loads added, which are possible during the construction period, but are of short duration such as from strong winds (paragraph 3-25) and construction equipment surcharges. Case I4 does not apply to the freestanding floodwall, and will not be evaluated.

The required design criteria for each case of inland floodwalls is dependent upon the following:

• The structure classification – either a normal or critical structure

• The loading condition - usual, unusual, or extreme

• The amount of soil characterization available and certainty in soil design parameters – limited, ordinary, or well-defined

The proposed floodwall is considered a critical structure during a flood stage (Case I1 or I2) because failure of the wall would cause loss of life. The floodwall is considered a normal structure for earthquake loading (Case I3) because failure would be unlikely to cause loss of life.

The loading condition for the 100-year flood loading is unusual. The loading condition for water to the top of the floodwall is extreme because the return period is greater than 750 years (Table 1, USACE ECB 2014-24). Because hydrological data was only available up to a return period of 500 years, the data was extrapolated to a return period of 750 years using both a straight-line trend and a logarithmic trend (Figure 1) to show that the top of the wall is just above the 750-year return period water level. The load condition for the operational basis earthquake is unusual, but the maximum credible earthquake is extreme.
STABILITY EVALUATION OF PROPOSED ALA WAI CANAL FLOODWALLS

The information regarding soil characterization is currently limited, and final design of critical structures is not allowed with only limited soil data. Therefore, the stability evaluations of the proposed floodwall were made assuming ordinary soil characterization; validation of this information will be required before final design.

Based on these descriptions, the analysis assumes the following:

- Case I1 is an unusual loading on a critical structure with ordinary soil characterization.
- Case I2 is an extreme loading on a critical structure with ordinary soil characterization.
- Case I3A is an unusual loading on a normal structure with ordinary soil characterization.
- Case I3B is an extreme loading on a normal structure with ordinary soil characterization.

Table 2 summarizes the required minimum factors of safety for each load case as set forth in EM 1110-2-2100 (USACE, 2005). The floodwall design stability criteria in Table 2 are taken from Table 2 of ECB 2014-24 (USACE, 2014) and Tables 3-2, 3-3, and 3-5 of EM 1110-2-2100 (USACE, 2005).
The analysis methods specified in EM 1110-2-2100 (USACE, 2005), EM 1110-2-2502 (USACE, 1989), and ECB 2014-24 (USACE, 2014) were incorporated into an Excel spreadsheet so that multiple analyses of different wall heights and foundation sizes could be evaluated. The Excel spreadsheet was validated using Example 3 in Appendix N of EM 1110-2-2502.

The forces on the wall include soil loads, water loads, uplift loads caused by seepage pressures, and the weight of the wall itself. Force and moment limit equilibrium methods were used to evaluate the factors of safety for the different failure modes. The wall heights and freeboards listed in Table 1 were evaluated for stability to determine the required width and depth of footing, and the depth of the keyway beneath the wall.

A cantilevered floodwall was considered for these analyses. Different types of walls may also be considered, depending on the constraints from adjacent utilities that may limit the amount of space available for floodwall construction. A pilaster wall (with pier-supported pilasters and wall panels between), or a sheet pile wall may provide an alternative type of wall where less footprint is necessary.

Detailed utility constraints were not yet available at the time of writing. Special design details to accommodate utility crossings were qualitatively considered, as presented herein. The structural requirements of these special details must be further evaluated in the PED phase.

The following assumptions were considered in evaluating stability of the floodwall:

- A crack between the soil and the canal side of the floodwall was assumed, in accordance with USACE guidelines. This results in the full water head in uplift at the base of the key. There is no soil pressure on the canal side of the wall, only water pressure.
- The uplift pressures beneath the wall were estimated using the simplified line of seepage method.
- Passive soil pressure at the toe of the wall in sliding analyses was estimated as 1/2 of the ultimate passive pressure, calculated using the buoyant weight.
- The buoyant weight was equal to the saturated soil unit weight minus the pore pressures that were estimated using the line-of-creep method.
- Sliding stability was evaluated for both a horizontal-sliding plane and a plane inclined from the bottom of the key to the toe of the wall.
- The interface friction between the concrete and the soil was equal to 2/3 of the internal friction angle of the soil.
- Water level is at normal level during an earthquake.

### Table 2

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Loading Condition</th>
<th>Sliding Factor of Safety</th>
<th>Overturning Criteria, Minimum Base Area in Compression</th>
<th>Bearing Capacity Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Design Flood</td>
<td>1.5</td>
<td>75 percent</td>
<td>3.0</td>
</tr>
<tr>
<td>I2</td>
<td>Water to Top of Wall</td>
<td>1.1</td>
<td>Resultant within base</td>
<td>2.0</td>
</tr>
<tr>
<td>I3A</td>
<td>Earthquake (OBE)</td>
<td>1.3</td>
<td>75 percent</td>
<td>2.0</td>
</tr>
<tr>
<td>I3B</td>
<td>Earthquake (MCE)</td>
<td>1.1</td>
<td>Resultant within base</td>
<td>&gt;1.0</td>
</tr>
</tbody>
</table>
4.0  Soil Material Properties

The soil material properties along the floodwall have not yet been investigated as part of this project. Investigation of the foundation materials was performed as part of an evaluation of the stability of the existing canal retaining walls in 1999. According to the report by Geoloabs-Hawaii, the soil beneath the foundation of the proposed floodwalls generally consists of loose to medium dense silty sand fill materials. Zones of soft to stiff clayey silt and clay, of unknown plasticity, were also observed. The fill thickness varies up to approximately 6 feet, and is generally underlain by cemented coral rubble, which provides the foundation for the existing canal bank retaining walls. Laboratory testing was not performed on the soil materials.

According to the material type descriptions, an internal friction angle of 28 degrees and zero cohesion for the foundation soil beneath the proposed floodwalls was assumed for these analyses. A moist unit weight of 115 pounds per cubic foot (pcf) and a saturated unit weight of 130 pcf were assumed. The friction coefficient between the bottom of the concrete floodwall and the fill materials was estimated as 0.36 based on an assumed friction angle of 2/3 of the soil internal friction angle.

These assumed soil properties must be verified through field sampling and laboratory testing as part of the PED phase. Specifically, a soil investigation must be performed to provide a high level of confidence in the foundation strength and loading conditions for final design of the Ala Wai Canal floodwalls, in accordance with EM 1110-2-2100, Section 3-4 (USACE, 2005).

The analyses performed assume effective stress (drained) conditions based on the soil being mostly silty sand material. If significant amount of clay is present, undrained analysis should be performed to evaluate the stability under loading from a rapid rise in the water level.

5.0  Results of Analyses

5.1  Cantilever Floodwall

Figure 2 shows a general floodwall shape and key to the variable dimensions of a cantilever floodwall. The required wall dimensions are summarized in Tables 3 and 4 for the different wall heights and freeboard requirements listed in Table 1.

An attempt was made to limit the depth of the key to no more than 5 feet below grade for ease of construction. The same level of stability can be achieved by inversely adjusting the wall width and key depth for a given floodwall height. In other words, if the key is deepened, the wall footing width may be decreased to avoid adjacent utilities, or if the wall width is increased, the key depth can be decreased to avoid utilities passing below the wall.
Figure 2. Floodwall Typical Diagram

**TABLE 3**

Wall Dimension Requirements – Right Bank Floodwall

<table>
<thead>
<tr>
<th>Start Station</th>
<th>End Station</th>
<th>Wall Height, H (feet)</th>
<th>Depth of Footing, D (feet)</th>
<th>Wall Thickness, t (feet)</th>
<th>Width of Toe, Wt (feet)</th>
<th>Width of Heel, Wh (feet)</th>
<th>Depth of Key, Dk (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11+15</td>
<td>30+00</td>
<td>0 to 2.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>(McCully Bridge)</td>
<td>30+00</td>
<td>3 to 4</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>30+00</td>
<td>59+00</td>
<td>4 to 5.4</td>
<td>2</td>
<td>1.5</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

**TABLE 4**

Wall Dimension Requirements – Left Bank Floodwall

<table>
<thead>
<tr>
<th>Location</th>
<th>End Station</th>
<th>Wall Height, H (feet)</th>
<th>Depth of Footing, D (feet)</th>
<th>Wall Thickness, t (feet)</th>
<th>Width of Toe, Wt (feet)</th>
<th>Width of Heel, Wh (feet)</th>
<th>Depth of Key, Dk (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10+50</td>
<td>30+00</td>
<td>0 to 2.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>(McCully Bridge)</td>
<td>30+00</td>
<td>3 to 4</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>30+00</td>
<td>42+00</td>
<td>4 to 5</td>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
<td>3.5</td>
<td>3</td>
</tr>
<tr>
<td>42+00</td>
<td>67+00</td>
<td>5 to 5.6</td>
<td>2</td>
<td>1.5</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>67+00</td>
<td>84+00</td>
<td>4 to 5</td>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
<td>3.5</td>
<td>3</td>
</tr>
<tr>
<td>84+00</td>
<td>100+00</td>
<td>5 to 6</td>
<td>2</td>
<td>1.5</td>
<td>2.5</td>
<td>4.5</td>
<td>3</td>
</tr>
<tr>
<td>100+00</td>
<td>103+47</td>
<td>5 to 6</td>
<td>2</td>
<td>1.5</td>
<td>2.5</td>
<td>4.5</td>
<td>3</td>
</tr>
</tbody>
</table>
The sidewalk can be integrated into the structure, but should be reinforced to not have differential settlement or cracking between the wall footing and sidewalk that would result in a tripping hazard. Waterstop details and structural evaluations for bridging across utilities will be analyzed as part of the PED phase.

The next step in the analysis is to evaluate the seepage beneath the wall and check the exit gradient at the toe of the wall to make sure that the gradient is low enough to limit the risk of piping beneath the wall. It is expected that this will be performed as part of the PED phase, unless otherwise directed.

6.0 References


Attachment 4

Updated Ala Wai Canal Floodwalls Details
### RIGHT BANK FLOOD WALL

**LOCATION**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>H max</th>
<th>d key</th>
<th>l</th>
<th>Wt</th>
<th>Wh</th>
</tr>
</thead>
<tbody>
<tr>
<td>11+15 to 30+65 Right</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>30+65 to 34+65 Right</td>
<td>4</td>
<td>2</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>34+65 to 50+65 Right</td>
<td>7.4</td>
<td>3</td>
<td>1.5</td>
<td>35</td>
<td>4</td>
</tr>
</tbody>
</table>

**SCALE:** 3/8"=1'

**NOTES:**

1. Filter diaphragm consists of trench with imported sand to prevent piping at utility penetrations.

### LEFT BANK FLOOD WALL

**LOCATION**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>H max</th>
<th>d key</th>
<th>l</th>
<th>Wt</th>
<th>Wh</th>
</tr>
</thead>
<tbody>
<tr>
<td>10+65 to 30+65 Left</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>30+65 to 34+65 Left</td>
<td>6</td>
<td>2</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>34+65 to 50+65 Left</td>
<td>7</td>
<td>3</td>
<td>1.5</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>50+65 to 71+65 Left</td>
<td>7.6</td>
<td>3</td>
<td>1.5</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>71+65 to 79+65 Left</td>
<td>7</td>
<td>3</td>
<td>1.5</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>79+65 to 103+65 Left</td>
<td>7</td>
<td>3</td>
<td>1.5</td>
<td>35</td>
<td>4</td>
</tr>
</tbody>
</table>

**SCALE:** 3/8"=1'

**NOTES:**

1. Filter diaphragm consists of trench with imported sand to prevent piping at utility penetrations.

### FLOOD WALL OVER BOX CULVERT (TYP)

**SECTION**

**SCALE:** 3/8"=1'

**NOTES:**

- Low Permeability CLSM
- Filter Diaphragm
- 3'-0" Filter Diaphragm

### FLOOD WALL OVER PIPE CULVERT (TYP)

**SECTION**

**SCALE:** 3/8"=1'

**NOTES:**

- Low Permeability CLSM
- Filter Diaphragm
- 3'-0" Filter Diaphragm

---

**SCALE:** 3/8"=1'

**NOTES:**

- Filter diaphragm consists of trench with imported sand to prevent piping at utility penetrations.
NOTES:

1. Native soil is subject to caving, and groundwater table must be lowered below the excavation to allow dry construction.

2. Dewatering to construct a concrete key will likely require a positive groundwater cutoff system in addition to pumping from wells or well-points installed inside the positive groundwater cutoff limits.

3. At culvert penetrations, dewatering with more closely spaced deep well systems will be required, because sheet piles cannot be used.
Attachment 5

Waikiki Buffer Zone
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The intent of this document is to document several edits and revisions to the report resulting from the FINAL review of the Feasibility Report and Integrated Environmental Impact Statement. Edits are primarily undertaken to clarify inconsistencies within the data associated with the report and/or to correct clerical errors in quantities. The revisions do not affect the selection of the recommended plan or other substantive considerations contemplated by the FEIS. Each edit is discussed further below. Errata include the following:

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Table ES-2. Summary of the Recommended Plan

Descriptions of the recommended plan were inconsistent throughout the report. This includes Table ES-2; Table 16; Table 18; Appendix D, Table 1; and Appendix E, Table 1. These tables describe the general dimensions and scale of the structural measures proposed, particularly the debris and detention basins in the upper watershed. The debris and detention basins are not uniform in size and therefore the descriptions were generalized, however, inconsistencies existed between descriptions. As such, the tables were revised to contain consistent values, utilizing the maximum dimensions as the general descriptors of the structures across all tables based on the design drawings previously included in the report. Edits to structural dimensions of the Waihi Debris and Detention Basin, the Waiakeakua Debris and Detention Basin, the Waioao Debris and Detention Basin, the Pukele Debris and Detention Basin, the Makiki Debris and Detention Basin, and Kanewai Multi-Purpose Detention Basin were made consistent throughout each table. In addition, the excavation volume for the Makiki Debris and Detention Basin was included in the project feature description to clarify the amount of excavation necessary to meet upstream storage targets. No changes or revisions were required for descriptions of the Woodlawn Ditch Detention Basin, the Manoa In-Stream Debris Catchment, the Ala Wai Canal Floodwalls, the Hausten Ditch Detention Basin, the Ala Wai Golf Course Multi-Purpose Detention Basin, the Floodwarning System or the environmental mitigation features in any of the referenced tables.
<table>
<thead>
<tr>
<th>Flood Risk Management Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waihi Debris and Detention Basin</td>
<td>Earthen structure, approximately 42 feet high and 477 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. New access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Waiakeakua Debris and Detention Basin</td>
<td>Earthen structure, approximately 37 feet high and 401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert.</td>
</tr>
<tr>
<td>Woodlawn Ditch Detention Basin</td>
<td>Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side.</td>
</tr>
<tr>
<td>Mānoa In-stream Debris Catchment</td>
<td>Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
</tr>
<tr>
<td>Kanewai Field Multi-Purpose Detention Basin</td>
<td>Earthen berm, approximately 9 feet high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.</td>
</tr>
<tr>
<td>Wai’ōma’o Debris and Detention Basin</td>
<td>Earthen structure, approximately 34 feet high and 275 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,060 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Pūkele Debris and Detention Basin</td>
<td>Earthen structure, approximately 35 feet high and 82 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 14,330 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Makiki Debris and Detention Basin</td>
<td>Earthen structure, approximately 36 feet high and 100 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,035 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Hausten Ditch Detention Basin</td>
<td>Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Ala Wai Golf Course Multi-Purpose Detention Basin</td>
<td>Earthen berm, on average 2.7 feet high, around the north and east perimeter of the golf course; grouted riprap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.</td>
</tr>
<tr>
<td>Floodwarning System</td>
<td>Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.</td>
</tr>
</tbody>
</table>

**Table 16. Summary of the Recommended Plan**

Descriptions of the recommended plan were revised for consistency with Table ES-2. Project feature dimensions, project footprints, excavation volumes, and culvert lengths were each edited for consistency.
<table>
<thead>
<tr>
<th>Flood Risk Management Measure</th>
<th>Original Design</th>
<th>Design Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waihi Debris and Detention Basin</td>
<td>Earthen structure, approximately 24 feet high and 225 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&amp;M.</td>
<td>Structure height increased to 42 ft; length increased to 477 ft; Arch culvert replaced with a 12’x6’ box culvert; Culvert length increased from 130 ft to 205 ft; Approximately 150 linear feet of riprap scour protection added downstream of culvert; Project footprint increased from 12,714 ft² to 35,200 ft².</td>
</tr>
<tr>
<td>Waiakeakua Debris and Detention Basin</td>
<td>Earthen structure, approximately 20 feet high and 185 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream sides; debris catchment feature located on upstream end of culvert; energy dissipation structure to be located on downstream end of culvert.</td>
<td>Structure height increased to 37 ft; length increased to 401 ft; Arch culvert length increased from 110 to 200 ft; Approximately 150 linear feet of riprap scour protection added downstream of culvert; Project footprint increased from 29,180 ft² to 41,620 ft².</td>
</tr>
<tr>
<td>Woodlawn Ditch Detention Basin</td>
<td>Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side.</td>
<td>No change</td>
</tr>
<tr>
<td>Mānoa In-stream Debris Catchment</td>
<td>Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
<td>No change</td>
</tr>
<tr>
<td>Kanewai Field Multi-Purpose Detention Basin</td>
<td>Earthen berm, approximately 7 feet high, around 3 sides of the field; grouted rip rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.</td>
<td>Berm height increased to 9 ft</td>
</tr>
<tr>
<td>Waiʻōmaʻo Debris and Detention Basin</td>
<td>Earthen structure, approximately 24 feet high and 120 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. Excavation of approx. 2,000 yd³ to provide required detention volume upstream of berm; low-flow channel with existing substrate to be restored following excavation. New access road to be constructed for construction and O&amp;M.</td>
<td>Structure height increased to 34 ft; length increased to 275 ft; Arch culvert replaced with a 12’x6’ box culvert; Culvert length increased from 130 ft to 170 ft; Approximately 150 linear feet of riprap scour protection added downstream of culvert; Detention basin excavation increased to 3,060 yd³; Project footprint increased from 6,985 ft² to 19,890 ft².</td>
</tr>
<tr>
<td>Pūkele Debris and Detention Basin</td>
<td>Earthen structure, approximately 24 feet high and 120 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&amp;M.</td>
<td>Structure height increased to 35 ft; length decreased to 82 ft; Arch culvert replaced with a 12’x6’ box culvert; Culvert length increased from 130 ft to 160 ft; Approximately 150 linear feet of riprap scour protection added downstream of culvert; Excavation of 14,330 yd³ from 15,620 ft² upstream of structure for additional detention capacity; Project footprint increased from 2,920 ft² to 16,660 ft².</td>
</tr>
<tr>
<td>Makiki Debris and Detention Basin</td>
<td>Earthen structure, approximately 24 feet high and 100 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&amp;M.</td>
<td>Structure height increased to 36 ft; Arch culvert length increased from 130 ft to 160 ft; Approximately 150 linear feet of riprap scour protection added downstream of culvert; Excavation of 3,035 yd³ from 14,040 ft² upstream of structure for additional detention capacity; Project footprint increased from 7,250 ft² to 17,165 ft².</td>
</tr>
<tr>
<td>Flood Risk Management Measure</td>
<td>Original Design</td>
<td>Design Changes</td>
</tr>
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<td>-------------------------------</td>
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</tr>
<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.</td>
<td>Floodwall height optimized as described below. The floodwall near the outlet to the ocean was extended at an elevation of 7.9 ft MSL between the Kalakaua Bridge and the Ala Moana Bridge to account for future sea level rise (described in Section 8.3).</td>
</tr>
<tr>
<td>Hausten Ditch Detention Basin</td>
<td>Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.</td>
<td>Floodwall and berm heights optimized as described below.</td>
</tr>
<tr>
<td>Ala Wai Golf Course Multi-Purpose Detention Basin</td>
<td>Earthen berm, averaging 4 feet high, around the north and east perimeter of the golf course; grouted rip rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.</td>
<td>Berm height increased to an elevation ranging between 10.0-11.9 ft MSL; berm averages 2.7 feet in height above the existing surface</td>
</tr>
</tbody>
</table>

Table 18. Summary of the Recommended NED Plan and Alternative 2A
Descriptions of the recommended plan were revised for consistency with Table ES-2. Clarification that the Manoa-Palolo Drainage Canal Floodwall is not included in the recommended plan has also been included in the table.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Alternative</th>
<th>Description of Measure</th>
<th>O&amp;M Requirements</th>
<th>Total Area of Disturbance</th>
<th>Permanent Structure Footprint</th>
<th>Temporary Disturbance (e.g. staging), (ac)</th>
<th>Vegetation Management</th>
<th>Extent of Inundation (duration for 1% ACE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MĀNOA</strong></td>
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</tr>
<tr>
<td>Waihi Debris and Detention Basin</td>
<td>2A</td>
<td>Earthen structure, approximately 42 feet high and 477 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. New access road to be constructed for construction and O&amp;M.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of structure) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>1.5</td>
<td>355</td>
<td>0.8</td>
<td>355</td>
<td>0.1 0.3 40</td>
</tr>
<tr>
<td>Waihi Debris Catchment</td>
<td>NED</td>
<td>Concrete pad, approximately 8 feet wide and 140 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.3</td>
<td>48</td>
<td>0.07</td>
<td>8</td>
<td>0.1 0.2 40</td>
</tr>
<tr>
<td>Waiakeakua Debris and Detention Basin</td>
<td></td>
<td>Earthen structure, approximately 37 feet high and 401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of structure) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>1.7</td>
<td>350</td>
<td>1.0</td>
<td>350</td>
<td>0.1 0.5 40</td>
</tr>
<tr>
<td>Waiakeakua Debris Catchment</td>
<td>2A</td>
<td>Concrete pad, approximately 8 feet wide and 140 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.2</td>
<td>48</td>
<td>0.03</td>
<td>8</td>
<td>0.1 0.2 40</td>
</tr>
<tr>
<td>Woodlawn Ditch Detention Basin</td>
<td>NED</td>
<td>Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area.</td>
<td>1.9</td>
<td>120</td>
<td>1.1</td>
<td>60</td>
<td>0.1 1 40</td>
</tr>
<tr>
<td>Measure</td>
<td>Alternative</td>
<td>Description of Measure</td>
<td>O&amp;M Requirements</td>
<td>Total Area of Disturbance</td>
<td>Permanent Structure Footprint</td>
<td>Temporary Disturbance (e.g. staging), (ac)</td>
<td>Vegetation Management</td>
<td>Extent of Inundation (duration for 1% ACE)</td>
</tr>
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<td>----------------------------------------------</td>
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</tr>
<tr>
<td>Po’elua Place Debris Catchment</td>
<td>2A</td>
<td>Earthen berm and debris catcher with metal poles to capture debris on east side of Mānoa Stream; grate with inlet to culvert for intake of water to the Mānoa District Park multi-purpose detention basin.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.6</td>
<td>165</td>
<td>0.2</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>Mānoa In-stream Debris Catchment</td>
<td>NED</td>
<td>Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.1</td>
<td>48</td>
<td>0.01</td>
<td>8</td>
<td>0.1</td>
</tr>
<tr>
<td>Mānoa District Park Multi-Purpose Detention Basin</td>
<td>2A</td>
<td>Earthen berm (approximately 13 feet high) around 3 sides of Mānoa District Park; 600-foot-long culvert from Poelua Place to detention basin; concrete spillway with grouted rip-rap on detention and stream side; 2-foot drain pipe to release water back to Mānoa Stream</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a field for park use (with no woody vegetation) during non-flood conditions.</td>
<td>12.9</td>
<td>600</td>
<td>2.2</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>Innovation Center Improvements</td>
<td>NED</td>
<td>Decrease existing grade to allow high flows onto the site; debris catcher installed with metal pipes along edge of site to catch debris as flows re-enter Mānoa Stream.</td>
<td>Cut/clear vegetation within cleared zoned (entire site) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>1.1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>Kanewai Field Multi-Purpose Detention Basin</td>
<td>2A</td>
<td>Earthen berm, approximately 9 feet high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a field for park use (with no woody vegetation) during non-flood conditions.</td>
<td>6.1</td>
<td>70</td>
<td>0.9</td>
<td>70</td>
<td>0.1</td>
</tr>
<tr>
<td>Measure</td>
<td>Alternative</td>
<td>Description of Measure</td>
<td>O&amp;M Requirements</td>
<td>Total Area of Disturbance</td>
<td>Permanent Structure Footprint</td>
<td>Temporary Disturbance (e.g. staging), (ac)</td>
<td>Vegetation Management</td>
<td>Extent of Inundation (duration for 1% ACE)</td>
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<tr>
<td>PĀLOLO</td>
<td>2A</td>
<td><strong>Waiʻōmaʻo Debris and Detention Basin</strong></td>
<td>Earthen structure, approximately 34 feet high and 275 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,060 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M. Cut/clear vegetation within cleared zoned (20 feet around perimeter of structure and excavation area) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>1.6 720 0.5 320 0.1 1.1 40</td>
<td></td>
<td>1.0 acre inundated for up to 10 hours</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Waiʻōmaʻo Debris Catchment</strong></td>
<td>Concrete pad, approximately 8 feet wide and 50 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad. Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.4 48 0.1 8 0.1</td>
<td>0.1 40</td>
<td>None</td>
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<td><strong>Pūkele Debris and Detention Basin</strong></td>
<td>Earthen structure, approximately 35 feet high and 82 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 14,330 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M. Cut/clear vegetation within cleared zoned (20 feet around perimeter of structure) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>1.6 810 0.4 310 0.1</td>
<td>0.1 40</td>
<td>0.8 acre inundated for up to 9 hours</td>
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<td><strong>Pūkele Debris Catchment</strong></td>
<td>Concrete pad, approximately 8 feet wide and 25 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad. Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
<td>0.2 48 0.1 8 0.1</td>
<td>0.1 40</td>
<td>None</td>
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<tr>
<td>Measure</td>
<td>Alternative</td>
<td>Description of Measure</td>
<td>O&amp;M Requirements</td>
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<tr>
<td>Mānoa–Pālolo Canal Floodwalls</td>
<td>2A NED</td>
<td>Add concrete floodwalls (9 to 12 feet high) along the right bank of the Canal from the Ala Wai Canal to Date Street.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of floodwalls) twice per year, allowing no woody vegetation to grow in this area.</td>
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<td>Total Area (ac)</td>
<td>Length of Stream (ft)</td>
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<td></td>
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<td></td>
<td>2.1</td>
<td>0.03</td>
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<td>0.1</td>
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<td>None</td>
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<tr>
<td>Makiki Debris and Detention Basin</td>
<td>2A NED</td>
<td>Earthen structure, approximately 24 feet high and 260 feet across; arch culvert to allow small storm flows to pass; concrete spillway with grouted rip-rap on the upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of structure) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.</td>
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<td>Total Area (ac)</td>
<td>Length of Stream (ft)</td>
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<td>1.1</td>
<td>170</td>
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<td>0.5</td>
<td>120</td>
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<td>0.1</td>
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<td></td>
<td>0.8 acre inundated for up to 9 hours</td>
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<td></td>
<td></td>
<td></td>
<td>0.5 acre inundated for up to 9 hours</td>
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<tr>
<td>ALA WAI</td>
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<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>2A NED</td>
<td>Concrete floodwalls, offset from existing Canal walls. Floodwalls would range up to 4 feet high for the recommended plan and up to 5 feet high for Alt. 2A. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Three pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of floodwalls) twice per year, allowing no woody vegetation to grow in this area. Periodically inspect drainage pipes and gates, and remove any impediments to movement. Inspect, test, and maintain pump systems annually. Paint and/or grease metal parts, as needed.</td>
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<td>Total Area (ac)</td>
<td>Length of Stream (ft)</td>
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<td>11.8</td>
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<td>0.3</td>
<td>0</td>
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<tr>
<td>Measure</td>
<td>Alt.</td>
<td>Description of Measure</td>
<td>O&amp;M Requirements</td>
<td>Total Area of Disturbance</td>
<td>Permanent Structure Footprint</td>
<td>Temporary Disturbance (e.g. staging), (ac)</td>
<td>Vegetation Management</td>
<td>Extent of Inundation (duration for 1% ACE)</td>
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<tr>
<td>Hausten Ditch Detention Basin</td>
<td>2A</td>
<td>Concrete floodwalls and an earthen berm (approximately 7 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm and floodwalls) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a field for recreational use during non-flood conditions. Periodically inspect slide gates and actuators and remove any impediments to movement. Paint and/or grease metal parts, as needed.</td>
<td>Total Area (ac)</td>
<td>Length of Stream (ft)</td>
<td>Total Area (ac)</td>
<td>Length of Stream (ft)</td>
<td>Total Area (ac)</td>
</tr>
<tr>
<td></td>
<td>NED</td>
<td></td>
<td></td>
<td>1.4</td>
<td>70</td>
<td>0.2</td>
<td>35</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.5 acres inundated for up to 4 hours</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ala Wai Golf Course Multi-Purpose Detention Basin</td>
<td>2A</td>
<td>Earthen berm, up to approximately 7 feet high, around the north and east perimeter of the golf course; grouted rip-rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.</td>
<td>Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a golf course (with no woody vegetation in sediment basin) for recreational use during non-flood conditions. Periodically inspect floodgate and remove any impediments to movement. Paint and/or grease metal parts, as needed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25.6</td>
</tr>
<tr>
<td>NON-STRUCTURAL</td>
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</tr>
<tr>
<td>Floodwarning System</td>
<td>2A</td>
<td>Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.</td>
<td>Periodically inspect gages for proper operating conditions. Keep area around sensors free from sediment deposits and plant growth, or other impediments to data collection.</td>
<td>minimal</td>
<td>minimal</td>
<td>minimal</td>
<td>minimal</td>
<td>minimal</td>
</tr>
<tr>
<td>COMPENSATORY MITIGATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falls 7 and 8</td>
<td>2A</td>
<td>Installation of grouted stones to eliminate passage barrier by providing a suitable surface for migration of native species at 2 in-stream structures.</td>
<td>Periodically inspect in-stream structure for potential erosion or undercutting; reinforce as needed.</td>
<td>0.05</td>
<td>110</td>
<td>0.004</td>
<td>10</td>
<td>0.05</td>
</tr>
<tr>
<td>TOTAL FOR ALTERNATIVE 2A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67.3</td>
<td>2347</td>
<td>11.1</td>
<td>707</td>
<td>2.3</td>
</tr>
<tr>
<td>TOTAL FOR ALTERNATIVE 3A-2.2 (NED Plan)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>57.0</td>
<td>3503</td>
<td>9.5</td>
<td>1898</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Table 19. Estimated Excavation and Discharge of Fill within Waters of the U.S.

Data displayed in Table 19 neglected to include the excavation required for the Makiki Debris and Detention Basin and errantly included figures for excavation of the Ala Wai Multi-Purpose Detention Basin, which does not constitute a jurisdictional impact to Waters of the U.S. In addition, at the request of the Environmental Protection Agency (EPA), an additional column detailing the volume of fill associated with the construction has been included in the table. Consistent with Appendix E3, Table 3, Table 19 below has been updated to accurately reflect the impacts of excavation and fill in jurisdictional areas.

Table 19. Estimated Excavation and Discharge of Fill within Waters of the U.S.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Length of Stream to be Disturbed (feet)</th>
<th>Length of Stream in Permanent Footprint (feet)</th>
<th>Construction</th>
<th>O&amp;M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Excavation</td>
<td>Fill</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(yd³)a</td>
<td>(yd³)a</td>
</tr>
<tr>
<td>Waihi debris and detention basinb</td>
<td>355</td>
<td>355</td>
<td>0</td>
<td>676</td>
</tr>
<tr>
<td>Waiakeakua debris and detention basinb</td>
<td>350</td>
<td>350</td>
<td>0</td>
<td>828</td>
</tr>
<tr>
<td>Woodlawn Ditch detention basin</td>
<td>120</td>
<td>60</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Mānoa in-stream debris catchment</td>
<td>48</td>
<td>8</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Kanewai Field multi-purpose detention basin</td>
<td>70</td>
<td>70</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td>Wai‘ōma’o debris and detention basinb</td>
<td>720</td>
<td>320</td>
<td>3,060</td>
<td>730</td>
</tr>
<tr>
<td>Pūkele debris and detention basinb</td>
<td>810</td>
<td>310</td>
<td>14,330</td>
<td>677</td>
</tr>
<tr>
<td>Makiki debris and detention basinb</td>
<td>780</td>
<td>310</td>
<td>3,035</td>
<td>674</td>
</tr>
<tr>
<td>Ala Wai Canal floodwalls</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hausten Ditch detention basin</td>
<td>70</td>
<td>35</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Ala Wai Golf Course multi-purpose detention basin</td>
<td>70</td>
<td>70</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Flood warning system</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mitigation – Falls 7</td>
<td>50</td>
<td>5</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Mitigation – Falls 8</td>
<td>60</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,503</td>
<td>1,898</td>
<td>20,425</td>
<td>3,734</td>
</tr>
</tbody>
</table>
Table 20. Hydrologic Model Results for Peak Flow Discharge Values at Select Locations

A formatting error resulted in the inaccurate display of discharge frequencies in Table 20. The table has been corrected with the appropriate values from the analysis detailed in Appendix A.

<table>
<thead>
<tr>
<th>Stream Location</th>
<th>Annual Chance Exceedance (ACE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Makiki Stream (at confluence with Ala Wai Canal)</td>
<td>900</td>
</tr>
<tr>
<td>Mānoa Stream (at confluence with Pālolo Stream)</td>
<td>2,600</td>
</tr>
<tr>
<td>Pālolo Stream (at confluence with Mānoa Stream)</td>
<td>1,300</td>
</tr>
<tr>
<td>Ala Wai Canal (at mouth)</td>
<td>8,000</td>
</tr>
</tbody>
</table>

Table 21. Approximate Average Bankfull Channel Capacities and Annual Chance Exceedance (Existing Conditions)

A formatting error resulted in the inaccurate display of annual chance exceedance frequencies in Table 21. The table has been corrected with the appropriate values from the analysis detailed in Appendix A.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reach</th>
<th>Reach Designation</th>
<th>Average Bankfull Peak Discharge Capacity (ft³/s)</th>
<th>Annual Chance Exceedance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ala Wai</td>
<td>Lower</td>
<td>ALA 1</td>
<td>12,200</td>
<td>20</td>
</tr>
<tr>
<td>Ala Wai</td>
<td>Middle</td>
<td>ALA 2</td>
<td>6,900</td>
<td>20</td>
</tr>
<tr>
<td>Ala Wai</td>
<td>Upper</td>
<td>ALA 3</td>
<td>1,300</td>
<td>20</td>
</tr>
<tr>
<td>Kanahā</td>
<td>Ditch</td>
<td>KAH 1, KAH 2</td>
<td>350</td>
<td>50</td>
</tr>
<tr>
<td>Kanahā</td>
<td>Split</td>
<td>KAO 1</td>
<td>N/A</td>
<td>20</td>
</tr>
<tr>
<td>Makiki</td>
<td>Upper</td>
<td>MAK 3, MAK 4</td>
<td>1,200</td>
<td>5</td>
</tr>
<tr>
<td>Makiki</td>
<td>Lower</td>
<td>MAK 1, MAK 2</td>
<td>650</td>
<td>50</td>
</tr>
<tr>
<td>Mānoa</td>
<td>Main</td>
<td>MAN 1</td>
<td>4,300</td>
<td>20</td>
</tr>
<tr>
<td>Mānoa</td>
<td>Main</td>
<td>MAN 2</td>
<td>7,600</td>
<td>2</td>
</tr>
<tr>
<td>Mānoa</td>
<td>Main</td>
<td>MAN 3 to MAN 6</td>
<td>3,500</td>
<td>20</td>
</tr>
<tr>
<td>Mānoa</td>
<td>Main</td>
<td>MAN 7</td>
<td>5,400</td>
<td>2</td>
</tr>
<tr>
<td>Pālolo</td>
<td>Main</td>
<td>PAL 1, PAL 2</td>
<td>6,000</td>
<td>2</td>
</tr>
<tr>
<td>Pālolo</td>
<td>Main</td>
<td>PAL 3, PAL 4</td>
<td>3,400</td>
<td>10</td>
</tr>
<tr>
<td>Pālolo</td>
<td>Lower</td>
<td>MPC 1, MPC 2</td>
<td>15,400</td>
<td>2</td>
</tr>
<tr>
<td>Pūkele</td>
<td>Tributary</td>
<td>PUK 1</td>
<td>2,700</td>
<td>2</td>
</tr>
<tr>
<td>University</td>
<td>UH Split</td>
<td>UNI 1, UNI 2</td>
<td>N/A</td>
<td>10</td>
</tr>
<tr>
<td>Wai‘ōma‘o</td>
<td>Tributary</td>
<td>WAI 1</td>
<td>2,600</td>
<td>2</td>
</tr>
</tbody>
</table>
### Appendix D, Table 1. Summary of the Recommended Plan

Descriptions of the recommended plan were revised for consistency with Table ES-2.

<table>
<thead>
<tr>
<th>Flood Risk Management Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waihi Debris and Detention Basin</td>
<td>Earthen structure, approximately 42 feet high and 477 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. New access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Waiakeakua Debris and Detention Basin</td>
<td>Earthen structure, approximately 37 feet high and 401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert.</td>
</tr>
<tr>
<td>Woodlawn Ditch Detention Basin</td>
<td>Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side.</td>
</tr>
<tr>
<td>Mānoa In-stream Debris Catchment</td>
<td>Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
</tr>
<tr>
<td>Kanewai Field Multi-Purpose Detention Basin</td>
<td>Earthen berm, approximately 9 feet high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.</td>
</tr>
<tr>
<td>Wai‘ōma‘o Debris and Detention Basin</td>
<td>Earthen structure, approximately 34 feet high and 275 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,060 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Pūkele Debris and Detention Basin</td>
<td>Earthen structure, approximately 35 feet high and 82 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 14,330 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Makiki Debris and Detention Basin</td>
<td>Earthen structure, approximately 36 feet high and 100 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,035 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Hausten Ditch Detention Basin</td>
<td>Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Ala Wai Golf Course Multi-Purpose Detention Basin</td>
<td>Earthen berm, on average 2.7 feet high, around the north and east perimeter of the golf course; grouted rip rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.</td>
</tr>
<tr>
<td>Floodwarning System</td>
<td>Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.</td>
</tr>
</tbody>
</table>
# Appendix E3, Table 1. Flood Risk Management Measures and Associated Compensatory Measures in the Recommended Plan

Descriptions of the recommended plan were revised for consistency with Table ES-2.

<table>
<thead>
<tr>
<th>Flood Risk Management Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waihi Debris and Detention Basin</td>
<td>Earthen structure, approximately 42 feet high and 477 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. New access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Waiakeakua Debris and Detention Basin</td>
<td>Earthen structure, approximately 37 feet high and 401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert.</td>
</tr>
<tr>
<td>Woodlawn Ditch Detention Basin</td>
<td>Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side.</td>
</tr>
<tr>
<td>Mānoa In-stream Debris Catchment</td>
<td>Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.</td>
</tr>
<tr>
<td>Kanewai Field Multi-Purpose Detention Basin</td>
<td>Earthen berm, approximately 9 feet high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.</td>
</tr>
<tr>
<td>Waiʻōmaʻo Debris and Detention Basin</td>
<td>Earthen structure, approximately 34 feet high and 275 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,060 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pūkele Debris and Detention Basin</td>
<td>Earthen structure, approximately 35 feet high and 82 feet across; box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 14,330 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Makiki Debris and Detention Basin</td>
<td>Earthen structure, approximately 36 feet high and 100 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approximately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 3,035 yd³ to provide required detention volume upstream of berm; new access road to be constructed for construction and O&amp;M.</td>
</tr>
<tr>
<td>Ala Wai Canal Floodwalls</td>
<td>Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Hausten Ditch Detention Basin</td>
<td>Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.</td>
</tr>
<tr>
<td>Ala Wai Golf Course Multi-Purpose Detention Basin</td>
<td>Earthen berm, on average 2.7 feet high, around the north and east perimeter of the golf course; grouted rip rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.</td>
</tr>
<tr>
<td>Floodwarning System</td>
<td>Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.</td>
</tr>
<tr>
<td>Compensatory mitigation measures (Falls 7 and 8)</td>
<td>Removal of passage barrier at two separate in-stream structures. Each of the structures currently has an overhanging lip, such that the stream flow over these structures is free-falling and does not maintain contact with the surface of the structure, creating a barrier to upstream passage for native species. The proposed mitigation involves installation of grouted stones as part of the existing in-stream structure to provide a suitable surface for migration of the native species to upstream habitat.</td>
</tr>
</tbody>
</table>
Appendix E3, Table 3. General Description of Construction-Related Excavation and Placement of Fill within Waters of the U.S.

Data displayed in Table 3 of Appendix E3 neglected to include a summary of fill volumes constituting jurisdictional impacts to Waters of the U.S. The table below has been updated to accurately reflect the impacts of excavation and fill in jurisdictional areas and is consistent with Table 19 (above).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Component of Measure</th>
<th>Excavated Material</th>
<th>Fill Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>Waihi debris and detention basin</td>
<td>Culvert</td>
<td>Concrete box, 12’x6’</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Detention berm</td>
<td>Compacted fill Grouted rip-rap</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>Scour Protection</td>
<td>Stone rip-rap</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Debris catchment feature</td>
<td>Concrete footing</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel posts (8” dia.)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Access road</td>
<td>Base course (gravel)</td>
<td>2</td>
</tr>
<tr>
<td>Waiakeakua debris and detention basin</td>
<td>Culvert</td>
<td>Concrete footing</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Detention berm</td>
<td>Compacted fill Grouted rip-rap</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td>Debris catchment feature</td>
<td>Concrete footing</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel posts (8” dia.)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Scour Protection</td>
<td>Stone rip-rap</td>
<td>500</td>
</tr>
<tr>
<td>Woodlawn Ditch detention basin</td>
<td>Culvert</td>
<td>Concrete footing</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Detention berm</td>
<td>Compacted fill Grouted rip-rap</td>
<td>3</td>
</tr>
<tr>
<td>Manoa in-stream debris catchment</td>
<td>Debris catchment feature</td>
<td>Concrete footing</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel posts (8” dia.)</td>
<td>14</td>
</tr>
<tr>
<td>Kanewai Field multi-purpose detention basin</td>
<td>Spillway</td>
<td>Grouted rip-rap</td>
<td>41</td>
</tr>
<tr>
<td>Waiomao debris and detention basin</td>
<td>Culvert</td>
<td>Concrete box, 12’x6’</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>Detention berm</td>
<td>Compacted fill Grouted rip-rap</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>Scour Protection</td>
<td>Stone rip-rap</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Debris catchment feature</td>
<td>Concrete footing</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel posts (8” dia.)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Access road</td>
<td>Base course (gravel)</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Detention Basin</td>
<td>Excavation</td>
<td>3,060</td>
</tr>
<tr>
<td>Measure</td>
<td>Component of Measure</td>
<td>Excavated Material</td>
<td>Fill Material</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>---------------</td>
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<tr>
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**Narrative Revisions**

The following revision (strikethrough/bold insert) is required to achieve consistency between the narrative of the report with the Clean Water Act Section 404(b)(1) evaluation included in Appendix E3:

“The project would involve placement of approximately 4,234 3,734 yd$^3$ of fill material in jurisdictional Waters of the U.S.; in addition, excavation would also be required for construction of one three of the in-stream detention basins, as well as for routine maintenance (removal of debris and sediment).”

(Section 8.1, par. 5, page 8-1).

**Amendments**

The Record of Decision (ROD) regarding the EIS was signed by the Assistant Secretary of the Army (Civil Works) on 13 September 2018. The signed ROD has been inserted into Appendix E.