ALA WAI CANAL FLOOD RISK MANAGEMENT STUDY
O'AHU, HAWAI'I

FINAL FEASIBILITY STUDY REPORT WITH INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

APPENDIX I
DESIGN DRAWINGS

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WAIHI DEBRIS AND DETENTION BASIN

WAIAKEAKUA DEBRIS AND DETENTION BASIN

WOODLAWN DITCH DETENTION

MAKIKI DEBRIS AND DETENTION BASIN

MANOA IN-STREAM DEBRIS CATCHMENT

PUKELE DEBRIS AND DETENTION BASIN

WAIOMAO DEBRIS AND DETENTION BASIN

KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN

HAUSTEN DITCH DETENTION

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION

ALA WAI CANAL FLOODWALLS

Kanaha Stream
Makiki Stream
Waiakeakua Stream
Waiomao Stream
Manoa Stream
Palolo Stream
ALA WAI CANAL
H-1

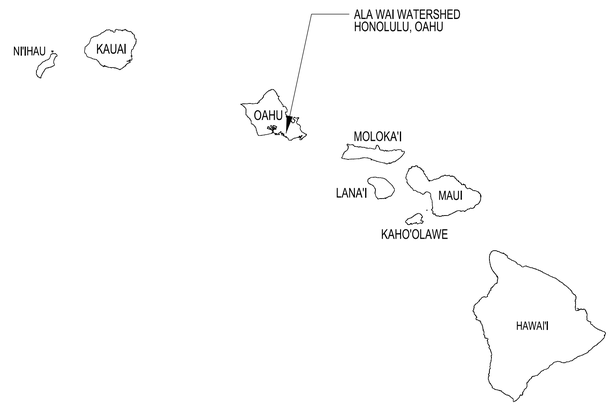
N

SITE LOCATIONS
NOT TO SCALE

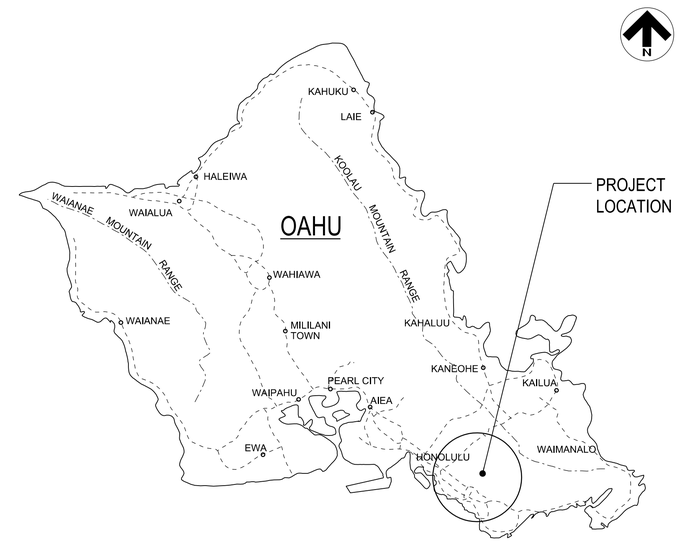
ALA WAI CANAL PROJECT

HONOLULU, OAHU, HI

PROJECT TITLE



VICINITY MAP
NOT TO SCALE



PROJECT LOCATION
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ALA WAI CANAL PROJECT

SITE LOCATIONS
PROJECT LOCATION & VICINITY MAP

SHEET IDENTIFICATION
G-001
SHEET 1 OF 31

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ALA WAI CANAL PROJECT
INDEX TO DRAWINGS

SHT. NO	SHT. REF. NO.	DESCRIPTION
1	G-001	SITE LOCATIONS, PROJECT LOCATION AND VICINITY MAP
2	G-002	INDEX TO DRAWINGS
3	C-101	ALA WAI CANAL FLOODWALLS, SITE PLAN
4	C-102	HAUSTEN DITCH DETENTION, SITE PLAN
5	C-103	ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION, PLAN
6	C-104	ALA WAI UPPER LEFT BANK PLAN
7	C-105	ALA WAI UPPER END PLAN
8	C-106	KALAKAUA AVE AND ALA WAI BLVD PLAN
9	C-107	ALA WAI CANAL AND MCCULLY ST PLAN
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15	C-309	ALA WAI CANAL MIDDLE AND LOWER RIGHT BANK, PROFILE AND SECTION
16	C-310	ALA WAI CANAL MIDDLE AND LOWER LEFT BANK, PROFILE AND SECTION
17	C-311	ALA WAI CANAL UPPER LEFT BANK, PROFILE
18	C-313	PUKELE DEBRIS AND DETENTION BASIN, PLAN AND SECTIONS
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20	C-316	HAUSTEN DITCH DETENTION FLOODWALLS AND BERM, PROFILE AND SECTIONS
21	C-317	ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION, PROFILE AND SECTION
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29	A-102	PUMP STATION 2 - FLOOR PLAN
30	A-301	PUMP STATION 1 - SECTIONS
31	A-302	PUMP STATION 2 - SECTIONS

GENERAL NOTES:

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN ON THESE PLANS. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND ADJUST WORK PLAN ACCORDINGLY PRIOR TO BEGINNING CONSTRUCTION.
2. COORDINATE SYSTEM: NAD 1983 (HARN), HAWAII ZONE 3 (US FEET)
3. PROVIDE FENCING TO MAINTAIN SECURITY AND SAFETY AT ALL TIMES.
4. UNLESS SHOWN OTHERWISE, ALL DISTURBED AREAS NOT RECEIVING A HARD SURFACE SHALL BE COVERED WITH GRASS.
5. CONTRACTOR SHALL SUBMIT A COMPLETE SOIL EROSION CONTROL PLAN FOR REGULATORY APPROVAL. CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MAINTAINING EROSION CONTROL DEVICES DURING CONSTRUCTION. CONTRACTOR SHALL TAKE ALL OTHER MEASURES TO POSITIVELY PRECLUDE EROSION MATERIALS FROM LEAVING THE SITE.
6. EXISTING UNDERGROUND UTILITIES OBTAINED FROM AS-BUILTS AND FROM FIELD SURVEYS. CONTRACTOR SHALL POTHOLE AND FIELD VERIFY DEPTH AND LOCATION PRIOR TO EXCAVATION AND PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION.
7. THE CONTRACTOR SHALL VERIFY AND CHECK ALL DIMENSIONS AND DETAILS SHOWN ON THE DRAWINGS PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCY SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER FOR CLARIFICATION BEFORE PROCEEDING WITH CONSTRUCTION.
8. THERE WILL BE A FLOODWARNING SYSTEM INSTALLED FOR THIS PROJECT.
9. ANY ITEMS OF HISTORICAL OR ARCHEOLOGICAL VALUE OBSERVED DURING CONSTRUCTION ACTIVITIES SHALL BE REPORTED IMMEDIATELY TO THE CONTRACTING OFFICER, AND THE CONTRACTOR SHALL CEASE ALL ACTIVITIES THAT MAY RESULT IN THE DESTRUCTION OF SUCH RESOURCES IN ACCORDANCE WITH THE SPECIAL CONTRACT REQUIREMENTS.
10. PROVIDE PERMANENT FENCING AROUND DETENTION BASIN MEASURES TO PROVIDE SECURITY AND SAFETY.

GENERAL ABBREVIATIONS

A.C.	ASHPALT CONCRETE
AVE	AVENUE
BLVD	BOULEVARD
CONC	CONCRETE
DIA	DIAMETER
EL	ELEVATION
EXIST	EXISTING
FT	FOOT, FEET
IN	INCH, INCHES
INV	INVERT
LB	LEFT BANK
MAX	MAXIMUM
MSL	MEAN SEA LEVEL
NTS	NOT TO SCALE
o.c.	ON CENTER
O&M	OPERATIONS AND MAINTENANCE
PL	PLACE
RB	RIGHT BANK
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
SQ	SQUARE
ST	STREET
STA	STATION
THK	THICK
TMK	TAX MAP KEY
TYP	TYPICAL
W.S.	WATER SURFACE
YR	YEAR

SYMBOLS

&	AND
@	AT
℄	CENTER LINE
'	FOOT, FEET
"	INCH, INCHES

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ALA WAI CANAL PROJECT

INDEX OF DRAWINGS, GENERAL NOTES
ABBREVIATIONS & SYMBOLS

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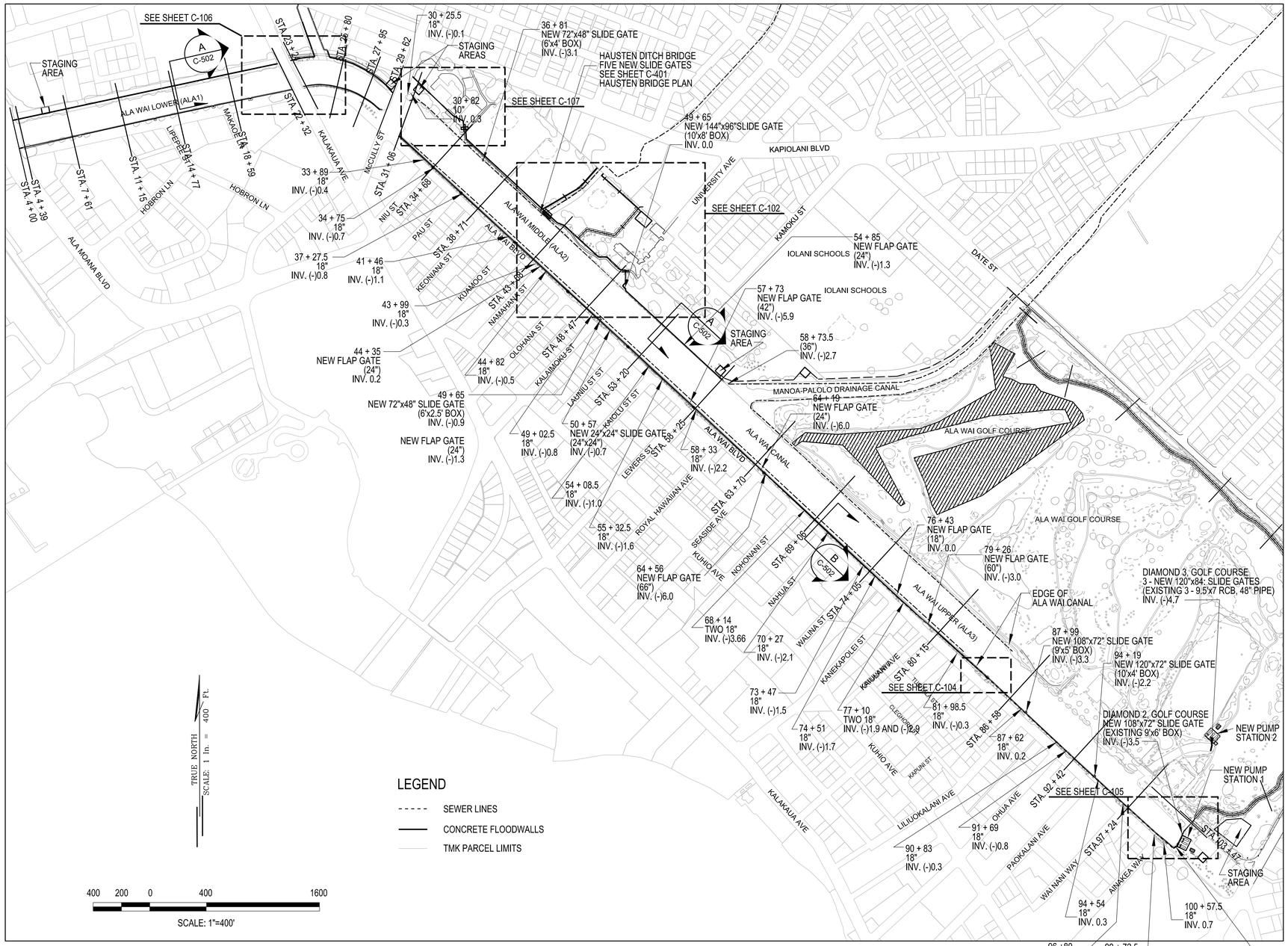
G-002
SHEET 2 OF 31



LEGEND

- SEWER LINES
- CONCRETE FLOODWALLS
- TMK PARCEL LIMITS

SITE PLAN
ALA WAI CANAL FLOODWALLS

ALA WAI CANAL INTERIOR DRAINAGE TABLE

CULVERT NAME	STATION	SIZE & TYPE	NOTES
DIAMOND 2, GOLF COURSE	102+45.5	108"x72" SLIDE GATE	PUMP STATION 1
DIAMOND 1, ALA WAI BLVD	101+75	144"x96" SLIDE GATE	
DIAMOND 3, GOLF COURSE	96+67	3 - 120"x84" SLIDE GATES	PUMP STATION 2
100+57.5	100+57.5	18" FLAP GATE	INV. 0.7
99+72.5	99+72.5	18" FLAP GATE	INV. 0.6
96+80	96+80	18" FLAP GATE	INV. (-)0.3
94+54	94+54	18" FLAP GATE	INV. 0.3
94+19	94+19	120"x72" SLIDE GATE	INV. (-)2.2
91+69	91+69	18" FLAP GATE	INV. (-)0.8
90+83	90+83	18" FLAP GATE	INV. (-)0.3
87+99	87+99	108"x72" SLIDE GATE	INV. (-)3.3
87+62	87+62	18" FLAP GATE	INV. 0.2
81+98.5	81+98.5	18" FLAP GATE	INV. (-)0.3
79+26	79+26	60" FLAP GATE	INV. (-)3.0
77+10	77+10	TWO 18" FLAP GATES	INV. (-)1.9 AND (-)2.9
76+43	76+43	18" FLAP GATE	INV. 0.0
74+51	74+51	18" FLAP GATE	INV. (-)1.7
73+47	73+47	18" FLAP GATE	INV. (-)1.5
70+27	70+27	18" FLAP GATE	INV. (-)2.1
68+14	68+14	TWO 18" FLAP GATES	INV. (-)3.7
64+56	64+56	66" FLAP GATE	INV. (-)6.0
64+19	64+19	24" FLAP GATE	INV. (-)6.0
58+73.5, RB	58+73.5	36" FLAP GATE	INV. (-)2.7
58+33	58+33	18" FLAP GATE	INV. (-)2.2
57+73	57+73	42" FLAP GATE	INV. (-)5.9
55+32.5	55+32.5	18" FLAP GATE	INV. (-)5.6
54+08.5	54+08.5	18" FLAP GATE	INV. (-)1.0
54+85, RB	54+85	24" FLAP GATE	INV. (-)1.3
50+57	50+57	24"x24" SLIDE GATE	INV. (-)0.7
49+65, RB	49+65	144"x96" SLIDE GATE	INV. 0.0, PUMP STATION 3
49+65	49+65	72"x48" SLIDE GATE & 24" FLAP GATE	INV. (-)1.3 & (-)0.9
49+02.5	49+02.5	18" FLAP GATE	INV. (-)0.8
44+82	44+82	18" FLAP GATE	INV. (-)0.5
44+35	44+35	24" FLAP GATE	INV. 0.2
43+99	43+99	18" FLAP GATE	INV. (-)0.3
HAUSTEN DITCH BRIDGE	42+10	4 - SLIDE GATES	SEE SHEET C-401
41+46	41+46	18" FLAP GATE	INV. (-)1.1
37+27.5	37+27.5	18" FLAP GATE	INV. (-)0.8
36+81, RB	36+81	72"x48" SLIDE GATE	INV. (-)3.1
34+75	34+75	18" FLAP GATE	INV. (-)0.7
33+89	33+89	18" FLAP GATE	INV. (-)0.4
30+82, RB	30+82	10" FLAP GATE	INV. 0.3
30+25.5, RB	30+25.5	18" FLAP GATE	INV. (-)0.1

NOTES:

1. SEE SHEET C-309 FOR THE RIGHT BANK (MOUNTAIN SIDE) PROFILE OF ALA WAI MIDDLE (ALA2) AND ALA WAI LOWER (ALA1).
2. SEE SHEET C-310 FOR THE LEFT BANK (OCEAN SIDE) PROFILE OF ALA WAI MIDDLE (ALA2) AND ALA WAI LOWER (ALA1).
3. SEE SHEET C-311 FOR THE LEFT BANK (OCEAN SIDE) PROFILE OF ALA WAI UPPER (ALA3).
3. SEE SHEET C-103 FOR ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN.

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ALA WAI CANAL PROJECT

ALA WAI LOWER, MIDDLE & UPPER FLOODWALLS
SITE PLAN

SHEET IDENTIFICATION
C-101
SHEET 3 OF 31

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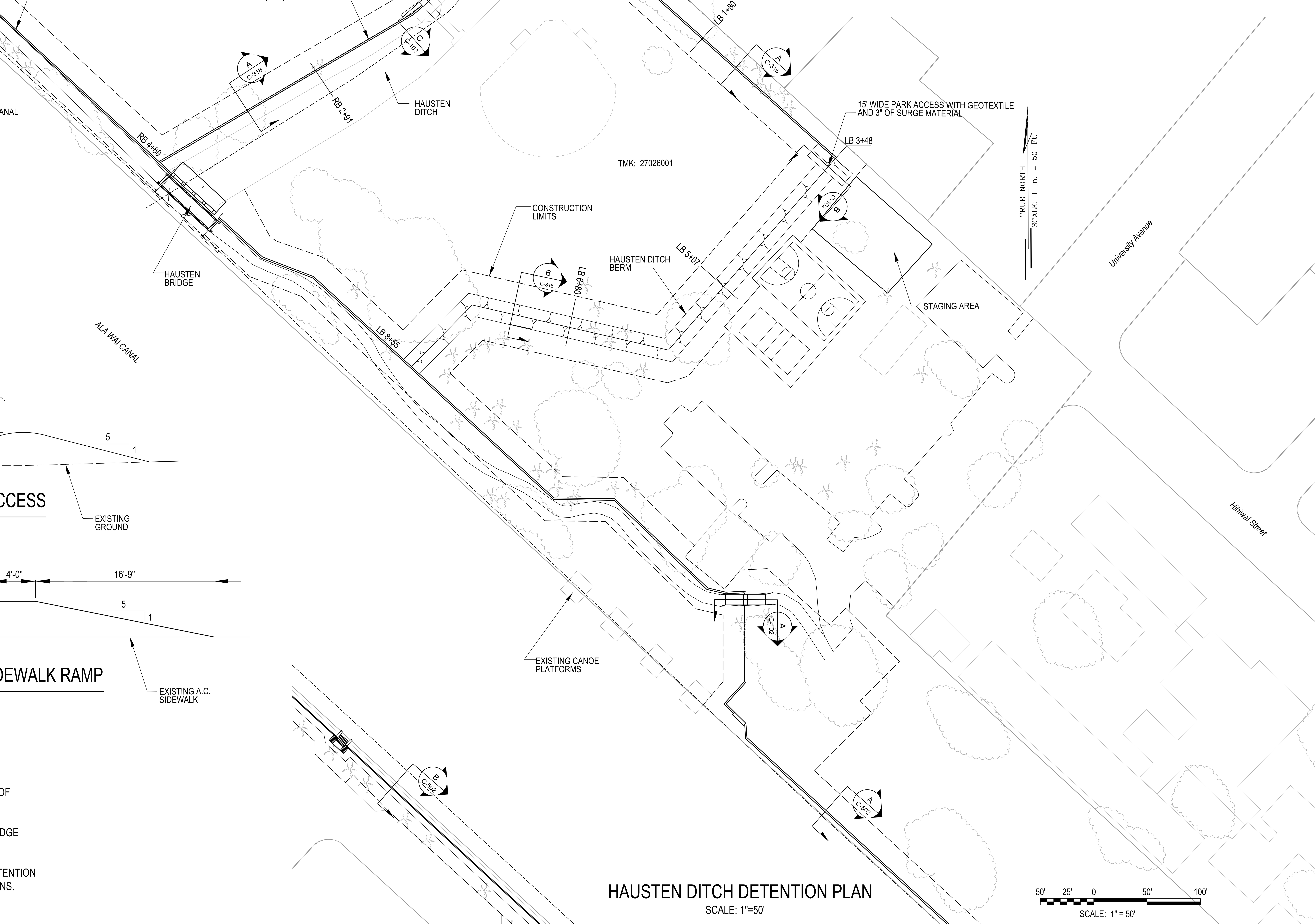

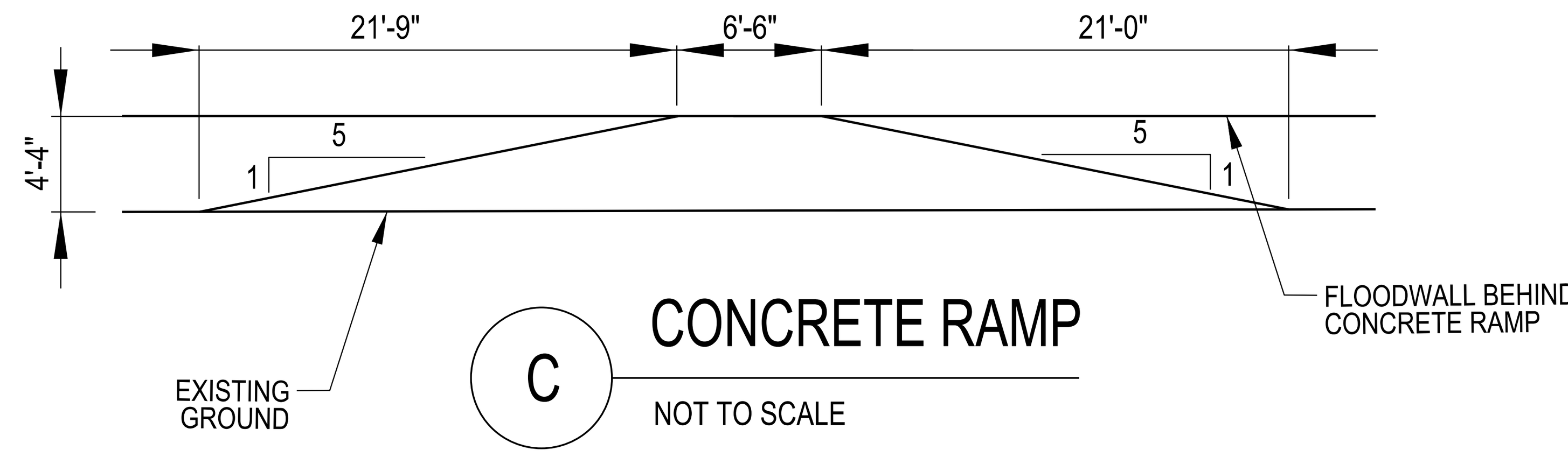

C **CONCRETE RAMP**
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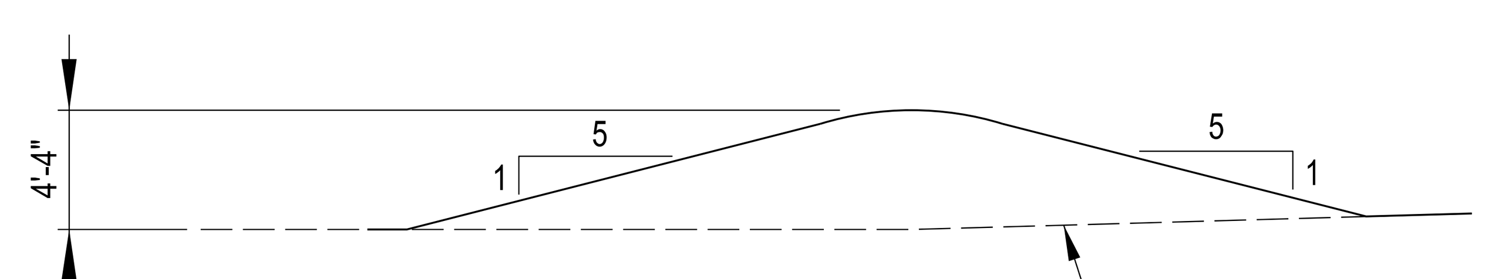
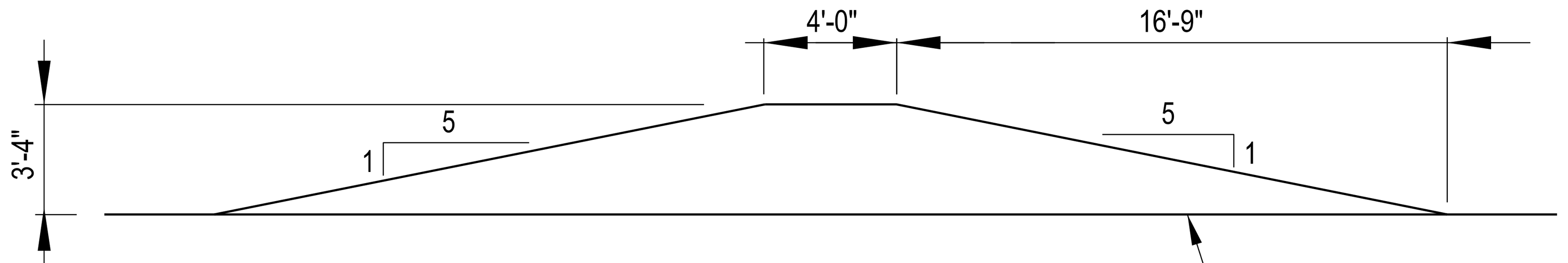


B **PARK ACCESS**
NOT TO SCALE



A **NEW SIDEWALK RAMP**
SCALE: 1"=5'

NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-401 FOR THE HAUSTEN DITCH BRIDGE NEW CONRETE WALL PLAN.
3. SEE SHEET C-316 FOR THE HAUSTEN DITCH DETENTION FLOODWALLS AND BERM, PROFILE AND SECTIONS.

HAUSTEN DITCH DETENTION PLAN
SCALE: 1"=50'

50' 25' 0 50' 100'
SCALE: 1" = 50'

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ALA WAI CANAL PROJECT

HAUSTEN DITCH DETENTION PLAN

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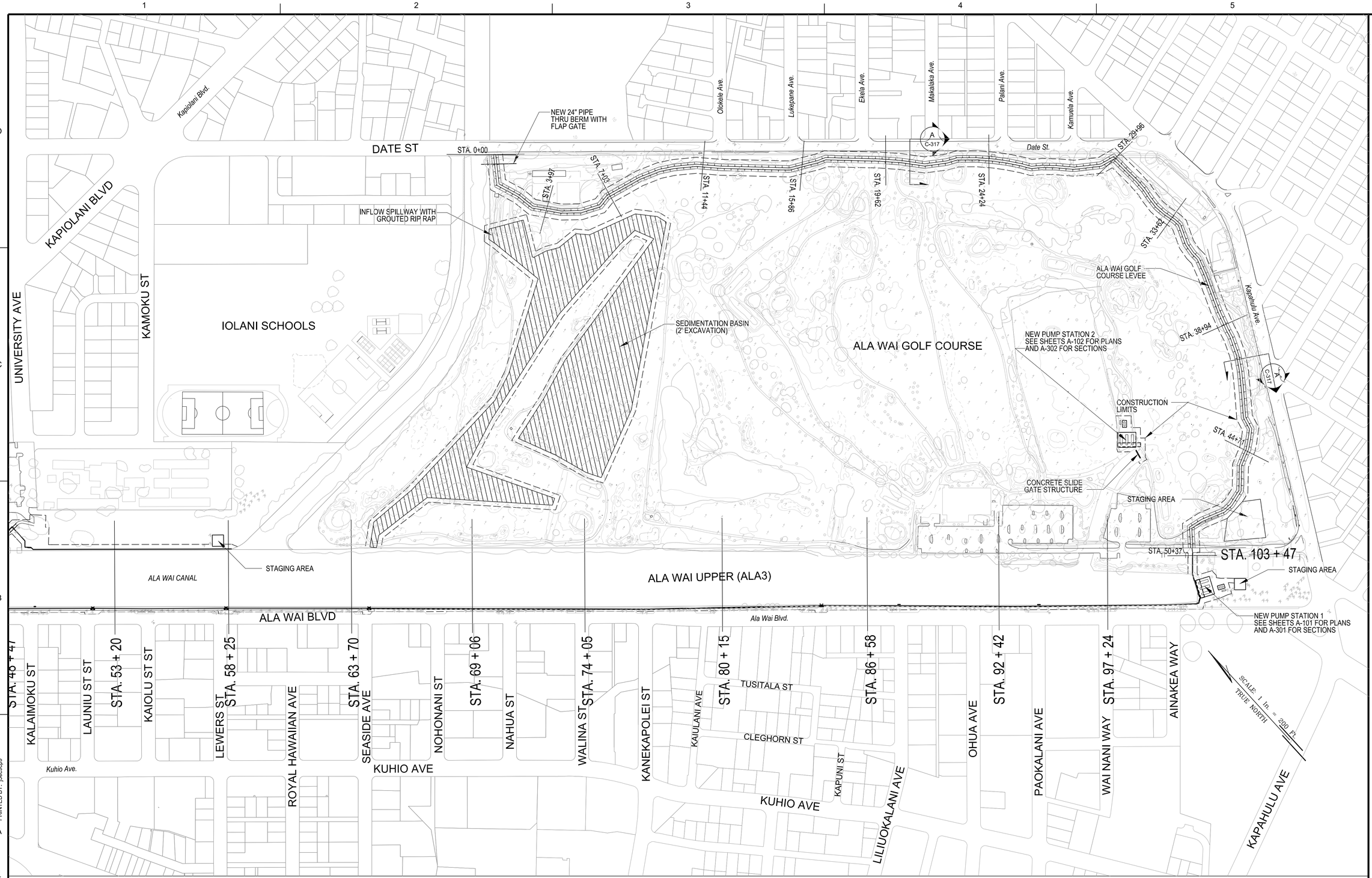
C-102
SHEET 4 OF 31



NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-317 FOR THE ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION, PROFILE AND SECTION.

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN

SCALE: 1"=200'

200' 100' 0 200' 400'

SCALE: 1" = 200'

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DRAWING NUMBER:

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ALA WAI CANAL PROJECT

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN

SHEET IDENTIFICATION
C-103
SHEET 5 OF 31

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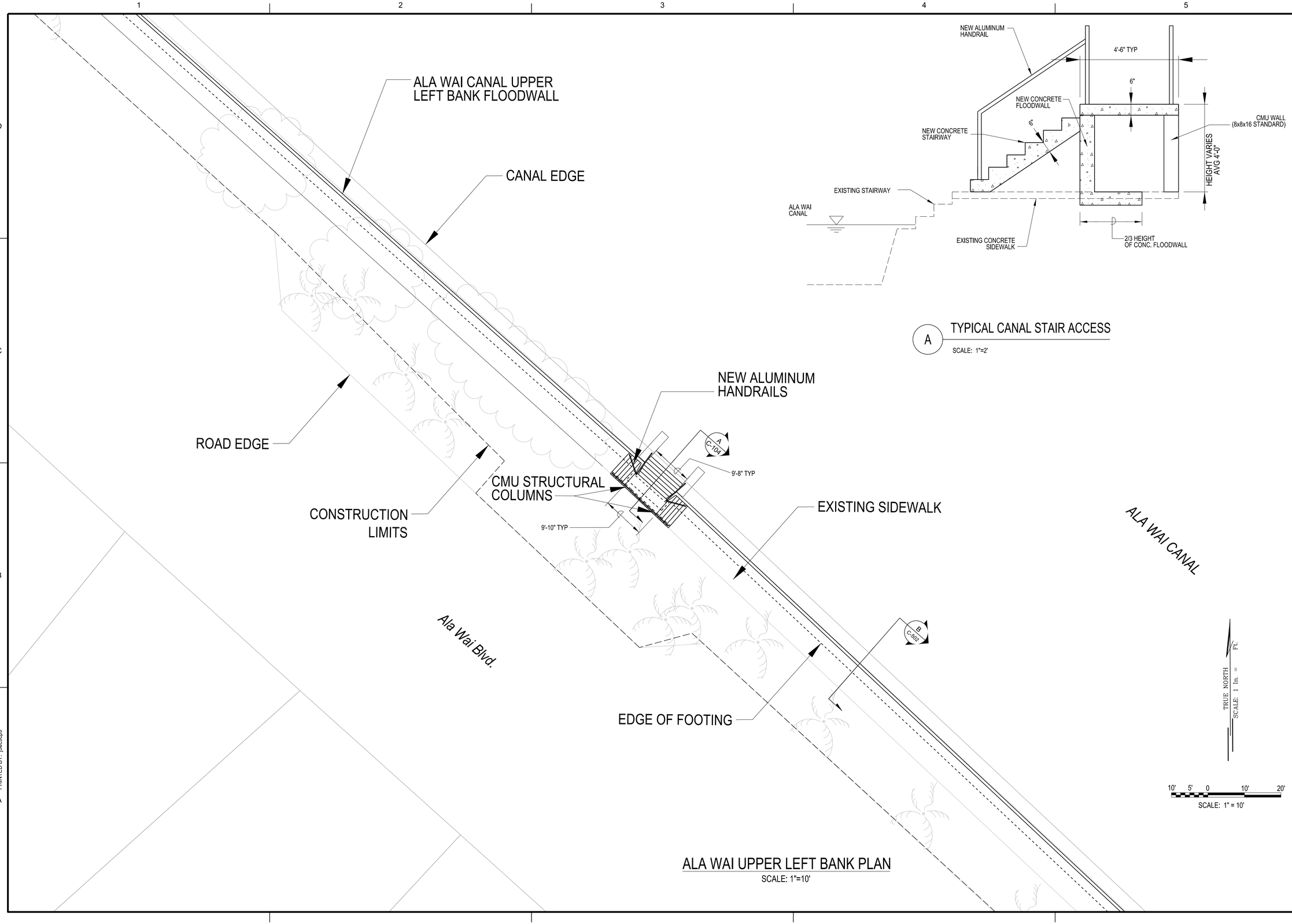

ALA WAI UPPER LEFT BANK PLAN
SCALE: 1"=10'

A TYPICAL CANAL STAIR ACCESS
SCALE: 1"=2'

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ALA WAI CANAL PROJECT

ALA WAI UPPER LEFT BANK PLAN

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SHEET 6 OF 31

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ALA WAI CANAL

EXISTING SIDEWALK

B
C-502

ALA WAI CANAL UPPER
LEFT BANK FLOODWALL

CANAL EDGE

ROAD EDGE

NEW FLOODGATE

A
C-317

CONSTRUCTION
LIMITS

Ala Wai Golf Course Rd.

CONCRETE SLIDE GATE
STRUCTURES

Ala Wai Blvd.

NEW PUMP STATION 1
SEE SHEETS A-101 FOR PLAN
AND A-301 FOR SECTIONS

STAGING AREA

Ainakea Way

TRUE NORTH
SCALE: 1 in. = 50 FT.

NOTES:

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

ALA WAI UPPER END PLAN
SCALE: 1"=20'

20' 10' 0 20' 40'
SCALE: 1" = 20'

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ALA WAI CANAL PROJECT

ALA WAI UPPER END PLAN

SHEET IDENTIFICATION
C-105
SHEET 7 OF 31

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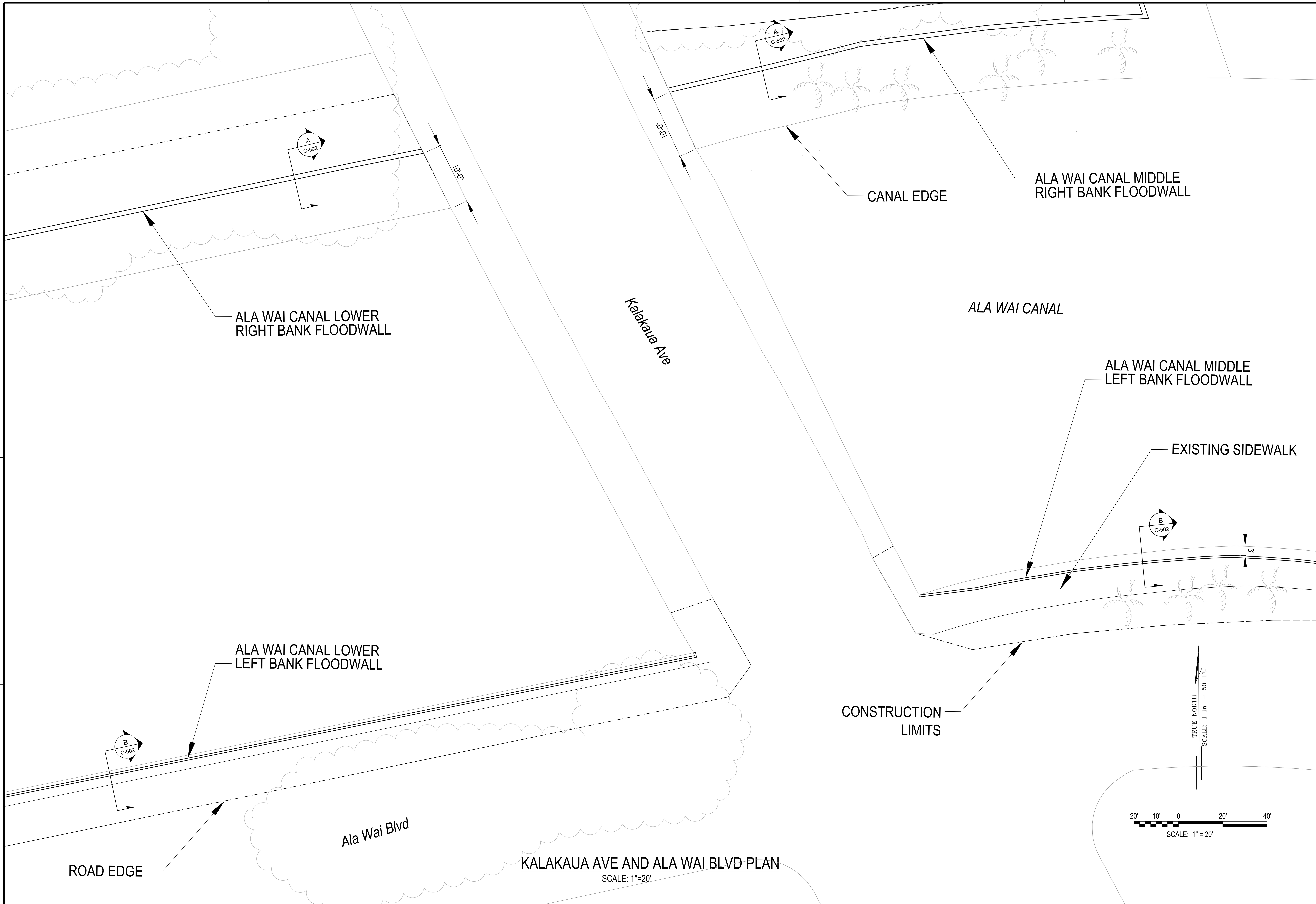

KALAKAUA AVE AND ALA WAI BLVD PLAN

SCALE: 1"=20'

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US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

KALAKAUA AVE AND ALA WAI BLVD PLAN

SHEET IDENTIFICATION
C-106
SHEET 8 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\KALAKAUA AVE AND ALA WAI BLVD PLAN
MODEL NAME: C-106
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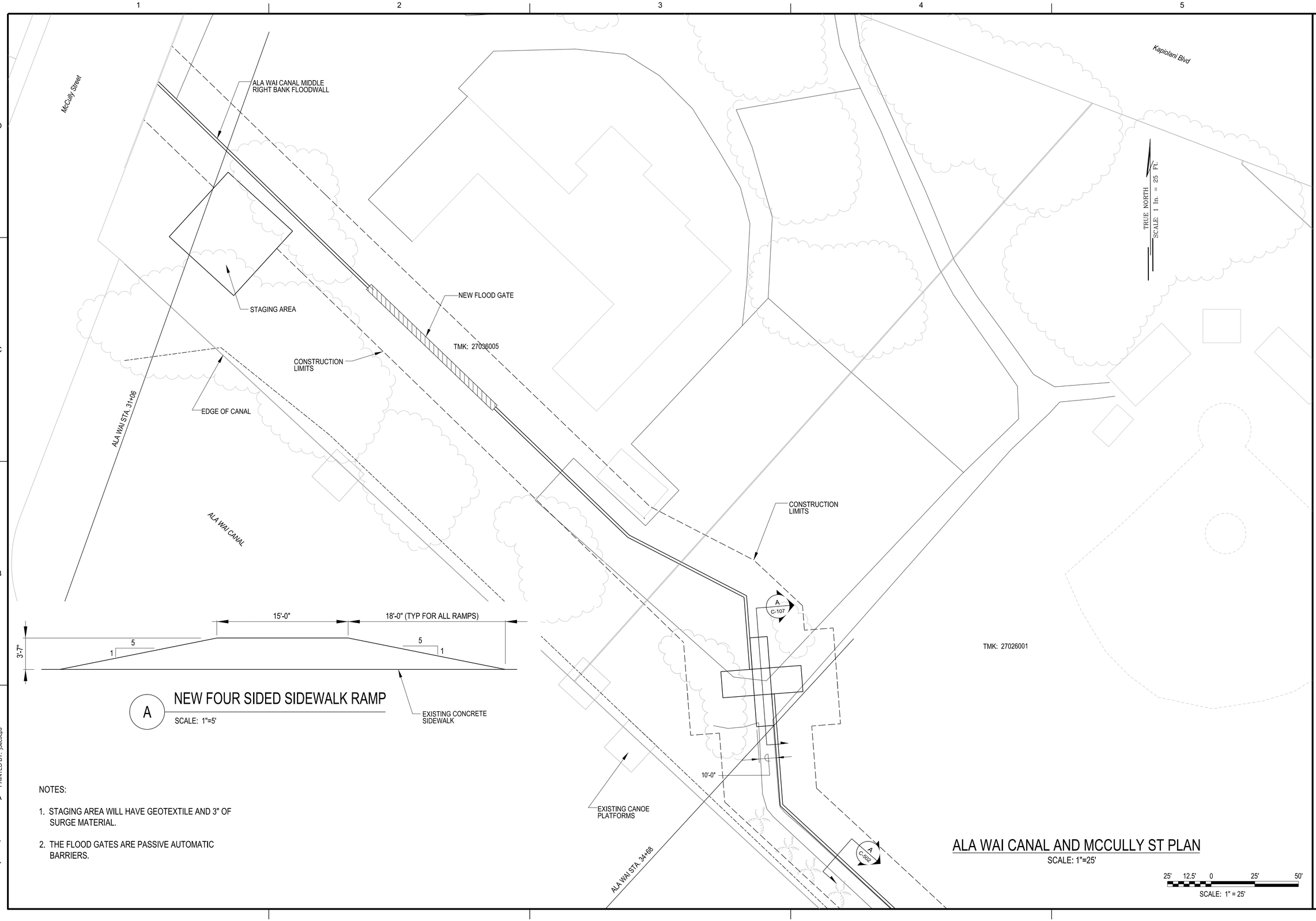

NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. THE FLOOD GATES ARE PASSIVE AUTOMATIC BARRIERS.

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JPH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE:
SIZE: ANSI D
CHECKED BY:
PLOT DATE:
FILE NAME: ALA WAI CANAL AND MCCULLY ST PLAN
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

ALA WAI CANAL AND MCCULLY ST PLAN

SHEET IDENTIFICATION
C-107
SHEET 9 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\ALA WAI CANAL AND MCCULLY ST PLAN
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DATE & TIME: 8/30/2016 9:59:19 AM
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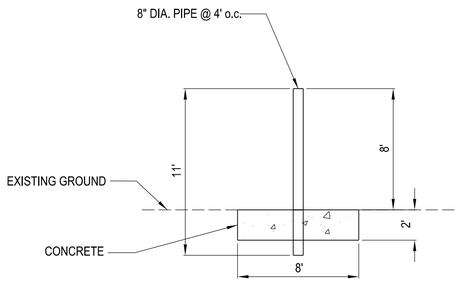
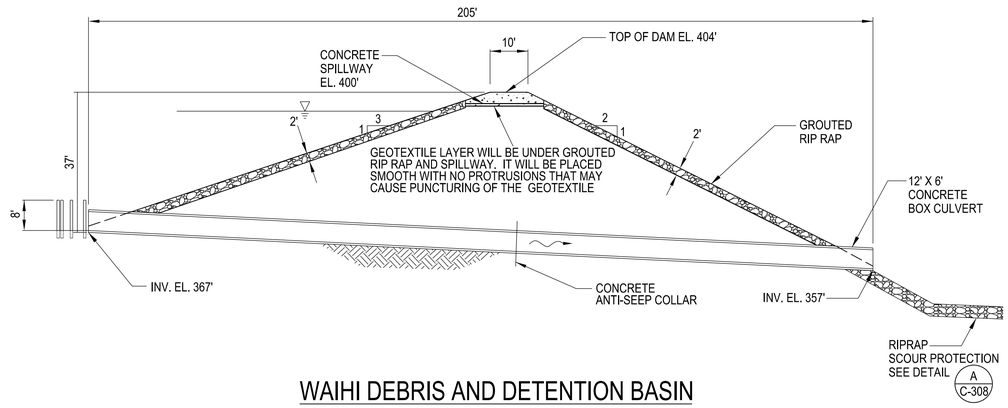
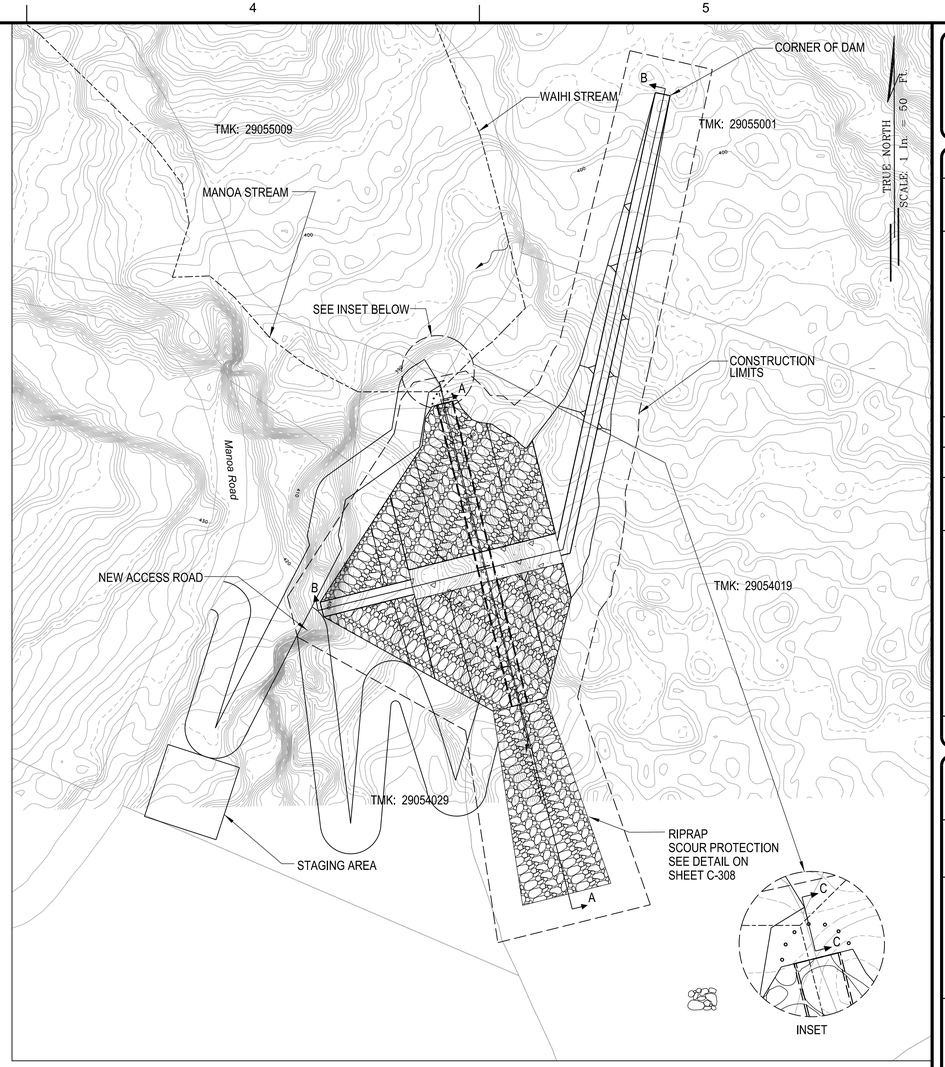
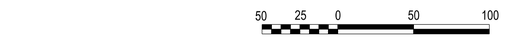


WAIHI DEBRIS AND DETENTION BASIN
SECTION C-C
SCALE: 1"=5'

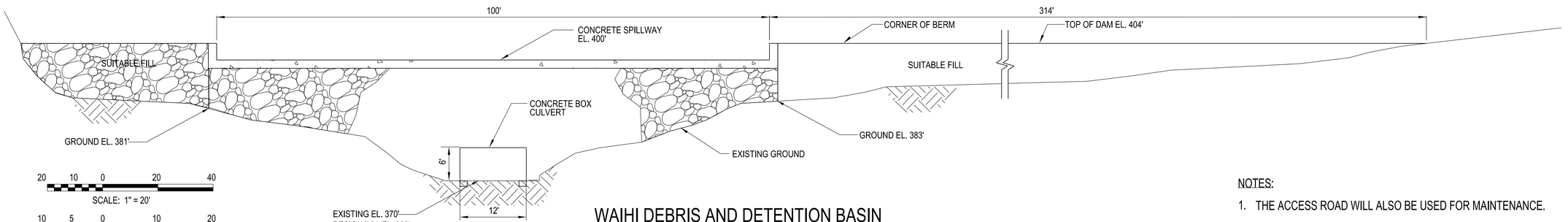


WAIHI DEBRIS AND DETENTION BASIN
SECTION A-A
SCALE: 1"=20'





PLAN
SCALE: 1"=50'



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

NOTES:

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

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Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
SUBMITTED BY:	
PLOT SCALE: AS SHOWN	PLOT DATE:
SIZE: ANSI D	FILE NAME: Ala_Wai_C-301xxx
DATE:	REVISION:
SOLICIT. / CONTRACT NO.:	
LOCATION CODE	
DRAWING NUMBER:	

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

WAIHI DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-301
SHEET 10 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil!Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-301xxx
MODEL NAME: C-301
DATE & TIME: 8/30/2016 10:27:53 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d01151949\PDF-AECv3.pltcfg
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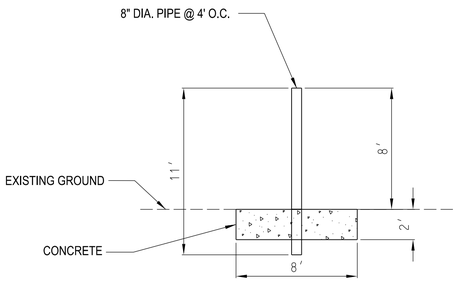
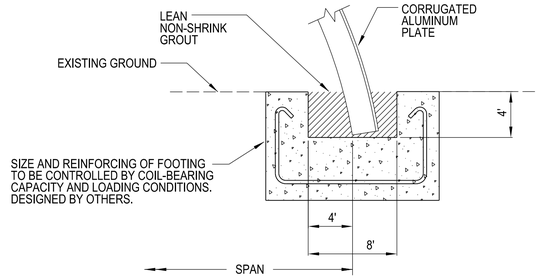
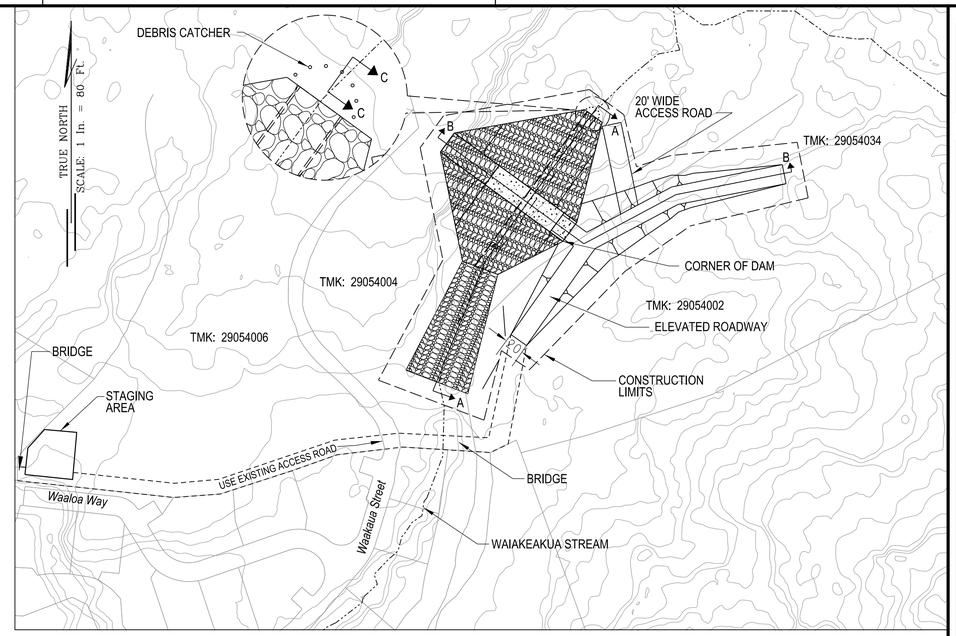
PRINTED BY: j3ec9cp9



WAIAKEAKUA DEBRIS AND DETENTION BASIN
SECTION C-C
SCALE: 1"=5'



SLOTTED CONCRETE FOOTING
WAIAKEAKUA DEBRIS AND DETENTION BASIN
SECTION D-D
SCALE: NTS



PLAN
SCALE: 1"=80'

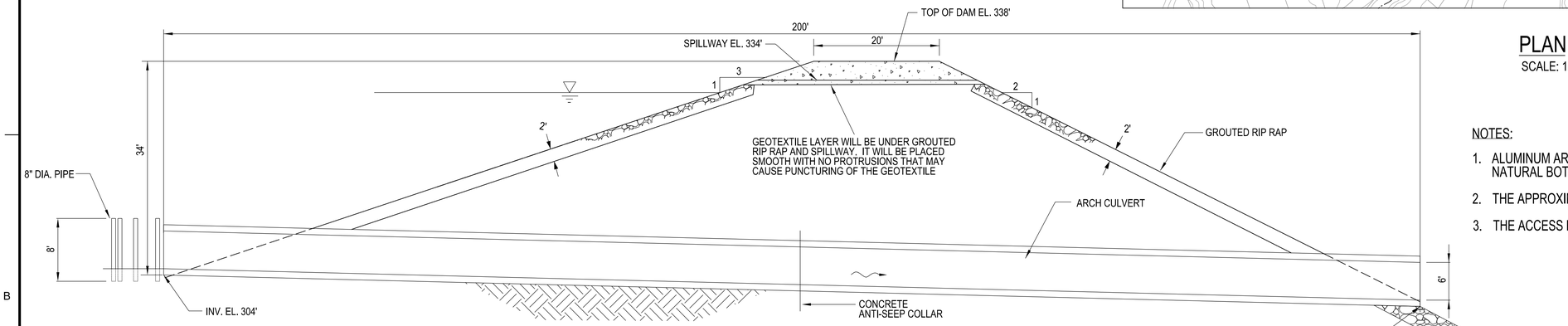
SOLID LINE = 5' CONTOURS

80 40 0 80 160

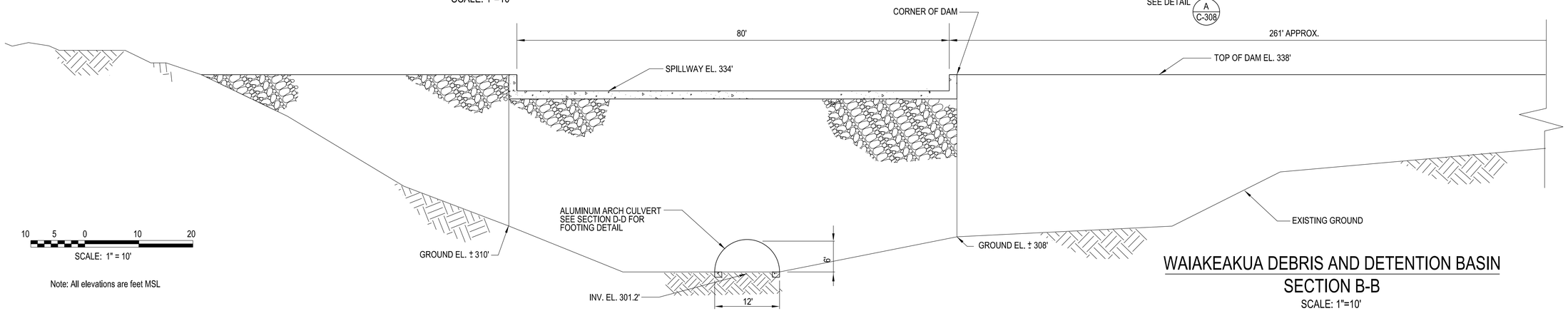
SCALE: 1" = 80'

NOTES:

1. ALUMINUM ARCH CULVERT METAL THICHNESS 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.



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



10 5 0 10 20

SCALE: 1" = 10'

Note: All elevations are feet MSL

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

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Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH	DATE:
DRAWN BY:	CHECKED BY:
SUBMITTED BY:	
PLOT SCALE: 1:1	PLOT DATE: 8/30/2016
SIZE: ANSI D	FILE NAME: Ala_Wai_C-302xxx

REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

WAIAKEAKUA DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-302
SHEET 11 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil!Documents11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-302xxx
MODEL NAME: C-302
DATE & TIME: 8/30/2016 10:30:01 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d0115194\PDT-AECv3.pltcfg
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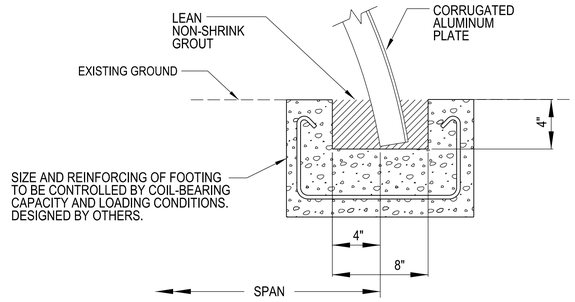
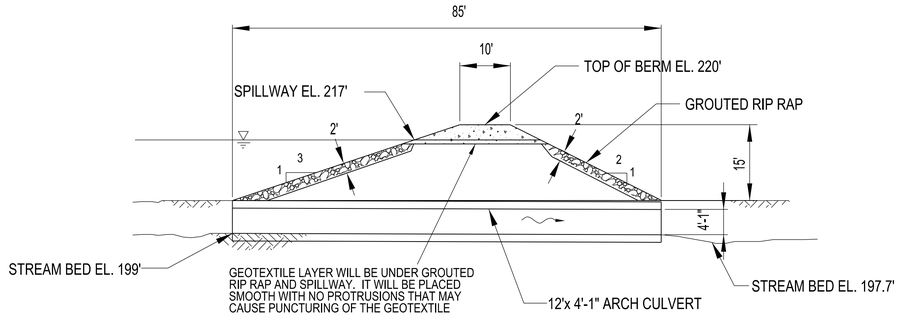
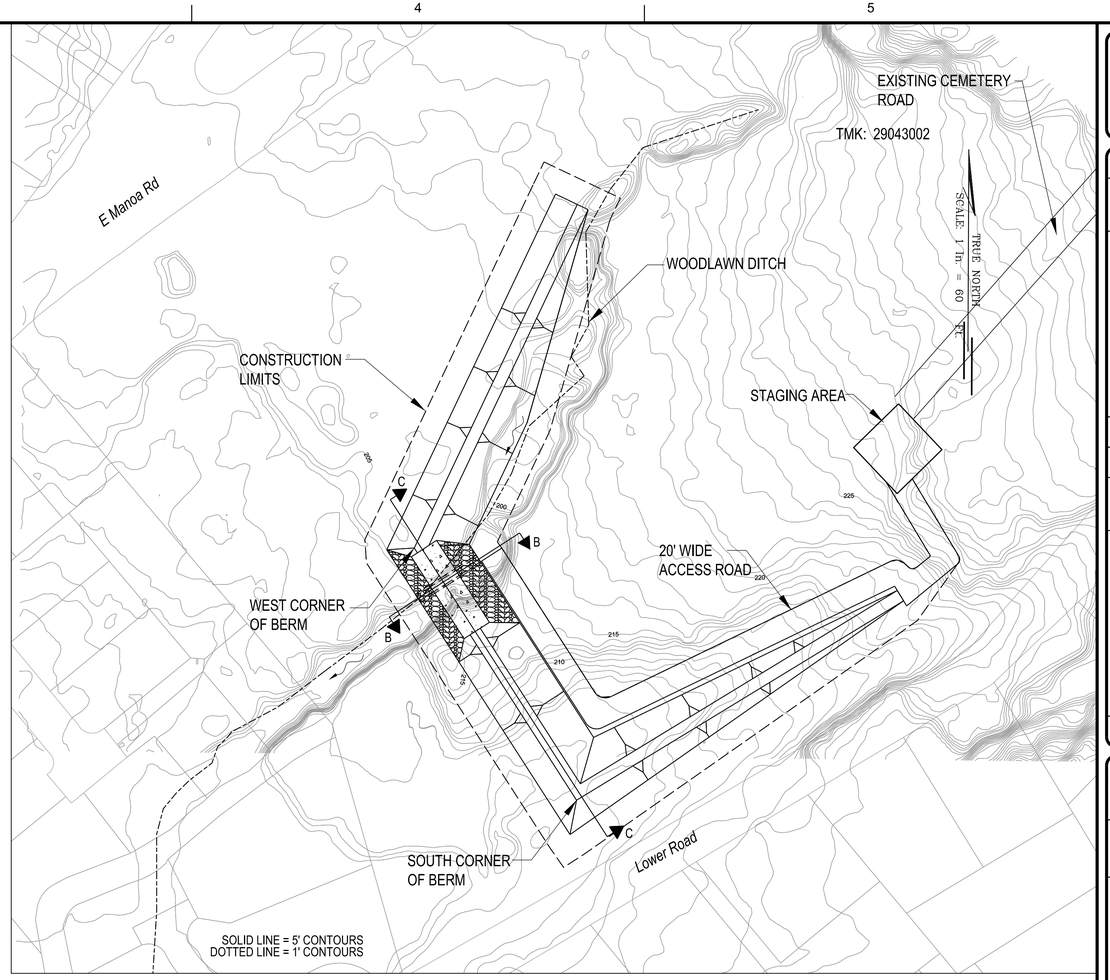
PRINTED BY: j3ec9cp9



SLOTTED CONCRETE FOOTING
WOODLAWN DITCH DETENTION BASIN
SECTION D-D
SCALE: NTS

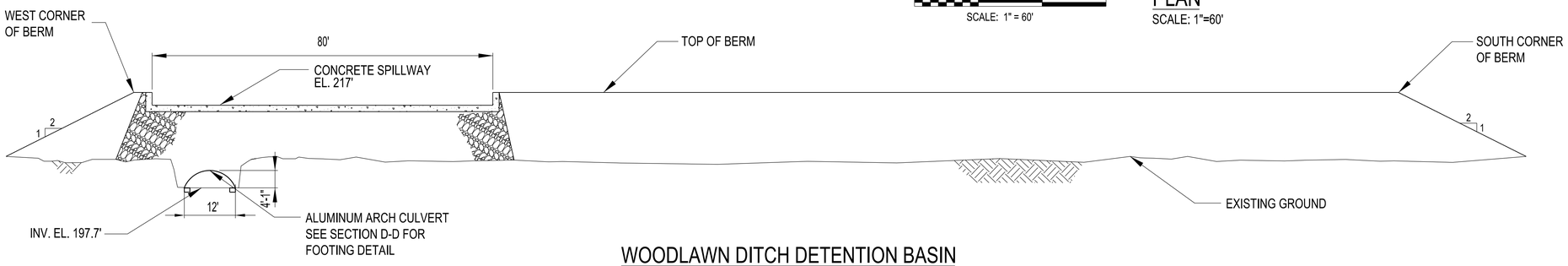


WOODLAWN DITCH DETENTION BASIN
SECTION B-B
SCALE: 1"=15'



60 30 0 60 120
SCALE: 1" = 60'

PLAN
SCALE: 1"=60'



WOODLAWN DITCH DETENTION BASIN
SECTION C-C
SCALE: 1"=15'

15 7.5 0 15 30
SCALE: 1" = 15'

Note: All elevations are feet MSL

NOTES:

1. ALUMINUM ARCH CULVERT METAL THICHNESS IS 1.50". WITH A NATURAL BOTTOM.
2. THE APPROXIMATE AREA UNDER THE ARCH CULVERT IS 35.3 SQ FT.

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MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
SIZE: ANSI D
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: WoodlawnDitch Detention Basin

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

WOODLAWN DITCH
DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-305
SHEET 12 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil!Documents1\1 Other Locations\2 - Oahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Woodlawn Ditch Detention Basin
MODEL NAME: C-305
DATE & TIME: 8/30/2016 10:31:15 AM
LAST SAVED BY: j3ec9cp9
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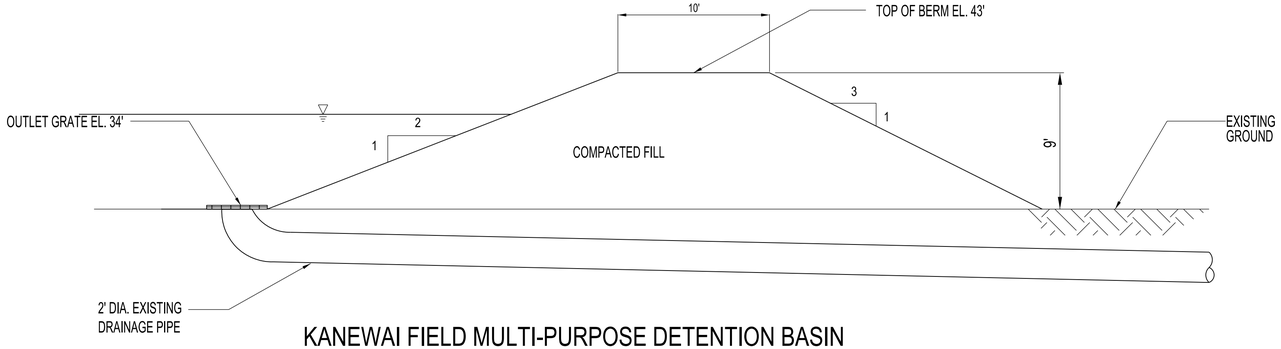
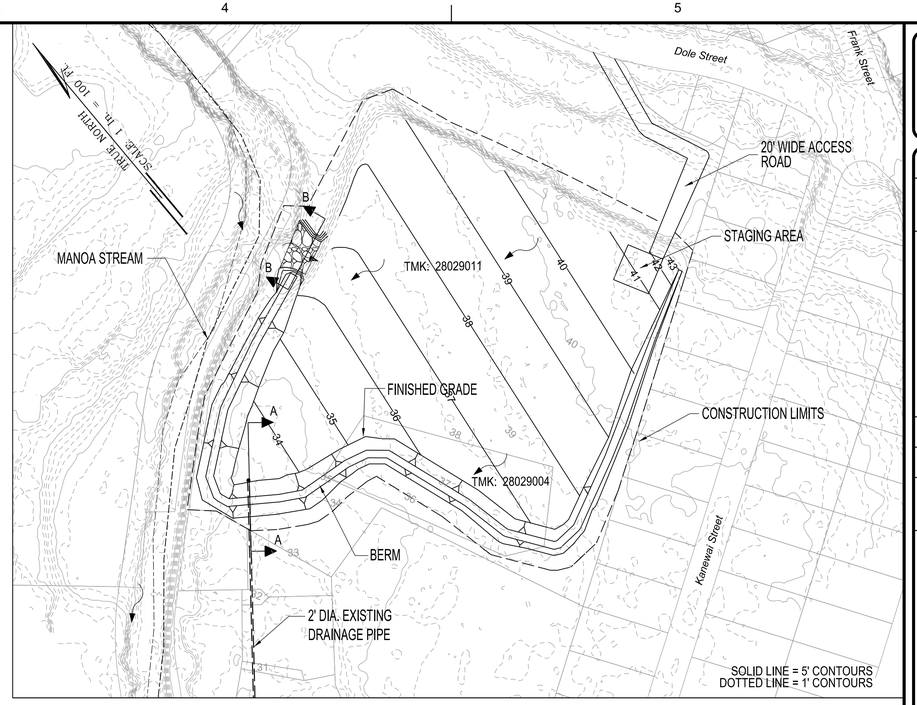
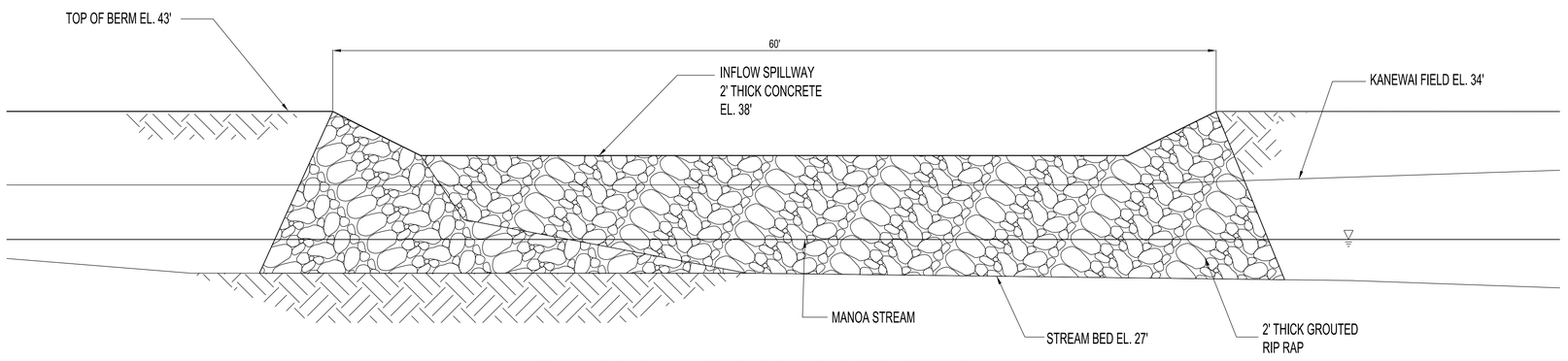
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ec9cp9



KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN
SECTION A-A
SCALE: 1" = 5'



PLAN
SCALE: 1" = 100'



KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN
SECTION B-B
SCALE: 1" = 5'

5' 2.5' 0 5' 10'
SCALE: 1" = 5'
Note: All elevations are feet MSL

US Army Corps of Engineers
Honolulu District

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MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY:
DRAWN BY:
SUBMITTED BY:
APPROVED BY:
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT SCALE:
PLOT DATE: 8/30/2016
FILE NAME: Ala_Wai_C-306xxx
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI CANAL PROJECT

KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-306
SHEET 13 OF 31

FILE: pw:\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil!Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-306xxx
MODEL NAME: C-306
DATE & TIME: 8/30/2016 10:26:03 AM
LAST SAVED BY: j3ec9cp9
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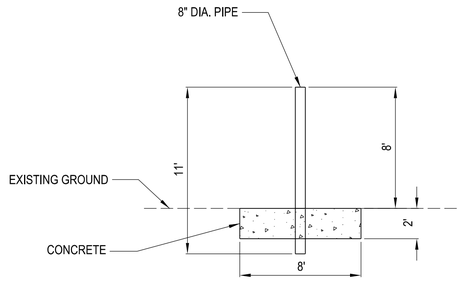
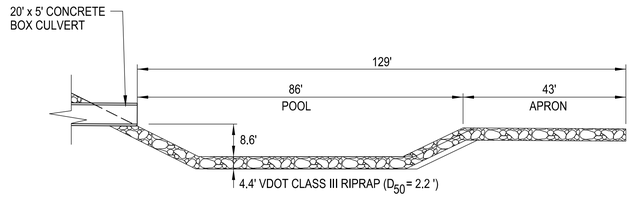
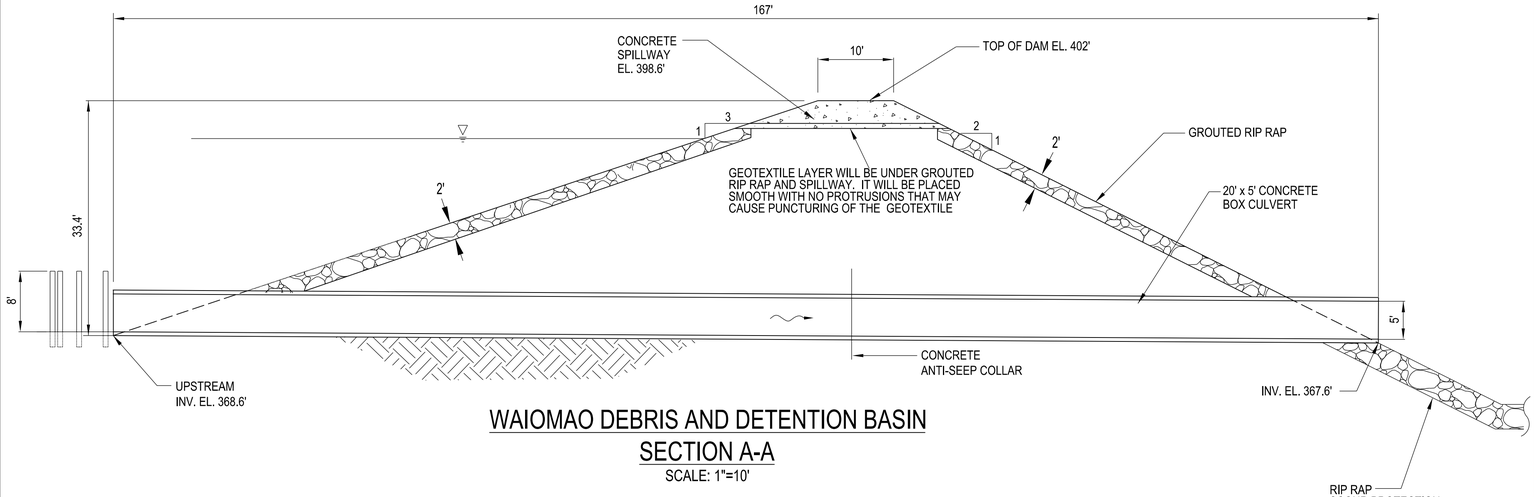


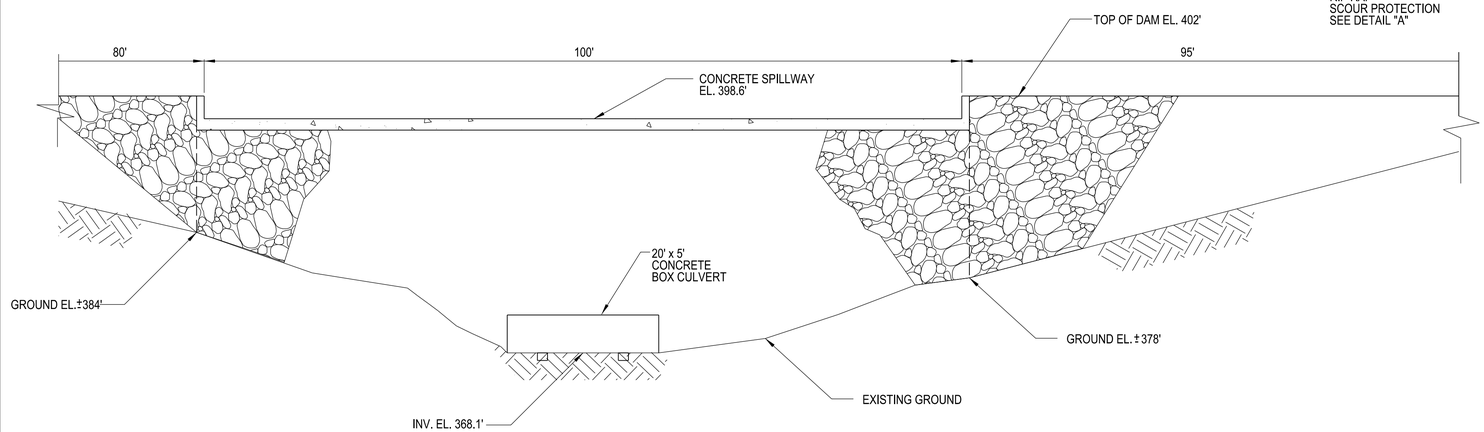
WAIOMAO DEBRIS AND DETENTION BASIN
SECTION C-C
SCALE: 1"=5'



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



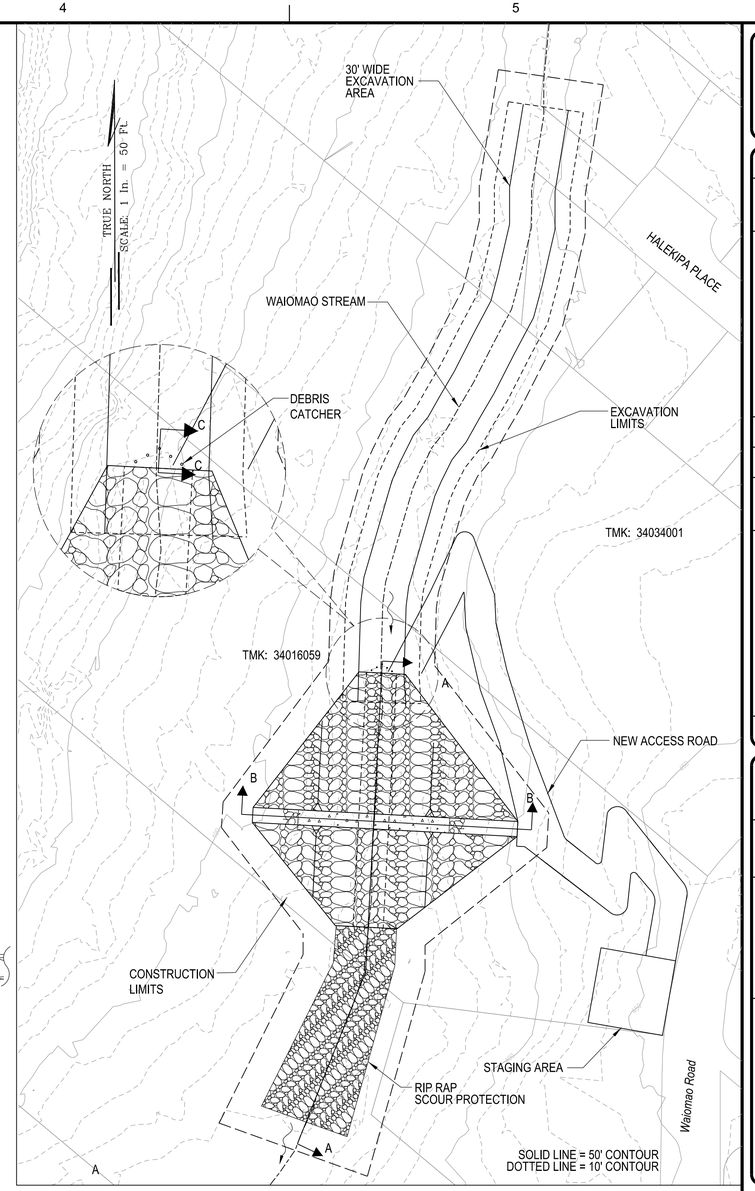
WAIOMAO DEBRIS AND DETENTION BASIN
SECTION A-A
SCALE: 1"=10'



10 5 0 10 20
SCALE: 1" = 10'

Note: All elevations are feet MSL

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



PLAN
SCALE: 1"=50'

50 25 0 50 100
SCALE: 1" = 50'

NOTES:

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

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
CHECKED BY:
PLOT SCALE: AS SHOWN
SIZE: ANSI D
DATE:
BY:
LOCATION CODE
PLOT DATE:
FILE NAME: Ala_Wai_C-308xxx
REVISION:
SOLICIT. / CONTRACT NO.:
DRAWING NUMBER:

ALA WAI CANAL PROJECT

WAIOMAO DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-308
SHEET 14 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-308xxx
MODEL NAME: C-308
DATE & TIME: 8/30/2016 10:34:06 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d0115194\PDF-AECv3.pltcfg
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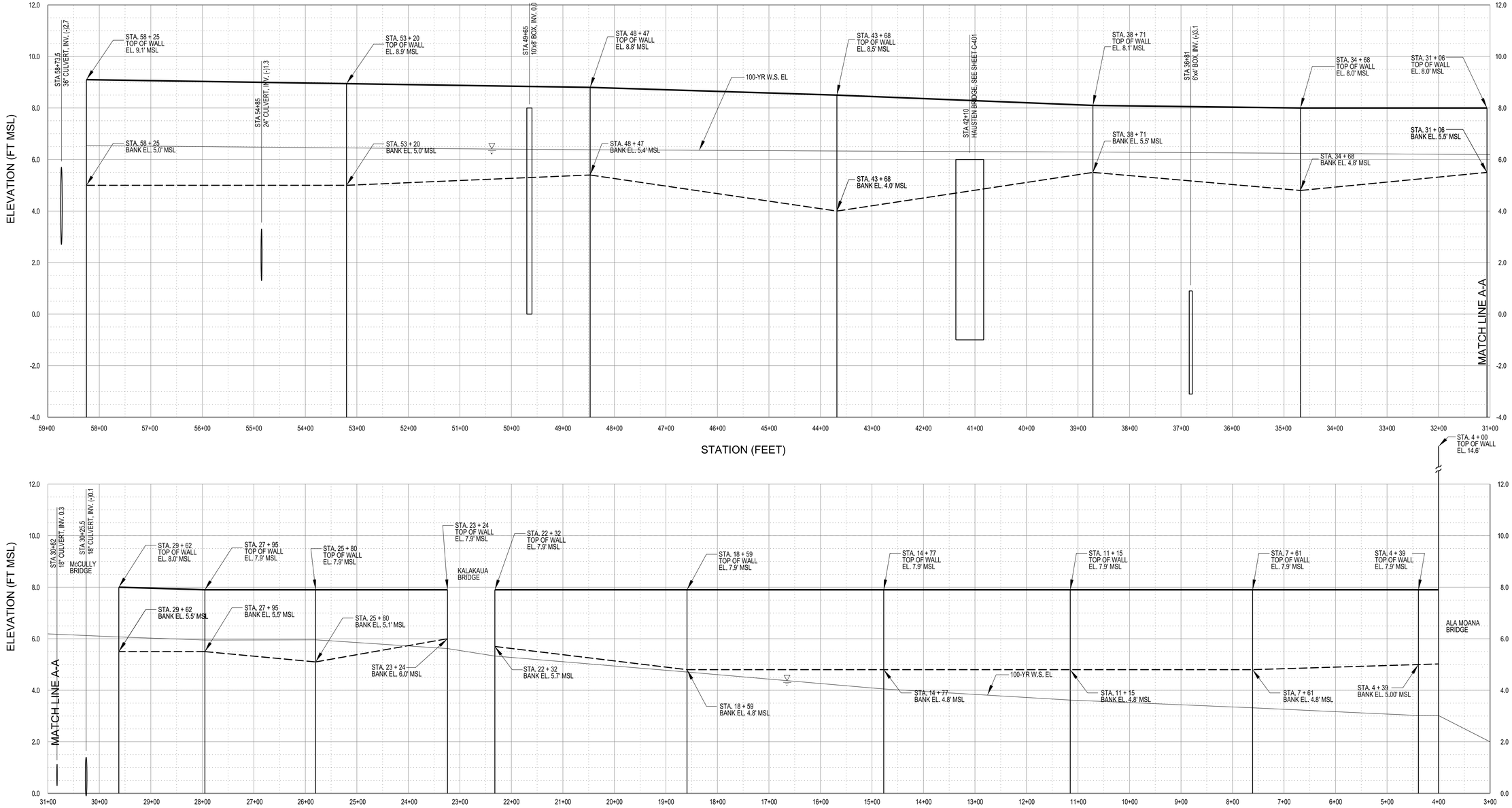


PROFILE

A1 ALA WAI MIDDLE (ALA2) AND LOWER (ALA1) RIGHT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

0' 50' 100' 200' 300'
0' 1" 2" 3" 4"

ALA WAI CANAL RIGHT BANK
STA 58 + 25 TO 25+80

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
58 + 25	4.1	9.1
53 + 20	3.9	8.9
48 + 47	3.4	8.8
43 + 68	4.5	8.5
38 + 71	2.6	8.1
34 + 68	3.2	8.0
31 + 06	2.5	8.0
MCCLULLY BRIDGE		
29 + 62	2.5	8.0
27 + 95	2.4	7.9
25 + 80	2.8	7.9

ALA WAI CANAL RIGHT BANK
STA 23 + 24 TO 4 + 00

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
23 + 24	1.9	7.9
KALAKAUA BRIDGE		
22 + 32	2.2	7.9
18 + 59	3.1	7.9
14 + 77	3.1	7.9
11 + 15	3.1	7.9
7 + 61	3.1	7.9
4 + 39	2.9	7.9
4 + 00	2.9	7.9

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1:1
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 2/24/2017
FILE NAME: Ala_Wai_C-309xxx.dgn
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

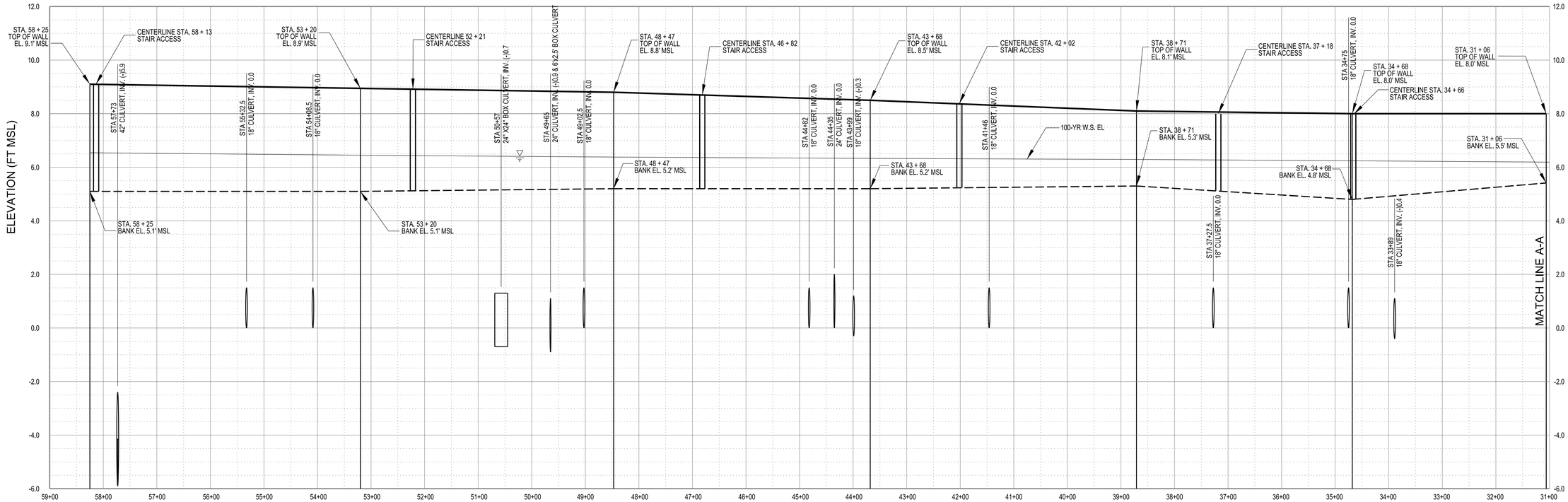
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

ALA WAI MIDDLE & LOWER RIGHT BANK FLOODWALLS
PROFILE AND SECTION

SHEET IDENTIFICATION
C-309
SHEET 15 OF 31

FILE: D:\Reviews\As_Designed\On_Going\Ala_Wai_Flood_Study\NEW TSP\Ala_Wai_C-309xxx.dgn
MODEL NAME: C-309
DATE & TIME: 2/24/2017 8:28:57 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: C:\ProgramData\Bentley\MicroStation V8i (SELECTseries)\WorkSpace\System\plotcfg\pdf.plotcfg
PEN TABLE: BW_and_Grayscale_Pen.tbl
PRINTED BY: j3ec9cp9



PROFILE

A1 ALA WAI CANAL MIDDLE (ALA2) AND LOWER (ALA1) LEFT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

0' 50' 100' 200' 300'
0' 1" 2" 3" 4"

NOTES:

1. SEE DETAIL "B" ON SHEET C-502 FOR ALA WAI CANAL MIDDLE (ALA2) TYPICAL LEFT BANK CONCRETE FLOODWALL SECTION.
2. ALA WAI CANAL LOWER (ALA1) IS FROM STATION 23+24 TO STATION 3+70.

ALA WAI CANAL LEFT BANK
STA TO 58 + 25 TO 25+80

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
58 + 25	4.0	9.1
53 + 20	3.8	8.9
48 + 47	3.6	8.8
43 + 68	3.3	8.5
38 + 71	2.8	8.1
34 + 68	3.2	8.0
31 + 06	2.5	8.0
MCCLULLY BRIDGE		
29 + 62	2.5	8.0
27 + 95	2.4	7.9
25 + 80	2.8	7.9

ALA WAI CANAL LEFT BANK
STA TO 23 + 24 TO 4 + 00

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
23 + 24	2.0	7.9
KALAKAUA BRIDGE		
22 + 32	0.9	7.9
18 + 59	3.2	7.9
14 + 77	3.2	7.9
11 + 15	3.2	7.9
7 + 61	3.2	7.9
4 + 39	2.9	7.9
4 + 00	2.9	7.9

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
FILE NAME: Ala_Wai_C-310xxx.dgn
SIZE: ANSI D
DATE:
CHECKED BY:
LOCATION CODE
DRAWING NUMBER:
REVISION:
SOLICIT. / CONTRACT NO.:

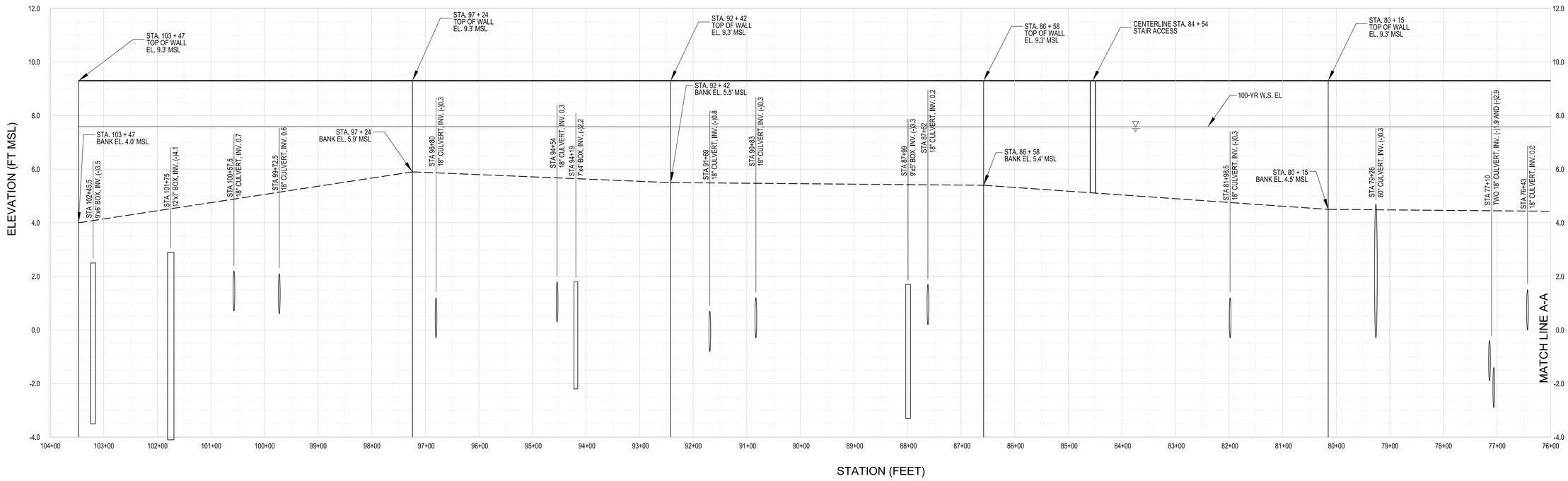
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

ALA WAI MIDDLE & LOWER LEFT BANK FLOODWALLS
PROFILE AND SECTION

SHEET IDENTIFICATION
C-310
SHEET 16 OF 31

FILE: D:\Reviews\As_Designed\On_Going\Ala_Wai_Flood_Study\NEW TSP\Ala_Wai_C-310xxx.dgn
MODEL NAME: C-310
DATE & TIME: 2/24/2017 8:32:59 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: C:\ProgramData\Bentley\MicroStation V8i (SELECTseries)\WorkSpace\System\plotcfg\pdf.plotcfg
PEN TABLE: BW_and_Grayscale_Pen.tbl
PRINTED BY: j3ec9cp9



PROFILE
ALA WAI CANAL UPPER (ALA3) LEFT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

ALA WAI CANAL LEFT BANK
STA 101 + 24 TO 58 + 25

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
103 + 47	5.3	9.3
97 +24	3.4	9.3
92 + 42	3.8	9.3
86 + 58	3.9	9.3
80 + 15	4.8	9.3
74 + 05	4.9	9.3
69 + 06	4.5	9.3
63 + 70	4.0	9.3
58 + 25	4.0	9.1

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Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH	DRAWN BY:	SUBMITTED BY:	PLOT SCALE: AS SHOWN	SIZE: ANSI D
CHECKED BY:			PLOT DATE:	FILE NAME: ALA WAI CANAL UPPER LEFT BANK, PROFILE & SECTION

DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

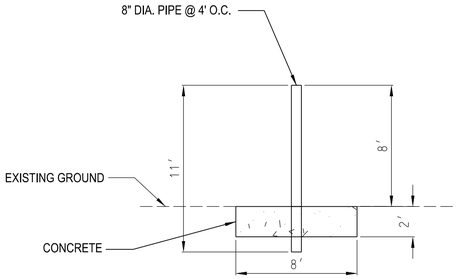
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

ALA WAI UPPER LEFT BANK FLOODWALLS
PROFILE AND SECTION

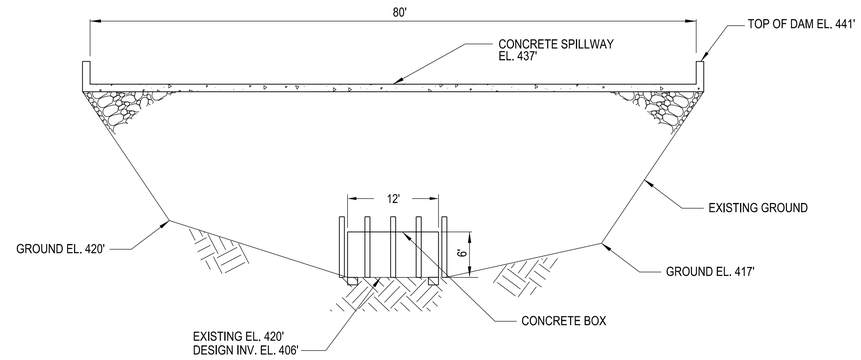
SHEET IDENTIFICATION
C-311
SHEET 17 OF 31

FILE: pw:\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\ALA WAI CANAL UPPER LEFT BANK, PROFILE & SECTION
MODEL NAME: C-311A
DATE & TIME: 8/30/2016 10:35:56 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d0115194\PDF-AECv3.pltcfg
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ec9cp9



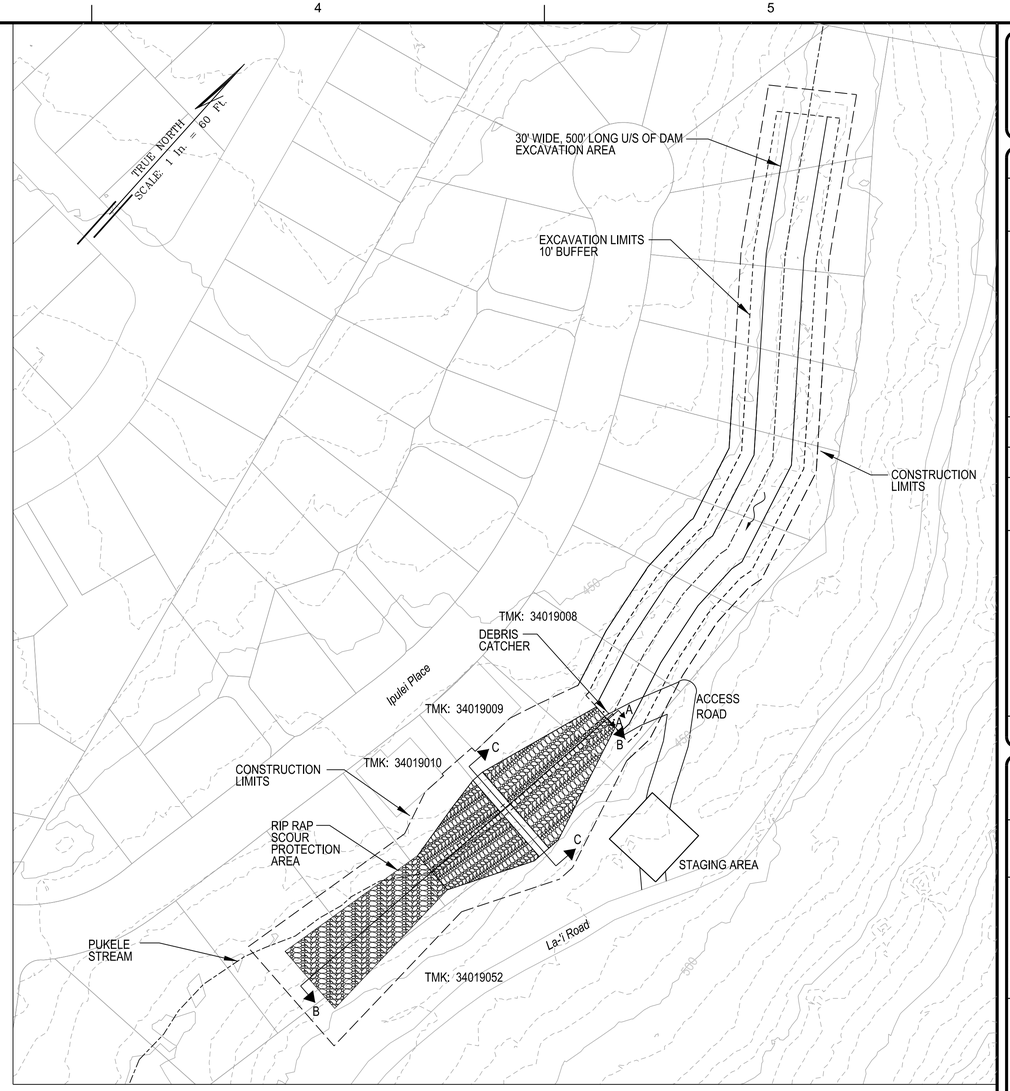
PUKELE DEBRIS AND DETENTION BASIN
SECTION A-A

SCALE: 1"=5'



PUKELE DEBRIS AND DETENTION BASIN
SECTION C-C

SCALE: 1"=5'



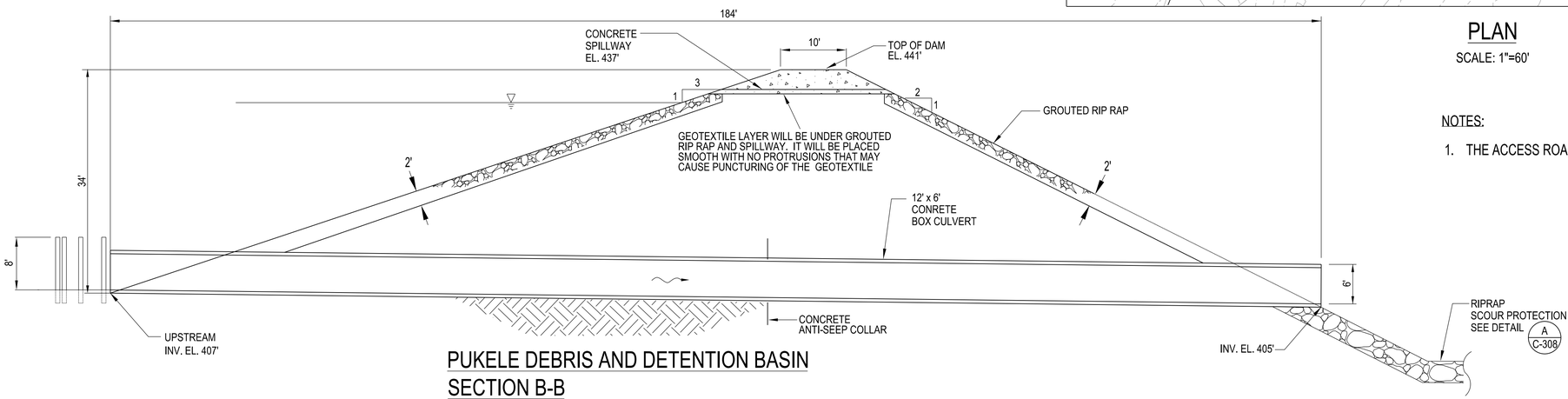
PLAN

SCALE: 1"=60'

SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

NOTES:

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



PUKELE DEBRIS AND DETENTION BASIN
SECTION B-B

SCALE: 1"=5'

5 2.5' 0 5 10

SCALE: 1" = 5'

Note: All elevations are feet MSL

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
SIZE: ANSI D
FILE NAME: Ala_Wai_C-313xxx
CHECKED BY:
SOLICIT / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
REVISION:
DATE:

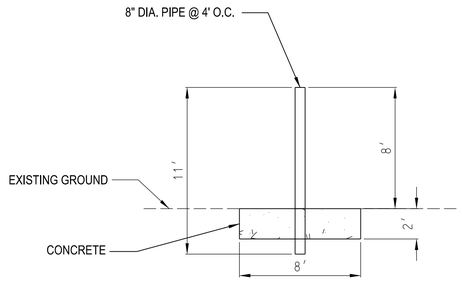
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

PUKELE DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

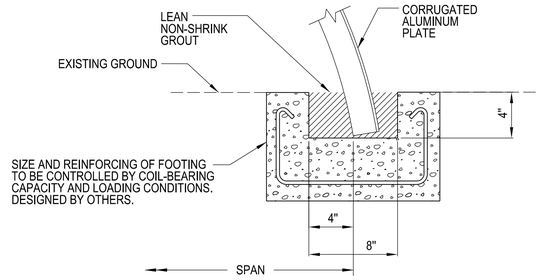
SHEET IDENTIFICATION
C-313
SHEET 18 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-313xxx
MODEL NAME: C-313
DATE & TIME: 8/30/2016 10:37:06 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d01151944\PDF-AECv3.pltcfg
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ec9cp9



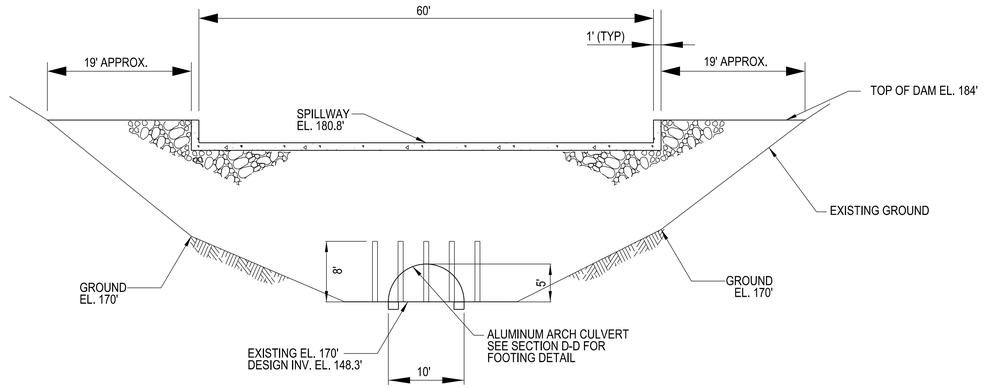
MAKIKI DEBRIS AND DETENTION BASIN SECTION A-A

SCALE: 1"=5'



SLOTTED CONCRETE FOOTING MAKIKI DEBRIS AND DETENTION SECTION D-D

SCALE: NTS

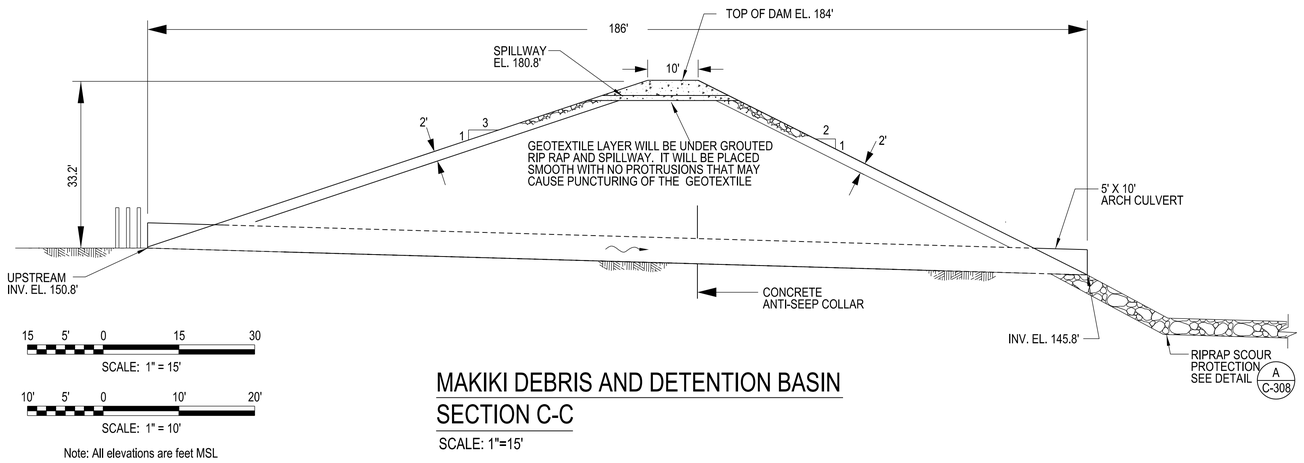


MAKIKI DEBRIS AND DETENTION BASIN SECTION B-B

SCALE: 1"=10'

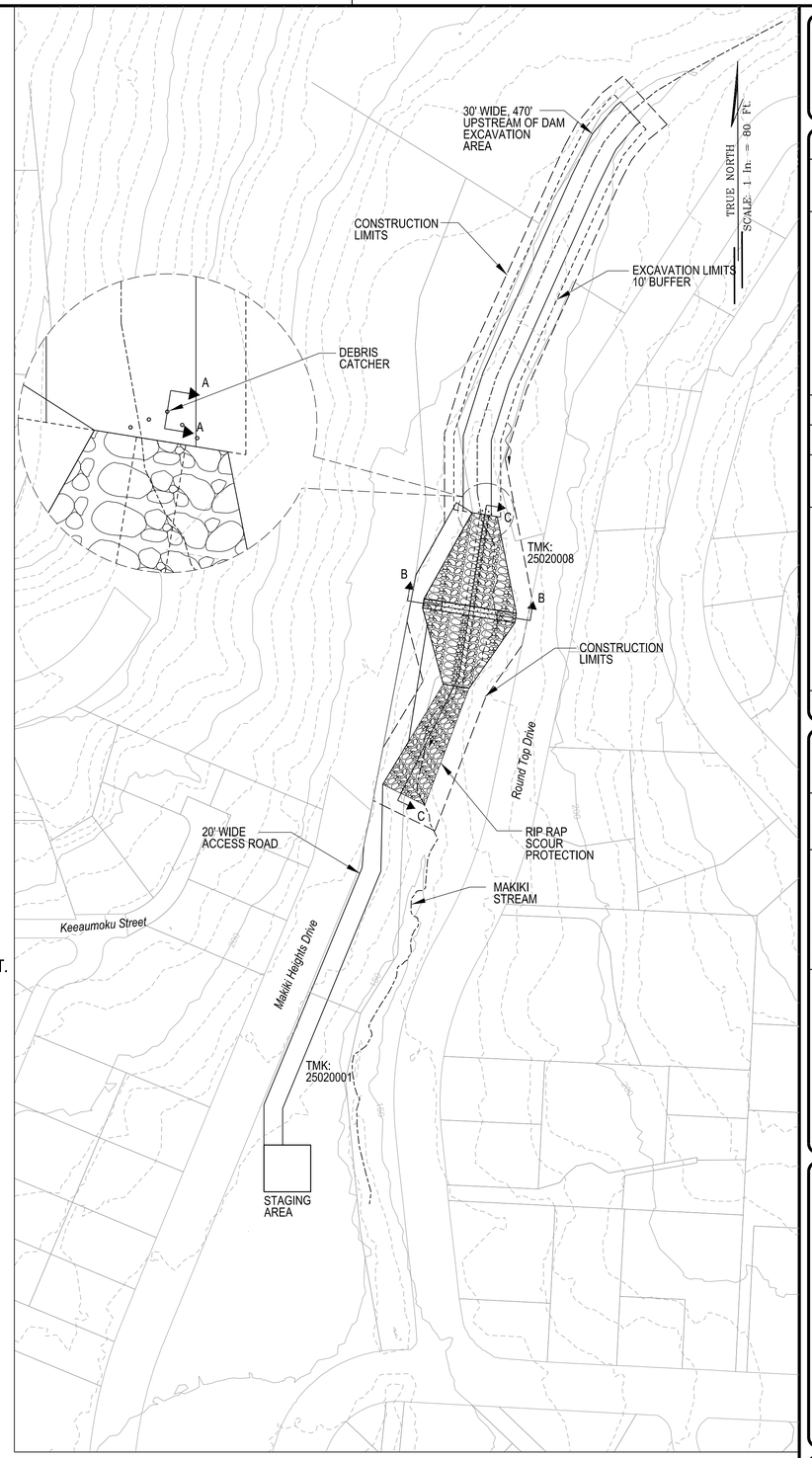
NOTES:

1. ALUMINUM ARCH CULVERT METAL THICHNESS 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.



MAKIKI DEBRIS AND DETENTION BASIN SECTION C-C

SCALE: 1"=15'



PLAN

SCALE: 1"=80'

SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DATE: | REVISION:
DESIGNED BY: JIH | DRAWN BY: CP | CHECKED BY: | SUBMITTED BY: | PLOT SCALE: | PLOT DATE: | SOLICIT. / CONTRACT NO.: | LOCATION CODE | DRAWING NUMBER: | SHEET NO.
SIZE: ANSI D | FILE NAME: Ala_Wai_C-315xxx

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

MAKIKI DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-315
SHEET 19 OF 31

FILE: pw:\\COE-POHPWP06FTS.poh.ds.usace.army.mil:coe-pohpwp06fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\Ala_Wai_C-315xxx
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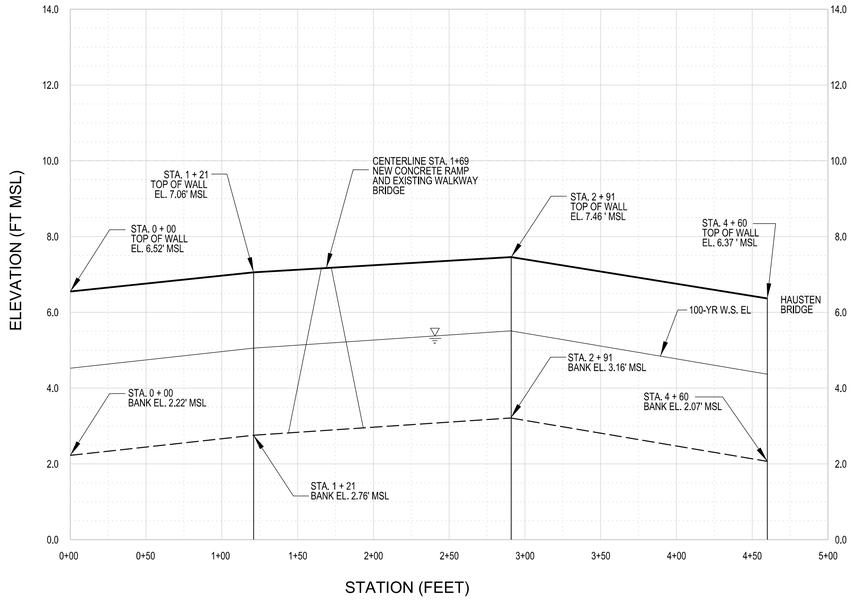
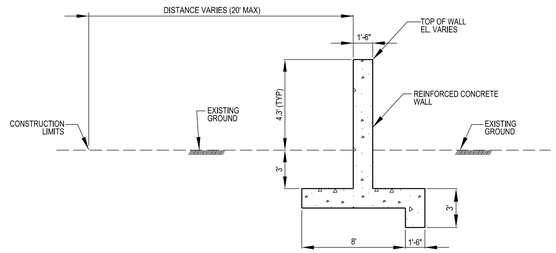
DATE & TIME: 8/30/2016 10:38:37 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d01151941PDF-AECV3.pltcfg
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: : j3ec9cp9



PROFILE

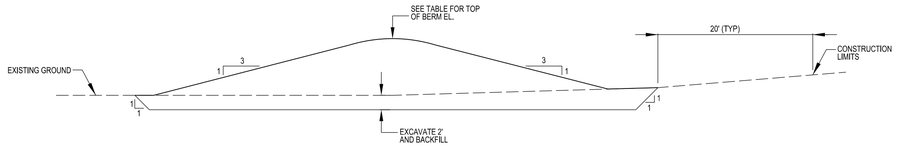
HAUSTEN DITCH RIGHT BANK FLOODWALL

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 2'



A HAUSTEN DITCH TYPICAL REINFORCED CONCRETE FLOODWALL SECTION

NOT TO SCALE



B HAUSTEN DITCH TYPICAL BERM

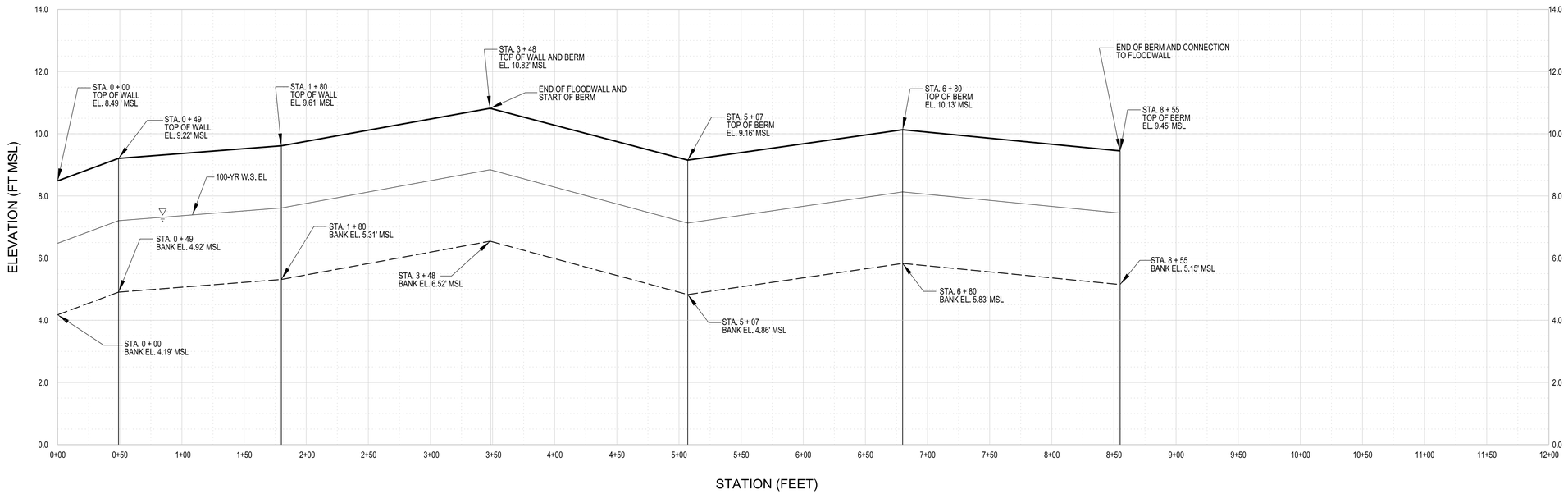
NOT TO SCALE

HAUSTEN DITCH RIGHT BANK FLOODWALL
STA TO 0 + 00 TO 4 + 60

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	4.30	6.52
1 + 21	4.30	7.06
2 + 91	4.30	7.46
4 + 60	4.30	6.37
HAUSTEN BRIDGE		

HAUSTEN DITCH LEFT BANK
FLOODWALL AND BERM
STA TO 0 + 00 TO 11 + 65

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	4.30	8.49
0 + 49	4.30	9.22
1 + 80	4.30	9.61
3 + 48	4.30	10.82
END OF FLOODWALL AND START OF BERM		
3 + 48	4.30	10.82
5 + 07	4.30	9.16
6 + 80	4.30	10.13
8 +55	4.30	9.45



PROFILE

HAUSTEN DITCH LEFT BANK FLOODWALL AND BERM

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 2'

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

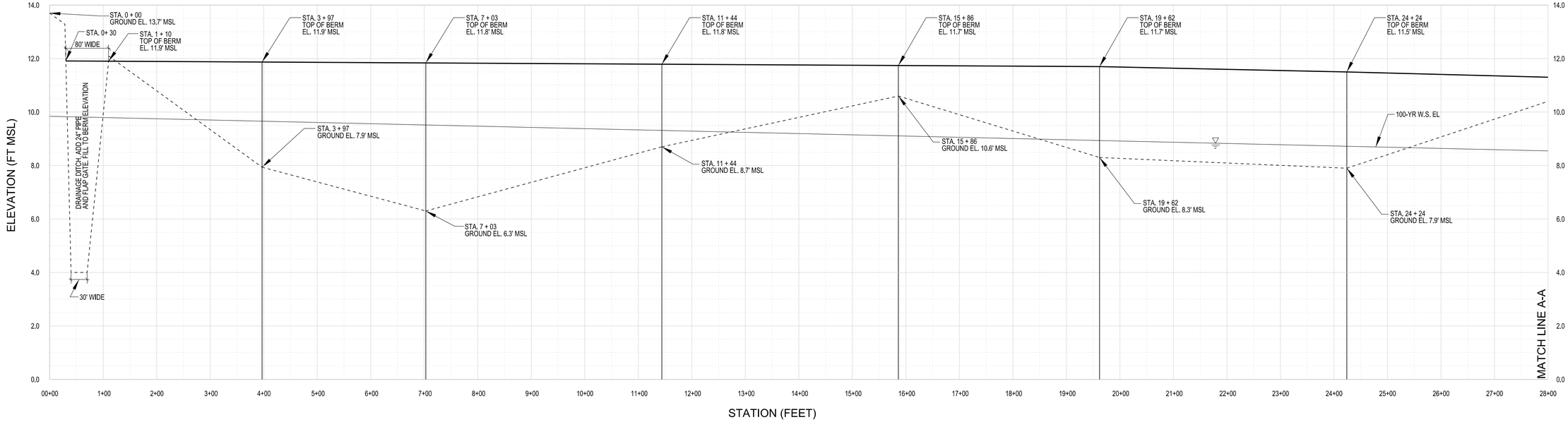
DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE: 8/30/16
FILE NAME: HAUSTEN DITCH DETENTION, PROFILE & SEC
DATE:
REVISION:
CHECKED BY:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
SIZE: ANSI D

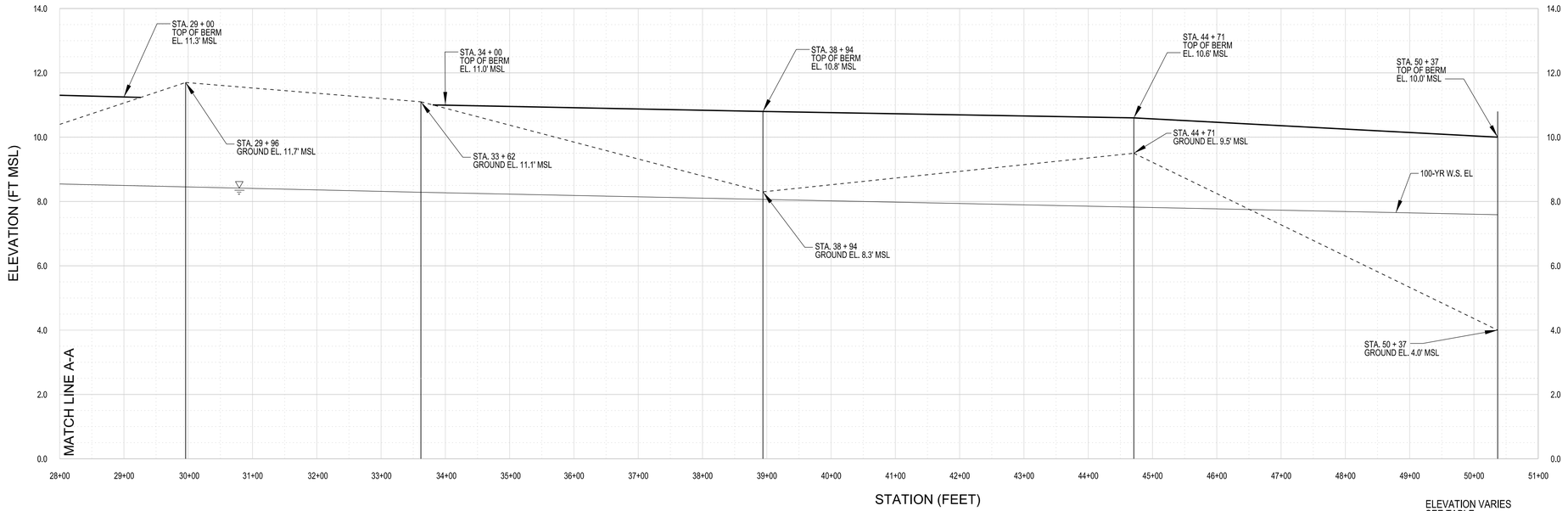
ALA WAI CANAL PROJECT

HAUSTEN DITCH DETENTION FLOODWALLS AND BERM
PROFILE AND SECTIONS

SHEET IDENTIFICATION
C-316
SHEET 20 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\HAUSTEN DITCH DETENTION, PROFILE & SEC
MODEL NAME: C-316
DATE & TIME: 8/30/2016 10:06:18 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9.dir\115194\PDF-AECv3.pltcfg
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ec9cp9



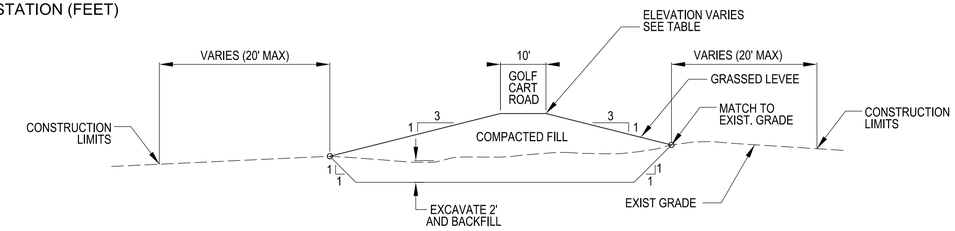


ALA WAI GOLF COURSE LEVEE
STA 0 + 00 TO 50 + 37

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	-	-
3 + 97	4.0	11.9
7 + 03	5.5	11.8
11 + 44	3.1	11.8
15 + 86	1.1	11.7
19 + 62	3.4	11.7
24 + 24	3.6	11.5
29 + 96	-	-
33 + 62	-	-
38 + 94	2.5	10.8
44 + 71	1.1	10.6
50 + 37	6.0	10.0

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION LEVEE PROFILE

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'



A TYPICAL LEVEE SECTION
NOT TO SCALE

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
PLOT DATE:
PLOT SCALE:
SIZE: ANSI D
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: ALA WAI GOLF COURSE MULTI-PURPOSE DETE

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

ALA WAI GOLF COURSE LEVEE
PROFILE AND SECTION

SHEET IDENTIFICATION
C-317
SHEET 21 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\ALA WAI GOLF COURSE MULTI-PURPOSE DETE
MODEL NAME: C-309
DATE & TIME: 8/30/2016 10:07:04 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9\d0115194\PDF-AECV3.pltcfg
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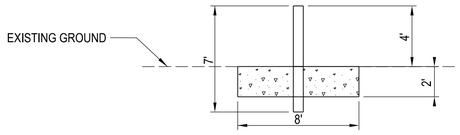
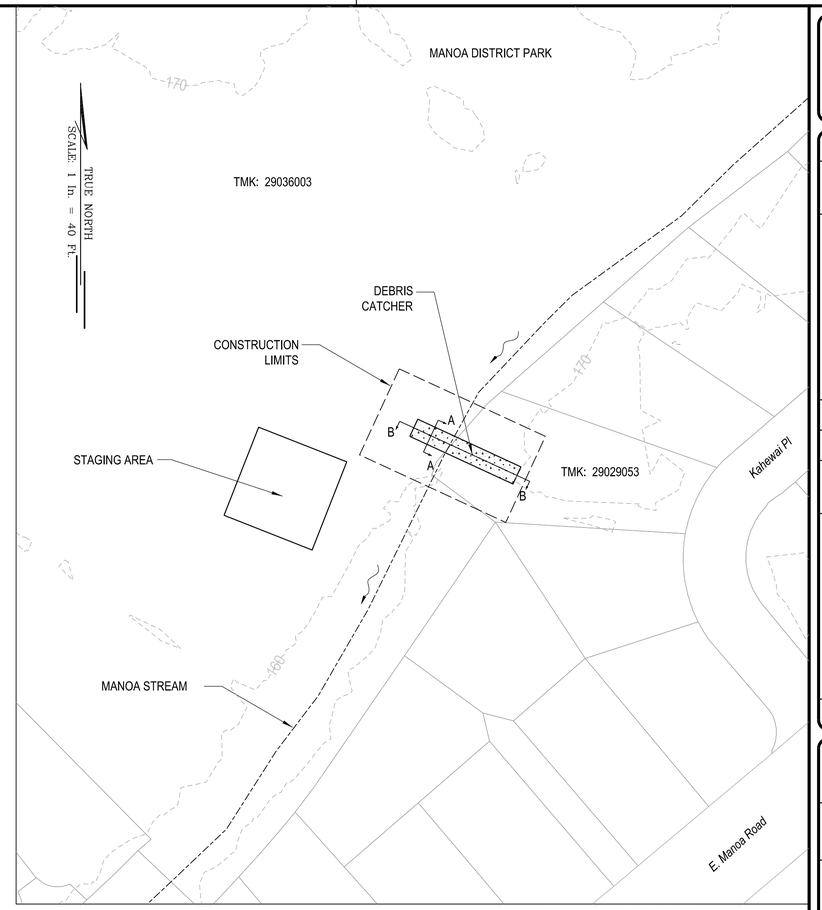


MANOA IN-STREAM DEBRIS CATHMENT
SECTION A-A

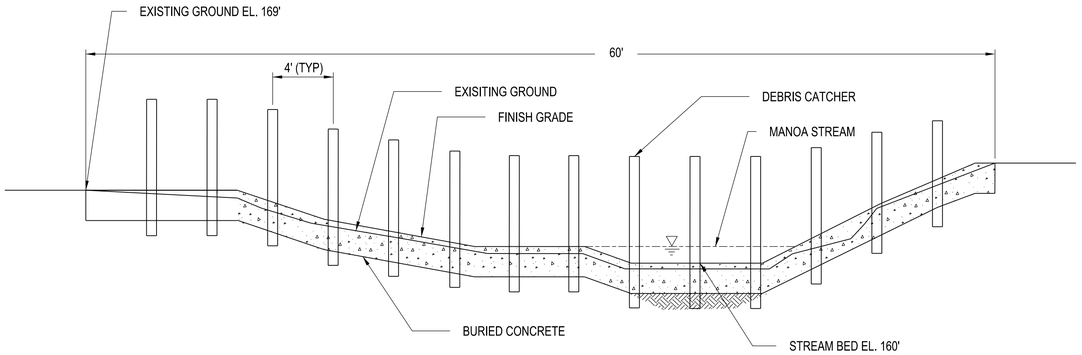
SCALE: 1"=5'



SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

PLAN

SCALE: 1"=40'



MANOA IN-STREAM DEBRIS CATCHMENT
SECTION B-B

SCALE: 1"=5'

5' 2.5' 0 5' 10'

SCALE: 1" = 5'

Note: All elevations are feet MSL

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE: 8/30/16
SIZE: ANSI D
DATE:
CHECKED BY:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: MANOA IN-STREAM DEBRIS CATCHMENT, PLAN

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

MANOA IN-STREAM DEBRIS CATCHMENT
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-318
SHEET 22 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil#coe-pohpwp08fts.poh.ds.usace.army.mil#Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\MANOA IN-STREAM DEBRIS CATCHMENT, PLAN
MODEL NAME: C-318
DATE & TIME: 8/30/2016 10:07:59 AM
LAST SAVED BY: j3ec9cp9
PLOTDRIVER: c:\pw-work\poh-1\j3ec9cp9.dir\115194\PDF-AECv3.pltcfg
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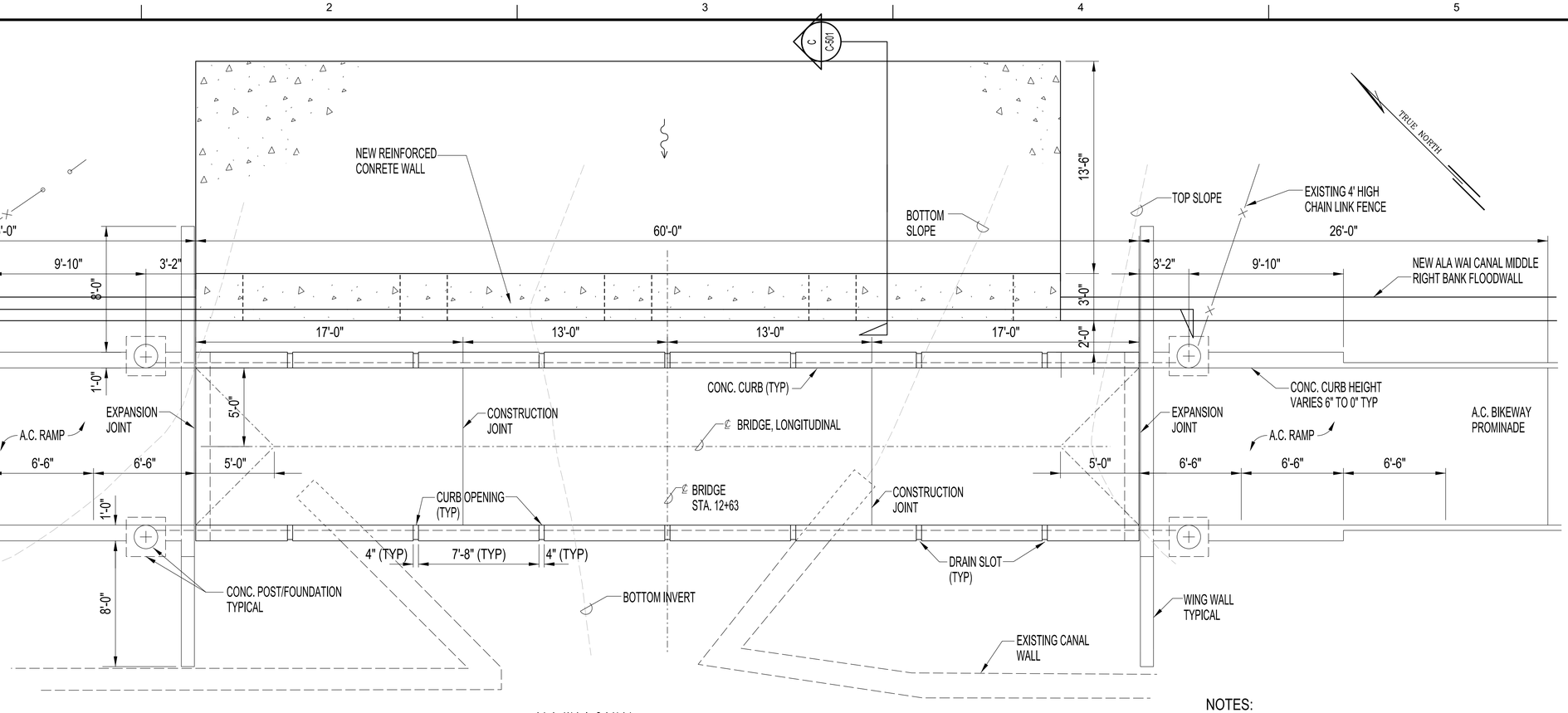
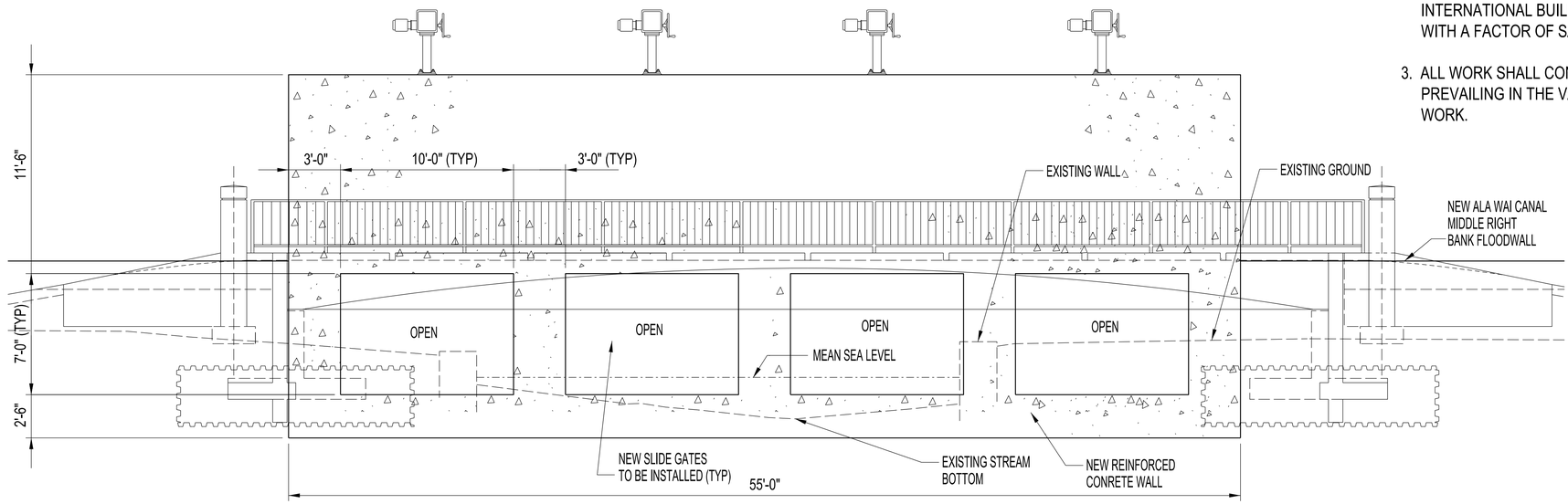
PRINTED BY: j3ec9cp9



A PLAN
SCALE: 1/4"=1'



B ELEVATION
SCALE: 1/4"=1'

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.

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE:
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 8/30/2016
FILE NAME: HAUSTEN BRIDGE PLAN & SECTIONS
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

HAUSTEN BRIDGE CONCRETE WALL
PLAN, SECTION AND ELEVATION

SHEET IDENTIFICATION
C-401
SHEET 23 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\NEW TSP\HAUSTEN BRIDGE PLAN & SECTIONS
MODEL NAME: C-401
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PRINTED BY: j3ec9cp9

STRUCTURAL NOTES:

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. PROVIDE DOWELS AS DIRECTED AND THOROUGHLY CLEAN AND ROUGHEN SURFACES BEFORE PROCEEDING WITH THE NEXT POUR.

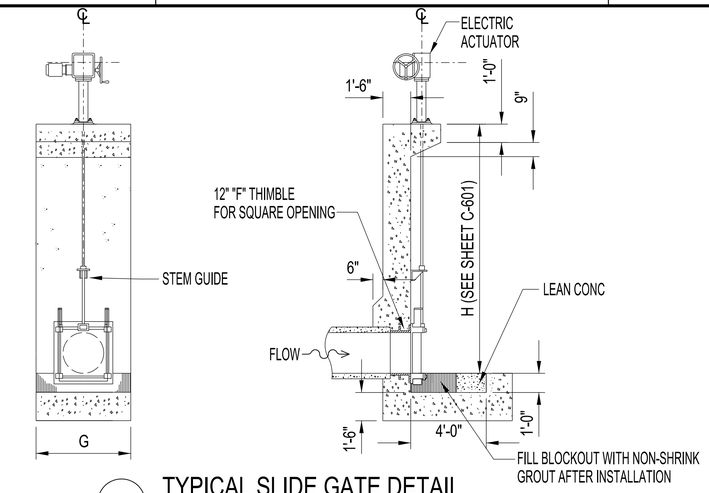
REINFORCING STEEL NOTES:

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.

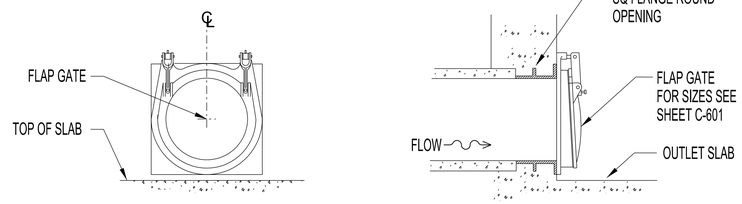
2. MINIMUM CONCRETE COVER:

CONCRETE DEPOSITED ON OR AGAINST EARTH.....3"

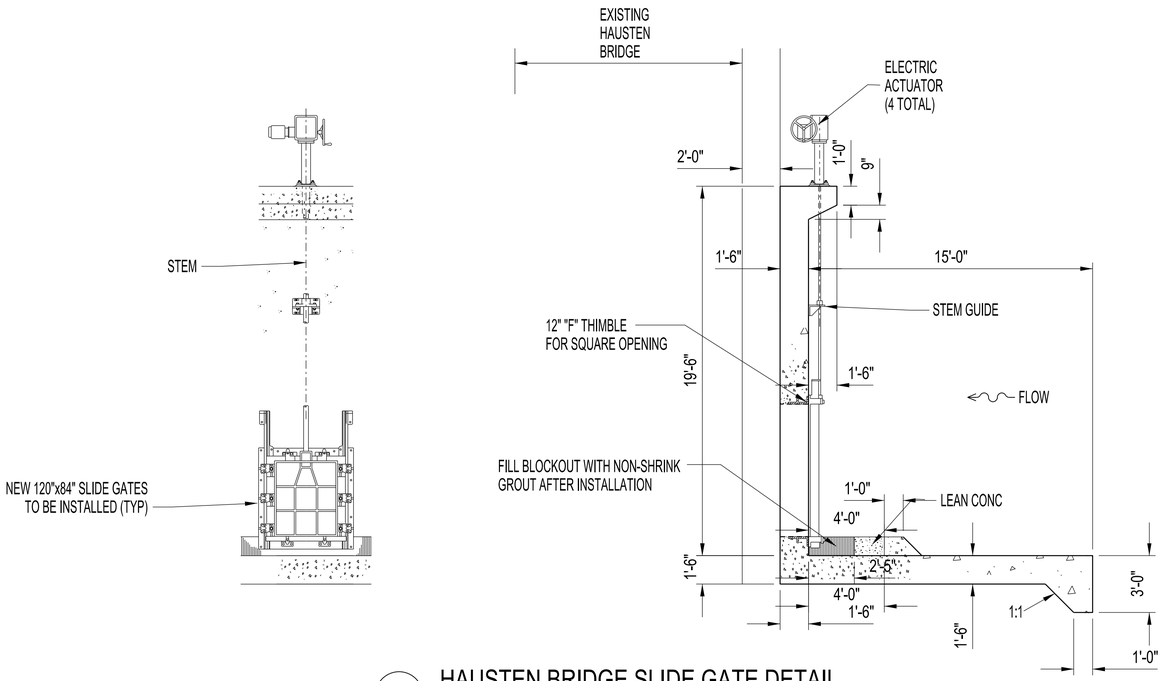
ALL OTHERS.....2"



A TYPICAL SLIDE GATE DETAIL
NTS



B TYPICAL FLAP GATE DETAIL
NTS



C HAUSTEN BRIDGE SLIDE GATE DETAIL
SCALE: 1/4"=1'

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: As noted
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE:
FILE NAME: STRUCTURAL NOTES AND MISCELLANEOUS DET
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

STRUCTURAL NOTES AND MISCELLANEOUS DETAILS

SHEET IDENTIFICATION
C-501
SHEET 24 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\STRUCTURAL NOTES AND MISCELLANEOUS DET
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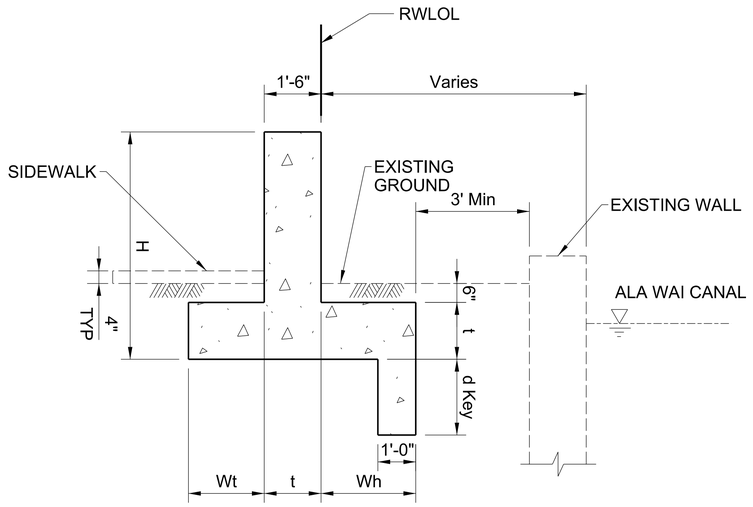
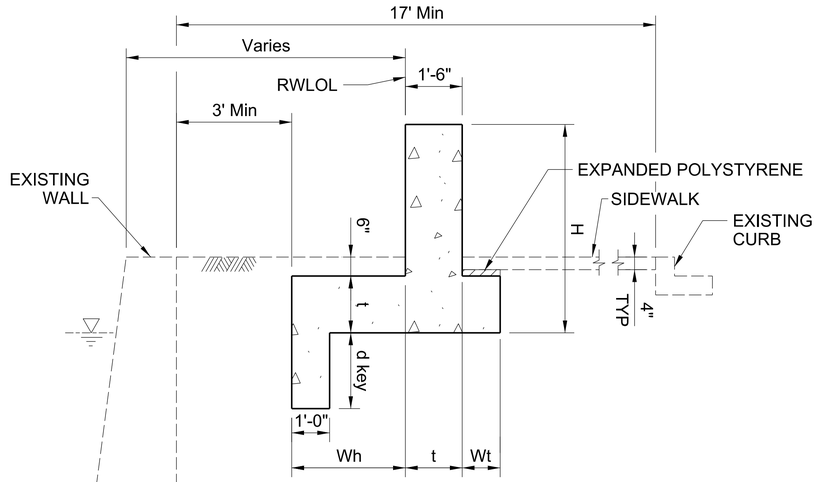


A RIGHT BANK FLOOD WALL

SCALE: 1/2"=1'

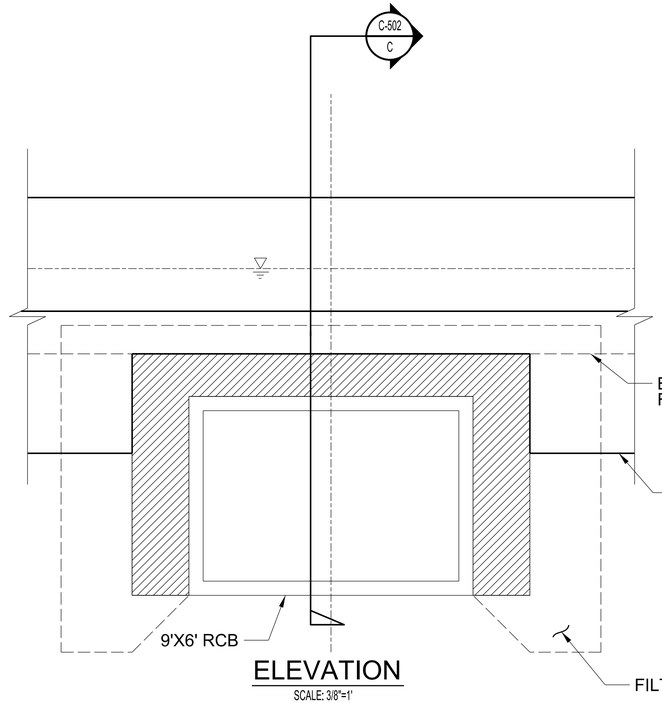
LOCATION	H max	d key	t	Wt	Wh
4+00 TO 20+00 RIGHT	5.1	2	1.5	1	2.5
20+00 TO 31+00 RIGHT	4	1	1.5	1	1
31+00 TO 40+00 RIGHT	6	2	1.5	2.5	2.5
40+00 TO 59+00 RIGHT	7.4	3	1.5	3.5	4



B LEFT BANK FLOOD WALL

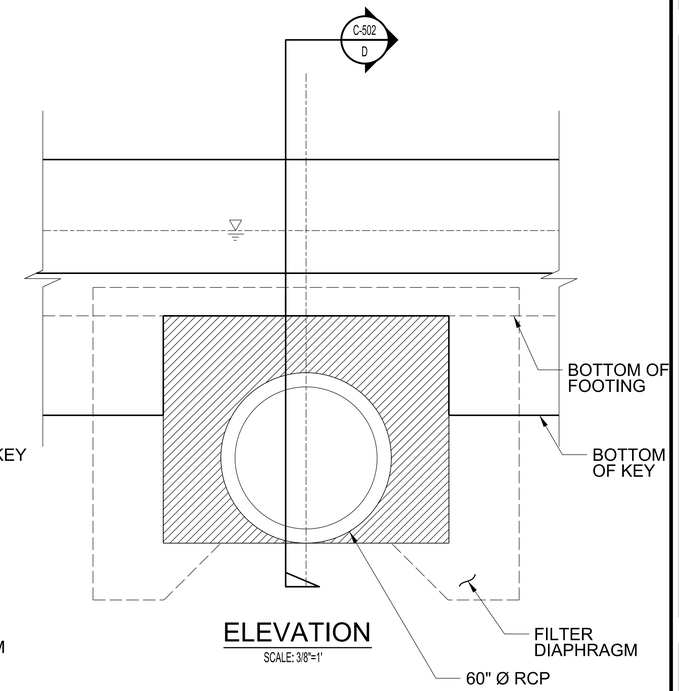
SCALE: 1/2"=1'

LOCATION	H max	d key	t	Wt	Wh
4+00 TO 20+00 LEFT	5.2	2	1.5	1	2.5
20+00 to 31+00 LEFT	4	1	1.5	1	1
31+00 to 42+00 LEFT	6	2	1.5	2.5	2.5
42+00 to 67+00 LEFT	7	3	1.5	3	3.5
67+00 to 84+00 LEFT	7.6	3	1.5	3.5	4
84+00 to 101+40 LEFT	7	3	1.5	3	3.5
101+40 to 103+47 LEFT	8	3	1.5	4	4.5



ELEVATION

SCALE: 3/8"=1'

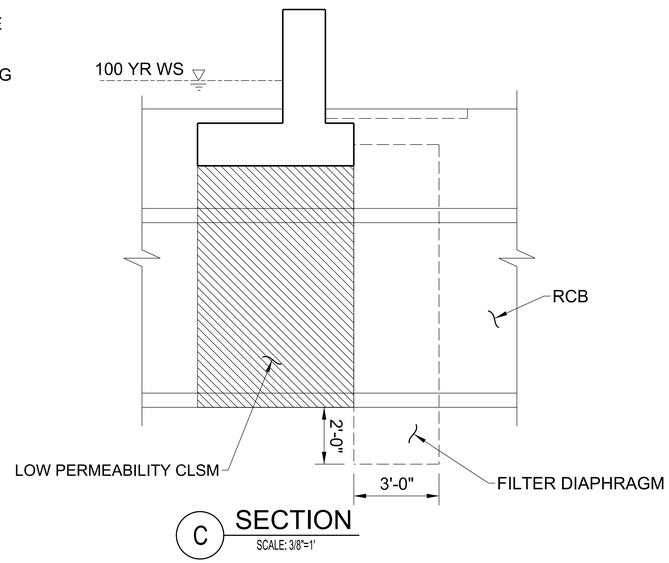


ELEVATION

SCALE: 3/8"=1'

NOTE:

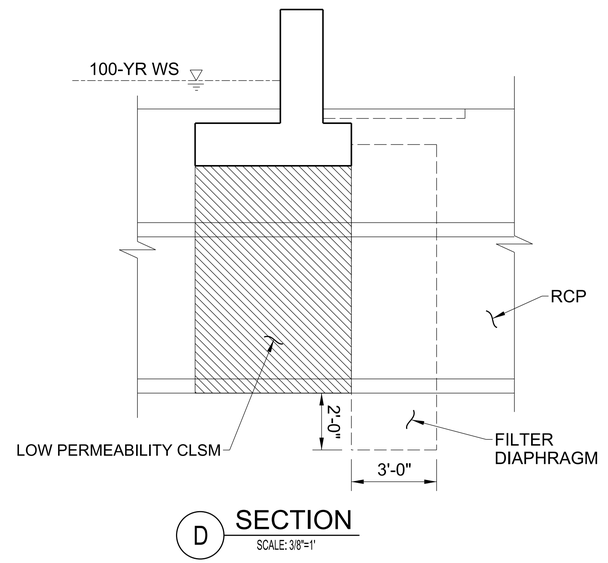
1. FILTER DIAPHRAGM CONSISTS OF TRENCH WITH IMPORTED SAND TO PREVENT PIPING AT UTILITY PENETRATIONS.



C SECTION

SCALE: 3/8"=1'

FLOOD WALL OVER BOX CULVERT (TYP)



D SECTION

SCALE: 3/8"=1'

FLOOD WALL OVER PIPE CULVERT (TYP)

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: J ELWOOD
DRAWN BY: P WALKER
CHECKED BY:
SUBMITTED BY:
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
PLOT SCALE: AS SHOWN
PLOT DATE: AUGUST
SIZE: ANSI D
FILE NAME: Ala_Wai_C-502xxx

ALA WAI CANAL PROJECT

FLOOD WALL DETAILS

SHEET IDENTIFICATION
C-502
SHEET 25 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\CH2MHILL\Ala_Wai_C-502xxx
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DATE & TIME: 2/24/2017 8:36:08 AM
LAST SAVED BY:
PLOTDRIVER: C:\ProgramData\Bentley\MicroStation V8i (SELECTseries)\WorkSpace\System\plotcfg\pdf.plotcfg
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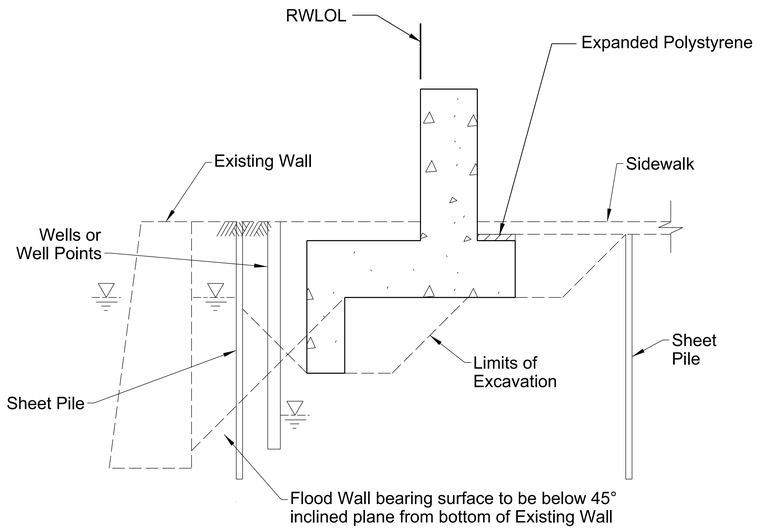
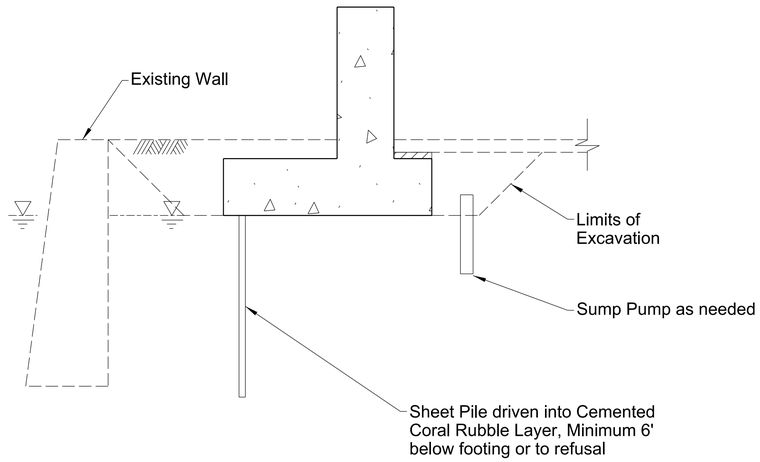


OPTION 1



OPTION 2

CONCEPTUAL DEWATERING REQUIREMENTS FOR LEFT BANK FLOOD WALL

SCALE: 1/2"=1'

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.

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Honolulu District

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MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: J ELWOOD
DRAWN BY: P WALKER
CHECKED BY:
SUBMITTED BY:
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
PLOT SCALE: AS SHOWN
PLOT DATE: 8/30/2016
SIZE: ANSI D
FILE NAME: Flood Wall Details

ALA WAI CANAL PROJECT

FLOOD WALL DETAILS

SHEET IDENTIFICATION
C-503
SHEET 26 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\CH2MHILLFlood Wall Details
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DATE & TIME: 8/30/2016 9:42:33 AM
LAST SAVED BY:
PLOTDRIVER: c:\pw-work\poh-1\j3ecdcp9\d0115194\PDT-AECv3.pltcfg
PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ecdcp9

SCHEDULE OF SLIDE GATES
ALONG THE ALA WAI CANAL

CULVERT NAME	STATION	SIZE (WIDTHxHEIGHT) AND TYPE	H	G
DIAMOND 2, GOLF COURSE	102+45.5	108"x72" RECTANGULAR OPENING SLIDE GATE	15'-0"	11'-6"
DIAMOND 1, ALA WAI BLVD	101+75	144"x96" RECTANGULAR OPENING SLIDE GATE	19'-0"	15'-0"
DIAMOND 3, GOLF COURSE	96+67	3 - 120"x84" RECTANGULAR OPENING SLIDE GATE	17'-6"	26'-0"
94+19	94+19	84"x48" RECTANGULAR OPENING SLIDE GATE	15'-6"	12'-6"
87+99	87+99	108"x60" RECTANGULAR OPENING SLIDE GATE	15'-0"	11'-6"
50+57	50+57	24"x24" SQUARE OPENING SLIDE GATE	6'-6"	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'-0"	7'-6"
36+81, RB	36+81	72"x48" RECTANGULAR OPENING SLIDE GATE	11'-0"	7'-6"
HAUSEN	42+10	4-120"x84" SLIDE GATE	10'-0"	7'-0"

GENERAL NOTES:

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

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Honolulu District

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MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: JAH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1.000000
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 8/30/2016
FILE NAME: SCHEDULE OF SLIDE GATES
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI WATERSHED PROJECT

SCHEDULE OF SLIDE GATES

SHEET IDENTIFICATION
C-601
SHEET 27 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil:coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Civil\Final\Alternative 3 (35%)\SCHEDULE OF SLIDE GATES
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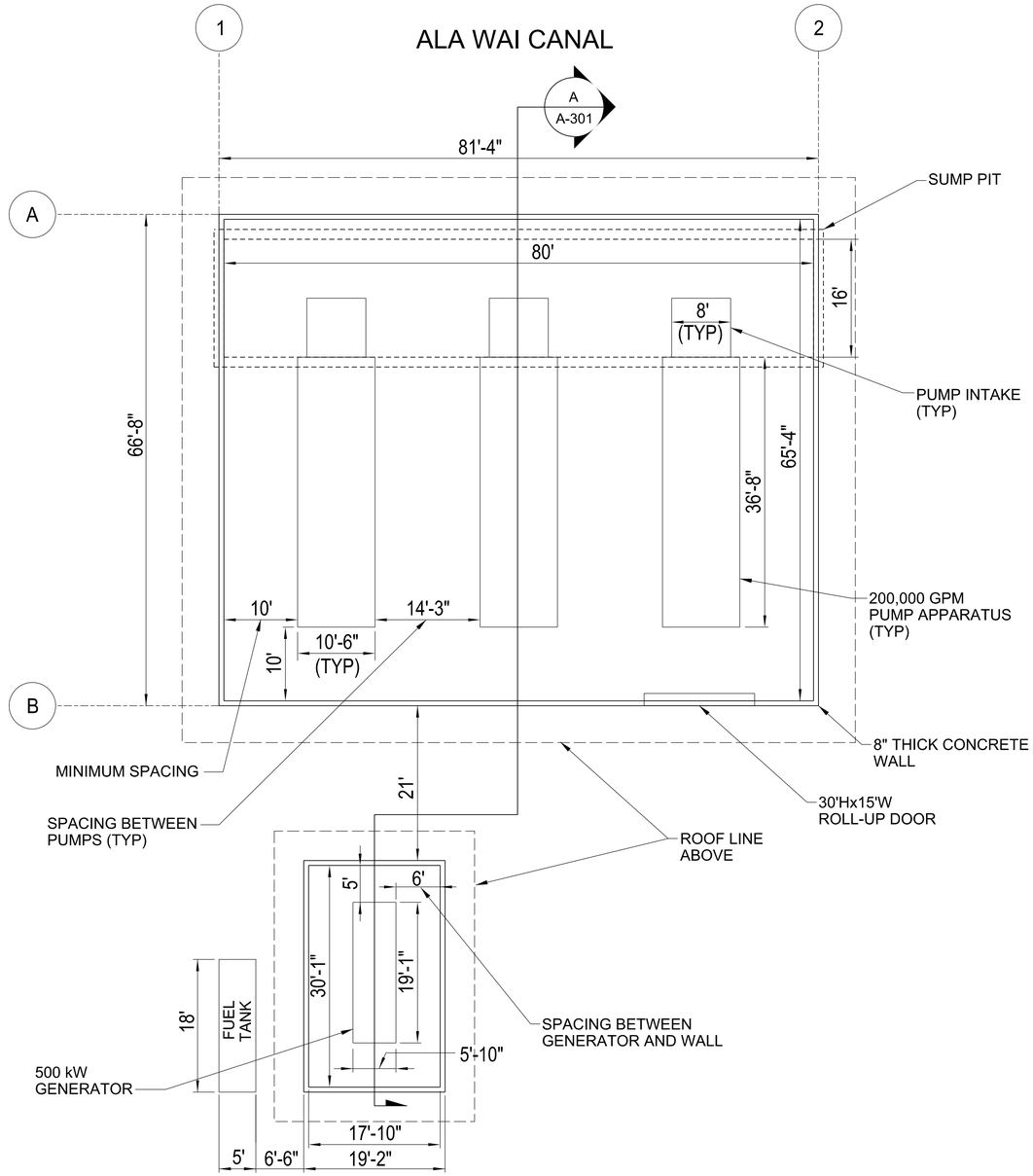
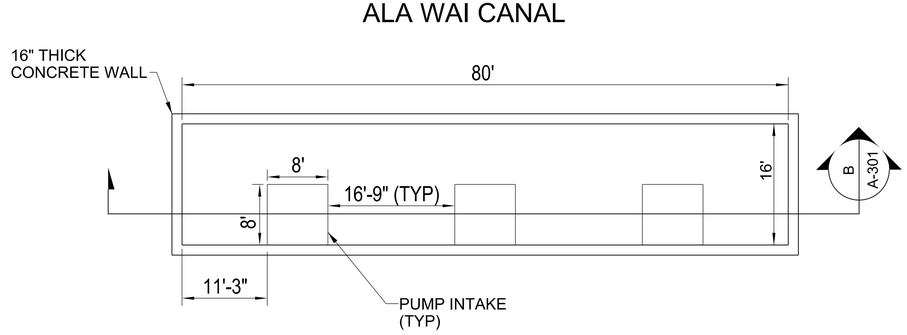


PUMP STATION 1 - FLOOR PLAN

SCALE: 1"=10'



SUMP PIT - FLOOR PLAN

SCALE: 1"=10'

TYPICAL NOTES FOR ALL PUMP STATIONS:

1. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE CODES AND BUILDING REGULATIONS HAVING JURISDICTION OVER THIS PROJECT.
2. THE NEW CONCRETE WALL SHALL CONFORM TO THE 2012 INTERNATIONAL BUILDING CODE (IBC) AND EM 1110-2-3104.
3. ALL WORK SHALL CONFORM TO THE BEST PRACTICE PREVAILING IN THE VARIOUS TRADES COMPRISING THE WORK.

10 5 0 10 30

SCALE: 1"=10'

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: As noted
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 8/30/2016
FILE NAME: PUMP STATION 1, PLAN
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI CANAL PROJECT

PUMP STATION 1 - FLOOR PLAN

SHEET IDENTIFICATION
A-101
SHEET 28 OF 31

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil\coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Architectural\Final\NEW TSP\PUMP STATION 1, PLAN
MODEL NAME: A-101
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LAST SAVED BY:
PLOTDRIVER: c:\pw-work\poh-1\j3ec8cp9\d0115194\PDT-AECv3.pltcfg
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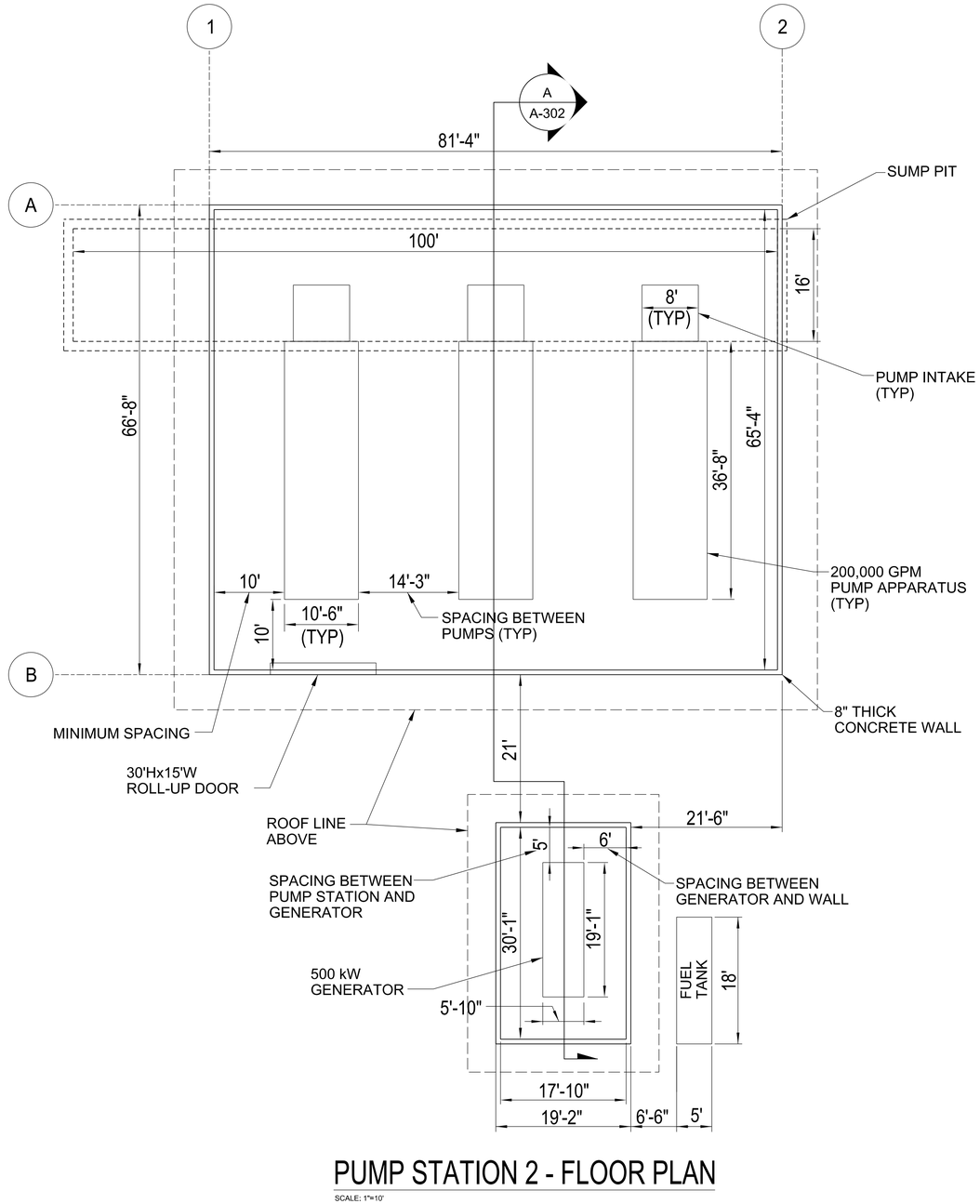
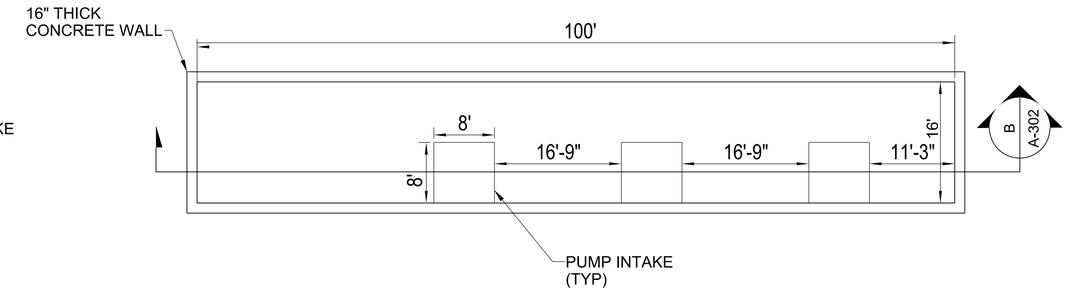


PUMP STATION 2 - FLOOR PLAN

SCALE: 1"=10'



SUMP PIT - FLOOR PLAN

SCALE: 1"=10'

NOTES:

1. SEE TYPICAL PUMP STATION NOTES ON SHEET A-101.

10 5 0 10 30

SCALE: 1"=10'

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil\coe-pohpwp08fts.poh.ds.usace.army.mil!Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Architectural\Final\NEW TSP\PUMP STATION 2_PLAN
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US Army Corps of Engineers
Honolulu District

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MARK	DESCRIPTION	DATE	APPR.

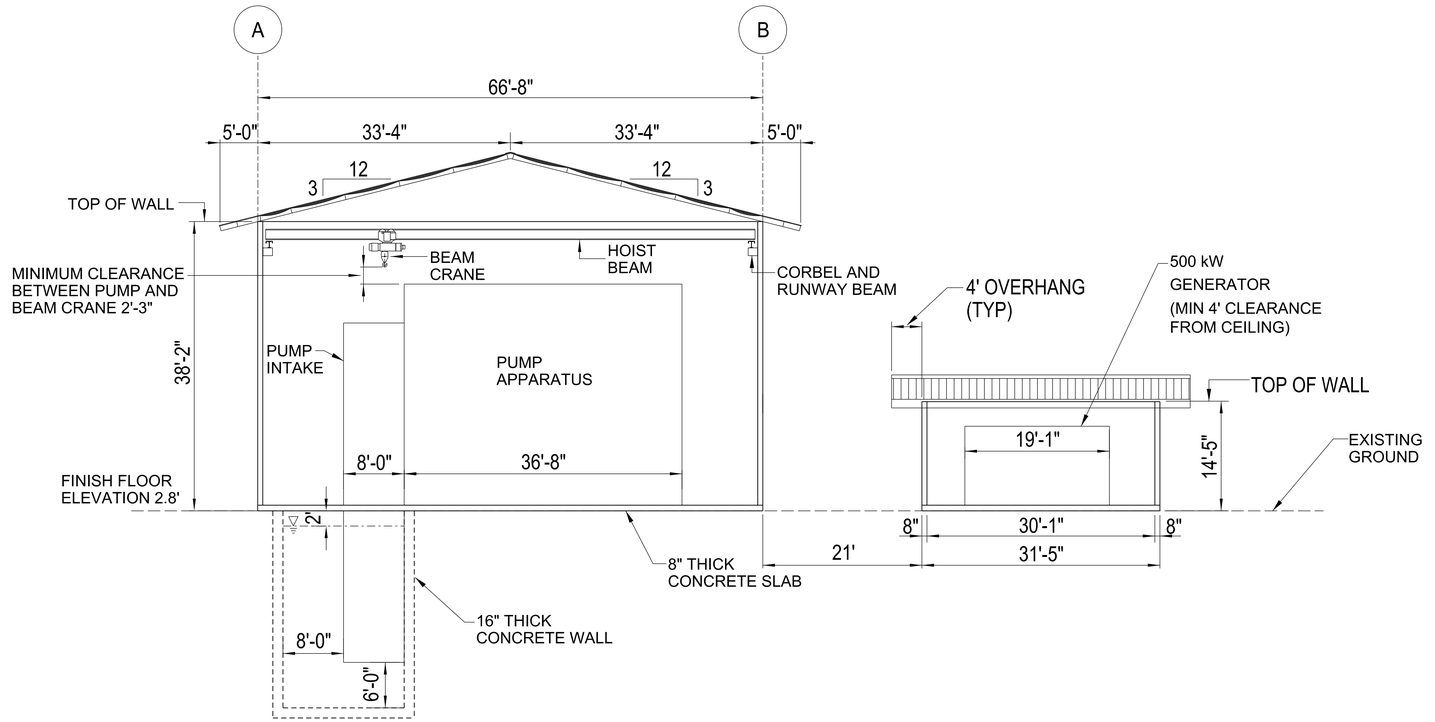
DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1=1
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 8/30/2016
FILE NAME: PUMP STATION 2_PLAN
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

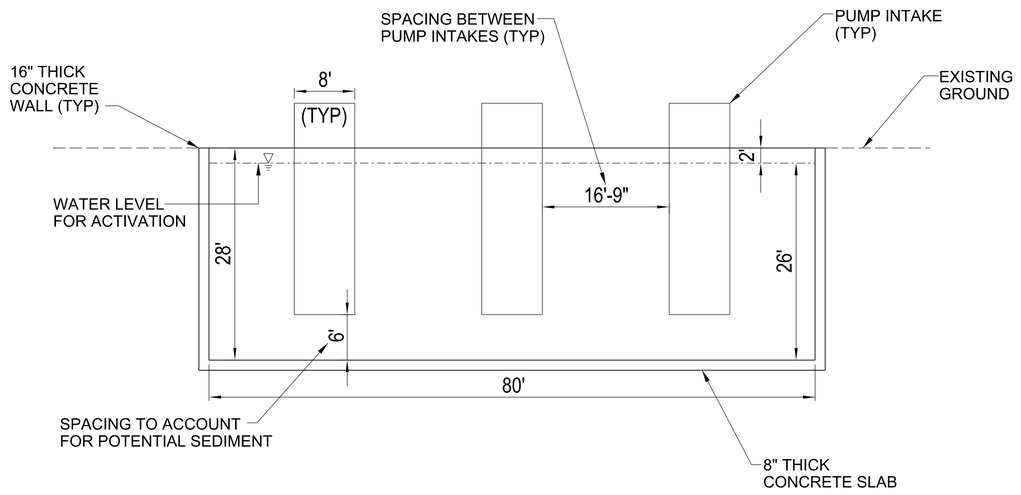
PUMP STATION 2 - FLOOR PLAN

SHEET IDENTIFICATION
A-102
SHEET 29 OF 31



A PUMP STATION 1 - SECTION

SCALE: 1"=10'



B PUMP SUMP PIT SECTION

SCALE: 1"=10'

10 5 0 10 30

SCALE: 1"=10'

FILE: pw:\\COE-POHPWP08FTS.poh.ds.usace.army.mil\coe-pohpwp08fts.poh.ds.usace.army.mil\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Water Shed\Ala Wai Canal Project\01-Drawings\Architectural\Final\Alternative 3 (35%)\PUMP STATION 1, SECTIONS
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PRINTED BY: j3ecdcp9

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

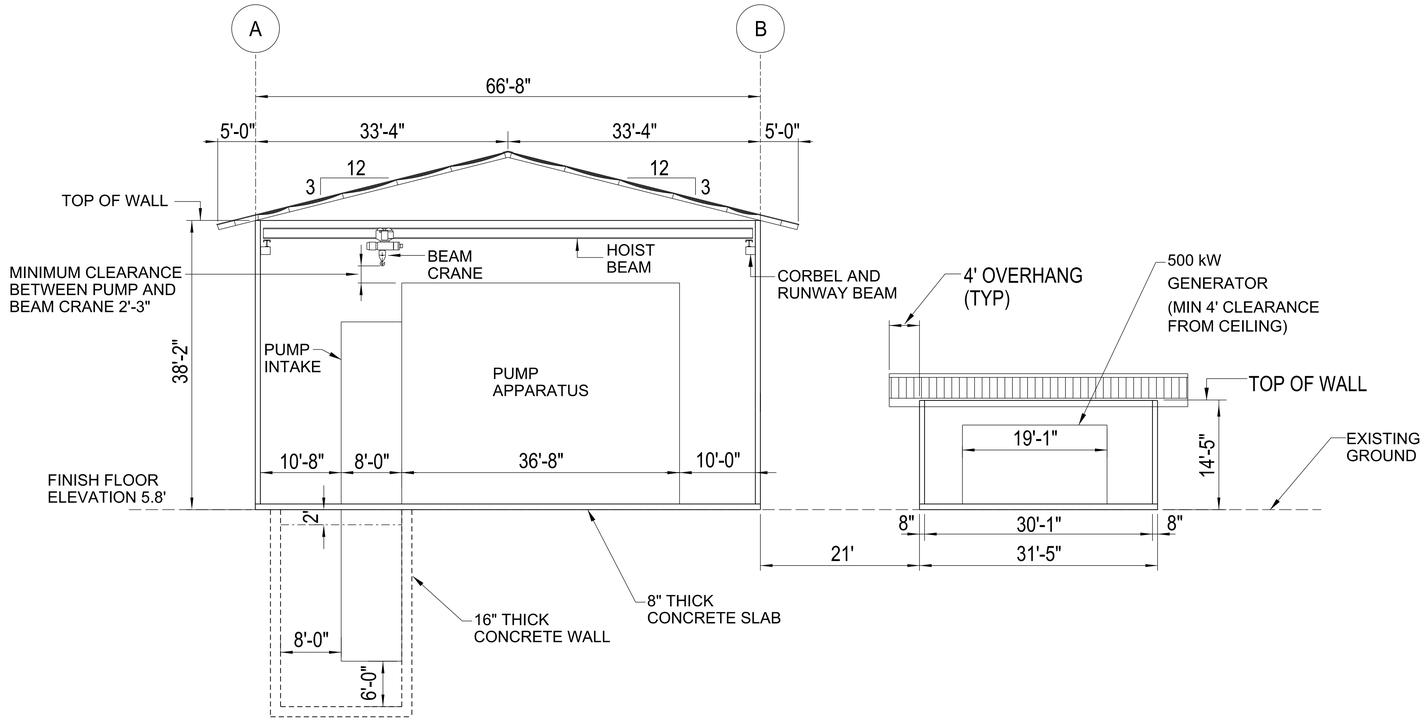
DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: 1
PLOT DATE:
SIZE: ANSI D
DATE:
CHECKED BY:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: PUMP STATION 1, SECTIONS

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

PUMP STATION 1 - SECTIONS

SHEET IDENTIFICATION
A-301
SHEET 30 OF 31



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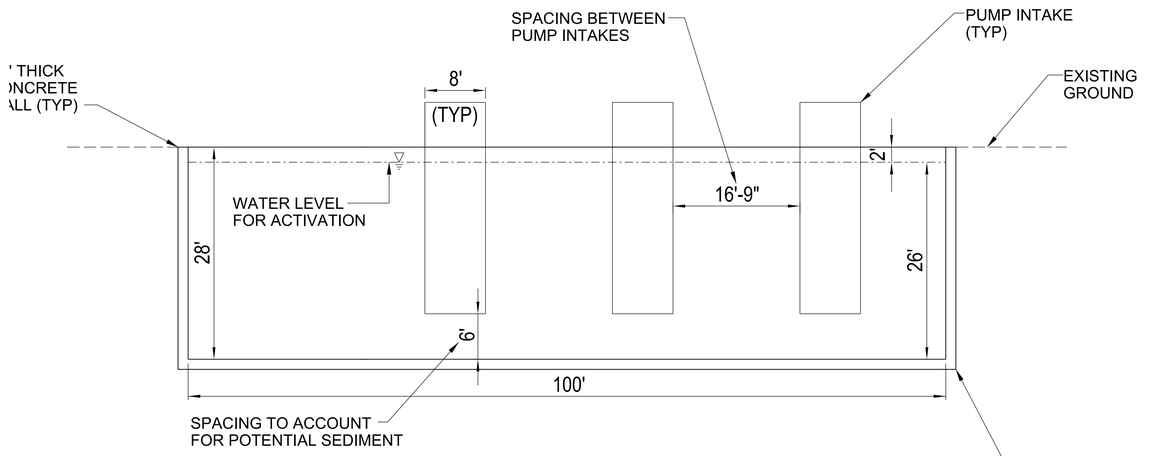
SCALE: 1"=10'



B PUMP SUMP PIT SECTION

SCALE: 1"=10'

10 5 0 10 30

SCALE: 1"=10'

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PEN TABLE: BW_and_Grayscale_Pen
PRINTED BY: j3ec9cp9

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.

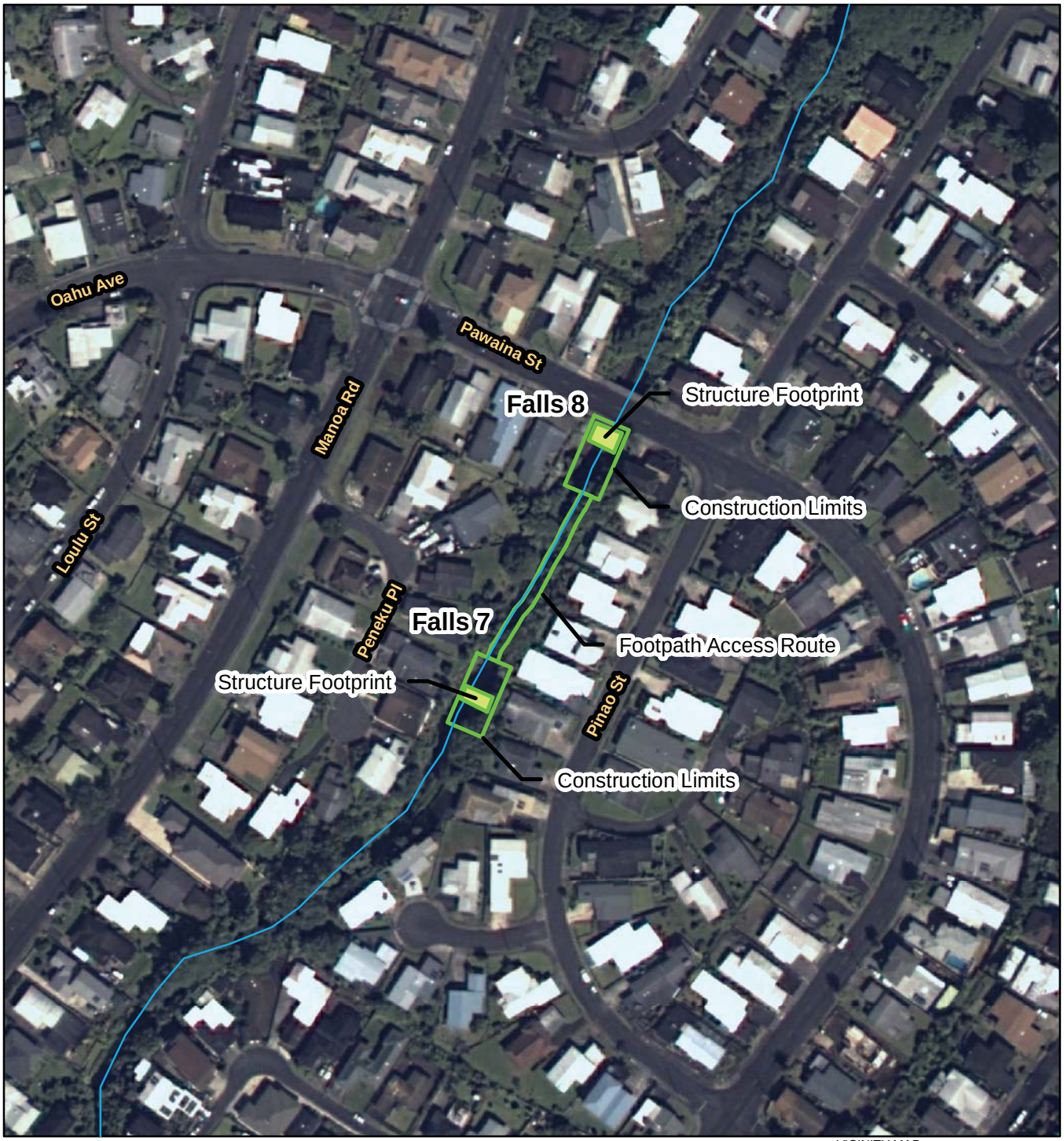
DESIGNED BY: JPH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
REVISIONS
SIZE: ANSI D
DATE:
CHECKED BY:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: PUMP STATION 2, SECTIONS
REVISION:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

PUMP STATION 2 - SECTIONS

SHEET IDENTIFICATION
A-302
SHEET 31 OF 31



LEGEND

Stream

Compensatory Mitigation Measure

N

0 100 200

Feet

VICINITY MAP

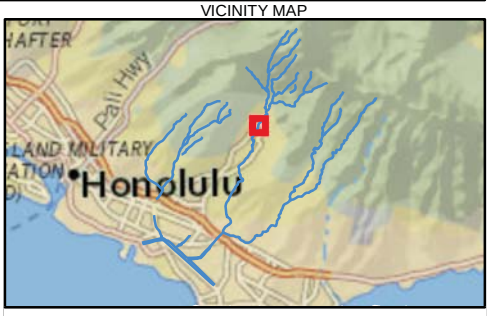


FIGURE 4
Compensatory Mitigation Measures
Ala Wai Canal Project
O'ahu, Hawai'i

CH2MHILL.

NOTES:

1. LOCATION OF A STAGING AREA WILL BE DETERMINED, IF NEEDED.
2. IF EQUIPMENT, MATERIALS AND/OR ACCESS IS PROVIDED VIA THE BRIDGE, THEN A PARTIAL LANE CLOSURE AND TRAFFIC CONTRL MAY BE REQUIRED.

ACCESS AND STAGING PLAN

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers

10% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

CH2M HILL, INC.
1132 BISHOP STREET, SUITE 1100
HONOLULU, HI 96813

DESIGNED BY: L HAYS | DATE: 5/XX/2015 | REVISION:
DRAWN BY: T STIMPSON | CHECKED BY: J YOUNG | SOLICIT./ CONTRACT NO.: 481684
SUBMITTED BY: J YOUNG | LOCATION CODE
PLOT SCALE: AS NOTED | PLOT DATE: 2015\05\12 | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: FILENAME

ALA WAI CANAL PROJECT

MITIGATION MEASURES

MANOA STREAM FALLS 7 AND 8
ACCESS AND STAGING PLAN

SHEET IDENTIFICATION
C-106
SHEET 09 OF 14

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:
PLOTDRIVER: $PLTDRV$$
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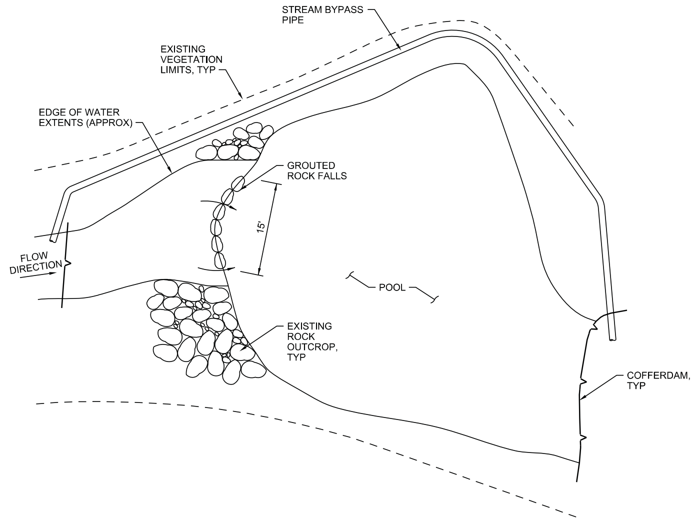
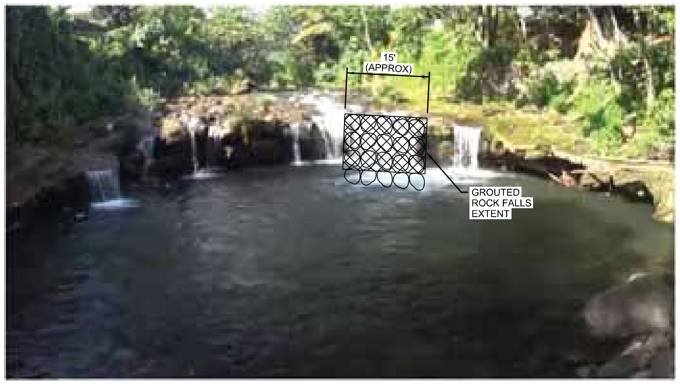


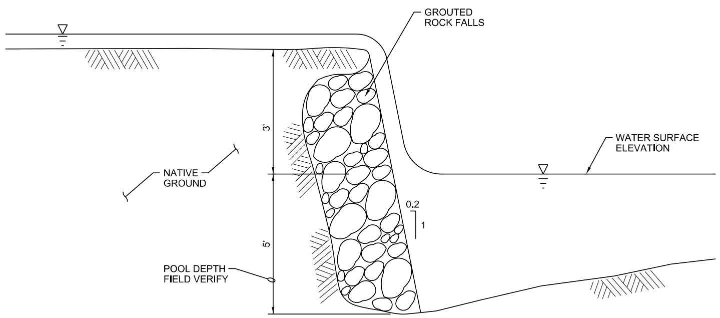
PLAN
NTS



NOTE:

DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SITE PHOTO
NTS



NOTE:

DIMENSIONS ARE APPROXIMATED BASED ON FIELD PHOTO.

SECTION
NTS

US Army Corps of Engineers

10% DESIGN

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

CH2M HILL, INC.
1132 BISHOP STREET, SUITE 1100
HONOLULU, HI 96813

DESIGNED BY: L HAYS		DATE: 5/XX/2015	REVISION:
DRAWN BY: T STIMPSON	CHECKED BY: J YOUNG	SOLICIT./ CONTRACT NO.: 481684	
SUBMITTED BY: J YOUNG		LOCATION CODE	
PLOT SCALE: AS NOTED	PLOT DATE: 2015\05\12	DRAWING NUMBER:	
SIZE: ANSI D	FILE NAME: FILENAME		

ALA WAI CANAL PROJECT
MITIGATION MEASURES

MANOA STREAM FALLS 7
REHABILITATION CONCEPT

SHEET IDENTIFICATION
C-107
SHEET 10 OF 14

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

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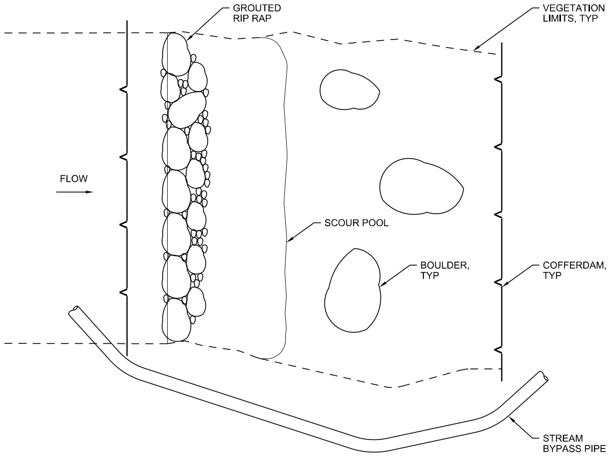
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

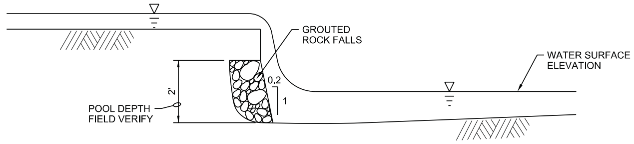


PLAN
1"=5'

NOTE:

DIMENSIONS ARE APPROXIMATE BASED ON FIELD PHOTO.

SITE PHOTO
NTS



NOTE:

DIMENSIONS ARE APPROXIMATE BASED ON FIELD PHOTO.

SECTION
1"=2'

US Army Corps of Engineers

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MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

CH2M HILL, INC.
1132 BISHOP STREET, SUITE 1100
HONOLULU, HI 96813

DESIGNED BY: L HAYS
DRAWN BY: T STIMPSON
CHECKED BY: J YOUNG
SUBMITTED BY: J YOUNG
PLOT SCALE: AS NOTED
PLOT DATE: 2015\05\12
SIZE: ANSI D
FILE NAME: FILENAME
DATE: 5/XX/2015
REVISION:
SOLICIT./ CONTRACT NO.: 481684
LOCATION CODE
DRAWING NUMBER:

ALA WAI CANAL PROJECT
MITIGATION MEASURES
MANOA STREAM FALLS 8
REHABILITATION CONCEPT

SHEET IDENTIFICATION
C-108
SHEET 11 OF 14

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:
PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

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

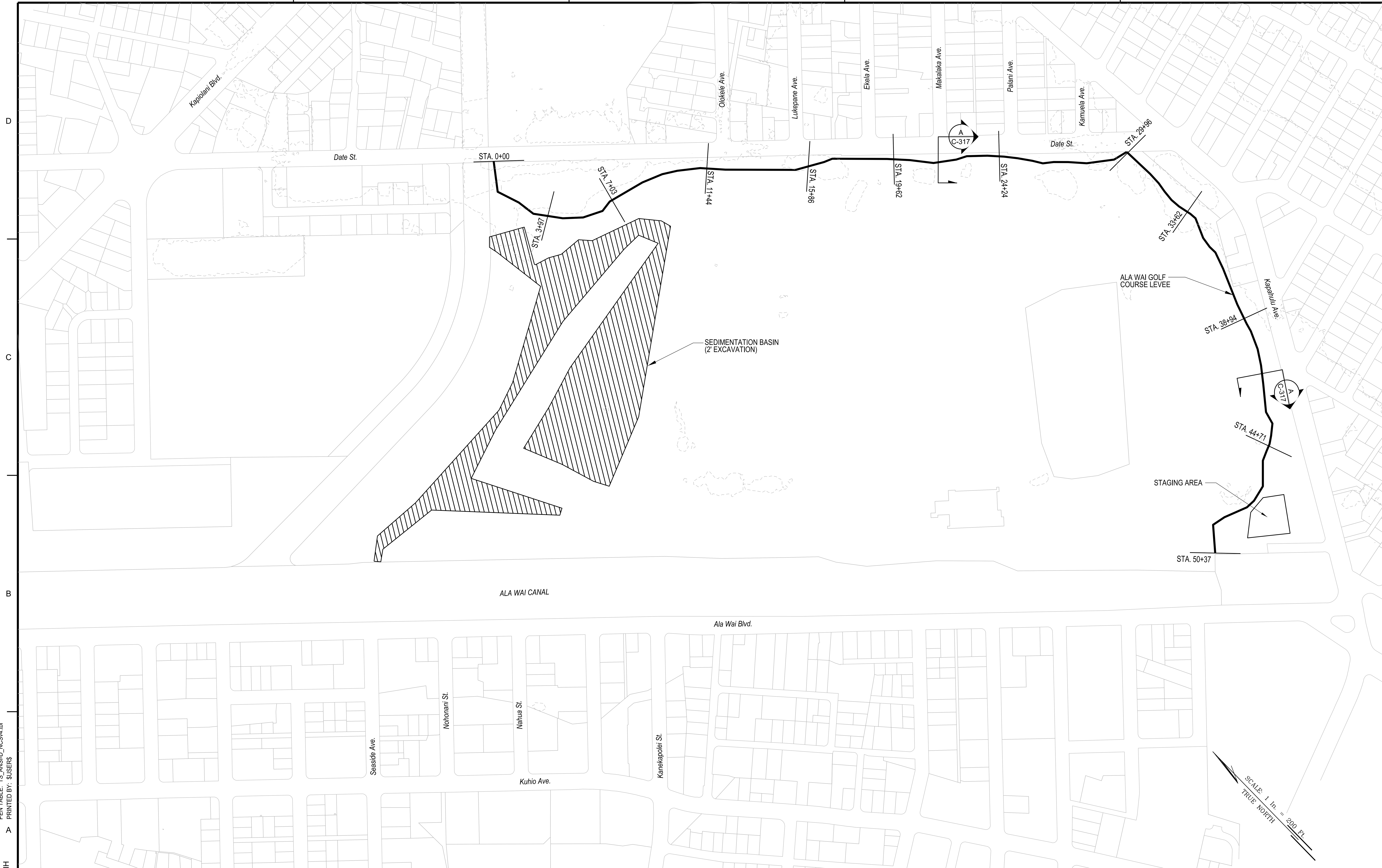
0+00
3+97
7+03
11+44
15+86
19+62
24+24
29+96
33+62
38+94
44+71
50+37

N

0 200 400 800 1,200 1,600
Feet

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)



FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal\Ala Wai Flood Study\01-Drawings\Civil\Final\Alternative 2\ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION
MODEL NAME: C-103
DATE & TIME: 1/8/2014 2:24:57 PM
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PLOTDRIVER: \\poh-netapp2\cad\misc\MS-WORKSPACE\standards\pltcfg\printer.pltcfg
PEN TABLE: TS_ANSI-D_NCSv4.tbl
PRINTED BY: $USER$

NOTES:

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

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION
PLAN

SCALE: 1"=200'

SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

200' 100' 0 200' 300'

SCALE: 1" = 200'

US Army Corps of Engineers®
HONOLULU DISTRICT

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MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

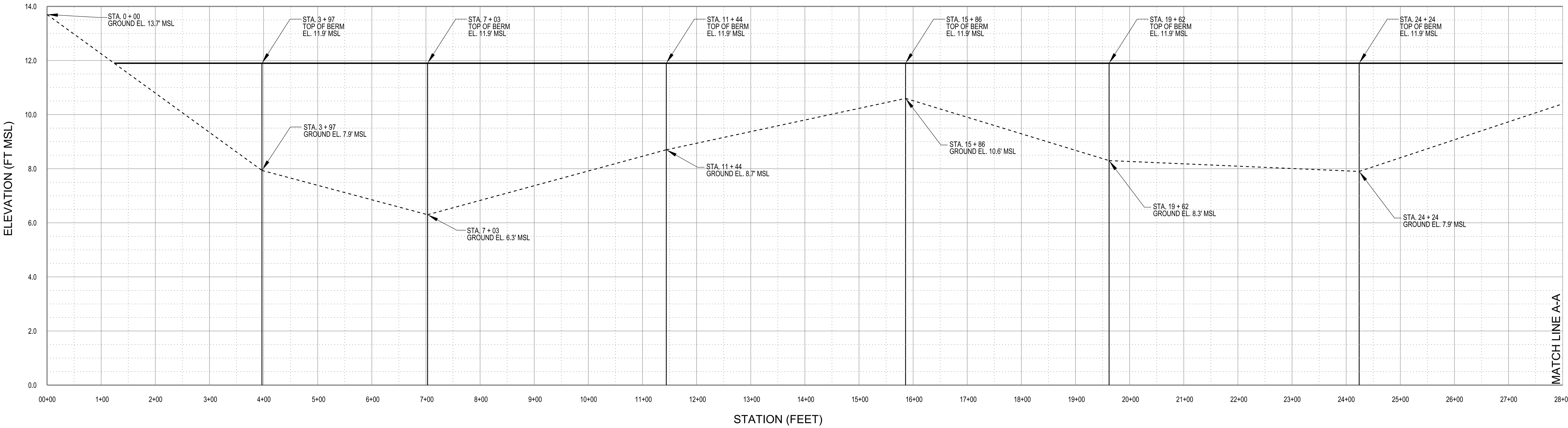
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

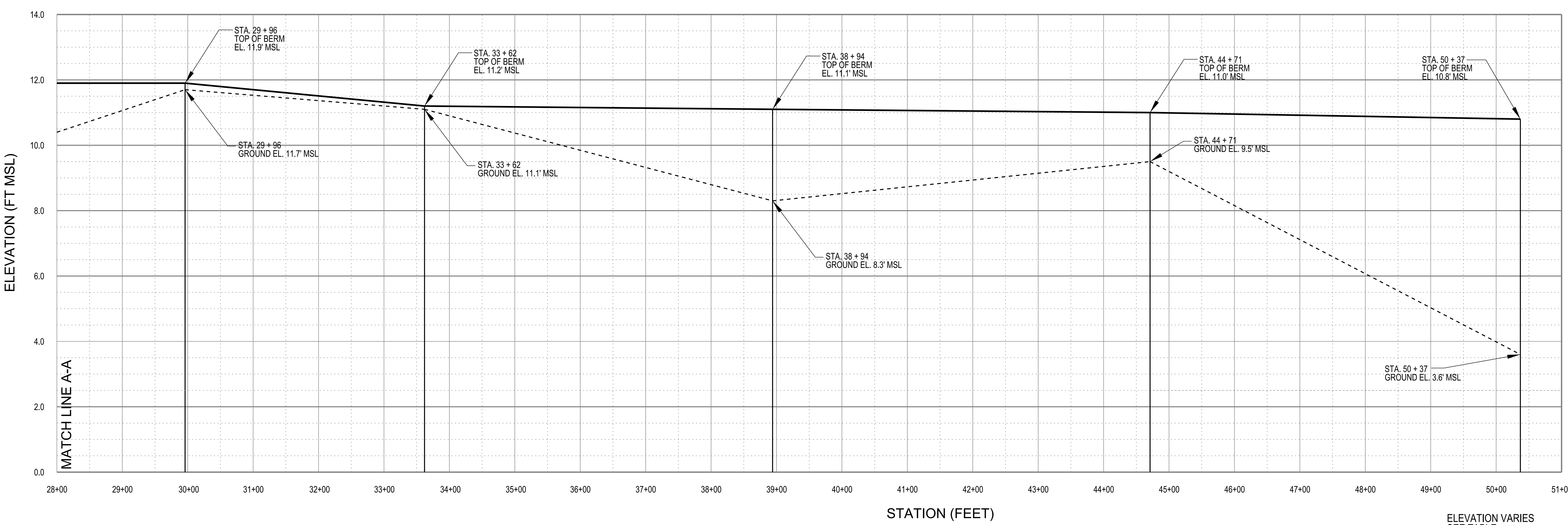
DESIGNED BY: JHH | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: 1/8/2014 | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION

ALA WAI WATERSHED PROJECT

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION
PLAN
ALTERNATIVE 2

SHEET IDENTIFICATION
C-103
SHEET 5 OF 25





ALA WAI GOLF COURSE BERM
STA 0 + 00 TO 50 + 37

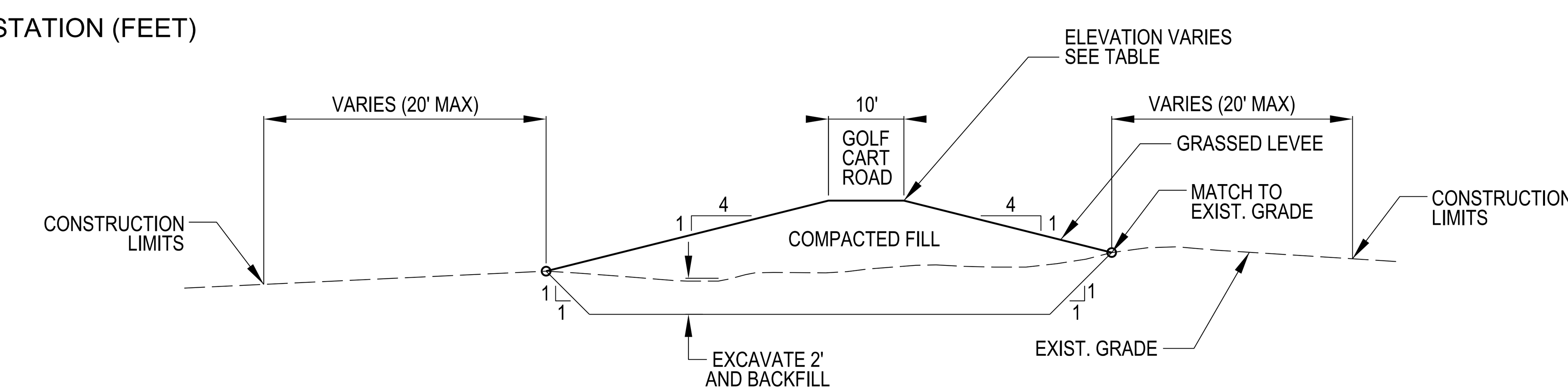
STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	-	-
3 + 97	4.0	11.9
7 + 03	5.6	11.9
11 + 44	3.2	11.9
15 + 86	1.3	11.9
19 + 62	3.6	11.9
24 + 24	4.0	11.9
29 + 96	0.2	11.9
33 + 62	0.1	11.2
38 + 94	2.8	11.1
44 + 71	1.5	11.0
50 + 37	7.2	10.8

NOTES:

1. NEW GOLF CART ROAD IS 2' THICK AC PAVEMENT.

ALA WAI GOLF COURSE BERM PROFILE

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'



A TYPICAL LEVEE SECTION
NOT TO SCALE

FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal\Ala Wai Flood Study\01-Drawings\Civil\Final\Alternative 2\C-317 ALA WAI GOLF COURSE PROFILE & SECTION
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DATE & TIME: 1/8/2014 4:44:30 PM
LAST SAVED BY: J3EC9JHH
PLOTDRIVER: \\poh-netapp2\cad\misc\MS-WORKSPACE\standards\pltcfg\printer.pltcfg
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HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR

10% DESIGN

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: JHH		DATE:	REVISION:
DRAWN BY:	CHECKED BY:	SOLICIT./ CONTRACT NO.:	
SUBMITTED BY:		LOCATION CODE	
PLOT SCALE: AS SHOWN	PLOT DATE: 1/8/2014	DRAWING NUMBER:	
SIZE: ANSI D	FILE NAME: C-317 ALA WAI GOLF COURSE PROFILE & SECTION		

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

ALA WAI GOLF COURSE BERMING
PROFILE AND SECTION
ALTERNATIVE 2

SHEET IDENTIFICATION
C-317
SHEET 20 OF 25

Brief Description of Measure
Need to determine how the water from the ditch gets into the golf course

N

27004001

27013002

27013009

27036001

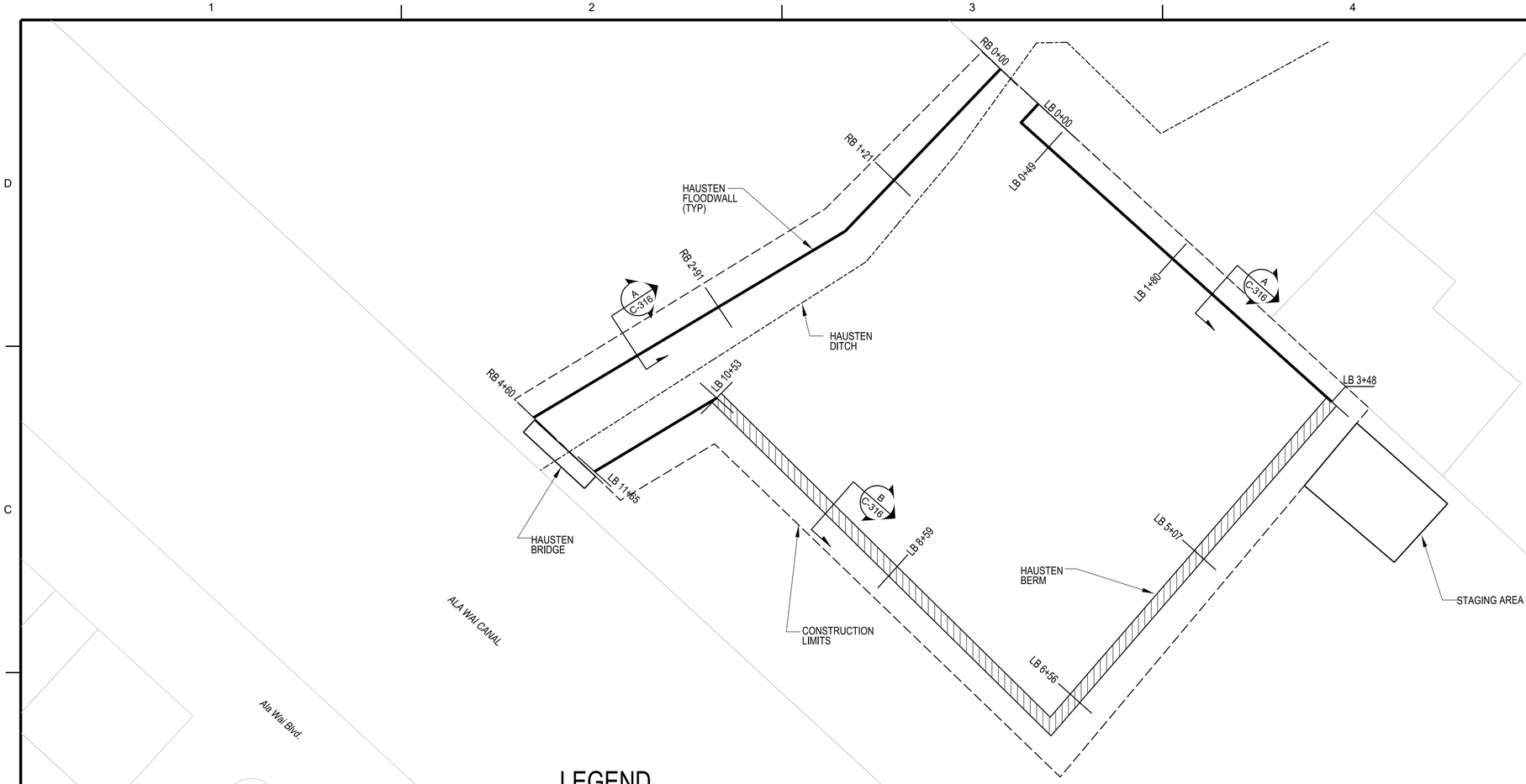
Hausten Ditch Bridge

27036007

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)

0 50 100 200 300 400 Feet



LEGEND

BERM

CONCRETE FLOODWALLS

NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-401 FOR THE HAUSTEN DITCH BRIDGE NEW CONRETE WALL PLAN.

HAUSTEN DITCH DETENTION PLAN

SCALE: 1"=50'

TRUE NORTH

SCALE: 1 In. = 50 Ft.

50' 25' 0 50' 100'

SCALE: 1" = 50'

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MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

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HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
PLOT SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE:
FILE NAME: HAUSTEN DITCH DETENTION
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI WATERSHED PROJECT

HAUSTEN DITCH DETENTION PLAN ALTERNATIVE 2

SHEET IDENTIFICATION
C-102
SHEET 4 OF 25

FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal\Ala Wai Flood Study\01-Drawings\Civil\Final\Alternative 2\HAUSTEN DITCH DETENTION
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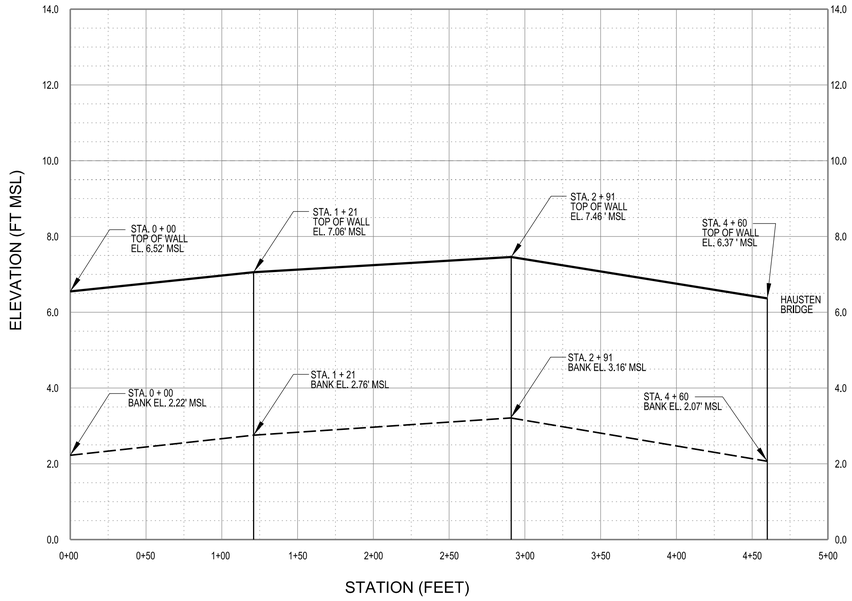
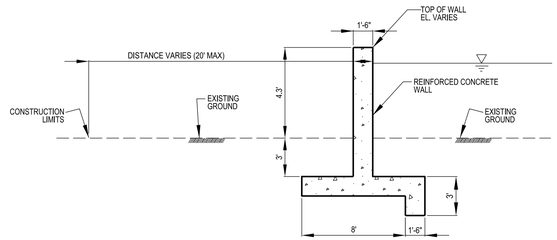
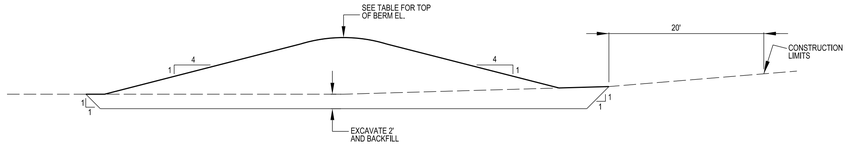


PROFILE
HAUSTEN DITCH RIGHT BANK FLOODWALL

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 2'



A TYPICAL REINFORCED CONCRETE FLOODWALL SECTION
NOT TO SCALE



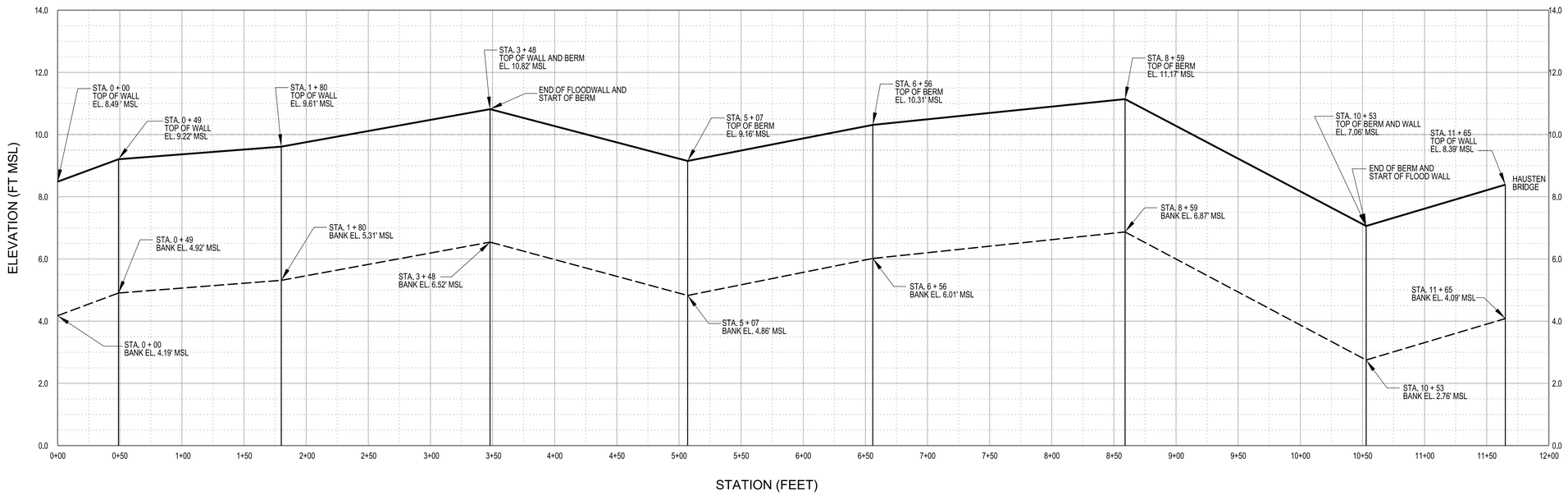
B HAUSTEN TYPICAL EARTHEN BERM SECTION
NOT TO SCALE

HAUSTEN DITCH RIGHT BANK FLOODWALL
STA TO 0 + 00 TO 4 + 60

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	4.30	6.52
1 + 21	4.30	7.06
2 + 91	4.30	7.46
4 + 60	4.30	6.37
HAUSTEN BRIDGE		

HAUSTEN DITCH LEFT BANK
FLOODWALL AND BERM
STA TO 0 + 00 TO 11 + 65

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
0 + 00	4.30	8.49
0 + 49	4.30	9.22
1 + 80	4.30	9.61
3 + 48	4.30	10.82
END OF FLOODWALL AND START OF BERM		
3 + 48	4.30	10.82
5 + 07	4.30	9.16
6 + 56	4.30	10.31
8 +59	4.30	11.17
10 + 53	4.30	7.06
END OF BERM AND START OF FLOODWALL		
10 + 53	4.30	7.06
11 + 65	4.30	8.39
HAUSTEN BRIDGE		



PROFILE
HAUSTEN DITCH LEFT BANK FLOODWALL AND BERM

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 2'

US Army Corps of Engineers
HONOLULU DISTRICT

10% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH	DRAWN BY:	SUBMITTED BY:	PLOT SCALE: 1=1 UNLESS SHOWN	SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DATE:	REVISION:
CHECKED BY:	SOLICIT. / CONTRACT NO.:
	LOCATION CODE
PLOT DATE: 4/16/2014	DRAWING NUMBER:
FILE NAME: C-316 HAUSTEN DITCH PROFILE & SECTIONS	

ALA WAI WATERSHED PROJECT

HAUSTEN DITCH FLOODWALL AND BERM
PROFILE AND SECTIONS
ALTERNATIVE 2

SHEET IDENTIFICATION
C-316
SHEET 19 OF 25

FILE: pw:\\POH-APP07FTS.poh.ds.usace.army.mil:poh-ap07ftsDocuments\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal\Ala Wai Flood Study\01-Drawings\Civil\Final\Alternative 2\C-316 HAUSTEN DITCH PROFILE & SECTIONS
MODEL NAME: C-316
DATE & TIME: 1/8/2014 4:14:26 PM
LAST SAVED BY: J3EC9JHH
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PEN TABLE: TS_ANSI-D_NCSv4.tbl
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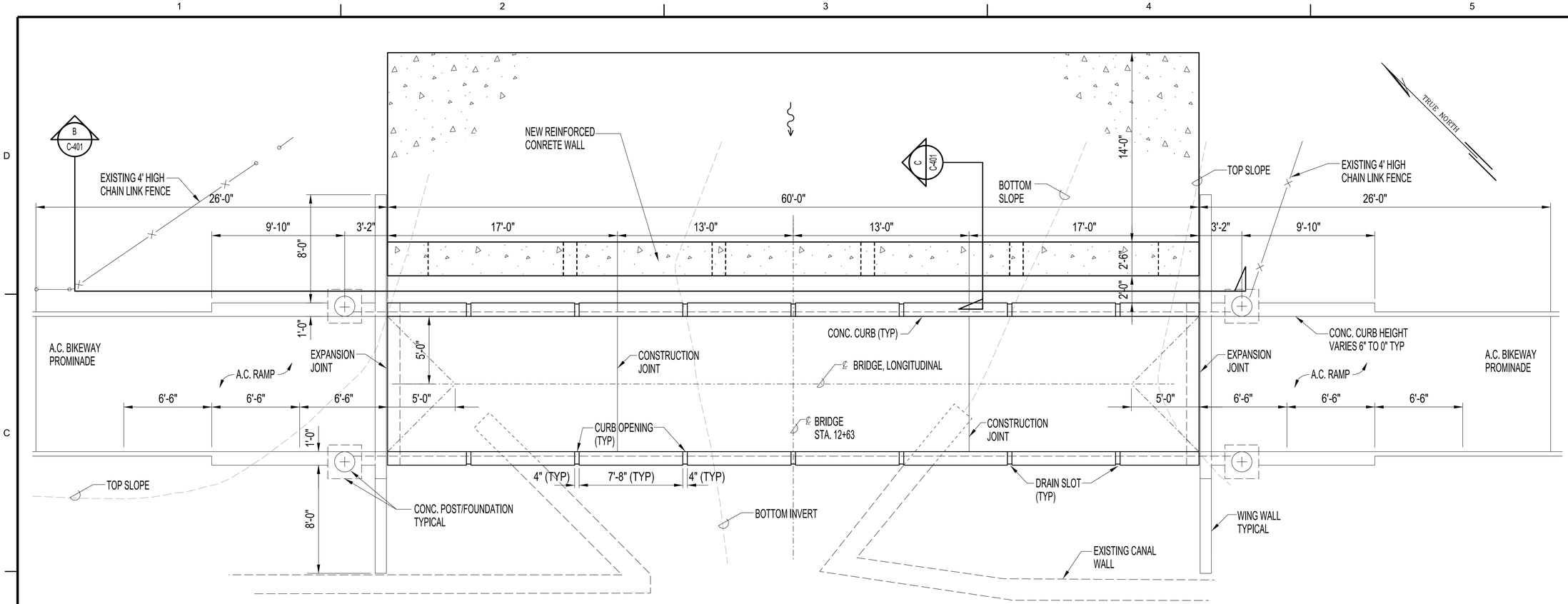
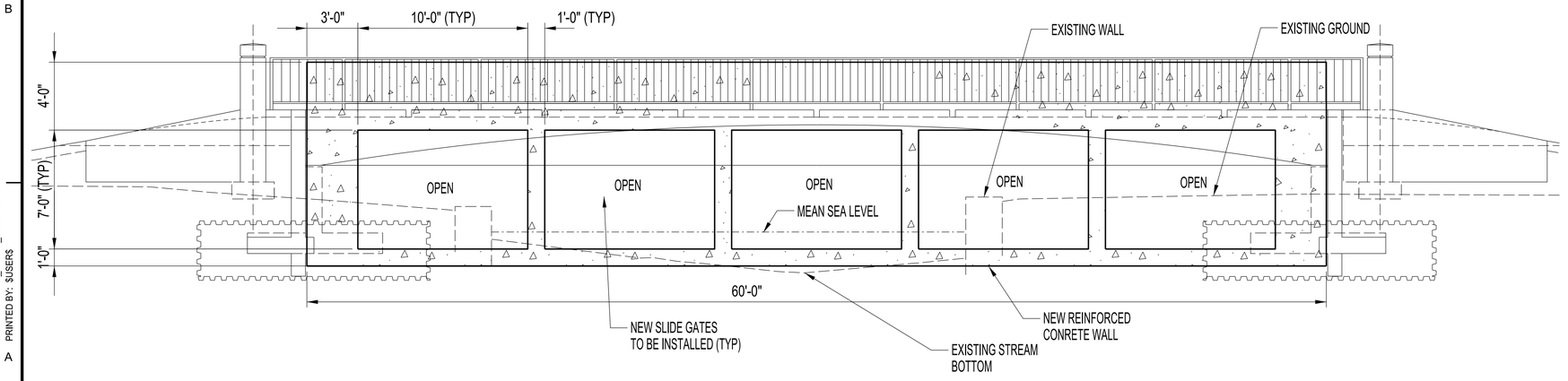
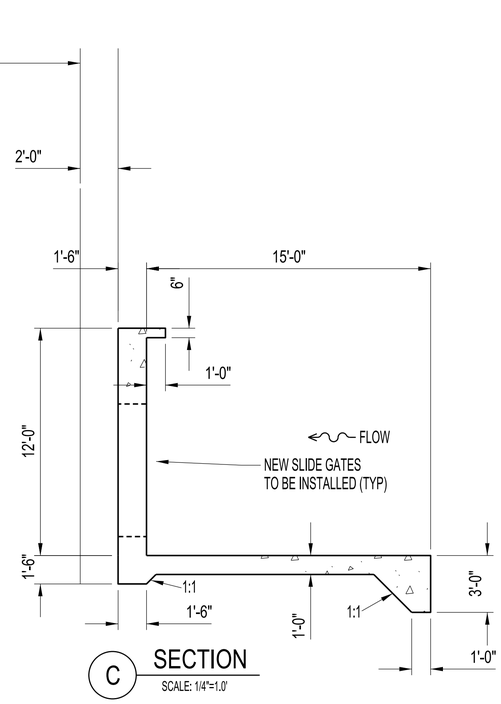


ALA WAI CANAL

A PLAN
SCALE: 1/4"=1.0'



B ELEVATION
SCALE: 1/4"=1.0'



C SECTION
SCALE: 1/4"=1.0'

US Army Corps of Engineers
HONOLULU DISTRICT

10% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: 1/8/2014
FILE NAME: C-401 HAUSTEN BRIDGE PLAN, SECTION & PROFILE
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

HAUSTEN BRIDGE CONCRETE WALL
PLAN, SECTION AND ELEVATION
ALTERNATIVE 2

SHEET IDENTIFICATION
C-401
SHEET 25 OF 25

FILE: pw:\POH-APD7FTS.poh.ds.usace.army.mil:poh-ap07fsDocuments\11 Other Locations\2 - O'ahu\Civil Works\Ala Wai Canal\Ala Wai Flood Study\01-Drawings\Civil\Final\Alternative 2\C-401 HAUSTEN BRIDGE PLAN, SECTION & PROFILE.dgn
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DATE & TIME: 1/8/2014 5:01:36 PM
LAST SAVED BY: J3EC9JHH
PLOTDRIVER: \\poh-hstapp2\cad\misc\MS-WORKSPACE\standards\pltcfg\printer.pltcfg
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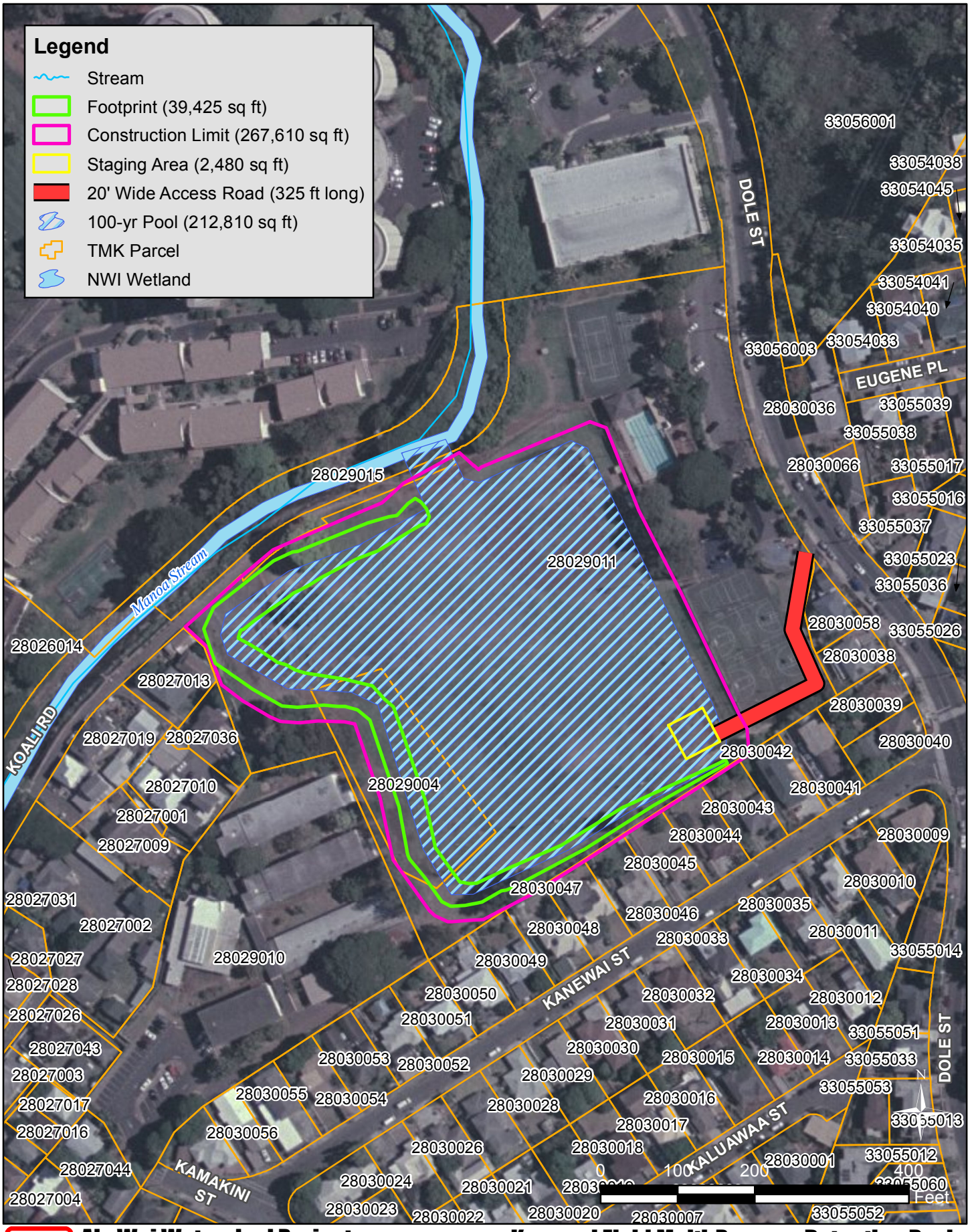

Ala Wai Watershed Project — **Kanewai Field Multi-Purpose Detention Basin**

Island of Oahu, Hawaii

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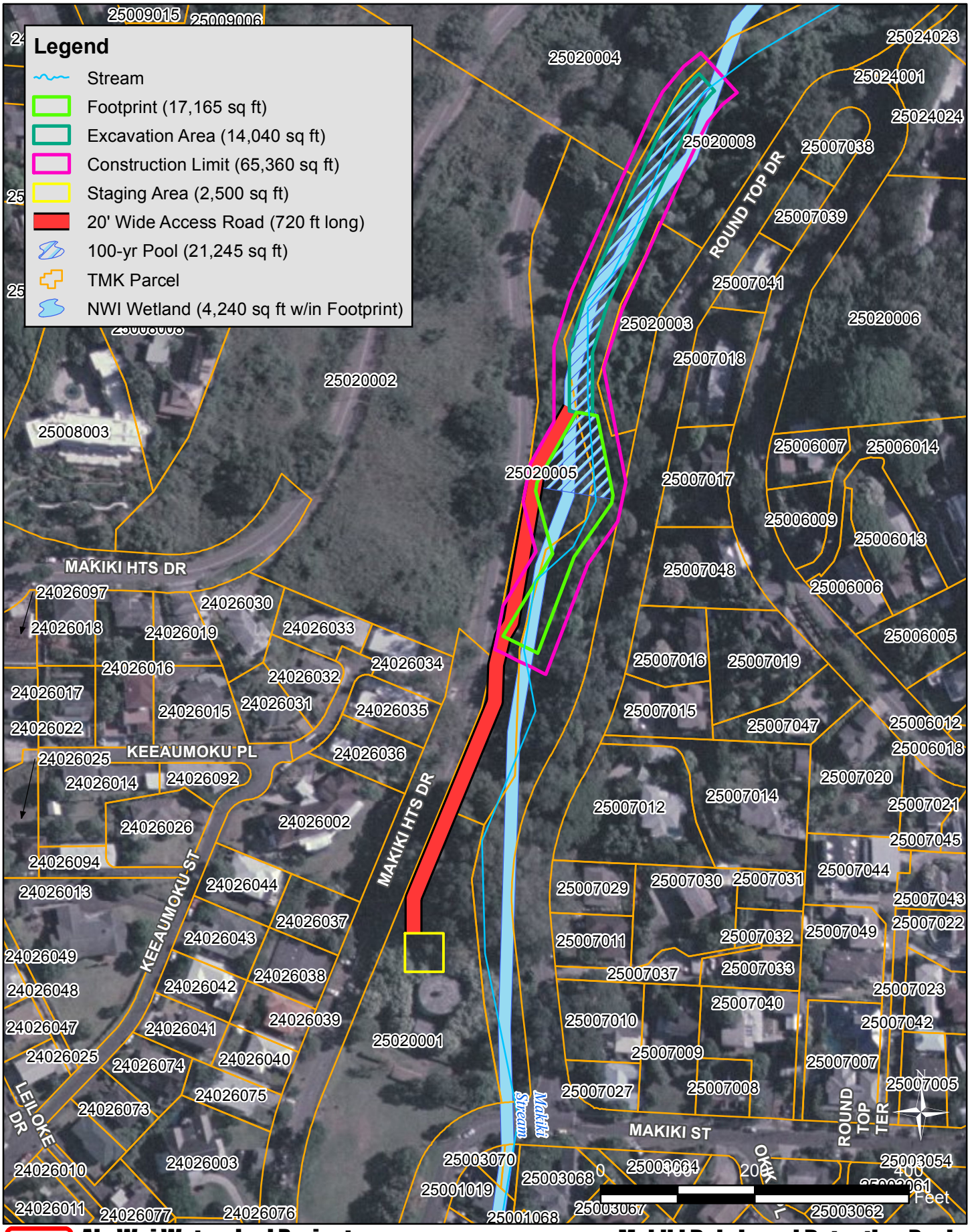

Ala Wai Watershed Project

Makiki Debris and Detention Basin

Island of Oahu, Hawaii

\\poh-netapp2\gis\Projects_Civil_Works\C0046\arcgismaps\Makiki_Debris_and_Detention_Basin_Alt3_20160627.mxd

Manoa Park In-Stream Debris Catchment

- Manoa In-stream Debris Catchment footprint (540 sq ft)
- Manoa In-stream Debris Catchment Construction Limits (3,740 sq ft)
- Manoa In-stream Debris Catchement Staging Area (2,500 sq ft)
- HI_OAHU.parcel_area_2011

Brief Description of Measure

Concrete pad; 8' wide, 2' thick, 140' across; steel posts (4' - 7' high), spaced every 4' along concrete pad

N

29037088
29029057
29036003
29029056
29029062
29029061
29029060
29029043
29029063
29029059
29029064
29029053
29029065
29029013
29029052
29029058
29029009
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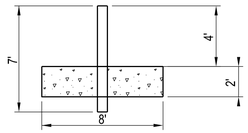
29074054
29074038
29029038
29074053
29029039
29029040
29074052
29074034
29029035
29074062
29074065

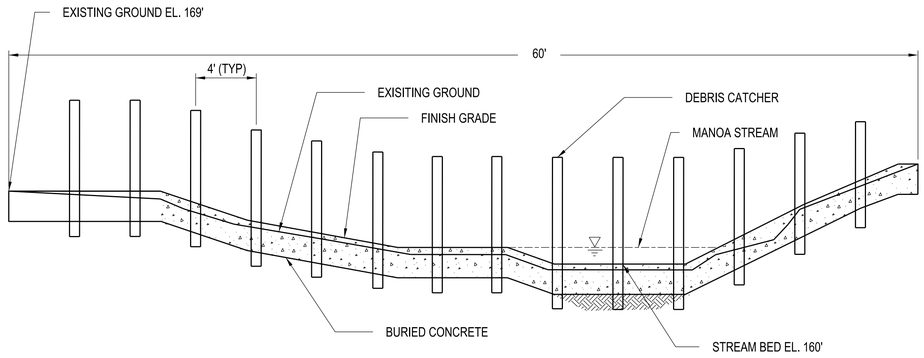
E Manoa Rd

0 50 100 200 300 400 Feet



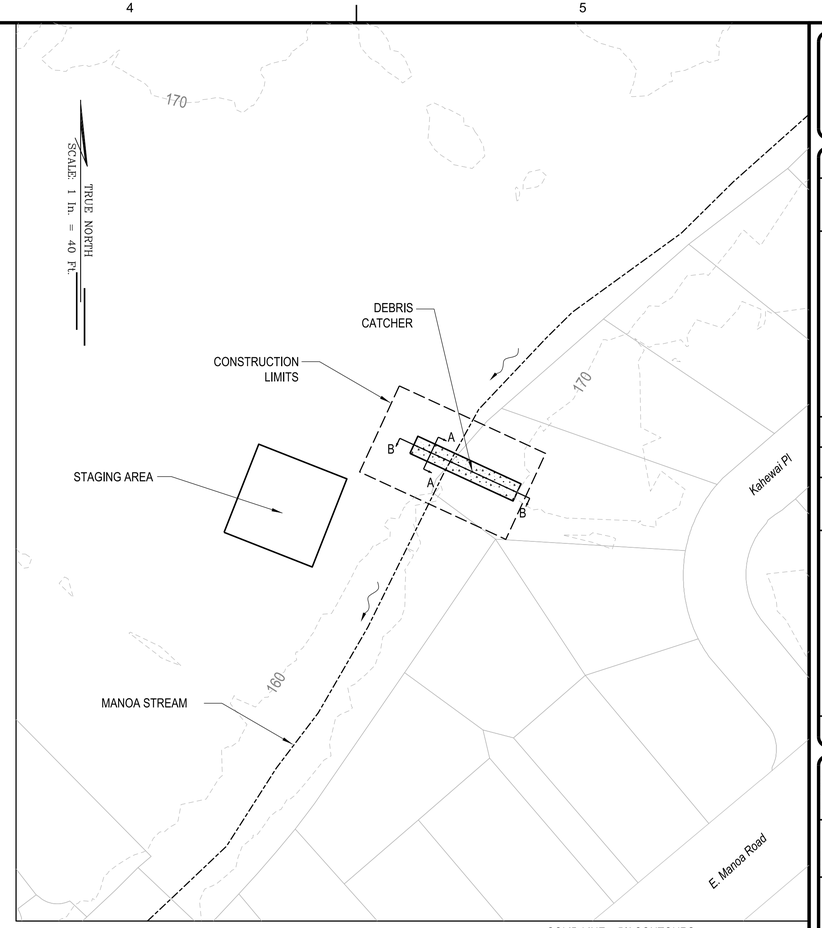
MANOA IN-STREAM DEBRIS CATHMENT
SECTION A-A

SCALE: 1"=5'



MANOA IN-STREAM DEBRIS CATCHMENT
SECTION B-B

SCALE: 1"=5'



SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

PLAN

SCALE: 1"=40'

SCALE: 1" = 5'

Note: All elevations are feet MSL

US Army Corps of Engineers
HONOLULU DISTRICT

10% DESIGN

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
SUBMITTED BY:
CHECKED BY:
PLOT SCALE: 1:1
PLOT DATE:
DATE:
SIZE: ANSI D
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: C-318 MANOA_PARK_IN-STREAM_DEBRIS_CATCHMENT_PLAN & SECTIONS
REVISION:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

MANOA IN-STREAM DEBRIS CATCHMENT
PLAN AND SECTIONS
ALTERNATIVE 3

SHEET IDENTIFICATION
C-318
SHEET 19 OF 19

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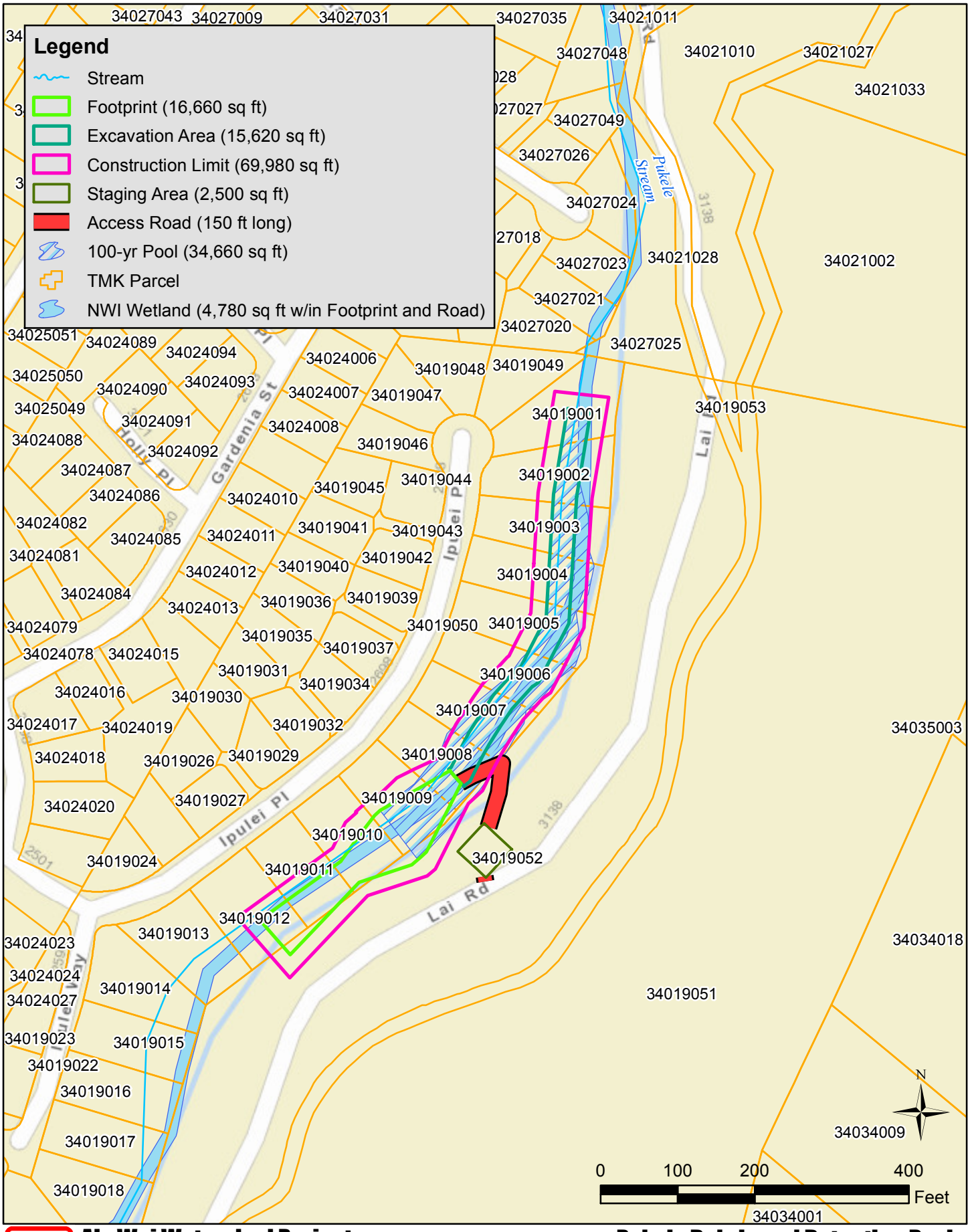

Ala Wai Watershed Project

Pukele Debris and Detention Basin

Island of Oahu, Hawaii

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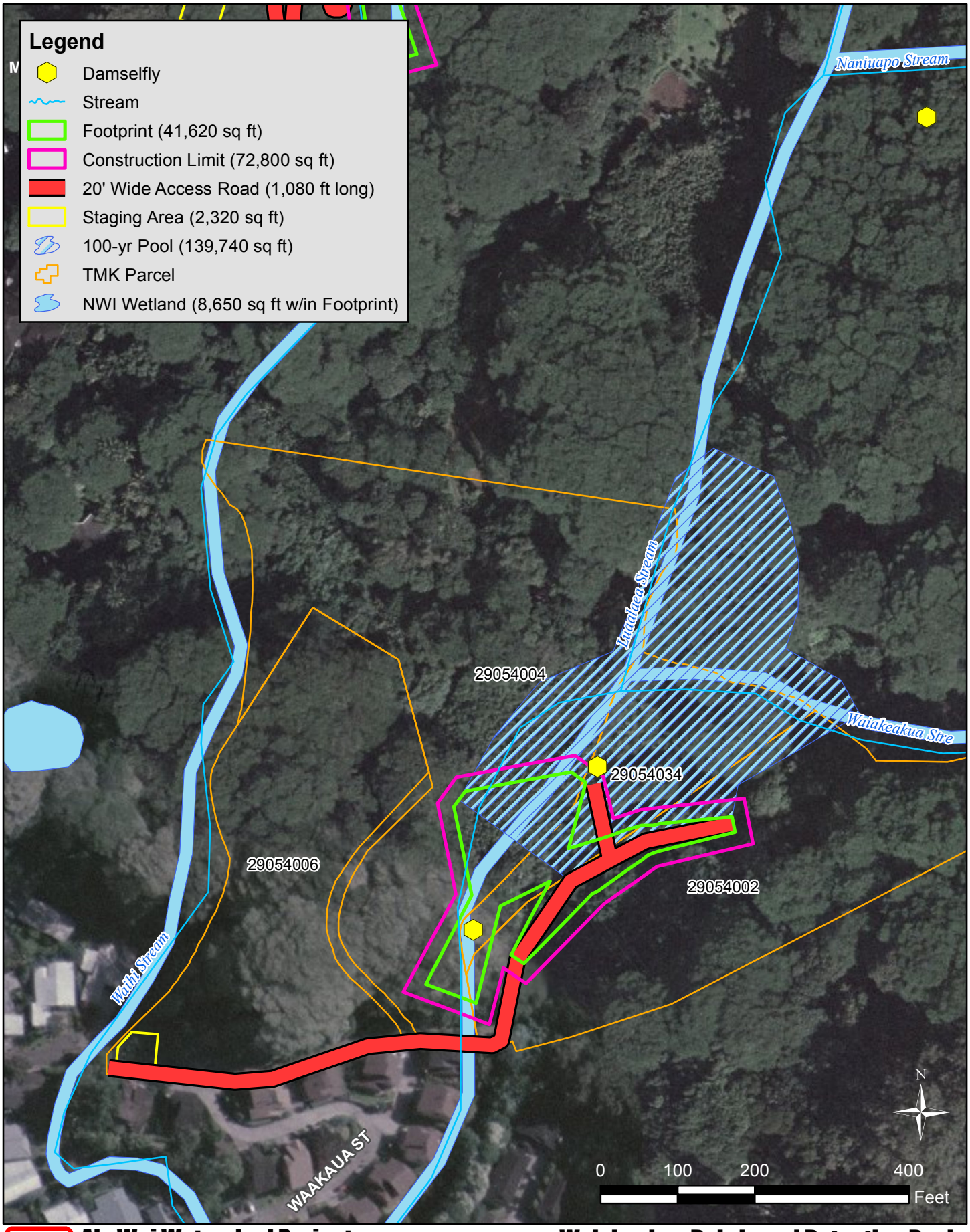

Ala Wai Watershed Project

Waiakeakua Debris and Detention Basin

Island of Oahu, Hawaii

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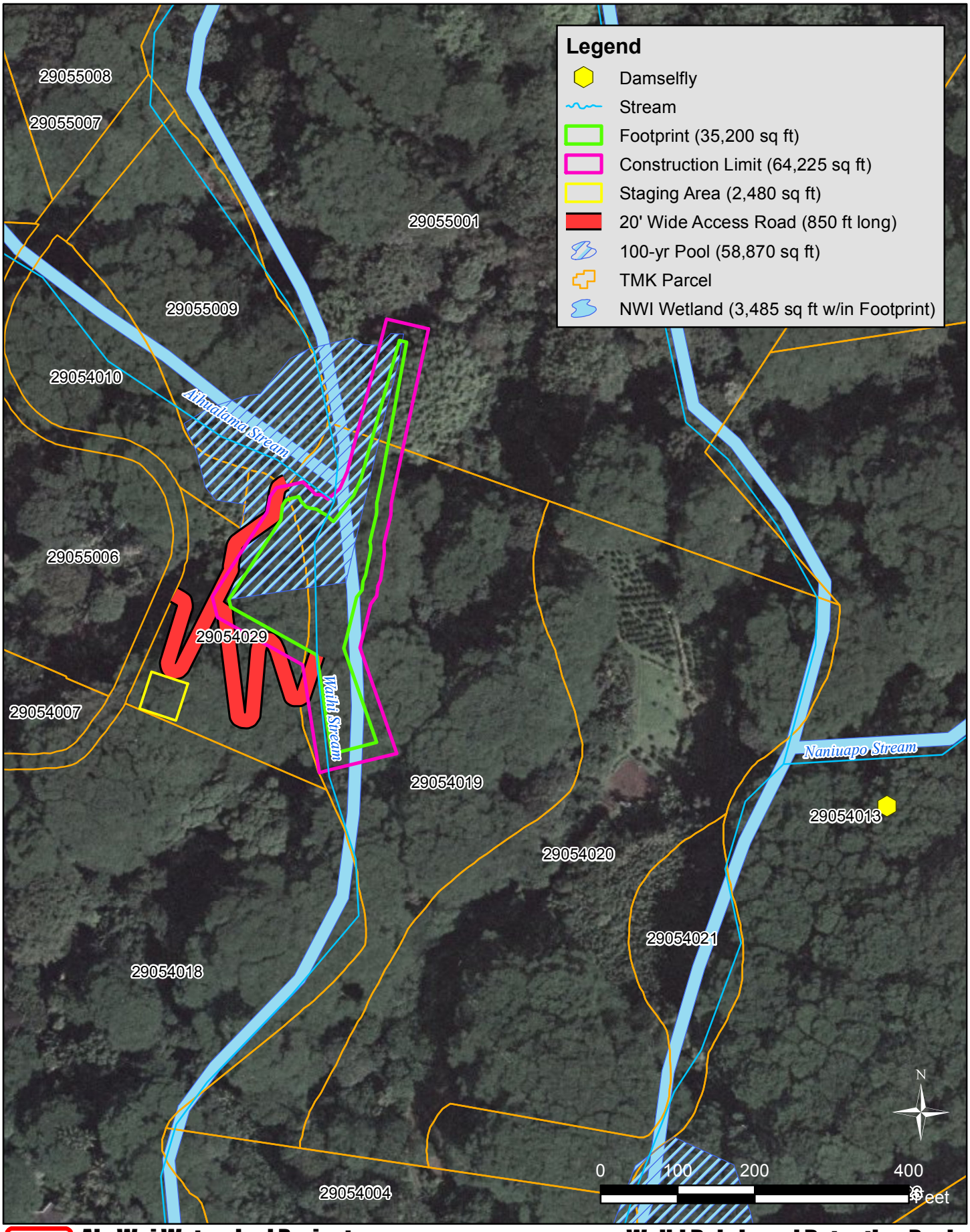

Ala Wai Watershed Project

Waihi Debris and Detention Basin

Island of Oahu, Hawaii

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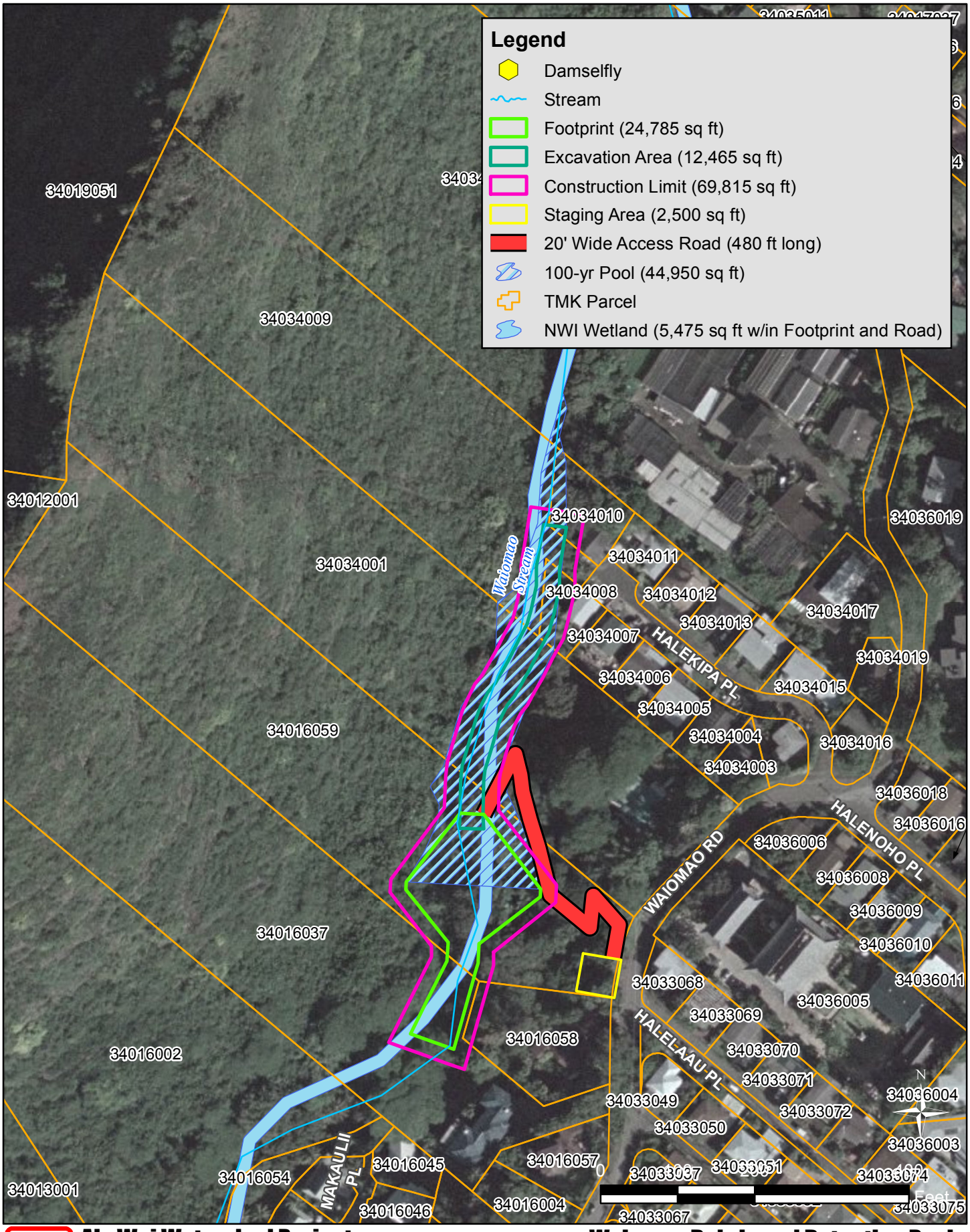

Ala Wai Watershed Project

Waiomao Debris and Detention Basin

Island of Oahu, Hawaii

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N

E Manoa Rd

Kolomona Pl

Lower Rd

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29043002

Brief Description of Measure

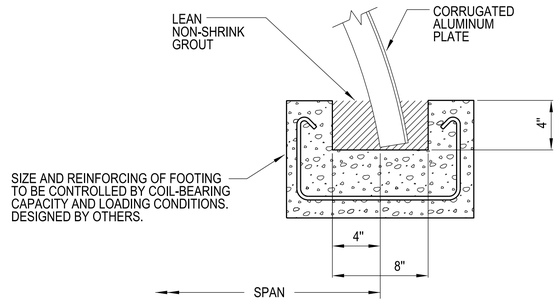
Three-sided berm; 20' high and 840' across; 5'x5' box culvert; concrete spillway (3'x80') above culvert; 18" of rip rap on downstream edge of spillway; 20-foot-wide perimeter to be maintained as cleared around around perimeter of berm; **NOTE: does NOT include diversion of flows via buried pipe along 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)

0 50 100 200 300 400

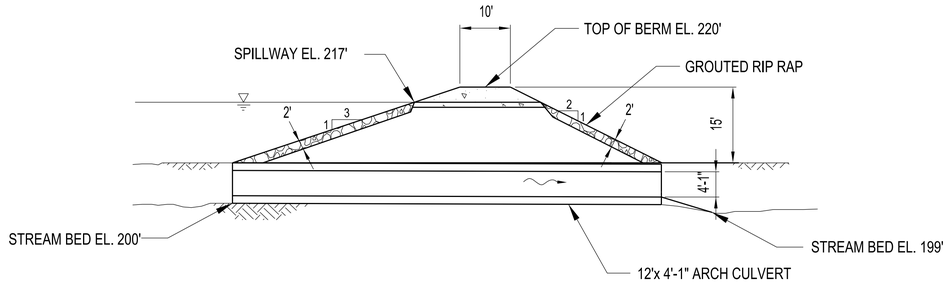
Feet



SLOTTED CONCRETE FOOTING

WOODLAWN DITCH DETENTION BASIN SECTION D-D

SCALE: NTS



WOODLAWN DITCH DETENTION BASIN SECTION B-B

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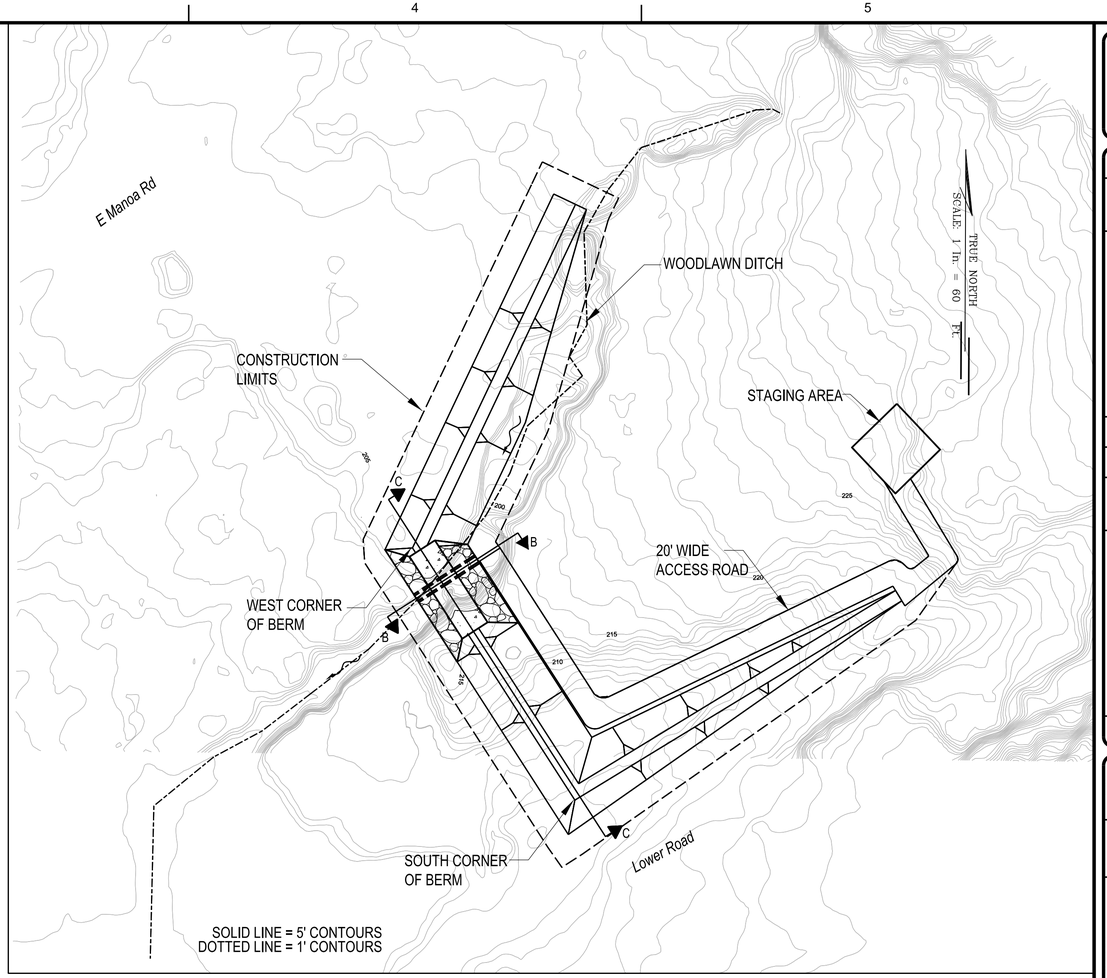
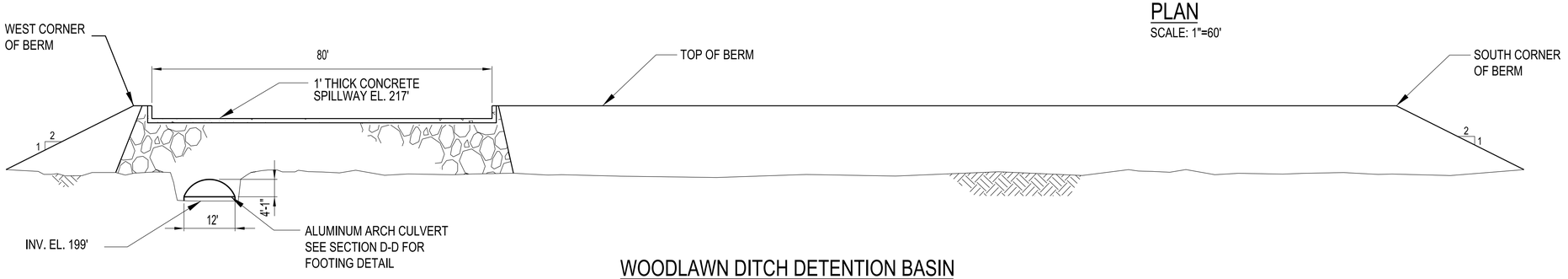


PLAN

SCALE: 1"=60'



WOODLAWN DITCH DETENTION BASIN SECTION C-C

SCALE: 1"=15'

15' 7.5' 0 15' 30'

SCALE: 1" = 15'

Note: All elevations are feet MSL

US Army Corps of Engineers
HONOLULU DISTRICT

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US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

SHEET IDENTIFICATION

SHEET 0 OF 0

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UTILITY ASSESSMENT REPORT

Ala Wai Canal Project
Honolulu, Hawaii

Contract No. W9128A-12-D-0009-0002

Prepared for:

US Army Corps of Engineers®

U.S. Army Corps of Engineers
Honolulu District
Building 230 (CEPOH-PP-C)
Fort Shafter, Hawaii 96856

June 2016

ch2m

Table of Contents

Tables

Attachments

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)

documentation. The reference documents that were determined to have relevant information and were used to identify utilities within the project area are listed in Table 1.

TABLE 1
Documentation Used for Identification of Existing Utilities

Source	Citation	Quick Reference [a]
On file at the City & County of Honolulu	City & County of Honolulu, Department of Design and Construction (DDC) Wastewater Division, Asbuilt Drawings, Job No. W18-07, Plan and Profile Sheets, 2/9/2009.	DDC Asbuilt, Job No. W18-07
Office of Environmental Quality Control (OEQC) Document Library	Ala Wai Canal Dredging, Final Environmental Assessment. Federal Aid Project No. STP No. STP-0300(038). Prepared by Belt Collins. October 1998.	Ala Wai Canal Dredging FEA
CH2M Office Library	Board of Water Supply. Distribution Maps for Oahu (hard copy). Revised 1988.	BWS Dist. Map (1988)
Provided by Board of Water Supply	Board of Water Supply. Distribution Map for Waikiki Area (electronic), provided May 2016.	BWS Dist. Map (2016)
Provided by Board of Water Supply	Board of Water Supply. Asbuilt Drawings for the Replacement of 12" Water Main Along Ala Wai Boulevard, Job No. 78-100. February 7, 1978.	BWS Asbuilt, Job No. 78-100
Provided by Board of Water Supply	City & 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.	DPW Asbuilt, Job No. 24-50
Provided by Board of Water Supply	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.	BWS Asbuilt, Job No. 92-016
Provided by Board of Water Supply	Asbuilt Drawings for Improvements of Kalakaua Ave. Fronting the Allure Waikiki Condo, CP Job# 2006/CP-278, Sheet C-4.2, 2010	Asbuilt for Allure Waikiki
Provided by Board of Water Supply	City & 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.	DPR Utility Plan, Job No. 89-009c
Provided by Board of Water Supply	City & County of Honolulu, Department of Parks and Recreation (DPR), Asbuilt Drawings for Ala Wai Golf Course Maintenance Facility, Job No. 96-011C, November 1996.	DPR Asbuilt, Job No. 96-011C
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Design and Construction. Waikiki Buffer Zone Map. 2009.	Waikiki Buffer Zone Map
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Design and Construction. Future Projects (Nos. 08-0107, 08-0108, 13-0062), Provided May 20, 2016.	DDC Future Projects
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Design and Construction. Hillside Terrace at Palolo, Provided May 20, 2016.	Hillside Terrace at Palolo
Provided by City and County of Honolulu, Department of Design and Construction	City & 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.	DDC Asbuilt for Hillside Terrace Subdivision Sewer Relocation
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Public Works (DPW) Division of Sewers. Asbuilt Drawings for Waiomao Sewers Improvement District No. 238, Job No. 47-72, December 1972.	DPW Asbuilt, Job No. 47-72
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Environmental Services (DES) Division of Collection System Maintenance. Asbuilt Drawings for Moiliili Area 3. June 2013.	DES Asbuilt, Moiliili Area 3

TABLE 1
Documentation Used for Identification of Existing Utilities

Source	Citation	Quick Reference [a]
Provided by City and County of Honolulu, Department of Design and Construction	City & County of Honolulu, Department of Environmental Services (DES) Division of Collection System Maintenance. Asbuilt Drawings for Palolo Area 3.1. June 2013.	DES Asbuilt, Palolo Area 3.1
Provided by Hawaii Gas	Hawaii Gas. Distribution Map for project area (electronic), provided May 2016.	Hawaii Gas distribution map
Provided by HECO	Documentation for Ala Wai 46kV Underground Cable Relocation Project (schematic figure), provided May 2016.	46kV Relocation Project documentation
City & County of Honolulu GIS Database	City & County of Honolulu, Department of Planning & Permitting, Honolulu Land Information System (HOLIS), Interactive GIS Web Map and Data Services.	C&C GIS database
N/A	Visual Inspection by CH2M staff, May 2016.	Visual inspection

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

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

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

Location	Utility Conflicts	Recommendations
Ala Wai Canal Floodwalls (Left Bank)	Underground 46kV electrical line along Ala Wai Boulevard between Kaiolu Street and McCully Street may be located within or near floodwall footprint; exact location is not known	Determine whether floodwall conflicts with electrical line once detailed information is obtained; microsite floodwalls or relocate utility, as needed
	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	Relocate within landscaped area, as needed
	16-inch and 30-inch diameter water lines located alongside McCully Street Bridge; bridge tie-in could impact water lines	Design bridge tie-in to accommodate water lines
	Wide variety of storm drains would be crossed by floodwall	Design floodwall to accommodate storm drain crossings
	Multiple force mains and sewer tunnel located in close proximity and crossed by floodwalls	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
	Power feeds and lines for walkway and street lighting located within or near floodwall footprint	Relocate as needed during construction
	Power feeds and lines for traffic signals (and traffic signal boxes) located within or near floodwall footprint	Relocate as needed during construction
	Irrigation lines located within or near floodwall footprint	Relocate as needed during construction
Ala Wai Canal Floodwalls (Right Bank)	Water line running along Ala Wai Promenade located within floodwall footprint	Relocate within promenade area as needed
	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	Design floodwall and/or flood gate to accommodate water lines
	Wide variety of storm drains would be crossed by floodwall	Design floodwall to accommodate storm drain crossings
	Multiple force mains and sewer tunnel located in close proximity and would be crossed by floodwalls	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
	Power feeds and park lights for Ala Wai Community Park located within or near floodwall footprint	Design floodwall to avoid lights or relocate closer to interior of park
	Power feeds for walkway lighting located within or near floodwall footprint	Relocate as needed during construction
	Irrigation lines located within or near floodwall footprint	Relocate as needed during construction

TABLE 3

Summary of Key Utilities Requiring Relocation and/or Design Modifications

Location	Utility Conflicts	Recommendations
Pump Station 1 (Kapahulu)	No utilities identified that require design modifications and/or relocation	N/A
Pump Station 2 (Golf Course)	Storm drain located within footprint of pump station	Design pump station to accommodate drain line
	Lighting for driving range located near pump station footprint (currently under construction)	Relocate lighting (or design pump station to avoid lighting) as needed
Pump Station 3 (University)	Proposed 46kV line to be installed in horizontal directional drill casing under Canal (est. 2018-2020) could conflict with pump station (sump)	Design pump station to avoid proposed 46kv line
	Transformers and electrical boxes located in (or near) pump station footprint	Design pump station to avoid transformers and electrical boxes
	Pump station would be located in close proximity to 72-inch diameter sewer tunnel; sump pump could conflict with sewer tunnel	Design pump station to avoid sewer tunnel
	Power feeds for lighting generally located within or near pump station footprint	Relocate as needed during construction
Ala Wai Golf Course Detention	Overhead electrical and telecommunications lines located along entrance road to golf course clubhouse could affect construction access	May require temporary relocation for construction
	Detention berm would cross water line that runs from Kapahulu Street to drainage channel	Design berm to accommodate waterline
	Detention berm would cross water line near maintenance facility in at least 2 locations; water line may also conflict with sediment basin	Relocate water line (or design berm and sediment basin to accommodate water line) as necessary
	Detention berm would cross large drain lines that run from Kapahulu Avenue through golf course, daylighting into drainage channel	Design berm to accommodate drain lines
	Storm drains running along edge of Ala Wai golf course property near Date Street would be in close proximity to detention berm	Confirm final design for berm does not conflict with storm drain; modify berm design and/or relocate storm drain as needed
	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	Relocate sewer lines (or design berm and sediment basin to accommodate sewer lines) as necessary
	Detention berm would cross 12-inch and 24-inch diameter sewer lines in eastern portion of golf course	Design berm to accommodate sewer lines and manholes
	Irrigation lines and equipment located within or near detention footprint	Relocate as needed during construction
Hausten Ditch Detention	72-inch diameter sewer tunnel and associated manholes located in close proximity to detention basin; detention berm may cross sewer tunnel	Identify measures to avoid/protect sewer; specifically need to consider loads imposed on sewer line and manhole access
	Power feeds for lighting may extend into detention footprint	Relocate as needed during construction
	Irrigation lines and equipment located within detention footprint	Relocate as needed during construction

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

Location	Utility Conflicts	Recommendations
Kanewai Detention	Overhead electrical line located along Manoa Stream, with pole at edge of construction limits	Relocate pole (or design detention berm to accommodate pole) as appropriate
	Overhead electrical and telecommunication lines along Dole Street may affect construction access	May require temporary relocation for construction
	Box culvert draining to Manoa Stream near baseball diamond is expected to conflict with excavation for detention basin	Design detention basin to avoid or accommodate feature (e.g., lower box culvert, replace box culvert with pipes or shallower box culvert)
	Irrigation lines may be located within or near detention footprint	Relocate as needed during construction
	Gaging station located near edge of construction limits; may be within footprint of detention basin	Design detention basin to avoid gaging station or relocate as necessary
Manoa In-Stream	Overhead electrical and telecommunication lines along Kahaloa Drive may affect construction access	May require temporary relocation
Woodlawn Detention	No utilities identified that require design modifications and/or relocation	N/A
Waiakeakua Debris and Detention Basin	Overhead electrical and telecommunication lines traverse along and across proposed construction access route and detention berm	Relocate poles and overhead lines (or design detention berm to accommodate utility) as appropriate
	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	Design access road and bridge reinforcement to accommodate water line and valves
	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	Design access road and bridge reinforcement to accommodate drainage feature
Waihi Debris and Detention Basin	No utilities identified	N/A
Makiki Debris and Detention Basin	Utility poles with overhead electrical and telecommunication lines located near perimeter of construction limits; may conflict with detention berm and/or affect construction access	Design detention berm as needed to avoid utility poles and lines and/or temporarily relocate for construction access
Pukele Debris and Detention Basin	Overhead electrical and telecommunication lines along La'i Road may affect construction access	May require temporary relocation for construction
	Storm drain extending from Ipulei Place with outfall near stream; storm drain could be impacted by detention berm	Confirm final design for berm does not conflict with storm drain; modify design and/or relocate storm drain as needed
	Sewer line and manholes located within (or near) construction limits along Pukele Stream and could be impacted by detention berm	Design detention berm to accommodate sewer line and manholes to extent possible; some degree of reinforcement may be necessary
Waiomao Debris and Detention Basin	Overhead electrical and telecommunication lines along Waiomao Road may affect construction access	May require temporary relocation for construction
	Sewer line and manholes located within (or near) construction limits along Waiomao Stream and may conflict with detention berm and/or access road	Design berm and access road to accommodate sewer line and manholes to extent possible; some degree of reinforcement may be necessary
Mitigation Sites (Falls 7 and 8)	No utilities identified that require design modifications and/or relocation	N/A

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).

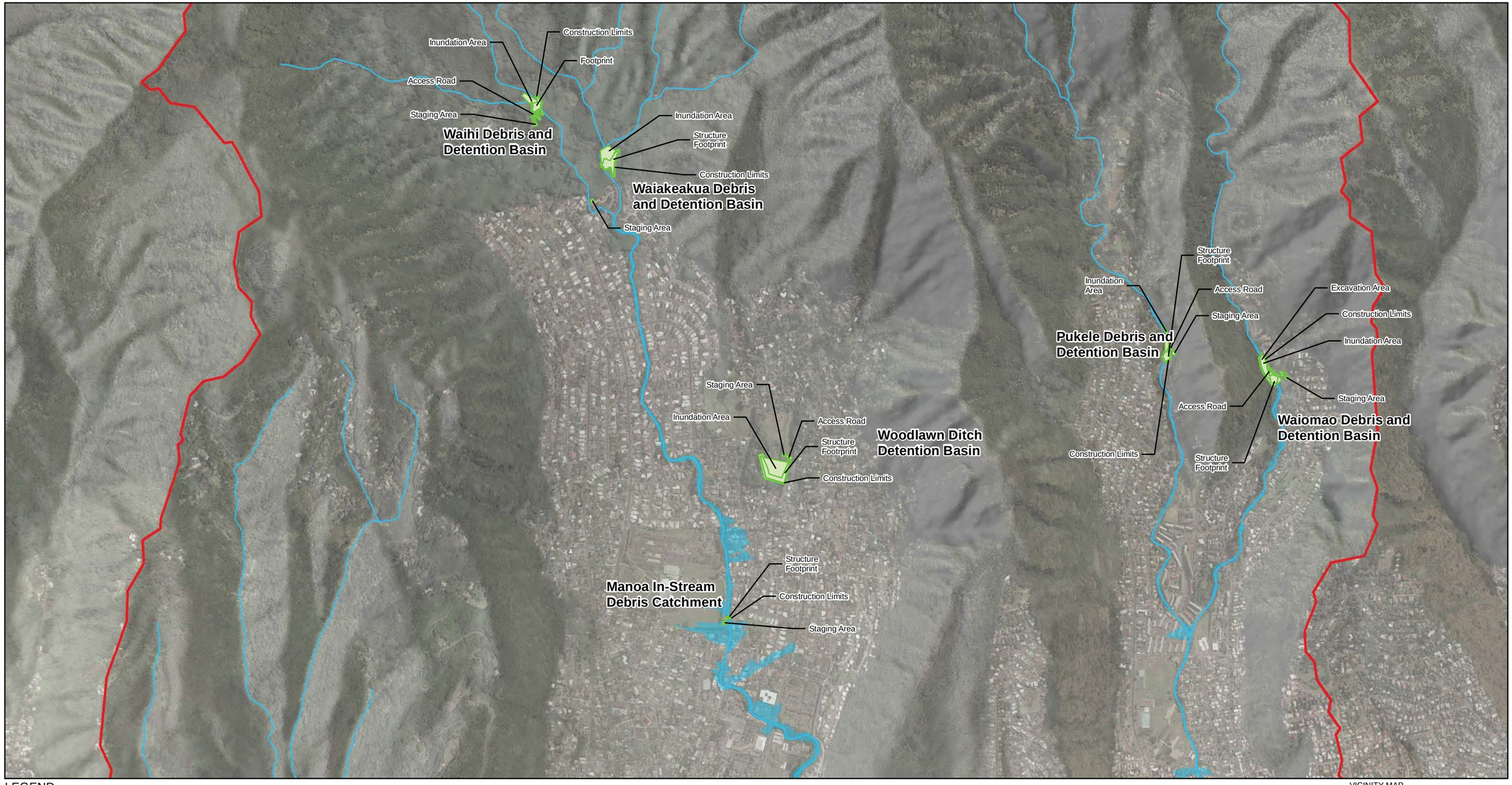
As detailed throughout this report, the occurrence and location of utilities were assessed based on publically-available documentation. This effort was as comprehensive as possible, and is believed to have captured the vast majority of utilities that occur within the construction limits for the project; 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

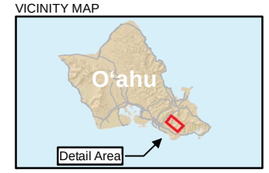
Location of Tentatively Selected Plan



LEGEND

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

VICINITY MAP



0 0.5 1 Miles

Projection: State Plane Hawai'i Zone 3 feet NAD83 HARN

DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

Tentatively Selected Plan
Upper Watershed
Ala Wai Canal Project
O'ahu, Hawai'i

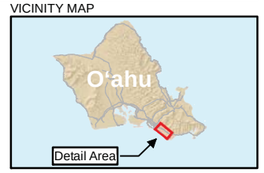
CH2MHILL

\\NALA\PROJ\USARMYCORPSOFENGINEE\381693ALAWAI\110_GIS\MAPFILES\MXD\AECOS\CRITICALHABITAT.MXD RMANGAN 9/28/2010 10:11:48

LEGEND

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

VICINITY MAP



0 0.5 1 Miles

Projection: State Plane Hawai'i Zone 3 feet NAD83 HARN

DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

Tentatively Selected Plan
Lower Watershed
Ala Wai Canal Project
O'ahu, Hawai'i

CH2MHILL

\\NALA\PROJ\USARMYCORPSOFENGINEE\381693ALAWAI\110_GIS\MAPFILES\MXD\AECOS\CRITICALHABITAT.MXD RMANGAN 9/28/2010 10:11:48

Attachment 2

Information Request Letters and Responses

Attachment 2a

Correspondence with Hawaiian Electric Company

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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.

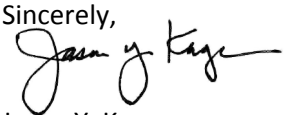
As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

- 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-builts 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

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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
- 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-builts 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

From: GUY MASAGATANI
To: Onaga, Jeff/HNL
Subject: RE: Request for As-builts/Distribution maps (Ala Wai)
Date: Friday, May 13, 2016 10:15:51 AM

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

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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:

- 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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- 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 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

From: Kahikina, Lori M K
To: Onaga, Jeff/HNL
Subject: Re: Info Request
Date: Tuesday, May 17, 2016 8:37:09 AM

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
>

From: Pobuk, Jack
To: Onaga, Jeff/HNL; Kage, Jason/HNL; Kaneko, Ross/HNL
Cc: Tanimoto, Ross; Houghton, Tim; Kahikina, Lori M K; Olaes, Marisol; Doyle, Frank
Subject: Ala Wai Canal Project, Request for Information Letter (Utilities)
Date: Thursday, May 19, 2016 5:59:56 PM

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

From: Kahikina, Lori M K
Sent: Monday, May 16, 2016 3:43 PM
To: Pobuk, Jack
Cc: Tanimoto, Ross; Houghton, Tim
Subject: Re: Request for Information Letter (Utilities)

Thank you, Jack. I hope they know that too. All we can provide is the sewer side.

Sent from my iPhone

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]

Sent: Monday, May 16, 2016 2:35 PM
To: Fukumoto, Diane S
Subject: Request for Information Letter (Utilities)

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

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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.

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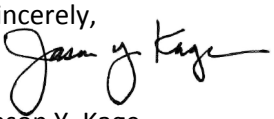
As part of project planning, USACE has contracted CH2M to examine utilities that may be potentially impacted by project features. This effort is focused on the following:

- 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)

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

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

ROBERT J. KRONING, P.E.
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

WW.A 16-016

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,

Robert J. Kroning, P.E.
Director

Enclosure

Attachment 2e

Correspondence with City and County of Honolulu

Department of Facility Maintenance

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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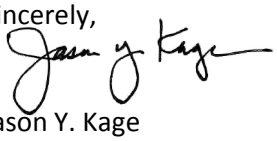
- Multiple In-stream Detention Basins (Sheets C-301, C-302, C-305, C-308, C-313, C-315)
- Manoa Stream Falls 7 & 8 (Sheets C-107 and C-108)

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-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

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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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- 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

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

HAWAIIGAS
THE CLEAN ENERGY COMPANY

May 23, 2016

RECEIVED
MAY 24 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, Pukele 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

Keith K. Yamamoto
Manager, Engineering

KKY:krs

Attached: CD

Attachment 2g

Correspondence with Oceanic – Time Warner Cable

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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.

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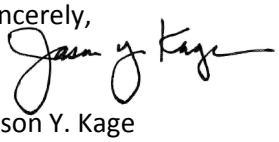
Sincerely,



Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE

Oceanic
Time Warner Cable

RECEIVED

MAY 16 2016

May 12, 1016

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,

Lionel Aguiar
OSP Engineer
Oceanic Time Warner Cable

200 Akamainui Street Mililani, Hawaii 96789-3999 Tel (808) 625-2100 Fax (808) 625-5888

Attachment 2h

Correspondence with Hawaiian Telcom, Inc.

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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.

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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 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.

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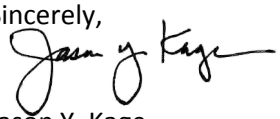

Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE

Hawaiian Telcom

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,

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

Attachments

cc: File

Attachment 2i

Correspondence with Sandwich Isles Communications, Inc.

CH2M HILL

1132 Bishop Street
Suite 1100

Honolulu, HI 96813

Tel 808.943.1133

Fax 808.954.4400

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.

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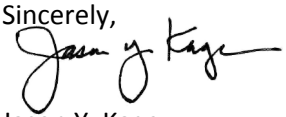


Jason Y. Kage
Project Manager

Enclosures (2)

Cc:
Michael Wyatt, USACE

Attachment 3

Detailed Listing of Utilities within the Project Construction Limits

Summary of Existing Utilities Located Within Construction Limits of Ala Wai Canal Project

Utility Type	Utility Owner	Project Location																
		Ala Wai Canal Floodwalls (Left Bank)	Ala Wai Canal Floodwalls (Right Bank)	Ala Wai Canal Floodwalls (Manoa Palolo Canal)	Pump Station 1 (Kapahulu)	Pump Station 2 (Golf Course)	Pump Station 3 (University)	Ala Wai Golf Course Detention	Hausten Ditch Detention	Kanewai Detention	Manoa In-Stream	Woodlawn Ditch Detention	Waiakeakua Debris / Detention Basin	Waihi Debris / Detention Basin	Makiki Debris / Detention Basin	Pukele Debris / Detention Basin	Waiomao Debris / Detention Basin	Mitigation Sites (Falls 7 and 8)
Electrical	Hawaiian Electric Company	●	●				●	●		●			●		●	●	●	
Water	Board of Water Supply	●	●					●					●					
Storm Drain	City & County of Honolulu	●	●	●	●	●	●	●	●	●	●	●	●			●	●	
Sanitary Sewer	City & County of Honolulu	●	●	●			●	●	●	●	●					●	●	●
Gas	Hawaii Gas	●																
Telecommunications	Oceanic Time Warner	●	●					●		●	●		●		●	●	●	
	Hawaiian Telcom																	
	Sandwich Isles Communications																	
Lighting	City & County of Honolulu	●	●	●		●	●		●	●								
Traffic Signals	City & County of Honolulu	●																
Irrigation	City & County of Honolulu	●	●	●		●		●	●	●								

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-13	Electrical conduit; size unknown	Crosses Canal at Ala Moana Blvd Bridge	Active	yes	Conduit encased in bridge structure	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on asbuilt
	Hawaiian Electric Company	Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-17	Electrical conduit; size unknown	Crosses Canal at McCully St Bridge	Active	yes	Conduit encased in bridge structure	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on asbuilt
	Hawaiian Electric Company	No detailed source documents identified	46kV underground sub-transmission line	Along Ala Wai Blvd between Kaiolu St and McCully St	Active	Unknown	Unknown	Assumed to be within Ala Wai Blvd roadway, but specific information has not been obtained	Determine whether floodwall conflicts with electrical line once detailed information is obtained; microsite floodwalls or relocate utility, as needed	Detailed information not obtained; locations not shown on plan drawings
	Hawaiian Electric Company	Ala Wai Canal Dredging FEA 46kV Relocation Project documentation	Two 46kv lines within 200'-wide easement crossing Canal; to be replaced by new line (see future project)	Extending across Canal between Kaiolu St and Ala Wai Neighborhood Park; manholes at intersection of Kaiolu St and Ala Wai Blvd	Active (to be replaced in future)	yes	Approx. 20 feet below grade (per 46kV relocation project info)	Floodwall would cross existing 46kV lines, but these are expected to be removed in 2018	N/A	Schematically shown on plan drawings based on 46kV Relocation Project documentation
	Hawaiian Electric Company	46kV Relocation Project documentation	Proposed 46kV line to be installed in horizontal directional drill casing under Canal	Crossing Canal between Kalaimoku St and University Ave, with associated trenching in Ala Wai Blvd roadway between Kaiolu St and Kalaimoku St	Future (planned to start in 2018)	yes	40-50' deep (at edge of Canal)	46kv line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station	Track utility information; confirm there would be no conflict once detailed utility information and location is available	Schematically shown on plan drawings based on 46kV Relocation Project documents; would also involve trenching between Kaiolu St and Kalaimoku St (expected to occur in Ala Wai Blvd. roadway, but design is not yet complete)
	Hawaiian Electric Company	DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16	Miscellaneous electrical distribution lines and other electrical infrastructure	Along entire length of Ala Wai Blvd, transitioning back and forth between roadway and landscaped area	Active	yes	Unknown	Partially located within or near floodwall footprint	Relocate within landscaped area, as needed	Partial location shown on plan drawings based on Asbuilt
Water	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016)	Underground distribution line; 12" diameter	Crosses Wai Canal at Ala Moana Blvd.; (attached to bridge)	Active	yes	Attached to bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	
	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-16	Underground distribution line; 12" diameter	Within Ala Wai Blvd roadway; crosses Canal at Kalakaua Ave (attached to bridge)	Active	yes	Attached to bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on Asbuilt
	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-17	Underground distribution line; 16" diameter	Crosses Canal at McCully St. (attached to bridge)	Active	yes	Attached to bridge	Bridge structure (and existing water line) not likely to be affected by floodwall, depending on design for bridge tie-in	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	

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Water (con't)	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-17	Underground distribution line; 30" diameter	Crosses Ala Wai Blvd. near McCully St.; in concrete encasement alongside upstream side of bridge	Active	yes	Alongside upstream side of bridge	Bridge structure (and existing water line) not likely to be affected by floodwall, depending on design for bridge tie-in	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	Partial location shown on plan drawings based on visual observation
	Board of Water Supply	BWS Dist Map (2016) BWS Asbuilt, Job No. 92-016	Underground distribution line (transitions between 12" and 16" diameter); an abandoned line runs parallel to this active line	Entire length of Ala Wai Blvd, within roadway	Active	no	N/A	Project is not expected to affect utilities within Ala Wai Blvd roadway	Design drawings and specifications should identify measures to avoid/protect utility, depending on final design	Partial location shown on plan drawings based on Asbuilt
	Board of Water Supply	BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-14	Lateral lines feeding approx. 40 fire hydrant along Ala Wai Blvd	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)	Active	yes	Typically 3' cover	Project is not expected to affect utilities within Ala Wai Blvd roadway	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)	Plan drawings only show fire hydrants on makai side of Ala Wai Blvd, west of Kalakaua Ave (4 total)
	Private	Ala Wai Canal Dredging FEA BWS Asbuilt, Job No. 78-100, Sheet 6	Private line for Sheraton Hotel; emergency replacement for original line was abandoned; replacement status unknown	Crossing Ala Wai Blvd. at Nahua St.	Active	yes	Invert = 0.2' (approx.)	Floodwall would cross abandoned water line; status of replacement line is unknown	Verify status of replacement line and design floodwall to accommodate water line as needed	Location of abandoned line shown on plan drawings based on Asbuilt; status of replacement line to be verified during design phase
Storm Drain	City & County of Honolulu	DPW Asbuilt, Job No. 24-50, Sheet 3	4"x4" culvert	Crossing Ala Wai Blvd at western terminus	Shown as proposed on asbuilt; not in C&C GIS database	yes	Unknown	Current City & County GIS records do not identify storm drain in this location; no conflict expected	Verify status of proposed storm drain and design floodwall to accommodate line if needed	Location not shown on plan drawings
	City & County of Honolulu	DPW Asbuilt, Job No. 24-50, Sheet 3	Reinforced concrete drain box; 12" diameter	Crossing Ala Wai Blvd. between Ala Moana Blvd. and Lipeepee St.	Shown on asbuilt; not in C&C GIS records	yes	Unknown	Current City & County GIS records do not identify storm drain in this location; no conflict expected	Verify status of drainage box and design floodwall to accommodate line if needed	Location not shown on plan drawings
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-13	8" diameter reinforced concrete pipe (RCP)	Crossing Ala Wai Blvd between Ala Moana Blvd and Lipeepee St	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-14	18" diameter RCP	Crossing Ala Wai Blvd between Ala Moana Blvd and Lipeepee St	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-14	8" diameter RCP	Crossing Ala Wai Blvd between Ala Moana Blvd and Lipeepee St	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheet C-14	18" diameter RCP	Crossing Ala Wai Blvd between Ala Moana Blvd and Lipeepee St	Active	yes	Unknown	Current City & County GIS records do not identify storm drain in this location; no conflict expected	Verify status of drainage box and design floodwall to accommodate line if needed	
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-15	48" diameter RCP	Crossing Ala Wai Blvd at Lipeepee St	Active	yes	Invert = approx. -14' (Asbuilt)	Floodwall would cross storm drain, but no conflict expected based on storm drain elevation	Confirm elevation of storm drain and design floodwall to accommodate line if needed	

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain (con't)	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-15	24" diameter RCP	Crossing Ala Wai Blvd at Lipeepee St	Active	yes	Invert = approx. -2.4'	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-15	24" diameter RCP	Crossing Ala Wai Blvd. at Makaoe Ln.	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 24" diameter in GIS database, 12" diameter on Asbuilt
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet C-16	18" diameter RCP	Crossing Ala Wai Blvd between Makaoe Ln and Kalakaua Ave	Active	yes	Invert = approx. -0.8'	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	Asbuilt for Allure Waikiki, Sheet C-4.2	2-18" diameter RCP	Crossing Ala Wai Blvd just west of Kalakaua Ave	Active	yes	Invert = 0.01	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheet C-16	18" diameter RCP	Crossing Ala Wai Blvd. east of Kalakaua Ave.	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database	18" diameter RCP	Crosses roadway west of McCully Street Bridge	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database	24" diameter RCP	Runs up middle of McCully Street	Active	no	Unknown	Floodwall would not cross storm drain	N/A	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Crossing Ala Wai Blvd. at Niu Street	Active	yes	Invert = -0.4' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Crossing Ala Wai Blvd. at Niu Street	Active	yes	Invert = -0.7' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Crossing Ala Wai Blvd. at Pau Street	Active	yes	Invert = -0.8' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 3	18" diameter RCP	Crossing Ala Wai Blvd. west of Kuamoo St.	Active	yes	Invert = -1.1' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4	18" diameter RCP	Crossing Ala Wai Blvd. west of Namahana St.	Active	yes	Invert = -0.3' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4	24" diameter RCP	Crossing Ala Wai Blvd. at Namahana St.	Active	yes	Invert = 0.2' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4	18" diameter RCP	Crossing Ala Wai Blvd. east of Namahana St.	Active	yes	Invert = -0.5' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database	RCP, unknown diameter	Crossing Ala Wai Blvd. west of Olohana St.	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4	18"diameter RCP	Crossing Ala Wai Blvd. west of Kalamoku St.	Active	yes	Invert = -0.8' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain (con't)	City & County of Honolulu	C&C GIS database USACE 35% design drawings	72" x 30" box culvert	Crossing Ala Wai Blvd. at Kalamoku St.	Active	yes	Invert = -0.9' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database BWS Asbuilt, Job No. 78-100, Sheet 4	24" diameter RCP	Crossing Ala Wai Blvd. at Kalamoku St.	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 4	18" diameter RCP	Crossing Ala Wai Blvd. east of Kalamoku St.	Active	yes	Invert = -0.7' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 18" diameter RCP in GIS database, 24" culvert on USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5	24" diameter RCP	Crossing Ala Wai Blvd. west of Kaiolu St.	Active	yes	Invert = -1.0' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 24" diameter in GIS database, 18" diameter in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5	24" diameter RCP	Crossing Ala Wai Blvd. east of Kaiolu St.	Active	yes	Invert = -1.6' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 24" diameter in GIS database, 18" diameter in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5	42" diameter RCP	Crossing Ala Wai Blvd. at Lewers St.	Active	yes	Invert = -5.9' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 5	24" diameter RCP	Crossing Ala Wai Blvd. east of Lewers St.	Active	yes	Invert = -2.2' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 24" diameter in GIS database, 18" diameter in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6	66" diameter RCP	Crossing Ala Wai Blvd. west of Seaside Ave.	Active	yes	Invert = -6.0' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	USACE design drawings show the 66" RCP and 24" RCP in reverse locations
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6	24" diameter RCP	Crossing Ala Wai Blvd. east of Seaside Ave.	Active	yes	Inv = -0.88' (Asbuilt) Inv = -6.0' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	USACE design drawings show the 66" RCP and 24" RCP in reverse locations; Shown as 24" diameter in GIS database, and 18" diameter in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6	18" diameter RCP	Crossing Ala Wai Blvd. at Nohonani St.	Active	yes	Inv = -0.80' (Asbuilt) Inv = -3.66' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	USACE 35% design drawings show two 18" diameter lines
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 6	24" diameter RCP	Crossing Ala Wai Blvd. at Nahua St.	Active	yes	Inv = -0.47' (Asbuilt) Inv = -2.1 (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 24" diameter in GIS database, 18" diameter in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. west of Walina St.	Active	yes	Inv = -0.4' (Asbuilt) Inv = -1.5' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. east of Walina St.	Active	yes	Inv = -0.40' (Asbuilt) Inv = -1.7 (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain (con't)	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. west of Kanekapolei St.	Active	yes	Inv = 0.00	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. east of Kanekapolei St.	Active	yes	Inv = -1.9' and -2.9' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	USACE 35% design drawings show two 18" diameter lines
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 78-100, Sheet 7	60" diameter RCP	Crossing Ala Wai Blvd. at Kaiulani Ave.	Active	yes	Inv = -3.04'	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 4	18" diameter RCP	Crossing Ala Wai Blvd. east of Kaiulani Ave.	Active	yes	Inv = -0.3'	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 5	18" diameter RCP	Crossing Ala Wai Blvd. west of Liliuokalani Ave.	Active	yes	Inv = 0.2' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	Box culvert	Crossing Ala Wai Blvd. at Liliuokalani Ave.	Active	yes	Inv = -3.3' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016,	18" diameter RCP	Crossing Ala Wai Blvd. at Ohua Ave.	Active	yes	Inv = -0.3' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016,	18" diameter RCP	Crossing Ala Wai Blvd. at Ohua Ave.	Active	yes	Inv = -0.8' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 6	7'x4' box drain (USACE 35% design drawings show 10' x 4')	Crossing Ala Wai Blvd. west of Paoakalani Ave	Active	yes	Inv = -2.2' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Shown as 7'x4' box culvert in GIS database and as 10'x4' culvert in USACE 35% design drawings
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Crossing Ala Wai Blvd. east of Paoakalani Ave	Active	yes	Inv. = 0.3' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. west of Wai Nani Way	Active	yes	Inv. = -0.3' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database	18" diameter RCP	Crossing Ala Wai Blvd. at Wai Nani Way	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. west of Ainakea Way	Active	yes	Inv = 0.6' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	USACE 35% design drawings BWS Asbuilt, Job No. 92-016, Sheet 7	18" diameter RCP	Crossing Ala Wai Blvd. east of Ainakea Way	Active	yes	Inv = 0.7' (USACE drawings)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Sanitary Sewer	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Force main; 42" diameter	Within Ala Wai Blvd roadway between Kaiolu St and Ala Moana Blvd.; crosses Canal near Ala Moana Blvd	Active	yes	Top of concrete pipe jacket at about -20 feet MSL (Ala Wai Canal Dredging FEA)	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	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	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
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3 and C-22	Force main, Hobas pipe; 2-36" diameter	Crossing Ala Wai Canal at Kaiolu Street	Active	yes	Inv = between -19 and -34' (GIS database)	Floodwall would cross force main near Kaiolu St; however, no conflict is expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	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
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Sewer tunnel, Hobas pipe; 72" diameter	Within Ala Wai Blvd between Kalakaua Ave. and Ala Moana Blvd.; crosses Canal between McCully St and Kalakaua Ave, and near Ala Moana Blvd	Active	yes	30'+ below grade	Floodwall would cross sewer tunnel in two locations (near Kalakaua Bridge and near Ala Moana Bridge); however, no conflict is expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	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
	City & County of Honolulu	C&C GIS database Waikiki Buffer Zone Map BWS Asbuilt, Job No. 78-100,	Gravity line; 27" diameter	Within Ala Wai Blvd ROW between Lewers St. and Kanekapolei St.	Active	no	Inv = approx. -13' (GIS database)	Project is not expected to affect utilities within Ala Wai Blvd roadway	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	
	City & County of Honolulu	C&C GIS database Waikiki Buffer Zone Map Ala Wai Canal Dredging FEA	Three gravity siphon lines; 21", 24" and 27" diameter	Crossing Canal at Lewers St.	Active	yes	Top of concrete jacket at -15.75' MSL (FEA); Inv = approx. -14 to -15.75' (GIS)	Floodwall would cross utility; however, no conflict is expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer and accommodate existing manhole, as needed	
	City & County of Honolulu	C&C GIS database Ala Wai Canal Dredging FEA Waikiki Buffer Zone Map DDC Asbuilt, Job No. W18-07, Sheet C-16	Force main; 20" diameter	Along Kalakaua Ave, crossing Ala Wai Blvd and Ala Wai Promenade	Active	yes	Estimated to have 6' cover	Bridge structure (and existing sewer) not expected to be affected by floodwall	Confirm final design for bridge tie-in does not conflict with existing sewer line once detailed information is obtained; include measures to avoid/protect, as needed	C&C GIS database shows three 12" diameter lines crossing Kalakaua Bridge
	City & County of Honolulu	Information provided by Jack Pobuk, ENV (email dated May 19, 2016)	Future plans to convert 72" force main to gravity line; and connect new gravity sewers to existing manholes along 72" force main	Existing 72" diameter force main line corridor	Future (dates TBD)	yes	TBD	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	Track additional detail and development of future plans	Not shown on plan drawings
Gas	Hawaii Gas	Hawaii Gas distribution map DDC Asbuilt, Job No. W18-07, Sheet C-16	Underground distribution line; 8" diameter transitioning to 6" diameter	Crossing Ala Wai Canal in conduit on Kalakaua Bridge	Active	yes	Approx. 4' cover near Ala Wai Blvd (Asbuilt)	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	
	Hawaii Gas	Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-13	4" diameter	Crossing Ala Wai Canal in conduit on Ala Moana Bridge	Active	yes	Inv = approx. 3.8' (Asbuilt)	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on Asbuilt
	Hawaii Gas	Hawaii Gas distribution map	Various	Various distribution lines within Ala Wai Blvd roadway (discontinuous)	Active and Abandoned	no	Unknown	Project is not expected to affect utilities within Ala Wai Blvd roadway	Design drawings and specifications should identify measures to avoid/protect gas lines, as needed	Not shown on plan drawings

Ala Wai Canal Floodwalls (Left Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Telecommunications	Unknown	Ala Wai Canal Dredging FEA	Cable	Conduit in Kalakaua Ave. Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
	Unknown	Ala Wai Canal Dredging FEA	Cable and telephone lines	Conduit in Ala Moana Blvd Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
	Unknown	Ala Wai Canal Dredging FEA	Telephone lines	Conduit in McCully St Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
	Unknown	DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16	Unknown telecommunication line	Within Ala Wai Blvd between Kalakaua Ave and Ala Moana Blvd	Active	no	Unknown	Project is not expected to affect utilities within Ala Wai Blvd roadway	Design drawings and specifications should identify measures to avoid/protect gas lines, as needed	
Lighting	City & County of Honolulu	Visual Inspection DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16	Multiple power feeds and lines; details not shown on asbuilt drawings	Between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
Traffic Signals	City & County of Honolulu	Visual Inspection	Multiple power feeds and lines, as well as traffic signal boxes; details not shown on asbuilt drawings	Between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
Irrigation	City & County of Honolulu	Visual Inspection DDC Asbuilt, Job No. W18-07, Sheets C-14 through C-16	Various line (inc. 2-1/2" and 1-1/4" diameter); details not shown on asbuilt drawings	Generally between Ala Wai Blvd and existing sidewalk; specific locations not shown on asbuilt drawings	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Partial location shown on plan drawings based on Asbuilt

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.

Ala Wai Canal Floodwalls (Right Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-13	Electrical line; size unknown	Crosses Canal at Ala Moana Blvd Bridge	Active	yes	Conduit encased in bridge structure	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on asbuilt
	Hawaiian Electric Company	Ala Wai Canal Dredging FEA DDC Asbuilt, Job No. W18-07, Sheet C-17	Electrical conduit; size unknown	Crosses Canal at McCully St Bridge	Active	yes	Conduit encased in bridge structure	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on asbuilt
	Hawaiian Electric Company	Ala Wai Canal Dredging FEA 46kV Relocation Project documentation	Two 46kv lines within 200'-wide easement crossing Canal; to be replaced by new line (see future project)	Extending across Canal between Ala Wai Neighborhood Park and Kaiolu St	Active (to be replaced by future project)	yes	Approx. 20 feet below grade (per 46kV relocation project info)	Floodwall would cross existing 46kV lines, but these are expected to be removed in 2018	N/A	Schematically shown on plan drawings based on 46kV Relocation Project documentation
	Hawaiian Electric Company	46kV Relocation Project documentation	Proposed 46kV line to be installed in horizontal directional drill casing under Canal	Crossing Ala Wai Canal, between Kalaimoku St and University Ave	Future (planned to start in 2018)	yes	40-50' deep (at edge of Canal)	46kv line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station	Track utility information; confirm there would be no conflict once detailed utility information and location is available	Schematically shown on plan drawings based on 46kV Relocation Project documentation
	Hawaiian Electric Company	Visual inspection DPR Utility Plan, Job No. 89-009c, Sheet C3	Overhead electrical line	Makai side of entrance road to Ala Wai Golf Course clubhouse	Active	yes	Aboveground	Floodwall and/or flood gate not expected to conflict with overhead electrical line	Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access	
Water	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016)	Underground distribution line; 12" diameter	Crosses Wai Canal at Ala Moana Blvd; attached to bridge	Active	yes	Attached to bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	
	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-16	Underground distribution line; 12" diameter	Crosses Canal at Kalakaua Ave; attached to bridge	Active	yes	Attached to bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	
	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-17	Underground distribution line; 16" diameter	Crosses Canal at McCully St. (attached to bridge)	Active	yes	Attached to bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	
	Board of Water Supply	Ala Wai Canal Dredging FEA BWS Dist Map (2016) DDC Asbuilt, Job No. W18-07, Sheet C-17	Underground distribution line; 30" diameter	Crosses Ala Wai Blvd. near McCully St.; in concrete encasement alongside upstream side of bridge	Active	yes	Alongside upstream side of bridge	Bridge structure (and existing water line) not expected to be affected by floodwall	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	Partial location shown on plan drawings based on visual observation
	Board of Water Supply	DPR Utility Plan, Job No. 89-009c, Sheet C3	3" diameter	Runs along entrance road to Ala Wai Golf Course clubhouse	Active	yes	Approx. 2-3' below ground	Water line crosses location where floodwall and/or flood gate would join with golf course detention berm	Design floodwall and/or flood gate to accommodate water line crossing once detailed information is obtained	
	Board of Water Supply	BWS Dist Map (2016) DPR Utility Plan, Job No. 89-009c, Sheet C3	8" diameter	Runs along entrance road to Ala Wai Golf Course clubhouse	Active	yes	Approx. 2-3' below ground	Water line crosses location where floodwall and/or flood gate would join with golf course detention berm	Design floodwall and/or flood gate to accommodate water line crossing once detailed information is obtained	
	Private	BWS Dist Maps (1988), Sheet 45	4" transitioning to 3" diameter	Along Ala Wai Promenade, west of Kalakaua Ave.	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate within promenade area as needed during construction	Not shown on plan drawings

Ala Wai Canal Floodwalls (Right Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Just east of Ala Moana Bridge	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	24" diameter RCP	Between Ala Moana Blvd and Kalakaua Ave	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	6'x7' box culvert	Between Ala Moana Blvd and Kalakaua Ave	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	RCP; diameter unknown	Between Ala Moana Blvd and Kalakaua Ave; near convention center	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	RCP; diameter unknown	Between Ala Moana Blvd and Kalakaua Ave; near convention center	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	18" diameter RCP	Just west of Kalakaua Ave	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	24" diameter RCP	Between Kalakaua Ave and McCully St	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-17	18" diameter RCP	Along McCully St. sidewalk (east side)	Active	yes	Inv = -.01' (USACE)	Storm drain is located within McCully St roadway, but exact location is unknown floodwall may conflict with storm drain depending on final design location	Confirm final design for floodwall does not conflict with existing storm drain once detailed utility information is obtained; modify design and/or relocate utility, as needed	
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A	8" diameter RCP	At the Ala Wai Recreation Center east of McCully St., outfall to Ala Wai Canal	Shown on Asbuilt; not in C&C GIS records	yes	Inv = approx 0.0' (Asbuilt)	Floodwall would cross storm drain (if verified to be present)	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Storm drain is not shown on C&C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A	24" diameter RCP	At the Ala Wai Recreation Center east of McCully St., outfall to Ala Wai Canal	Shown on Asbuilt; not in C&C GIS records	yes	Inv = approx 0.0' (Asbuilt)	Floodwall would cross storm drain (if verified to be present)	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Storm drain is not shown on C&C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheet C-25A	18" diameter RCP	Within the parking area for Ala Wai Recreation Center	Shown on Asbuilt; not in C&C GIS records	yes	Unknown	Floodwall would cross storm drain (if verified to be present)	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Storm drain is not shown on C&C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A	6" diameter RCP	At the Ala Wai Recreation Center by McCully St., outfall to Ala Wai Canal	Shown on Asbuilt; not in C&C GIS records	yes	Inv = approx 0.0' (Asbuilt)	Floodwall would cross storm drain (if verified to be present)	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	Storm drain is not shown on C&C GIS database, but GIS data show drain inlet in parking lot so storm drain assumed present
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheets C-17 and C-25A	6" diameter RCP	At the Ala Wai Recreation Center by McCully St., outfall to Ala Wai Canal	Shown on Asbuilt; not in C&C GIS records	yes	Inv = approx 0.0' (Asbuilt)	Current C&C GIS records do not identify storm drain in this location; no conflict expected	Verify status of drain pipe and design floodwall to accommodate line if needed	
	City & County of Honolulu	DDC Asbuilt, Job No. W18-07, Sheet C-18	24" diameter RCP	Running through Ala Wai Community Park, outfall to Ala Wai Canal	Active	yes	Inv = approx -1.75' (Asbuilt)	Current C&C GIS records do not identify storm drain in this location; no conflict expected	Verify status of drain pipe and design floodwall to accommodate line if needed	

Ala Wai Canal Floodwalls (Right Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain (con't)	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18	6'x4' box drain	Running through Ala Wai Community Park, outfall to Ala Wai Canal	Active	yes	Inv = -3.1' (USACE)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings	15' x 3' box culvert	Hausten Ditch	Active	yes	N/A	New slide gates proposed as part of project	Ensure design accommodates existing drainage feature once detailed information is obtained	Shown on plans as Hausten Ditch
	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18	10'x8' box drain	Running mauka to makai at University Ave, outfall to Ala Wai Canal	Active	yes	Inv = 0.0' (USACE)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-22	24" diameter RCP	Near Ala Wai Community Garden, outfall to Ala Wai Canal	Active	yes	Inv = -1.3' (USACE)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-22	36" diameter RCP	Near Moana-Palolo Drainage Canal, outfall to Ala Wai Canal	Active	yes	Inv = -2.7' (USACE)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
Sanitary Sewer	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Force main; 42" diameter	Crosses Canal just east of Ala Moana Blvd	Active	yes	Top of concrete pipe jacket at about -20 feet MSL (Ala Wai Canal Dredging FEA)	Floodwall may cross force main at terminus near Ala Moana Blvd Bridge; however, no conflict expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	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
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Force main, Hobas pipe; 2-36" diameter	Crosses Ala Wai Canal near Ala Wai Neighborhood Park (connecting to Mauka Pit)	Active	yes	Inv = between -19 and -34' (GIS)	Floodwall would cross force main near Kaiolu St; however, no conflict expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer line, as needed	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
	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Sewer tunnel, Hobas pipe; 72" diameter	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 mauka side of Canal just east of Ala Moana Blvd Bridge	Active	yes	30'+ below grade	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	Design drawings and specifications should identify measures to avoid/protect sewer line and accommodate manholes, as needed	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
	City & County of Honolulu	C&C GIS database Waikiki Buffer Zone Map Ala Wai Canal Dredging FEA	Three gravity siphon lines; 21", 24" and 27" diameter	Crosses Canal near Ala Wai Neighborhood Park, just west of Manoa Palolo Drainage Canal; continues as 48" diameter line toward Ala Wai Elementary School	Active	yes	Top of concrete pipe jacket at -15.75' MSL (Ala Wai Canal Dredging FEA); Inv = approx. -14 to -15.75' (GIS)	Floodwall would cross sewer lines; however, no conflict expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer line and accommodate manholes, as needed	
	City & County of Honolulu	C&C GIS database Ala Wai Canal Dredging FEA Waikiki Buffer Zone Map DDC Asbuilt, Job No. W18-07, Sheet C-16	20" diameter force main	Along Kalakaua Ave. crossing Ala Wai Blvd. and Ala Wai Promenade	Active	yes	Estimated to have 6' cover	Bridge structure (and existing sewer) not expected to be affected by floodwall	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	C&C GIS database shows three 12" diameter lines crossing Kalakaua Bridge

Ala Wai Canal Floodwalls (Right Bank)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Telecommunications	Unknown	Ala Wai Canal Dredging FEA	Cable and telephone lines	Conduit in Ala Moana Blvd Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
	Unknown	Ala Wai Canal Dredging FEA	Cable	Conduit in Kalakaua Ave. Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
	Unknown	Ala Wai Canal Dredging FEA	Telephone lines	Conduit in McCully St Bridge	Active	yes	Unknown	Bridge structure (and existing conduit) not expected to be affected by floodwall	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	Not shown on plan drawings
Park Lights	City & County of Honolulu	Visual inspection	Park lights	Surrounding baseball field at Ala Wai Community Park; two lights are located along existing walkway	Active	yes	Unknown	Generally located within or near floodwall footprint	Design floodwall to avoid lights or relocate closer to interior of park	Shown schematically on plan drawings based on visual observation
Lighting	City & County of Honolulu	Visual inspection DDC Asbuilt, Job No. W18-07, Sheet C-18 and up	Multiple power feeds and lines; complete details not shown on asbuilt drawings	Along edge of existing walkway from Manoa Palolo Drainage Canal to Kalakaua Ave (discontinuous)	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Partially shown on plan drawings near Ala Wai Neighborhood Park; specific location and full extent to be verified during design phase
	City & County of Honolulu	Visual inspection DDC Asbuilt, Job No. W18-07, Sheet C-25A	Multiple power feeds and lines; complete details not shown on asbuilt drawings	Parking area for Ala Wai Community Park (end of University Ave)	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Location not shown on plan drawings
Irrigation	City & County of Honolulu	Visual Inspection	Various lines and valves	Generally along walkway and within Ala Wai Community Park	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
Other	State Civil Defense	Visual Inspection	Warning siren (and associated power feed and lines)	Located within parking lot for Ala Wai Community Park (near intersection of McCully Street and Kapiolani Blvd)	Active	no	N/A	No conflict identified; included for reference	N/A	Not shown on plan drawings

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.

Ala Wai Canal Floodwalls (Manoa Palolo Drainage Canal)

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead lines	Along west side of Laau Street, parallel to Manoa Palolo Drainage Canal	Active	no	N/A	No conflict identified; included for reference	N/A	Schematically shown on plan drawings based on visual inspection
Water	Board of Water Supply	BWS Dist Map (2016)	30" diameter water line	Within Date St roadway/bridge	Active	no	N/A	Project is not expected to affect utilities within Date St roadway/bridge	Design drawings and specifications should identify measures to avoid/protect utility, depending on final design	Not shown on plan drawings
	Board of Water Supply	BWS Dist Map (2016)	12" diameter water line	Within Date St roadway/bridge	Active	no	N/A	Project is not expected to affect utilities within Date St roadway/bridge	Design drawings and specifications should identify measures to avoid/protect utility, depending on final design	Not shown on plan drawings
	Board of Water Supply	BWS Dist Map (2016)	12" diameter water line	Within Laau St roadway	Active	no	N/A	Project is not expected to affect utilities within Date St roadway	Design drawings and specifications should identify measures to avoid/protect utility, depending on final design	Not shown on plan drawings
Storm Drain	City & County of Honolulu	C&C GIS database	18" diameter RCP	Along Laau St, crossing Iolani School driveway and draining to Manoa Palolo Drainage Canal	Active	yes	Unknown	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-22	36" diameter RCP	Outfall to Ala Wai Canal near Moana-Palolo Drainage Canal	Active	yes	Inv = -2.7' (USACE)	Floodwall would cross storm drain	Design floodwall to accommodate existing storm drain crossing once detailed information is obtained	
Sanitary Sewer	City & County of Honolulu	C&C GIS database	30" diameter sewer line	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	Active	yes	Inv = approx. -9' (GIS)	Floodwall would cross sewer line; however, no conflict is expected based on sewer depth	Design drawings and specifications should identify measures to avoid/protect sewer and accommodate existing manholes, as needed	
Telecommunications	Unknown	Visual Inspection	Overhead lines	Co-located with electrical lines	Active	no	N/A	No conflict identified; included for reference	N/A	Not shown on plan drawings
Lighting	City & County of Honolulu	Visual Inspection	Electrical lines for street lighting	Located along makai side of Date Street	Active	no	N/A	Located near potential floodwall location but not expected to be within construction limits; no conflict expected	N/A	Not shown on plan drawings
	City & County of Honolulu	Visual Inspection	Electrical lines for pathway lighting	Located along pathway parallel to Manoa Palolo Drainage Canal	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
Traffic Signals	City & County of Honolulu	Visual Inspection	Power feeds and lines	Located along makai side of Date Street	Active	no	N/A	Located near potential floodwall location but not expected to be within construction limits; no conflict expected	N/A	Not shown on plan drawings
Irrigation	City & County of Honolulu	Visual Inspection	Various lines and valves	Located along pathway parallel to Manoa Palolo Drainage Canal	Active	yes	Unknown	Generally located within or near floodwall footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings

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.

Pump Stations

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
PUMP STATION 1 (KAPAHULU)										
Storm Drain	City & County of Honolulu	C&C GIS database Visual inspection USACE 35% design drawings	12' x 7' box culvert	At head of Ala Wai Canal in makai corner	Active	yes	Invert = -4.1' (USACE drawings)	Drainage feature to be incorporated into pump station design	Design drawings and specifications should identify measures to avoid/protect drainage feature	
	City & County of Honolulu	Visual inspection USACE 35% design drawings	4' x 3' box culvert, outfall has been covered	At head of Ala Wai Canal near center of channel	Abandoned (based on visual inspection)	yes	Unknown	Storm drain located within footprint of pump station, but is no longer in use; no conflict expected	N/A	
	City & County of Honolulu	Visual inspection USACE 35% design drawings	9' x 6' box culvert	At head of Ala Wai Canal in mauka corner	Active	yes	Invert = -3.5' (USACE drawings)	Drainage feature to be incorporated into pump station design	Design drawings and specifications should identify measures to avoid/protect drainage feature	
Lighting	City & County of Honolulu	Visual Inspection DDC Wastewater Div. Asbuilt	Multiple power feeds and lines; details not shown on asbuilt drawings	Along Ala Wai Blvd within/near existing sidewalk; specific locations not shown on asbuilt drawings	Active	no	Unknown	Located near pump station but not within construction limits; no conflict expected	N/A	Not shown on plan drawings
Traffic Signals	City & County of Honolulu	Visual Inspection	Multiple power feeds and lines; details not shown on asbuilt drawings	Along Ala Wai Blvd within/near existing sidewalk; specific location not shown on asbuilt drawings	Active	no	Unknown	Located near pump station but not within construction limits; no conflict expected	N/A	Not shown on plan drawings
PUMP STATION 2 (GOLF COURSE)										
Storm Drain	City & County of Honolulu	Visual inspection C&C GIS database USACE 35% design drawings	3 - 9.5'x7' RCB, 48" diameter pipe	Running through golf course, daylighting into drainage that flows to Ala Wai Canal	Active	yes	Invert = -4.7' (USACE drawings)	Drainage feature to be incorporated into pump station design	Design drawings and specifications should identify measures to avoid/protect drainage feature	
	City & County of Honolulu	C&C GIS database	18" RCP	Running through driving range, daylighting into drainage that flows to Ala Wai Canal	Active	yes	Unknown	Storm drain located within footprint of pump station	Design pump station to accommodate existing storm drain once detailed information is obtained	
Lighting	City & County of Honolulu	Visual Inspection	Lighting for driving range	Within interior portion of golf course, east of club house. Driving range is currently under renovation, so lighting location may be in flux	Active	yes	Unknown	Located near pump station footprint	Relocate lighting (or design pump station to avoid utility) as appropriate once detailed information is obtained	Not shown on plan drawings
Irrigation	City & County of Honolulu	DPR Asbuilt for Ala Wai Golf Course, Sheet C3	2" diameter	Running through golf course, from Kapahulu Ave across drainage channel	Active	no	Unknown	Located near pump station but not within construction limits; no conflict expected	N/A	

Pump Stations

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
PUMP STATION 3 (UNIVERSITY)										
Electrical	Hawaiian Electric Company	46kV Relocation Project documentation	Proposed 46kV line to be installed in horizontal directional drill casing under Canal	Crossing Ala Wai Canal, between Kalaimoku St and University Ave	Future (planned to start in 2018)	yes	40-50' deep (at edge of Canal)	46kv line would be installed prior to project and deep enough to avoid conflict with floodwall, but could conflict with pump station (sump)	Design pump station to avoid proposed 46kv line once crossing design information is obtained	Schematically shown on plan drawings based on 46kV Relocation Project documentation
	Hawaiian Electric Company	Visual Inspection DDC Asbuilt, Job No. W18-07, Sheet C-21	Transformer and electrical boxes	Near walkway, east of canoe club longhouse	Active	yes	Aboveground	Transformers and electrical boxes are generally located in (or near) pump station footprint	Design pump station to avoid transformers and electrical boxes once detailed utility information is obtained	Schematically shown on plan drawings based on visual observation
Storm Drain	City & County of Honolulu	C&C GIS database USACE 35% design drawings DDC Asbuilt, Job No. W18-07, Sheet C-18	10'x8' box drain	Running mauka to makai along University Ave, outfall to Ala Wai Canal	Active	yes	Inv = 0.0' (USACE drawings)	Drainage feature to be incorporated into pump station design	Design drawings and specifications should identify measures to avoid/protect drainage feature	
Sanitary Sewer	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Sewer Tunnel, Hobas pipe; 72" diameter	Along walkway near Ala Wai Neighborhood Park	Active	yes	30+ feet below grade	Pump station would be located in close proximity to sewer tunnel; sump pump could conflict with sewer tunnel	Design pump station to avoid sewer tunnel once detailed utility information is obtained	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
Lighting	City & County of Honolulu	Visual inspection DDC Asbuilt, Job No. W18-07, Sheet C-25A	Multiple power feeds and lines; complete details not shown on asbuilt drawings	Parking area for Ala Wai Community Park (end of University Ave)	Active	yes	Unknown	Generally located within or near pump station footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Location not shown on plan drawings

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.

Ala Wai Golf Course Multi-Purpose Detention

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	DPR Utility Plan, Job No. 89-009c, Sheets C-2 and C-3	Overhead electrical line	Makai side of entrance road to Ala Wai Golf Course clubhouse	Active	Yes	Aboveground	Overhead electrical line not expected to conflict with detention berm, but may affect construction access	Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access	
Water	Board of Water Supply	BWS Dist Map (2016)	24" diameter water line	Located near edge of golf course property along Kapahulu Ave	Active	Yes	Unknown	Detention berm is not expected to conflict with water line	Confirm that detention berm does not conflict with water line once detailed information is obtained; adjust berm design as needed	Not shown on plan drawings
	Board of Water Supply	BWS Dist Map (2016)	8" diameter waterline service	Connecting from Date St at Palani Ave to golf course	Active	Yes	Unknown	Detention berm is not expected to conflict with service line, but extent and location of service use is unknown	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	Not shown on plan drawings
	Board of Water Supply	BWS Dist Map (2016)	4" diameter waterline service	Connecting from Date St at Kapahulu Ave to golf course	Active	Yes	Unknown	Detention berm is not expected to conflict with service line, but extent and location of service use is unknown	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	Not shown on plan drawings
	City and County of Honolulu	DPR Utility Plan, Job No. 89-009c, Sheets C-2 & C-3	8" diameter fire line feeding fire hydrant and golf course club house	Runs along entrance road to golf course clubhouse	Active	Yes	Unknown	Fire line runs along entrance road; flood gate would be installed across road	Confirm final design for flood gate does not conflict with fire line once detailed information is obtained; include measures to avoid/protect, as needed	
	City and County of Honolulu	DPR Utility Plan, Job No. 89-009c, Sheets C-2 & C-3	3" diameter waterline connecting to golf course clubhouse	Located parallel to 8" fire line	Active	Yes	Unknown	Fire line runs along entrance road; flood gate would be installed across road	Confirm final design for flood gate does not conflict with fire line once detailed information is obtained; include measures to avoid/protect, as needed	
	City and County of Honolulu	DPR Utility Plan, Job No. 89-009c, Sheets C-2 & C-3	2" diameter waterline	Runs from Kapahulu St. to drainage channel	Active	Yes	Unknown	Detention berm would cross water line	Design berm to accommodate waterline once detailed information is obtained	
	City and County of Honolulu	DPR Utility Plan, Job No. 89-009c, Sheets C-4	6" diameter waterline	Located near southwest side of maintenance building on Date Street, and runs through golf course	Active	Yes	Unknown	Detention berm would cross water line in at least 2 locations; sediment basin would also conflict with water line	Relocate water line (or design berm and sediment basin to accommodate water line) as necessary, once detailed utility information is obtained	
	City & County of Honolulu	DPR Asbuilt, Job No. 96-011C, Sheets C-4	Abandoned 6" diameter water line; line has been cut & plugged	Located near southwest side of maintenance building on Date Street (parallel to active 6" waterline)	Abandoned	Yes	Unknown	Water line located within footprint of detention berm, but is no longer in use; no conflict expected	N/A	Not shown on plan drawings
	Board of Water Supply	DPR Asbuilt, Job No. 96-011C, Sheets C-4	Abandoned 8" diameter water line; may have been removed	Located near southeast side of maintenance building on Date Street	Abandoned	Yes	Unknown	Water line located within footprint of detention berm, but is no longer in use; no conflict expected	N/A	Not shown on plan drawings
	Board of Water Supply	DPR Asbuilt, Job No. 96-011C, Sheets C-4	2" and 8" diameter waterlines (parallel)	Located near west side of maintenance building on Date Street	Active	No	Unknown	Located near detention berm but not within construction limits; no conflict expected	N/A	

Ala Wai Golf Course Multi-Purpose Detention

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Storm Drain	City and County of Honolulu	Visual inspection C&C GIS database USACE 35% design drawings	3 - 9.5' x 7' RCB, 48" pipe	Runs through golf course and daylighs into drainage channel that flows to Ala Wai Canal	Active	yes	Unknown	Detention berm would cross drain lines	Design berm to accommodate existing drain lines once detailed information is obtained	
	City & County of Honolulu	Visual inspection USACE 35% design drawings	9' x 6' box culvert	At head of Ala Wai Canal in mauka corner	Active	yes	Unknown	Detention berm would not cross drain line; drain line within footprint of staging area	Design drawings and specifications should identify measures to avoid/protect drain line, as needed	
	City & County of Honolulu	Visual inspection USACE 35% design drawings	4' x 3' box culvert, outfall has been covered	At head of Ala Wai Canal near center of channel	Abandoned (based on visual inspection)	yes	Unknown	Storm drain located near footprint of staging area, but is no longer in use; no conflict expected	N/A	
	City & County of Honolulu	C&C GIS database	5.5' x 10' box culvert, with drain pipes tying in from adjacent residential area	Running along edge of Ala Wai golf course property between maintenance building and Palani St	Active	yes	Unknown	Storm drain located in close proximity to detention berm; may conflict depending on final design and exact location/depth of storm drain	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	
	City & County of Honolulu	C&C GIS database	42" diameter RCP	Running along edge of Ala Wai golf course property between Palani St and Kapahulu Ave	Active	yes	Unknown	Storm drain located in close proximity to detention berm; may conflict depending on final design and exact location/depth of storm drain	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	
Sanitary Sewer	City & County of Honolulu	C&C GIS database	30" diameter sewer line	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	Active	no	Unknown	Sewer line is located within Date St roadway, but approaches construction limits near northwest corner of golf course (near Manoa-Palolo Drainage Canal)	Design drawings and specifications should identify measures to avoid/protect sewer and accommodate manholes, as needed	
	City and County of Honolulu	DPR Asbuilt, Job No. 96-011C, Sheets C-4	6" diameter sewer line for maintenance facility	Located between west side of maintenance facility; connects to a 8" diameter sewer line that exits the property at Date-Kapahulu Sewer	Active	Yes	Inv = approx. 4.1' (Asbuilt)	Detention berm would cross sewer line	Design berm to accommodate existing sewer line once detailed information is obtained	
	City and County of Honolulu	DPR Asbuilt, Job No. 96-011C, Sheets C-4	8" diameter sewer line	Runs from golf course clubhouse to Date-Kapahulu Sewer (connects at sewer manhole [SMH] #1)	Active	Yes	Inv = approx. -5.38' (Asbuilt)	Detention berm would cross sewer line; sediment basin would also conflict with sewer line	Relocate sewer line (or design berm and sediment basin to accommodate sewer line) as necessary, once detailed utility information is obtained	
	City and County of Honolulu	C&C GIS database	24" diameter sewer line and manholes	Runs north to south through eastern portion of golf course (roughly from vicinity of Ekela St to Castle St)	Active	Yes	Unknown	Detention berm would cross sewer line	Design berm to accommodate existing sewer line and manholes once detailed information is obtained	
	City and County of Honolulu	C&C GIS database	12" diameter sewer line and manholes	Runs east to west through eastern portion of golf course (roughly from vicinity of Kamuela St to 24" sewer line)	Active	Yes	Unknown	Detention berm would cross sewer line	Design berm to accommodate existing sewer line and manholes once detailed information is obtained	

Ala Wai Golf Course Multi-Purpose Detention

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Gas	Hawaii Gas	Hawaii Gas distribution map	Various	Various distribution lines within Kapahulu Ave	Active	no	Unknown	Project is not expected to affect utilities within Kapahulu Ave roadway	Design drawings and specifications should identify measures to avoid/protect gas lines, as needed	Not shown on plan drawings
Telecommunications	Hawaiian Telcom	Hawaiian Telcom maps	Overhead telecommunication lines	Co-located with electrical lines on makai side of entrance road to Ala Wai Golf Course Clubhouse	Active	Yes	Overhead	Detention berm not expected to conflict with overhead telecommunication line	Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access	
Irrigation	City & County of Honolulu	Visual Inspection	Various lines and valves	Generally located within Ala Wai golf course; specific locations unknown	Active	yes	Unknown	Generally located within or near detention berm	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings

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.

Hausten Ditch Detention

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Water	Board of Water Supply	BWS Dist Maps (2016)	8" diameter waterline	Within University Ave and Hihiwai St roadways	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	Not shown on plan drawings
Storm Drain	City & County of Honolulu	C&C GIS database USACE 35% design drawings	15'x3' box culvert	Hausten Ditch	Active	yes	Unknown	Drainage feature located within footprint of detention basin; new slide gates proposed as part of project	Design drawings and specifications should identify measures to avoid/protect drainage feature	Shown on plans as Hausten Ditch
Sanitary sewer	City & County of Honolulu	C&C GIS database DDC Asbuilt, Job No. W18-07, Sheet G-3	Sewer tunnel, Hobas pipe; 72" diameter	Runs parallel to Canal (near walkway)	Active	yes	30'+ below grade	Detention basin would be located in close proximity to sewer tunnel and associated manholes; detention berm may cross tunnel near Canal	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	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
Lighting	City & County of Honolulu	Visual Inspection DDC Asbuilt, Job No. W18-07, Sheets C-23A and C-24	Multiple power feeds and lines; details not shown on as-built drawings	Along walkway	Active	yes	Unknown	Generally located within floodwall footprint, but may also extend into detention footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
	City & County of Honolulu	Visual Inspection	Multiple power feeds and lines; details not shown on as-built drawings	Within park, at sports courts	Active	yes	Unknown	Generally located outside construction area (based on visual observation), but may extend into detention basin footprint	Determine whether detention basin conflicts with utility once detailed information is obtained; relocate utility during construction, as needed	Not shown on plan drawings
Irrigation	City & County of Honolulu	Visual Inspection	Unknown; details not shown on as-built drawings	Throughout Ala Wai Community Park	Active	yes	Unknown	Generally located within or near detention basin footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
	City & County of Honolulu	Visual Inspection	Backflow preventer	Within Ala Wai Community Park, just west of the sports courts	Active	yes	Aboveground	Generally located within or near detention basin footprint	Relocate backflow preventer (or design detention berm to avoid backflow preventer) as appropriate	Not shown on plan drawings

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.

Kanewai Field Multi-Purpose Detention Basin

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead electrical lines	Running adjacent to Manoa Stream from Dole St. to Koali Rd.	Active	yes	Aboveground	Overhead electrical line and pole located at edge of construction limits for detention basin	Relocate pole (or design detention berm to accommodate pole) as appropriate once detailed information is obtained	Schematically shown on plan drawings based on visual inspection
	Hawaiian Electric Company	Visual Inspection	Overhead electrical lines	Running along Dole St., crossing between mauka and makai sides of road	Active	no	Aboveground	Overhead electrical line not expected to conflict with detention basin, but could affect construction access	Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access	Not shown on plan drawings
Water	Board of Water Supply	BWS Dist. Maps (1988), Sheet 50	20" diameter	Along Dole St	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	
	Board of Water Supply	BWS Dist. Maps (1988), Sheet 50	8" diameter	Along Kanewai St	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	
Storm Drain	City and County of Honolulu	Visual Inspection C&C GIS database	6' x 4' box culvert (with manhole located within park)	Runs from Dole St. to Manoa Stream; crosses near home plate (manhole located just east of baseball diamond)	Active	yes	Unknown (but appears to be relatively shallow based on visual inspection)	Box culvert could conflict with excavation for detention basin	Design detention basin to avoid or accommodate features (e.g., lower box culvert, replace box culvert with pipes or shallower box culvert)	
	City and County of Honolulu	Visual Inspection C&C GIS database	Inlet to 24" diameter RCP	At southern edge of park along row of houses on Koali Rd.	Active	yes	Unknown	Drain inlet located within footprint of detention basin; project is designed to utilize drain inlet and drain line	Design drawings and specifications should identify measures to avoid/protect drain line	
Sanitary Sewer	City and County of Honolulu	DES Asbuilt, Moiliili Area 3 C&C GIS database	6" diameter sewer main	Within park, running parallel to Dole St.	Active	yes	Unknown	Sewer line is not within construction limits for detention basin, but would be crossed by access road	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	
	City and County of Honolulu	C&C GIS database	4" diameter sewer line	Along eastern edge of tennis courts, parallel to 6" diameter sewer line	Active	yes	Unknown	Sewer line is not within construction limits for detention basin, but would be crossed by access road	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	
Telecommunications	Unknown	Visual Inspection	Overhead lines, co-located with electrical lines	Running along Dole Street, crossing between mauka and makai sides of road	Active	yes	Aboveground	Telecommunication lines not expected to conflict with detention basin, but could affect construction access	Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access	Not shown on plan drawings
Lighting	City and County of Honolulu	Visual Inspection	Electrical lines for park lighting	Exact locations are unknown	Active	yes	Unknown	Electrical lines are generally expected to be near park infrastructure and not within detention footprint, but exact locations are unknown	Determine whether detention basin conflicts with electrical lines once detailed information is obtained; relocate utility during construction, as needed	Not shown on plan drawings
Irrigation	City and County of Honolulu	Visual Inspection	Backflow preventer, valves and other miscellaneous irrigation features	Throughout park area, backflow preventer located next to wall between swimming pool and maintenance building	Active	yes	Unknown	May be located within or near detention footprint	Relocate as needed during construction (assuming locations may not be obtained as part of future survey effort)	Not shown on plan drawings
Other	U.S. Geological Survey	Visual Inspection	Stream gaging station	Located next to Manoa Stream, approximately midway between baseball diamond fencing and housing next to school	Active	yes	Aboveground	Gaging station located near edge of construction limits; may be within footprint of detention basin	Design detention basin to accommodate gaging station (or relocate as necessary) once detailed information is obtained	
	Unknown	Visual Inspection	Possible utility room	Under tennis courts at field elevation	Active	no	Aboveground	Possible utility room is not within construction limits, so no conflict is expected	Design drawings and specifications should identify measures to avoid/protect utility room, as needed	Not shown on plan drawings

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.

Manoa In-Stream Debris Catchment

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead lines	Located along mauka side of Kahaloa Dr. at entrance to park, with feeder lines crossing Kahaloa Dr.	Active	no	N/A	No conflict with in-stream debris catchment, but overhead lines may affect construction access	Include utility information in detailed design drawings/specifications, with provisions for temporary relocation as needed for construction access	Schematically shown on plan drawings based on visual inspection
Storm Drain	City & County of Honolulu	C&C GIS database	36" RCP	Runs through park and drains to Manoa Stream, just south of Kahaloa Dr	Active	no	N/A	Drain line is not within construction limits for in-stream debris catchment, but may be crossed as part of construction access	Design drawings and specifications should identify measures to avoid/protect drain line, as needed	
	City & County of Honolulu	C&C GIS database	24" RCP	Run through park and drains to Manoa Stream, just north of baseball diamond	Active	no	N/A	Drain line is not within construction limits for in-stream debris catchment, but may be crossed as part of construction access	Design drawings and specifications should identify measures to avoid/protect drain line, as needed	
	City & County of Honolulu	C&C GIS database	30" x 48" box culvert	Series of ditches around baseball diamond lead to box culvert that drains to Manoa Stream at southern tip of park	Active	no	N/A	Drainage feature is not within construction limits; no conflict expected	N/A	
Sanitary Sewer	City & County of Honolulu	C&C GIS database	15" diameter gravity-fed sewer line	Runs through park near walkway parallel to Manoa Stream	Active	no	Unknown	Sewer line is near construction limits for in-stream debris catchment; may be crossed by construction access	Design drawings and specifications should identify measures to avoid/protect sewer, as needed	
Telecommunications	Unknown	Visual Inspection	Overhead lines	Co-located with electrical lines	Active	no	N/A	No conflict with in-stream debris catchment, but overhead lines may affect construction access	Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access	Not shown on plan drawings
Lighting	City & County of Honolulu	Visual Inspection	Electrical lines for street lighting	Street lights located along makai side of Kahaloa Drive at entrance to park; location of electrical lines is unknown	Active	no	N/A	Exact location of electrical lines is unknown, but not expected to conflict with in-stream debris catchment	N/A	Not shown on plan drawings

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.

Woodlawn Ditch Detention

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead electrical lines	Along north side of Lower Rd	Active	no	N/A	Utility poles are located near detention berm, but are not within construction limits; no conflict expected	Design drawings and specifications should identify measures to avoid/protect utility, depending on final design	Schematically shown on plan drawings based on visual inspection
Water	Board of Water Supply	Visual observation BWS Dist. Maps (1988), Sheet 56	6" diameter water line and fire hydrant	Along Lower Rd	Active	no	N/A	Located in roadway outside of construction limits; no conflict expected	N/A	Water line not shown on plan drawings
Storm Drain	City & County of Honolulu	C&C GIS database	18" diameter RCP	Along Lower Rd	Active	no	N/A	Located in roadway outside of construction limits; no conflict expected	N/A	
	City & County of Honolulu	C&C GIS database	18" diameter RCP	Crossing intersection of Old E Manoa Rd and E Manoa Road, then running along E Manoa Road	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	
	City & County of Honolulu	C&C GIS database	18" diameter RCP, with manhole	Running along Pakanu Street, draining into Woodlawn Ditch	Active	no	N/A	Located at a distance from construction limits; no conflict expected	N/A	
Sanitary Sewer	City & County of Honolulu	C&C GIS database	10" diameter sewer line	Within E. Manoa Rd	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	
	City & County of Honolulu	C&C GIS database	8" diameter sewer line	Within Lower Rd	Active	no	N/A	Located in roadway at a distance from construction limits; no conflict expected	N/A	
Telecommunications	Hawaiian Telcom	Hawaiian Telcom maps	Overhead	Co-located with electrical lines along Lower Rd	Active	no	N/A	Utility poles are located near detention berm, but are not within construction limits; no conflict expected	Design drawings and specifications should identify measures to avoid/protect drain line, as needed	Not shown on plan drawings

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

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead electrical lines	Along BWS dirt access road	Active	yes	Aboveground	Traverses along and across proposed construction access route and detention berm	Relocate poles and overhead lines (or design detention berm to accommodate utility) as appropriate once detailed utility information is obtained	Schematically shown on plan drawings based on visual inspection
Water	Board of Water Supply	Visual Inspection BWS Dist. Maps (1988), Sheet 54	12" diameter water line	Runs from Manoa Tunnel #3 to Waaloa Way. Located along dirt access road; two valves located just east of bridge over Waiakeakua Stream	Active	yes	Unknown	Located within footprint of construction access road; water line and valves could be impacted by construction equipment and/or potential bridge reinforcement	Design access road and bridge reinforcement to accommodate existing water line and valves once detailed information is obtained	
	Board of Water Supply	Visual Inspection BWS Dist. Maps (1988), Sheet 54	6" diameter water line	Runs north to south, connecting to 12" waterline east of bridge over Waiakeakua Stream	Active	yes	Unknown	Located within footprint of construction access road; water line could be impacted by construction equipment and/or potential bridge reinforcement	Design access road and bridge reinforcement to accommodate existing water line once detailed information is obtained	
Storm Drain	City & County of Honolulu	Visual Inspection C&C GIS database	48" diameter RCP	Located along Waaloa Way, draining to stream at first bridge crossing	Active	no	N/A	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	Design access road and bridge reinforcement to accommodate existing drainage feature once detailed information is obtained	
Telecommunications	Hawaiian Telcom	Visual Inspection (2/19/2016) Hawaiian Telcom maps	Overhead telecommunication lines, co-located with electrical lines	Co-located with electrical lines	Active	yes	Aboveground	Traverses along and across proposed construction access route and detention berm	Relocate overhead lines (or design detention berm to accommodate utility) as needed once detailed utility information is obtained	Not shown on plan drawings

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.

Makiki Debris and Detention Basin

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

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.

Pukele Debris and Detention Basin

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

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.

Waiomao Debris and Detention Basin

Utility Type	Utility Owner	Source of Information	Description	General Location	Status	Within Const. Limits	Est. Depth Within Construction Limits	Potential Conflict with Proposed Feature	Recommended Resolution	Notes
Electrical	Hawaiian Electric Company	Visual Inspection	Overhead lines	Along west side of Waiomao Rd., crossing road in various locations	Active	no	N/A	No conflict with proposed detention basin, but electrical lines may affect construction access	Include utility information in detailed design drawings/ specifications, with provisions for temporary relocation as needed for construction access	Schematically shown on plan drawings based on visual inspection
Water	Board of Water Supply	BWS Dist. Maps (1988), Sheet 62	Parallel 6" and 8" diameter distribution lines	Along Waiomao Rd.	Active	no	N/A	Not located within construction limits; no conflict identified	None	
Storm Drain	City and County of Honolulu	C&C GIS database	18" diameter RCP transitioning to 24" diameter RCP	Extending west from Waiomao Rd	Active	no	Unknown	Located within or near to staging area	Design drawings and specifications should identify measures to avoid/protect drain line, as needed	In addition to utilities, there are various driveways and dwellings in the vicinity of the staging area and access road
	City and County of Honolulu	C&C GIS database	RCP; diameter unknown	Within Waiomao Rd	Active	no	Unknown	Not located within construction limits; no conflict identified	None	
Sanitary Sewer	City and County of Honolulu	C&C GIS database DPW Asbuilt, Job No. 47-72	8" diameter sewer main with 6' wide easement	Perpendicular to Halekipa Pl. through project area.	Active	yes	Unknown	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	
	City and County of Honolulu	C&C GIS Asbuilt DES Asbuilt, Palolo Area 3.1	8" diameter sewer main	Within Waiomao Rd	Active	no	Unknown	Not located within construction limits; no conflict identified	None	
Telecommunications	Unknown	Visual Inspection (5/19/2016)	Overhead lines	Along west side of Waiomao Rd., co-located with electrical lines	Active	No	N/A	No conflict with proposed detention basin, but telecommunication lines may affect construction access	Address utility avoidance and/or temporary relocation as part of detailed design process and/or defer to contractor	Not shown on plan drawings
Lighting	City & County of Honolulu	Visual Inspection (5/19/2016)	Street lights	Along west side of Waiomao Rd., co-located with electrical lines	Active	No	N/A	Not located within construction limits; no conflict identified	None	Not shown on plan drawings

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.

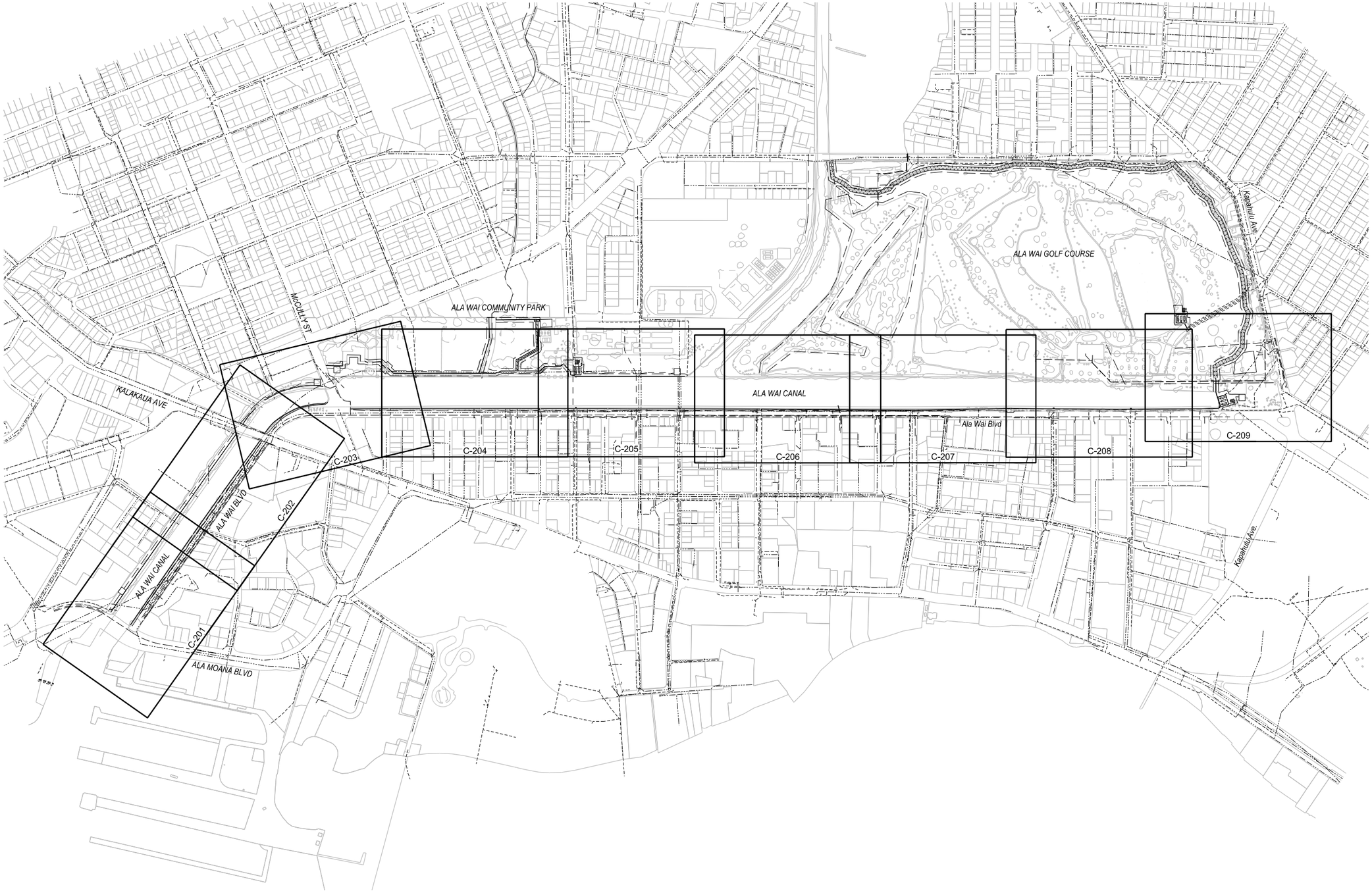
Mitigation Sites (Falls 7 and 8)

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

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



KEY MAP - ALA WAI CANAL FLOOD WALLS

1"=400'

0 400 800 1200

Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

DESIGNED BY:
DRAWN BY:
SUBMITTED BY:
DATE:
CHECKED BY:
PLOT SCALE: AS SHOWN
SIZE: ANSI D
PLOT DATE:
FILE NAME: $FILE$
REVISION:
SOLICIT / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-200
SHEET xx OF 19

PLOTDRIVER: $PLTDRV$S
PEN TABLE: $PENTBL$S
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX

ALA MOANA BLVD

CONSTRUCTION LIMITS

PROPOSED FLOOD WALL

ALA WAI CANAL

TO PACIFIC OCEAN

PROPOSED FLOOD WALL

PROPOSED FLOOD WALL

ALA WAI BLVD

CONSTRUCTION LIMITS

MATCH LINE SEE SHEET C-202

ALA MOANA 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 CROSSING ALA MONA BRIDGE (PARTIALLY SHOWN)
   b. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD (PARTIALLY SHOWN)
   c. 4" AND 12" STORM DRAINS CROSSING ALA WAI BLVD. BETWEEN ALA MOANA BLVD. AND LIPEEPEE STREET.
   d. 4" GAS LINE CROSSING ALA MOANA 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 MOANA BLVD BRIDGE
   h. STREET LIGHT AND TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.

N

ALA WAI CANAL FLOOD WALLS - 1

1"=50'

0 50 100 150

Scale In Feet

PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBLS$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

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SUBMITTED BY:
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SIZE: ANSI D
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FILE NAME: $FILE$
DATE:
REVISION:
SOLICIT / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

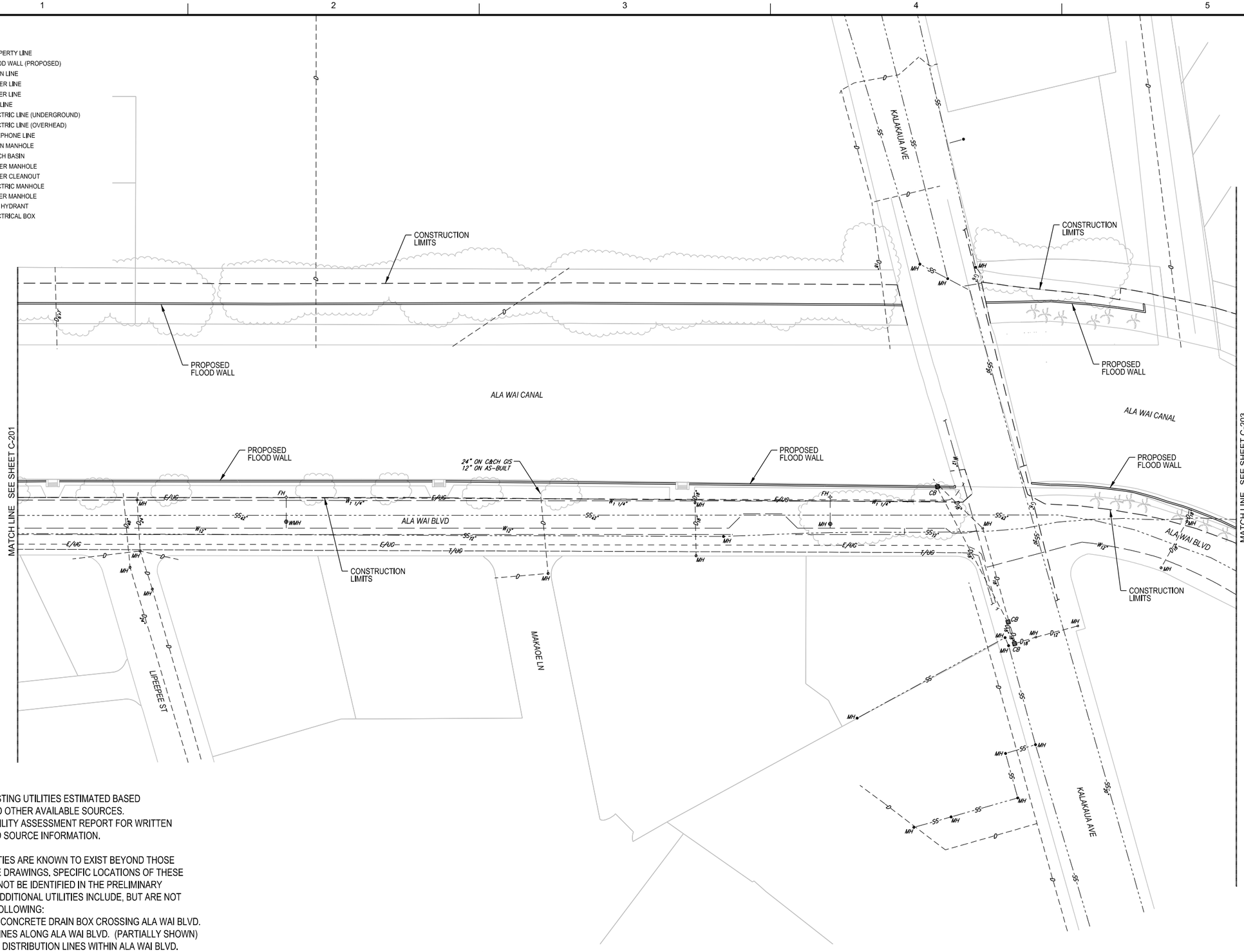
ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-201
SHEET 1 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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. 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 LIGHT AND TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.
   e. CABLE CONDUIT IN KALAKAUA AVE. BRIDGE
   f. 4" WATER DISTRIBUTION LINE TRANSITIONS TO 3" ALONG ALA WAI PROMENADE.

N

ALA WAI CANAL FLOOD WALLS - 2

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

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MARK	DESCRIPTION	DATE	APPR

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HONOLULU DISTRICT
HONOLULU, HAWAII

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CHECKED BY:
PLOT DATE: $DATE$
FILE NAME: $FILE$

REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

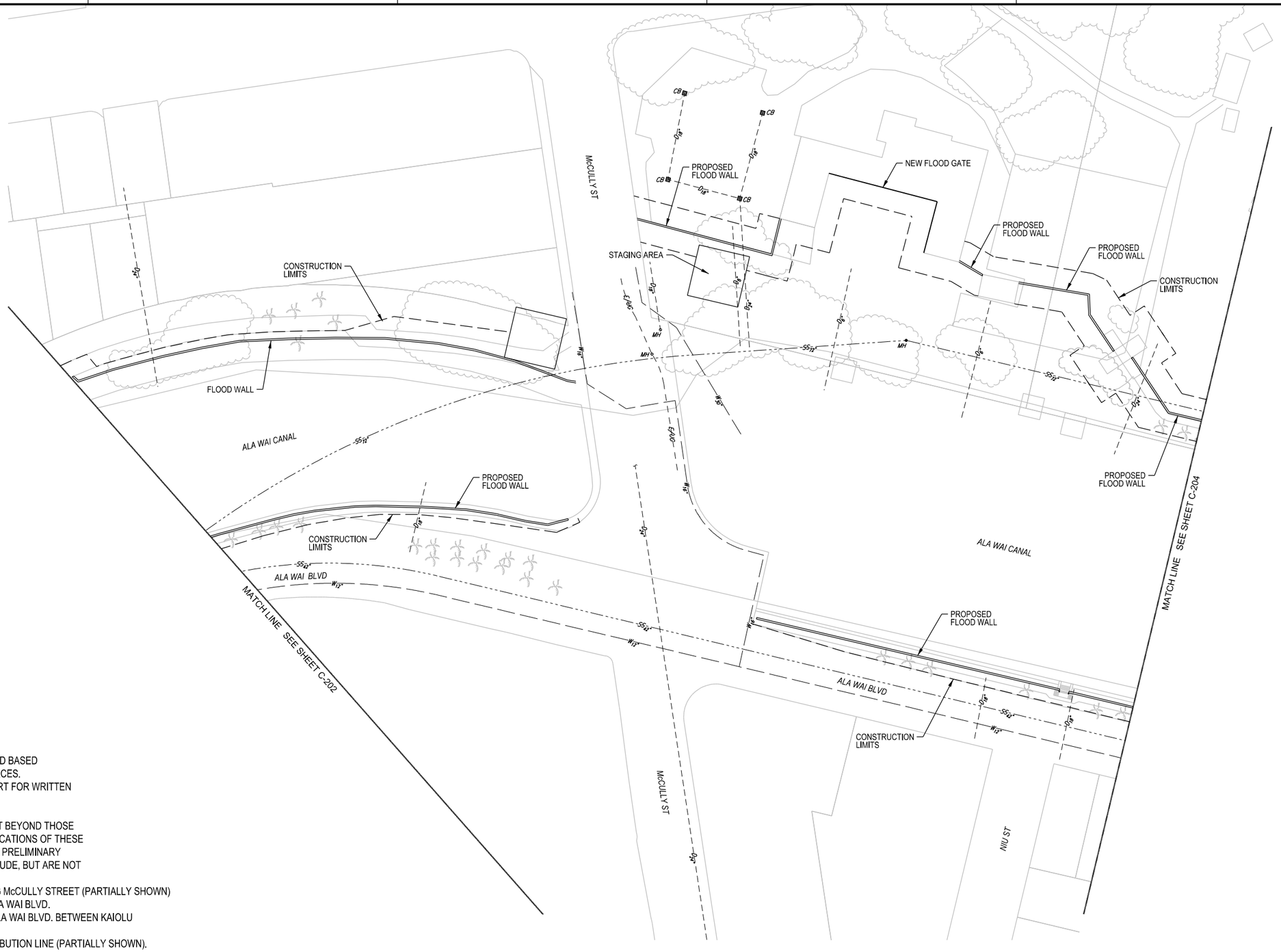
ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-202
SHEET 2 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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   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. 30-INCH UNDERGROUND WATER DISTRIBUTION LINE (PARTIALLY SHOWN).
   e. FIRE HYDRANT LATERALS
   f. IRRIGATION LINES ALONG ALA WAI BLVD.
   g. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   h. TELEPHONE CONDUIT IN McCULLY STREET BRIDGE
   i. STREET LIGHT AND TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.
   j. LIGHTING AND IRRIGATION IN ALA WAI COMMUNITY PARK AND PARKING LOT
   k. CIVIL DEFENSE WARNING SIREN AT CORNER OF KALAKAUA AVE. AND KAPIOLANI BLVD.

ALA WAI CANAL FLOOD WALLS - 3

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

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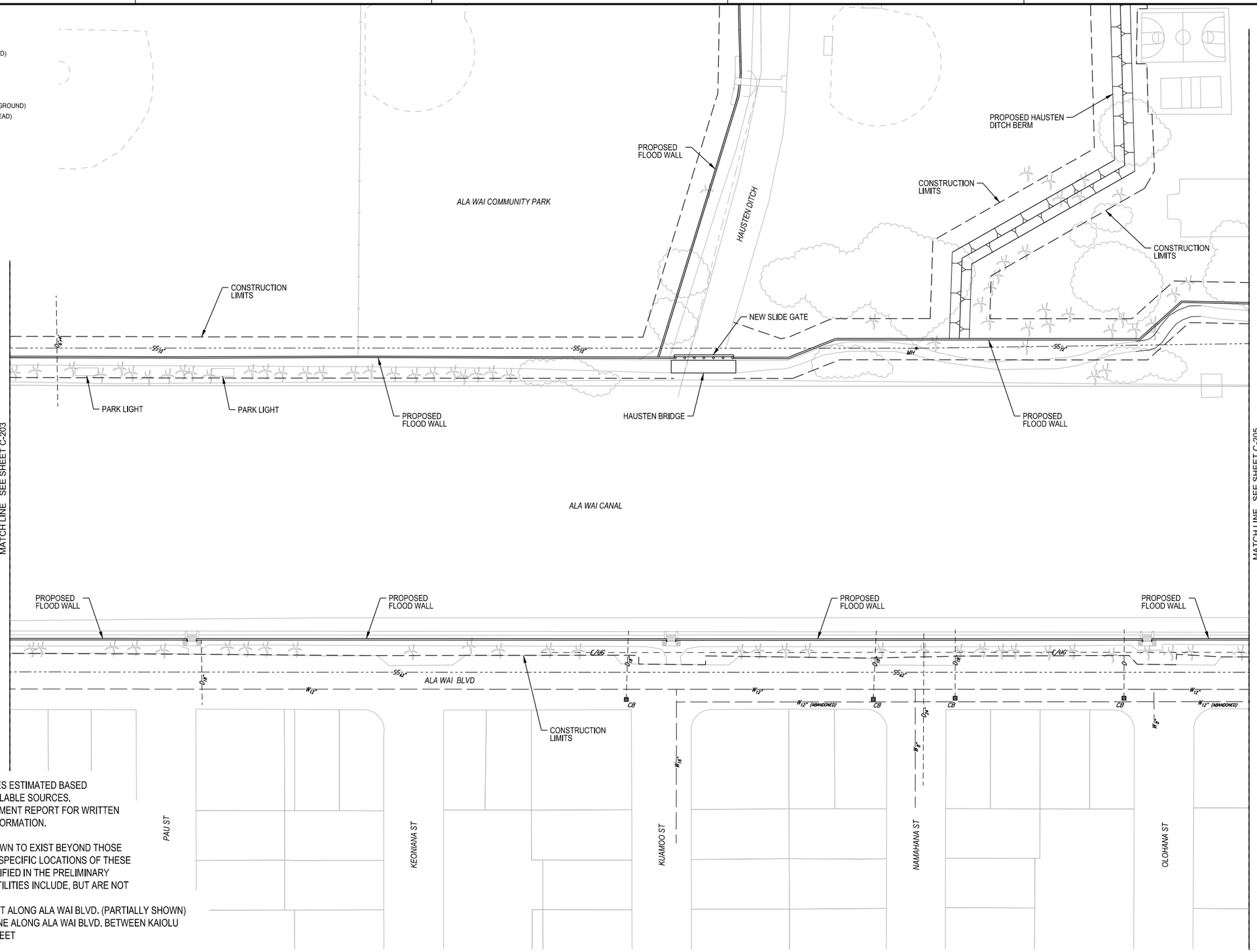
ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-203
SHEET 3 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



NOTES:

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   a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD. (PARTIALLY SHOWN)
   b. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY 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.

ALA WAI CANAL FLOOD WALLS - 4

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRVSS
PEN TABLE: $PENTBLSS
PRINTED BY: $USERS

FILE: $FILELS
MODEL NAME: $MODELNAMES
DATE & TIME: $DATES $TIMES
LAST SAVED BY:

US Army Corps of Engineers®

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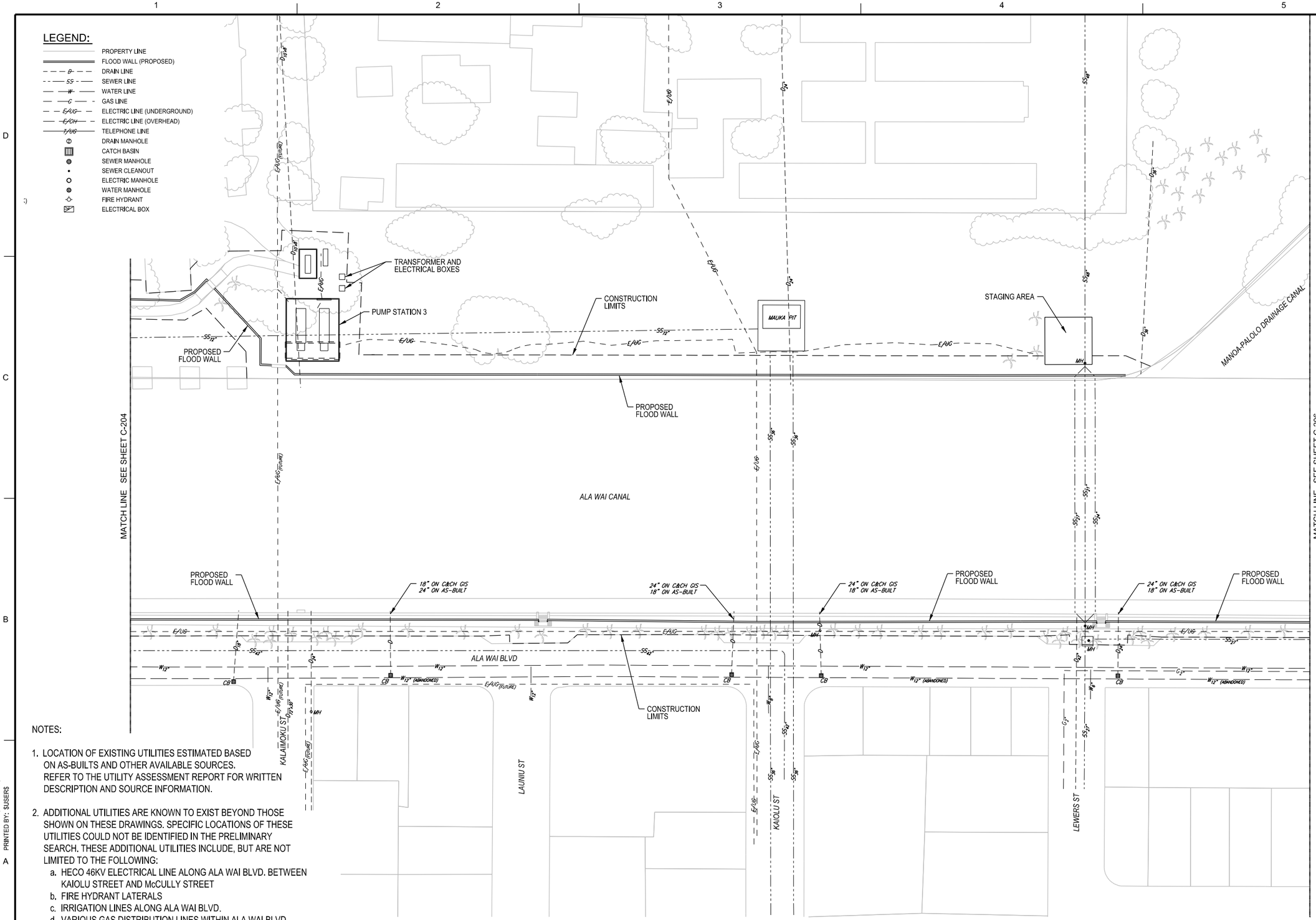
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-204
SHEET 4 OF 19



NOTES:

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   a. HECO 46KV ELECTRICAL LINE ALONG ALA WAI BLVD. BETWEEN KAIOLU STREET AND McCULLY STREET
   b. FIRE HYDRANT LATERALS
   c. IRRIGATION LINES ALONG ALA WAI BLVD.
   d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. LIGHTING CONDUITS ON BOTH SIDES OF ALA WAI CANAL (PARTIALLY SHOWN) AND PARKING AREA FOR ALA WAI COMMUNITY PARK.
   f. TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.

ALA WAI CANAL FLOOD WALLS - 5

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: $SCALE | PLOT DATE: $DATE | DRAWING NUMBER:
PLOT ROTATION: $ROTATION
SIZE: ANSI D | FILE NAME: $FILE$

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES PLAN

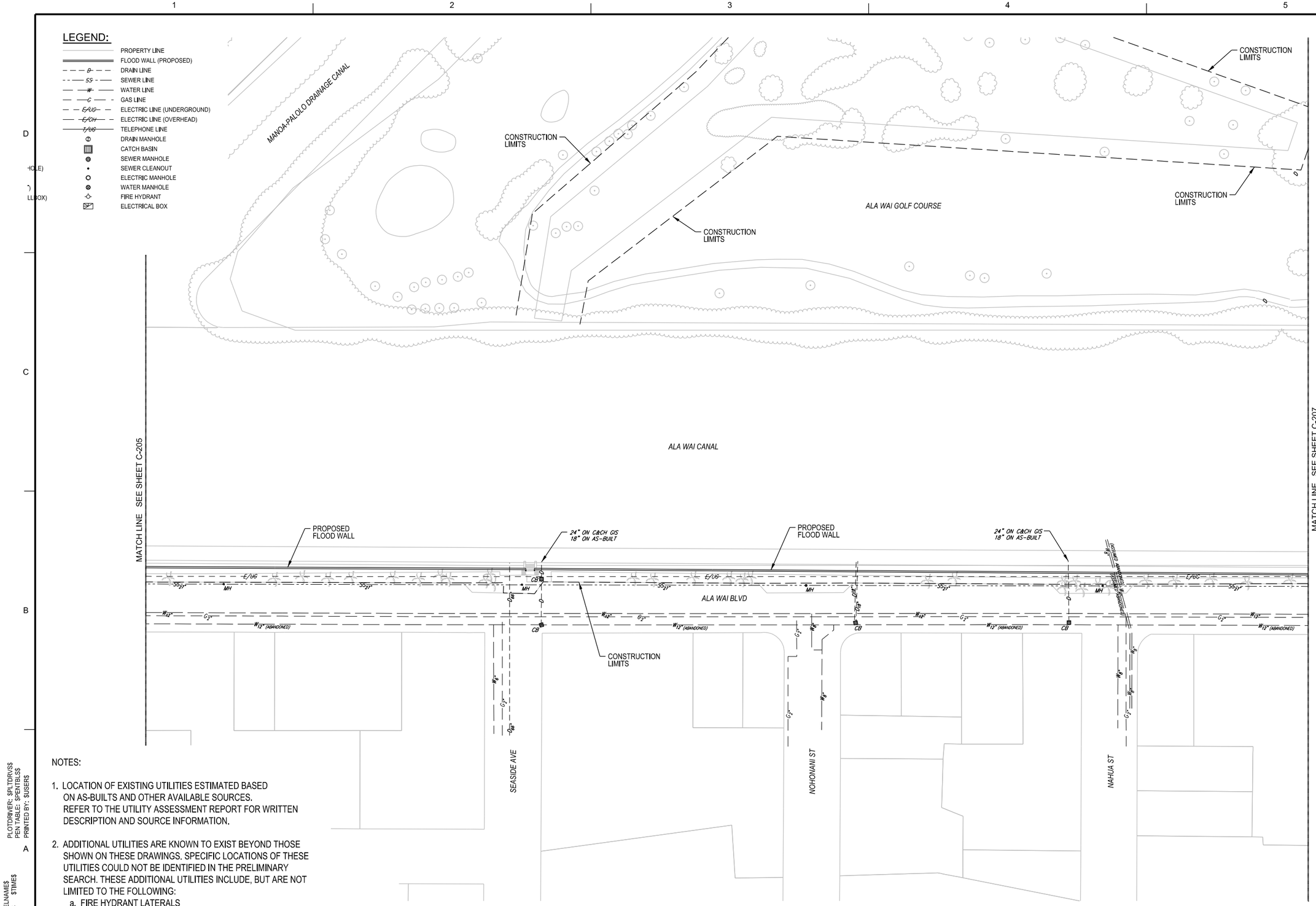
SHEET IDENTIFICATION
C-205
SHEET 5 OF 19

PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBL$S
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

LEGEND:

———	PROPERTY LINE
═══	FLOOD WALL (PROPOSED)
— — D — —	DRAIN LINE
- - — SS - —	SEWER LINE
— — W — —	WATER LINE
— — G — -	GAS LINE
— — E/UG — —	ELECTRIC LINE (UNDERGROUND)
— — E/OH — -	ELECTRIC LINE (OVERHEAD)
—— T/UG ——	TELEPHONE LINE
◎	DRAIN MANHOLE
▥	CATCH BASIN
◉	SEWER MANHOLE
•	SEWER CLEANOUT
○	ELECTRIC MANHOLE
⊗	WATER MANHOLE
⌖	FIRE HYDRANT
⊠	ELECTRICAL BOX



NOTES:

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    a. FIRE HYDRANT LATERALS
    b. IRRIGATION LINES ALONG ALA WAI BLVD.
    c. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
    d. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
    e. TRAFFIC SIGNAL CONDUITS ALONG ALA WAI BLVD.

N

ALA WAI CANAL FLOOD WALLS - 6

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBLS$
PRINTED BY: $USER$

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps
of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY:		DATE:	REVISION:
DRAWN BY:	CHECKED BY:	SOLICIT./ CONTRACT NO.:	
SUBMITTED BY:		LOCATION CODE	
PLOT SCALE: AS SHOWN	PLOT DATE: $DATE$	DRAWING NUMBER:	
SIZE: ANSI D	FILE NAME: $FILES$		

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES
PLAN

SHEET
IDENTIFICATION
C-206
SHEET 6 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- D — DRAIN LINE
- SS — SEWER LINE
- W — WATER LINE
- G — GAS LINE
- E/UG — ELECTRIC LINE (UNDERGROUND)
- E/OH — ELECTRIC LINE (OVERHEAD)
- T/UG — TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX

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. 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.

ALA WAI CANAL FLOOD WALLS - 7

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: $DATE$ | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILE$

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-207
SHEET 7 OF 19

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

PLOTDRIVER: $PLTDRV$
PEN TABLE: $PENTBL$
PRINTED BY: $USER$

LEGEND:

────	PROPERTY LINE
═══	FLOOD WALL (PROPOSED)
— — D — —	DRAIN LINE
- - SS - -	SEWER LINE
—— W ——	WATER LINE
—— G ——	GAS LINE
— E/UG —	ELECTRIC LINE (UNDERGROUND)
— E/OH —	ELECTRIC LINE (OVERHEAD)
— T/UG —	TELEPHONE LINE
⦾	DRAIN MANHOLE
▥	CATCH BASIN
◎	SEWER MANHOLE
•	SEWER CLEANOUT
○	ELECTRIC MANHOLE
⊗	WATER MANHOLE
-○-	FIRE HYDRANT
⊠	ELECTRICAL BOX

LE)

BOX)

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. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   e. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
   f. TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD.

ALA WAI CANAL FLOOD WALLS - 8

1"=50'

N

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY:		DATE:	REVISION:
DRAWN BY:	CHECKED BY:	SOLICIT./ CONTRACT NO.:	
SUBMITTED BY:		LOCATION CODE	
PLOT SCALE: AS SHOWN	PLOT DATE: $DATE$	DRAWING NUMBER:	
SIZE: ANSI D	FILE NAME: $FILES$		

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES
PLAN

SHEET
IDENTIFICATION
C-208
SHEET 8 OF 19

LEGEND:

────────	PROPERTY LINE
════════	FLOOD WALL (PROPOSED)
— — D — —	DRAIN LINE
- - SS - -	SEWER LINE
—— W ——	WATER LINE
—— G ——	GAS LINE
— — E/UG — —	ELECTRIC LINE (UNDERGROUND)
—— E/OH ——	ELECTRIC LINE (OVERHEAD)
—— T/UG ——	TELEPHONE LINE
◎	DRAIN MANHOLE
▥	CATCH BASIN
◈	SEWER MANHOLE
•	SEWER CLEANOUT
○	ELECTRIC MANHOLE
⊗	WATER MANHOLE
-ф-	FIRE HYDRANT
⊠	ELECTRICAL BOX

NOTES:

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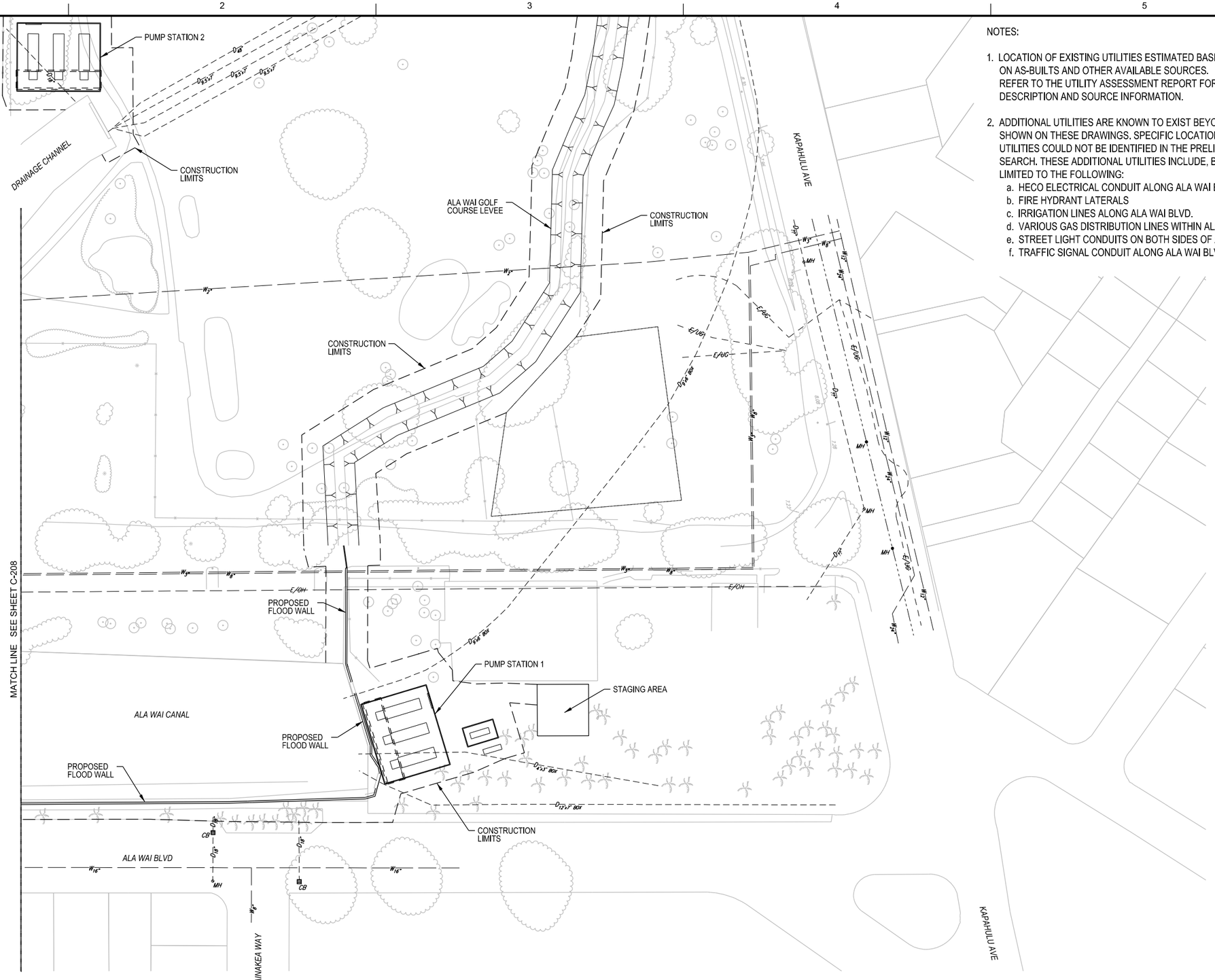
   - a. HECO ELECTRICAL CONDUIT ALONG ALA WAI BLVD.
   - b. FIRE HYDRANT LATERALS
   - c. IRRIGATION LINES ALONG ALA WAI BLVD.
   - d. VARIOUS GAS DISTRIBUTION LINES WITHIN ALA WAI BLVD.
   - e. STREET LIGHT CONDUITS ON BOTH SIDES OF ALA WAI CANAL
   - f. TRAFFIC SIGNAL CONDUIT ALONG ALA WAI BLVD.



N

ALA WAI CANAL FLOOD WALLS - 9

1"=50'

0 50 100 150

Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

DESIGNED BY:		DATE:	REVISION:
DRAWN BY:	CHECKED BY:	SOLICIT./ CONTRACT NO.:	
SUBMITTED BY:		LOCATION CODE	
PLOT SCALE: AS SHOWN	PLOT DATE: $DATE$	DRAWING NUMBER:	
SIZE: ANSI D	FILE NAME: $FILES$		

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES
PLAN

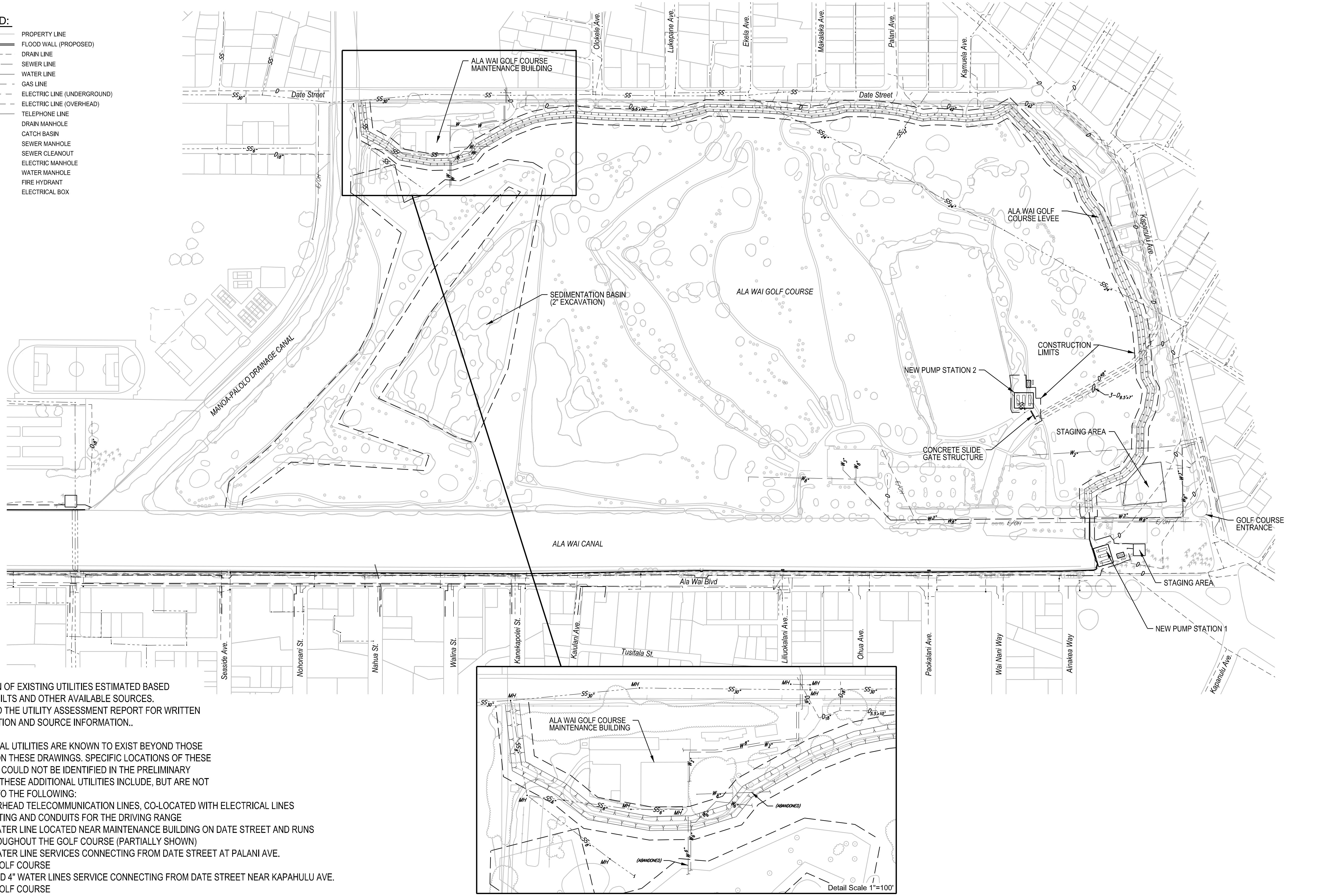
SHEET
IDENTIFICATION
C-209
SHEET 9 OF 19

PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBLS$
PRINTED BY: $USER$

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- D — DRAIN LINE
- SS — SEWER LINE
- W — WATER LINE
- G — GAS LINE
- E/UG — ELECTRIC LINE (UNDERGROUND)
- E/OH — ELECTRIC LINE (OVERHEAD)
- T/UG — TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



NOTES:

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   a. OVERHEAD TELECOMMUNICATION LINES, CO-LOCATED WITH ELECTRICAL LINES
   b. LIGHTING AND CONDUITS 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. 8" AND 4" 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-PALOLO DRAINAGE CANAL

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION

1"=200'

0 200 400 600
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: $DATE$ | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILE$$

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES
PLAN

SHEET IDENTIFICATION
C-210
SHEET 10 OF 19

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

PLOTDRIVER: $PLTDRV$
PEN TABLE: $PENTBL$
PRINTED BY: $USER$

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX

HAUSTEN DITCH

HAUSTEN DITCH FLOODWALL (TYP)

ALA WAI CANAL MIDDLE RIGHT BANK FLOODWALL

HAUSTEN DITCH

15' WIDE PARK ACCESS WITH GEOTEXTILE AND 3" OF SURGE MATERIAL

EDGE OF CANAL

NEW SLIDE GATE

HAUSTEN BRIDGE

CONSTRUCTION LIMITS

HAUSTEN DITCH BERM

STAGING AREA

University Ave.

ALA WAI CANAL

Hihiwai Street

CONSTRUCTION LIMITS

EXISTING CANOE PLATFORMS

NEW PUMP STATION 3

N

HAUSTEN DITCH DETENTION

1"=50'

0 50 100 150

Scale In Feet

NOTES:

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   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.

PLOTDRIVER: $PLTDRVSS
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

DESIGNED BY:
DRAWN BY:
SUBMITTED BY:
CHECKED BY:
PLOT SCALE: AS SHOWN
SIZE: ANSI D
PLOT DATE: $PLTS
FILE NAME: $FILE$$
DATE:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
REVISION:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

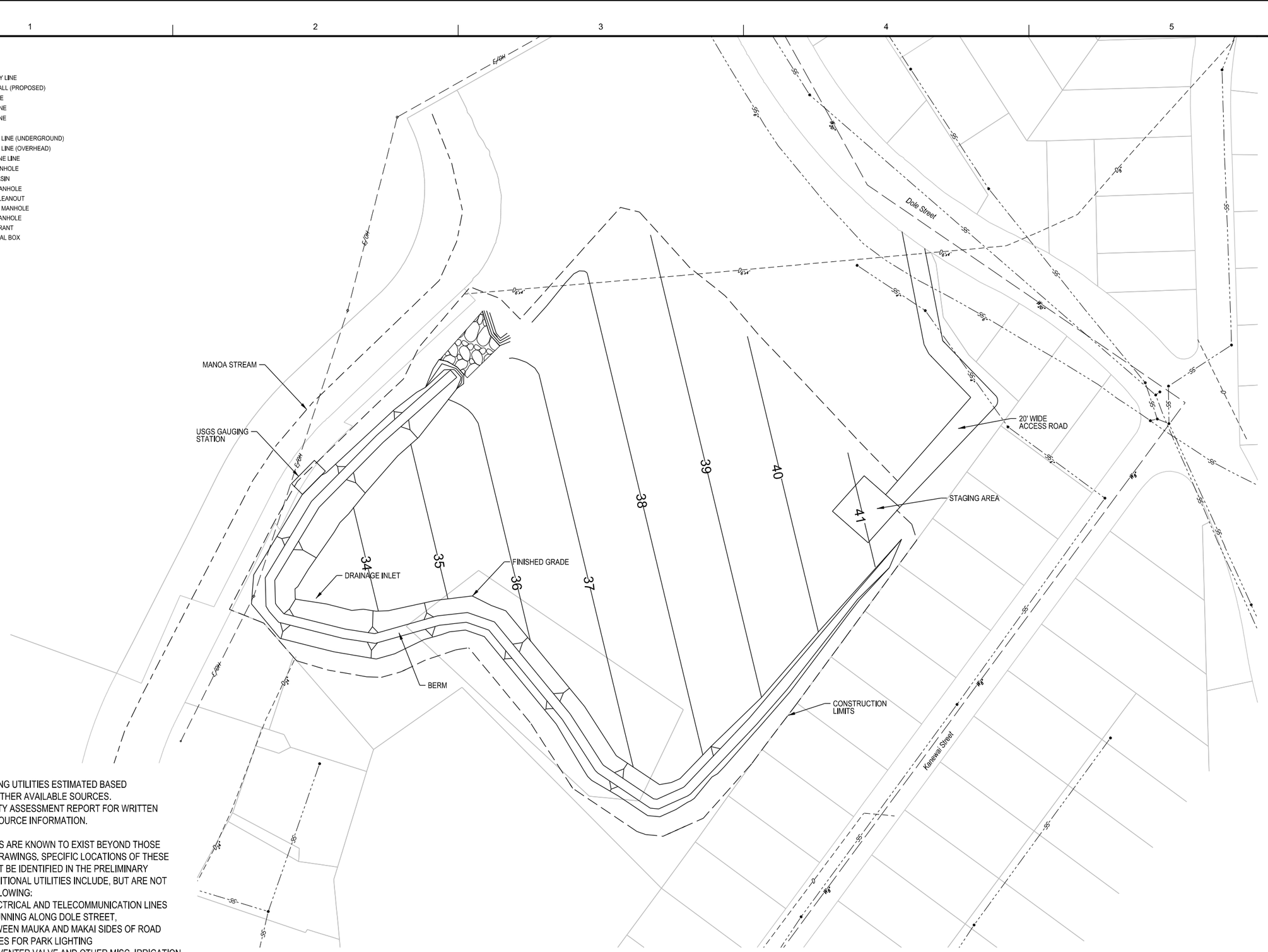
ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-211
SHEET 11 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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   a. OVERHEAD ELECTRICAL AND TELECOMMUNICATION LINES CO-LOCATED RUNNING ALONG DOLE STREET, CROSSING BETWEEN MAUKA AND MAKAI SIDES OF ROAD
   b. ELECTRICAL 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"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: AS SHOWN | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILE$

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

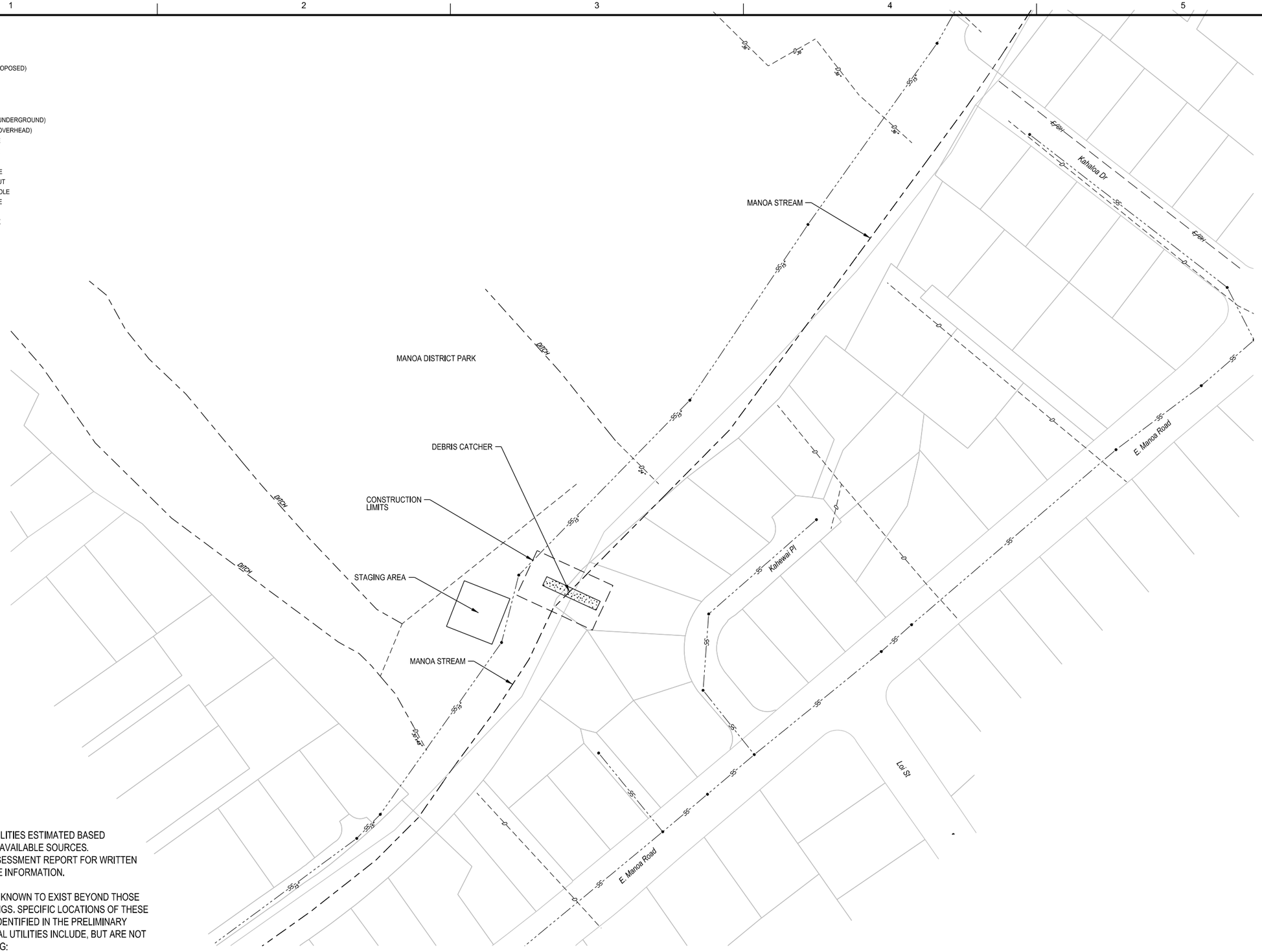
SHEET IDENTIFICATION
C-212
SHEET 12 OF 19

PLOTDRIVER: $PLTDRV$S
PEN TABLE: $PENTBL$S
PRINTED BY: $USER$

FILE: $FILE$S
MODEL NAME: $MODELNAME$S
DATE & TIME: $DATE$S $TIME$S
LAST SAVED BY:

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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   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.

N

MANOA IN-STREAM DEBRIS CATCHMENT

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRVSS
PEN TABLE: $PENTBLSS
PRINTED BY: $USERS

FILE: $FILELS
MODEL NAME: $MODELNAMES
DATE & TIME: $DATES $TIMES
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: $PLTDATE | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILESS

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

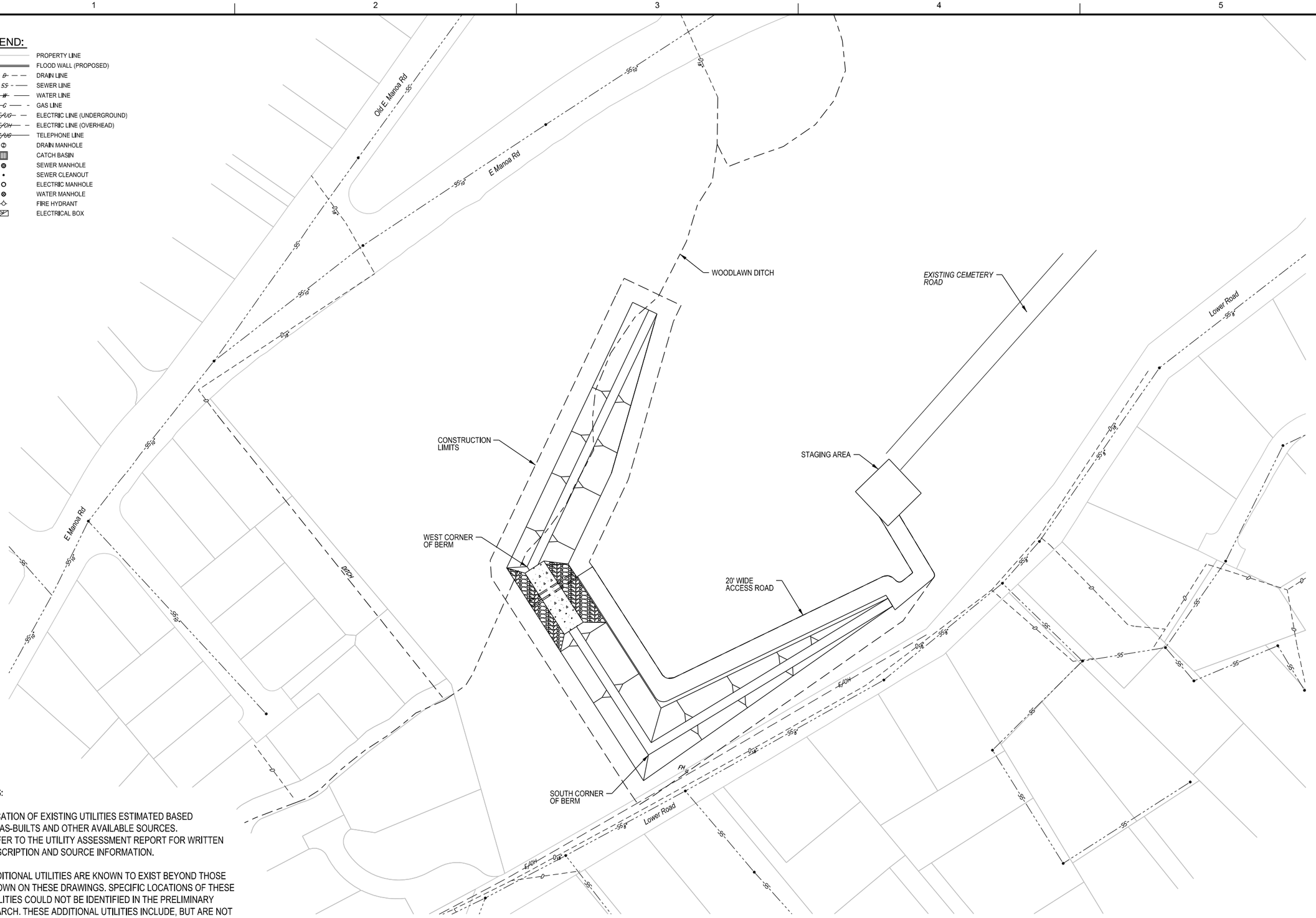
ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-213
SHEET 13 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES
   b. WATER LINES WITHIN ROADWAYS

N

WOODLAWN DITCH DETENTION

1"=50'

0 50 100 150
Scale In Feet

PLOTDRIVER: $PLTDRVSS
PEN TABLE: $PENTBLSS
PRINTED BY: $USERS

FILE: $FILEIS
MODEL NAME: $MODELNAMES
DATE & TIME: $DATES $TIMES
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILESS

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

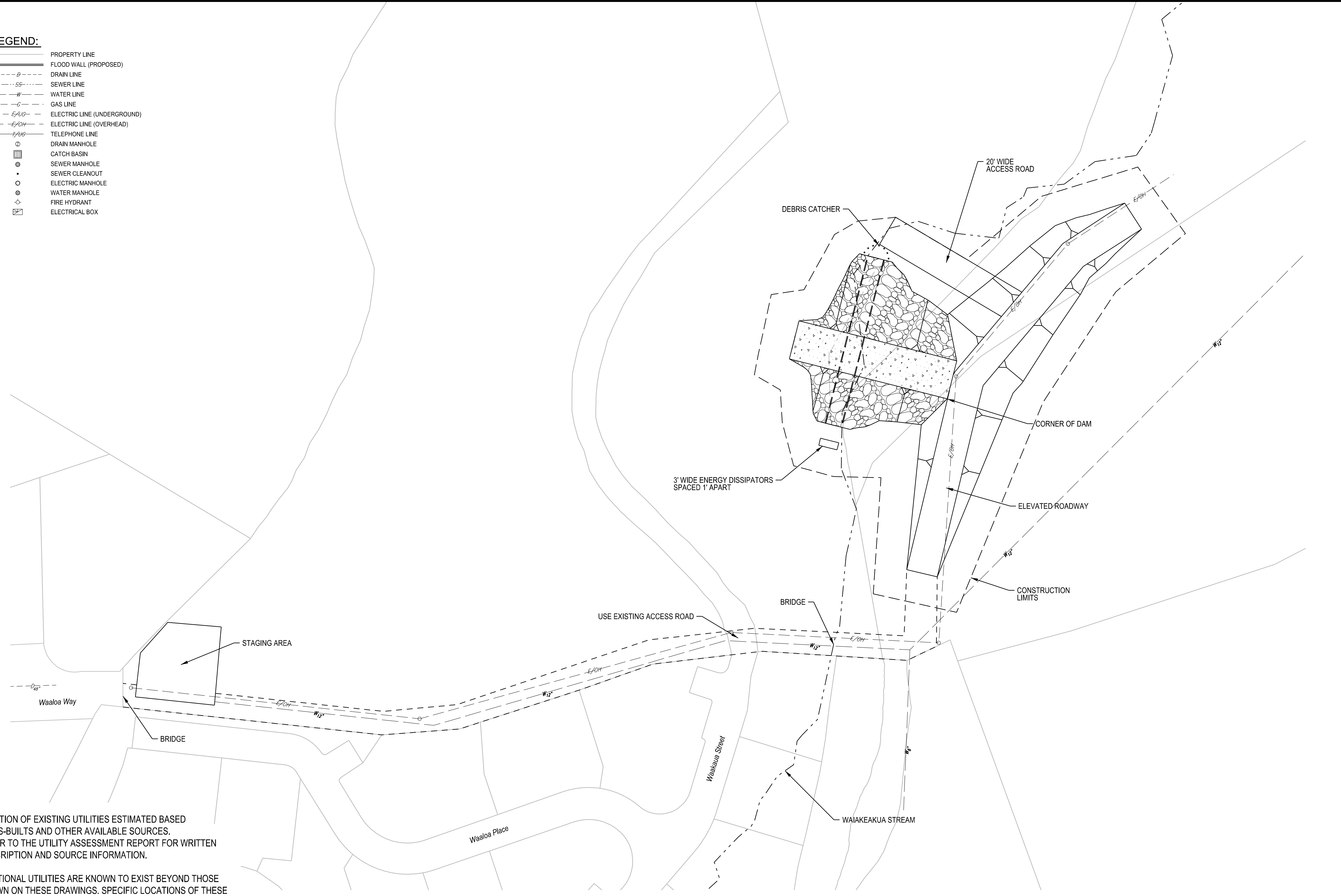
ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-214
SHEET 14 OF 19

LEGEND:

(line)	PROPERTY LINE
(line)	FLOOD WALL (PROPOSED)
--- D ---	DRAIN LINE
--- SS ---	SEWER LINE
--- W ---	WATER LINE
--- G ---	GAS LINE
--- E/UG ---	ELECTRIC LINE (UNDERGROUND)
--- E/OH ---	ELECTRIC LINE (OVERHEAD)
--- T/UG ---	TELEPHONE LINE
(symbol)	DRAIN MANHOLE
(symbol)	CATCH BASIN
(symbol)	SEWER MANHOLE
(symbol)	SEWER CLEANOUT
(symbol)	ELECTRIC MANHOLE
(symbol)	WATER MANHOLE
(symbol)	FIRE HYDRANT
(symbol)	ELECTRICAL BOX



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

WAIAKEAKUA DEBRIS AND DETENTION BASIN PLAN

1"=30'

0 30 60 120
Scale In Feet

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILEL$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: $DATE$ | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILE$$

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-215
SHEET 15 OF 19

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX

NOTES:

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   a. OVERHEAD TELECOMMUNICATIONS LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.

N

MAKIKI DEBRIS AND DETENTION BASIN

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY:
DRAWN BY:
SUBMITTED BY:
DATE:
CHECKED BY:
PLOT SCALE: 1
PLOT DATE: AS SHOWN
SIZE: ANSI D
REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: $FILE$

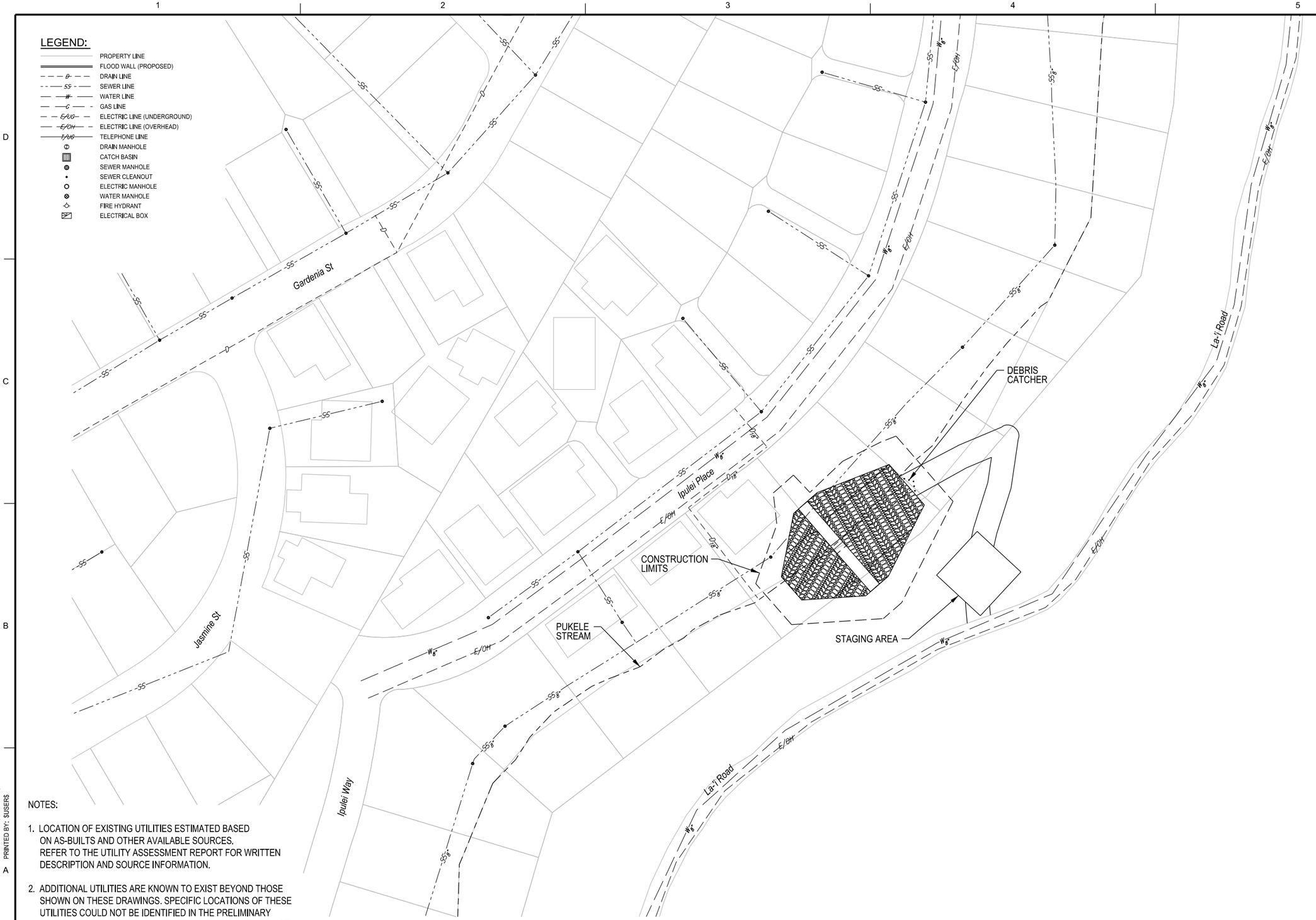
ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-216
SHEET 16 OF 19

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:



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   a. OVERHEAD TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES.
   b. STREET LIGHTING CO-LOCATED WITH ELECTRICAL POLES.

N

PUKELE DEBRIS AND DETENTION BASIN

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY:
DRAWN BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
SIZE: ANSI D
DATE:
CHECKED BY:
PLOT DATE: $DATE$
FILE NAME: $FILEIS
REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES PLAN

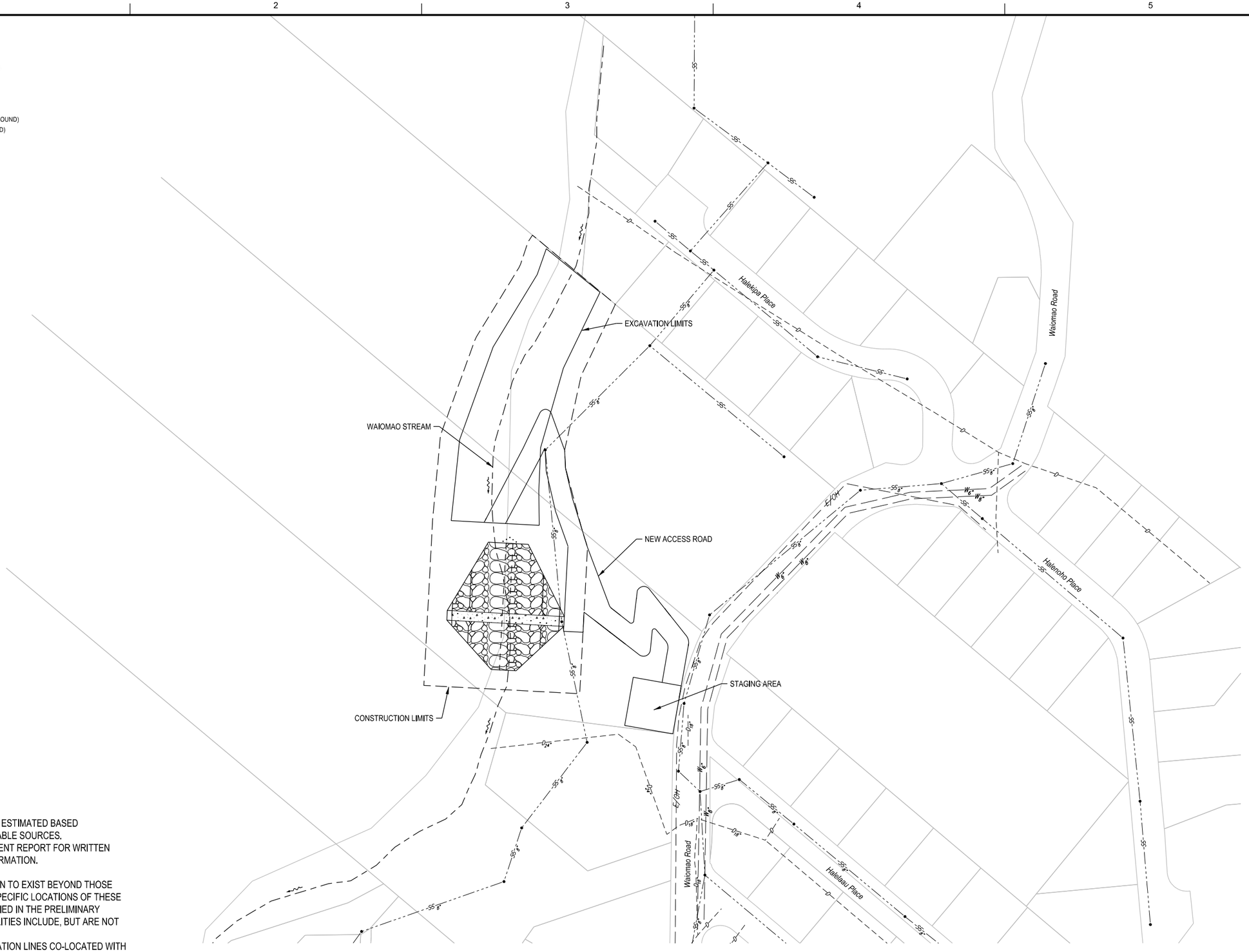
SHEET IDENTIFICATION
C-217
SHEET 17 OF 19

PLOTDRIVER: $PLTDRVSS
PEN TABLE: $PENTBLSS
PRINTED BY: $USERS

FILE: $FILEIS
MODEL NAME: $MODELNAMES
DATE & TIME: $DATES $TIMES
LAST SAVED BY:

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX



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 TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES ALONG WEST SIDE OF WAIOMAO ROAD.
   b. STREET LIGHTING CO-LOCATED WITH OVERHEAD ELECTRICAL LINES ALONG WEST SIDE OF WAIOMAO ROAD.

N

WAIOMAO DEBRIS AND DETENTION BASIN

1"=50'

0 50 100 150
Scale In Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT./ CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: AS SHOWN | PLOT DATE: AS SHOWN | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: $FILE$

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

EXISTING UTILITIES PLAN

SHEET IDENTIFICATION
C-218
SHEET 18 OF 19

PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:

LEGEND:

- PROPERTY LINE
- FLOOD WALL (PROPOSED)
- DRAIN LINE
- SEWER LINE
- WATER LINE
- GAS LINE
- ELECTRIC LINE (UNDERGROUND)
- ELECTRIC LINE (OVERHEAD)
- TELEPHONE LINE
- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- SEWER CLEANOUT
- ELECTRIC MANHOLE
- WATER MANHOLE
- FIRE HYDRANT
- ELECTRICAL BOX

Manoa Road

Pawaina Street

Peneku Place

Pinao Street

FALLS 8

FALLS 7

MANOA STREAM

ACCESS PATH
(FOOT TRAFFIC ONLY)

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 TELECOMMUNICATION LINES CO-LOCATED WITH OVERHEAD ELECTRICAL LINES ON SIDE OF PAWAINA STREET.

MANOA STREAM FALLS 7 AND 8 REHABILITATION

1"=30'

0 30 60 120
Scale In Feet

US Army Corps of Engineers®

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: $NAME
DRAWN BY: $NAME
SUBMITTED BY: $NAME
PLOT SCALE: AS SHOWN
SIZE: ANSI D
DATE: $DATE
CHECKED BY: $NAME
PLOT DATE: $DATE
FILE NAME: $FILES
REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

ALA WAI WATERSHED PROJECT
MITIGATION MEASURES

EXISTING UTILITIES
PLAN

SHEET IDENTIFICATION
C-219
SHEET 19 OF 19

FILE: $FILEIS
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
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PLOTDRIVER: $PLTDRVS$
PEN TABLE: $PENTBL$
PRINTED BY: $USER$

Attachment 5

Waikiki Buffer Zone Map

WAIKIKI BUFFER ZONE

Note: Construction activity may cause damage to the Beachwalk WWPS force mains from ground vibrations or soil liquefaction. Prevention, mitigation, and/or monitoring measures may need to be taker. It is the responsibility of the owner/contractor to prevent any impacts or potential damage to the force main.

DASHED – FORCE MAINS

SOLID – GRAVITY

N

0 230 460 690 920

Feet

Prepared by: Dept. of Design & Construction
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

DRAFT TECHNICAL MEMORANDUM

Ala Wai Canal Project

Design Update for Ala Wai Canal Floodwalls

Contract No. W9128A-12-D-0009-0002, Task Order 002

PREPARED FOR:	U.S. Army Corps of Engineers, Honolulu District
PREPARED BY:	Erika Powell Mark Twede Jennifer Elwood
DATE:	June 16, 2016
REVIEWED BY:	Lisa Kettley Jaco Esterhuizen

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 displace 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.

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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)

ALA WAI WATERSHED PROJECT

HONOLULU, OAHU, HI

WAIHI DEBRIS AND DETENTION BASIN

WAIAKEAKUA DEBRIS AND DETENTION BASIN

WOODLAWN DITCH DETENTION

MAKIKI DEBRIS AND DETENTION BASIN

MANOA IN-STREAM DEBRIS CATCHMENT

PUKELE DEBRIS AND DETENTION BASIN

WAIOMAO DEBRIS AND DETENTION BASIN

KANEWAI FIELD MULTI-PURPOSE DETENTION BASIN

HAUSTEN DITCH DETENTION

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION

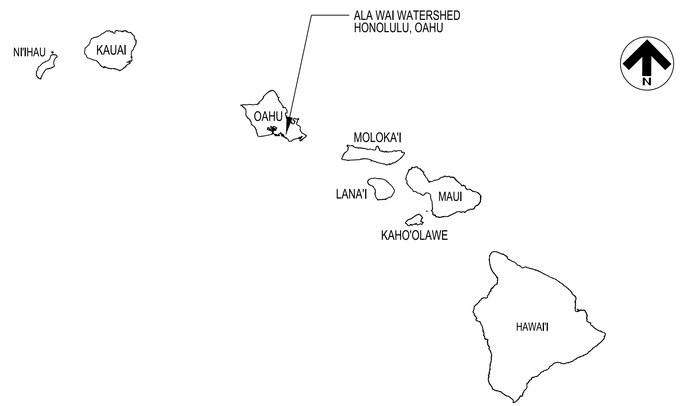
ALA WAI CANAL FLOODWALLS

Waiakeakua Stream
Waihi Stream
Kanaha Stream
Makiki Stream
Manoa Stream
Palolo Stream
Waiomao Stream
ALA WAI CANAL
H-1 FWY

N

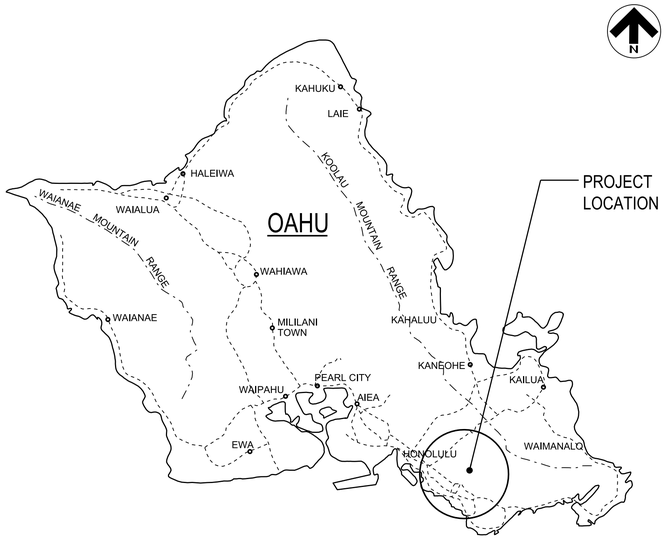
SITE LOCATIONS
NOT TO SCALE

PROJECT TITLE



VICINITY MAP

NOT TO SCALE



PROJECT LOCATION

NOT TO SCALE

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
SIZE: ANSI D
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: Ala_Wai_G-001xxx.dgn

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

SITE LOCATIONS
PROJECT LOCATION & VICINITY MAP

SHEET IDENTIFICATION
G-001
SHEET 1 OF 31

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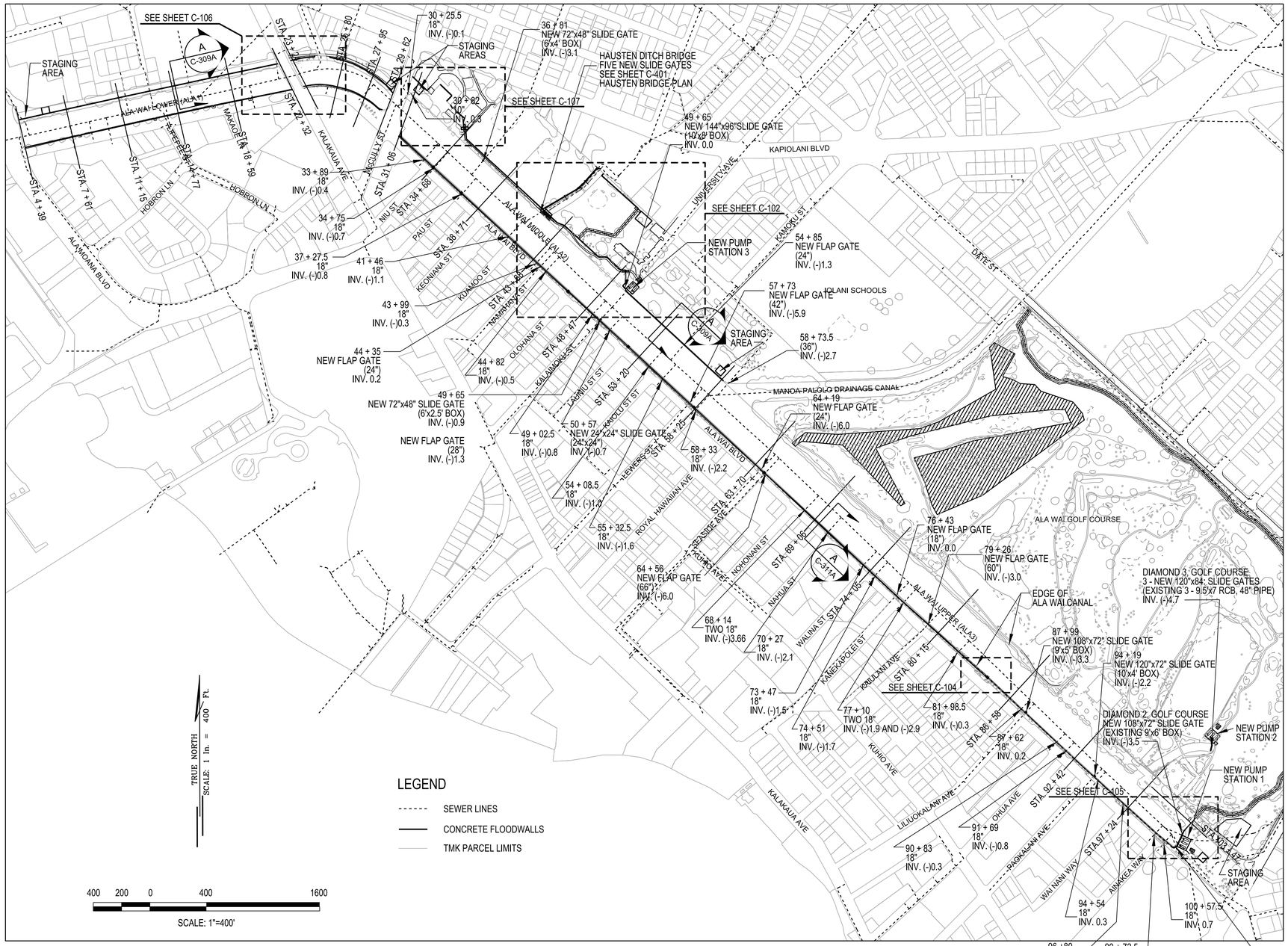

SITE PLAN
ALA WAI CANAL FLOODWALLS

ALA WAI CANAL INTERIOR DRAINAGE TABLE

CULVERT NAME	STATION	SIZE & TYPE	NOTES
DIAMOND 2, GOLF COURSE	102+45.5	108"x72" SLIDE GATE	PUMP STATION 1
DIAMOND 1, ALA WAI BLVD	101+75	144"x96" SLIDE GATES	
DIAMOND 3, GOLF COURSE	96+67	3 - 120"x84" SLIDE GATES	PUMP STATION 2
100+57.5	100+57.5	18" FLAP GATE	INV. 0.7
99+72.5	99+72.5	18" FLAP GATE	INV. 0.6
96+80	96+80	18" FLAP GATE	INV. (-)0.3
94+54	94+54	18" FLAP GATE	INV. 0.3
94+19	94+19	120"x72" SLIDE GATE	INV. (-)2.2
91+69	91+69	18" FLAP GATE	INV. (-)0.8
90+83	90+83	18" FLAP GATE	INV. (-)0.3
87+99	87+99	108"x72" SLIDE GATE	INV. (-)3.3
87+62	87+62	18" FLAP GATE	INV. 0.2
81+98.5	81+98.5	18" FLAP GATE	INV. (-)0.3
79+26	79+26	60" FLAP GATE	INV. (-)3.0
77+10	77+10	TWO 18" FLAP GATES	INV. (-)1.9 AND (-)2.9
76+43	76+43	18" FLAP GATE	INV. 0.0
74+51	74+51	18" FLAP GATE	INV. (-)1.7
73+47	73+47	18" FLAP GATE	INV. (-)1.5
70+27	70+27	18" FLAP GATE	INV. (-)2.1
68+14	68+14	TWO 18" FLAP GATES	INV. (-)3.7
64+56	64+56	66" FLAP GATE	INV. (-)6.0
64+19	64+19	24" FLAP GATE	INV. (-)6.0
58+73.5, RB	58+73.5	36" FLAP GATE	INV. (-)2.7
58+33	58+33	18" FLAP GATE	INV. (-)2.2
57+73	57+73	42" FLAP GATE	INV. (-)5.9
55+32.5	55+32.5	18" FLAP GATE	INV. (-)5.6
54+08.5	54+08.5	18" FLAP GATE	INV. (-)1.0
54+85, RB	54+85	24" FLAP GATE	INV. (-)1.3
50+57	50+57	24"x24" SLIDE GATE	INV. (-)0.7
49+65, RB	49+65	144"x96" SLIDE GATE	INV. 0.0, PUMP STATION 3
49+65	49+65	72"x48" SLIDE GATE & 28" FLAP GATE	INV. (-)1.3 & (-)0.9
49+02.5	49+02.5	18" FLAP GATE	INV. (-)0.8
44+82	44+82	18" FLAP GATE	INV. (-)0.5
44+35	44+35	24" FLAP GATE	INV. 0.2
43+99	43+99	18" FLAP GATE	INV. (-)0.3
HAUSTEN DITCH BRIDGE	42+10	4 - SLIDE GATES	SEE SHEET C-401
41+46	41+46	18" FLAP GATE	INV. (-)1.1
37+27.5	37+27.5	18" FLAP GATE	INV. (-)0.8
36+81, RB	36+81	72"x48" SLIDE GATE	INV. (-)3.1
34+75	34+75	18" FLAP GATE	INV. (-)0.7
33+89	33+89	18" FLAP GATE	INV. (-)0.4
30+82, RB	30+82	10" FLAP GATE	INV. 0.3
30+25.5, RB	30+25.5	18" FLAP GATE	INV. (-)0.1

NOTES:

1. SEE SHEET C-309 FOR THE RIGHT BANK (MOUNTAIN SIDE) PROFILE OF ALA WAI MIDDLE (ALA2) AND ALA WAI LOWER (ALA1).
2. SEE SHEET C-310 FOR THE LEFT BANK (OCEAN SIDE) PROFILE OF ALA WAI MIDDLE (ALA2) AND ALA WAI LOWER (ALA1).
3. SEE SHEET C-311 FOR THE LEFT BANK (OCEAN SIDE) PROFILE OF ALA WAI UPPER (ALA3).
3. SEE SHEET C-103 FOR ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN.

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MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

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PLOT SCALE: 1:1
PLOT MODE: 1
PLOT DATE:
SIZE: ANSI D
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: ala_wai_C-101xxx.dgn

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HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

ALA WAI LOWER, MIDDLE & UPPER FLOODWALLS
SITE PLAN

SHEET IDENTIFICATION
C-101
SHEET 3 OF 31

FILE: \\POH-AP09FTS\ProjectWise_DCS_Share\2324\143718_1\2Ala_Wai_C-101xxx.dgn
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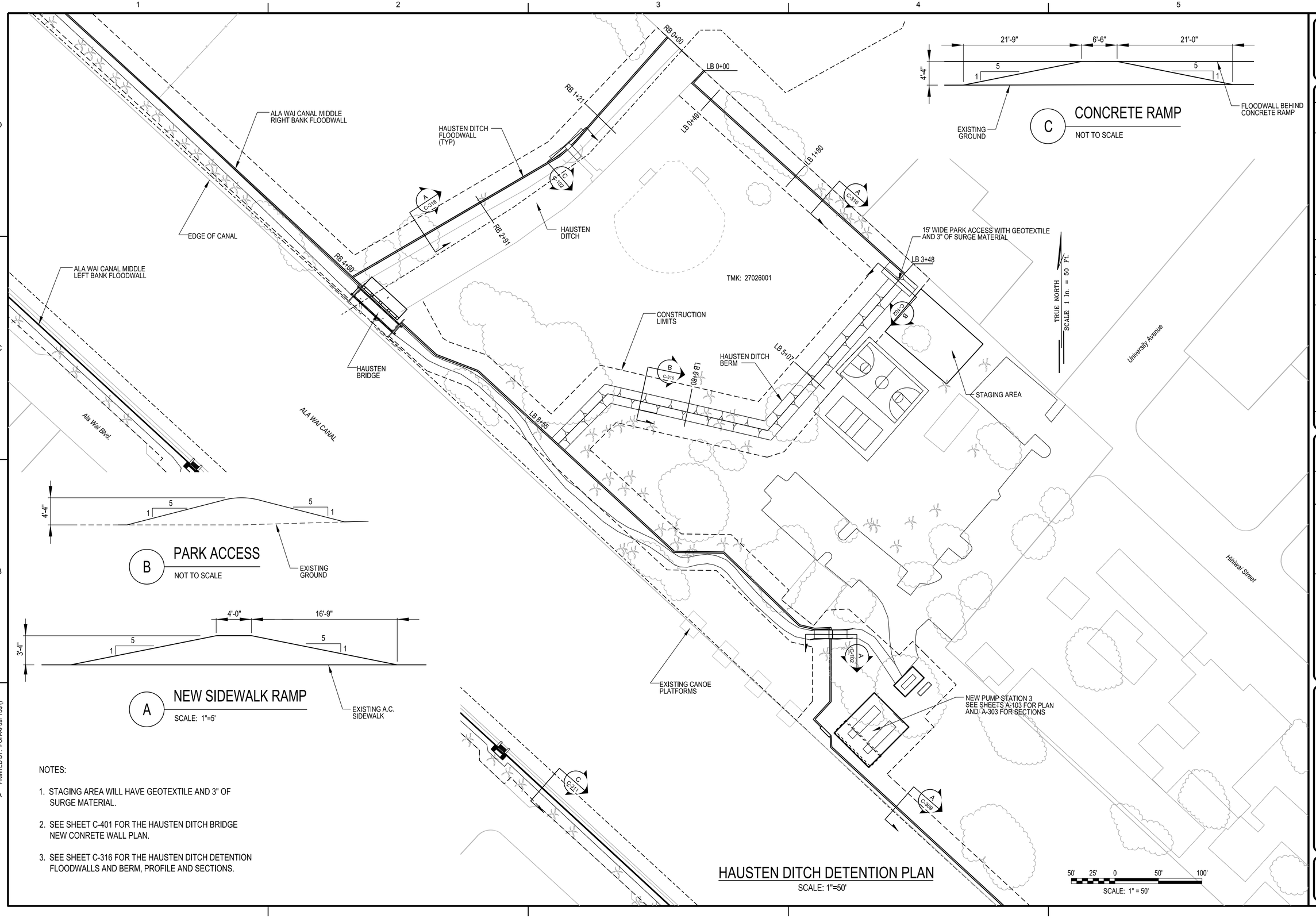

C CONCRETE RAMP
NOT TO SCALE

B PARK ACCESS
NOT TO SCALE

A NEW SIDEWALK RAMP
SCALE: 1"=5'

NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-401 FOR THE HAUSTEN DITCH BRIDGE NEW CONRETE WALL PLAN.
3. SEE SHEET C-316 FOR THE HAUSTEN DITCH DETENTION FLOODWALLS AND BERM, PROFILE AND SECTIONS.

HAUSTEN DITCH DETENTION PLAN
SCALE: 1"=50'

50' 25' 0 50' 100'
SCALE: 1" = 50'

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DESIGNED BY: JHH
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SCALE: AS SHOWN unless otherwise noted
PLOT SCALE: AS SHOWN
PLOT DATE:
FILE NAME: Ala_Wai_C-102xx.dgn
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LOCATION CODE
DRAWING NUMBER:
SIZE: ANSI D

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HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

HAUSTEN DITCH DETENTION PLAN

SHEET IDENTIFICATION
C-102
SHEET 4 OF 31

FILE: \\POH-AP09FTS\Project\Wise_DCS_Share\2506\143718_1\Ala_Wai_C-102xx.dgn
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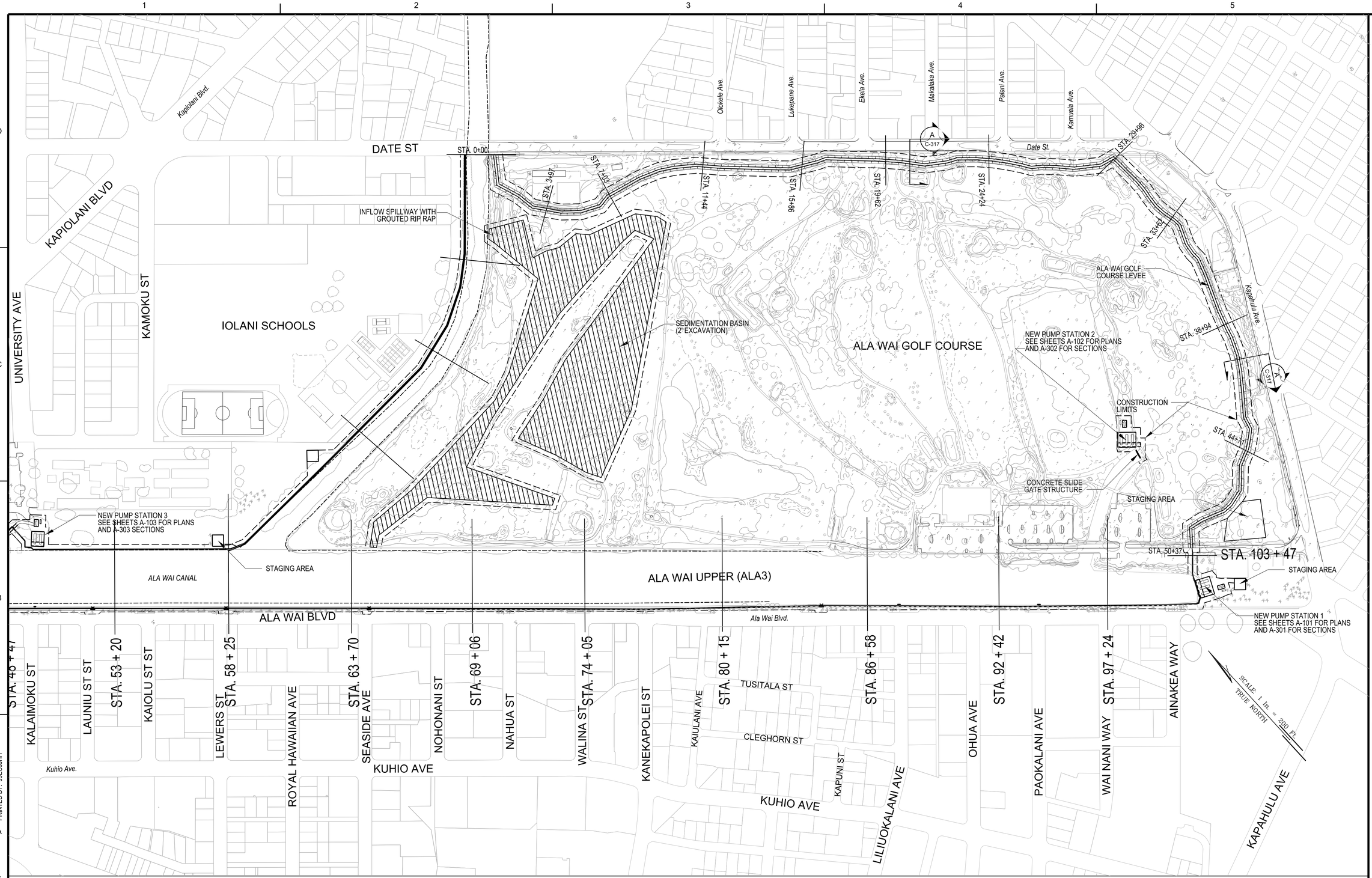

NOTES:

1. STAGING AREA WILL HAVE GEOTEXTILE AND 3" OF SURGE MATERIAL.
2. SEE SHEET C-317 FOR THE ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION, PROFILE AND SECTION.

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN

SCALE: 1"=200'

200' 100' 0 200' 300'

SCALE: 1" = 200'

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SIZE: ANSI D	FILE NAME: ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION	SOLICIT./ CONTRACT NO.:	LOCATION CODE	DRAWING NUMBER:			

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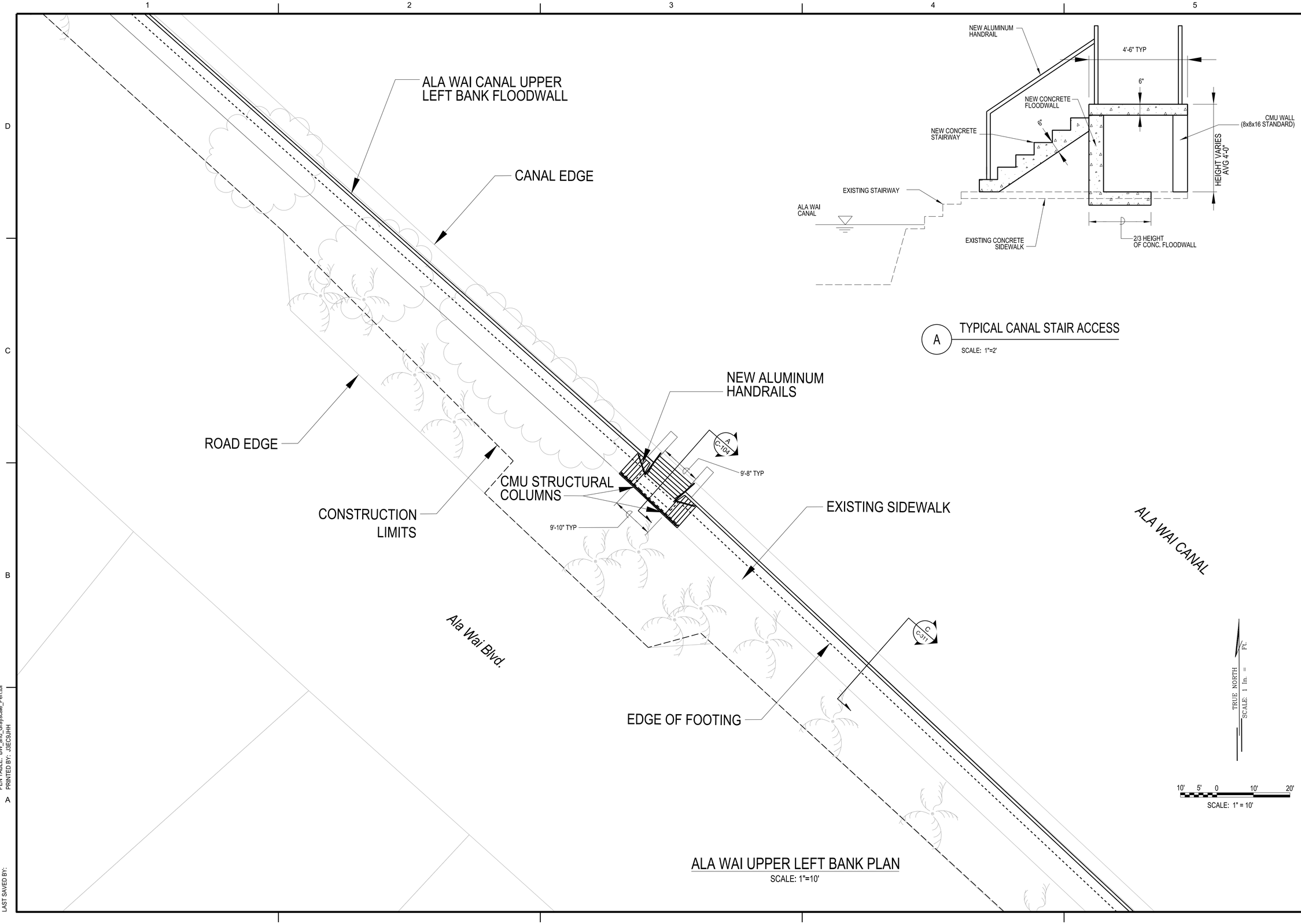
ALA WAI WATERSHED PROJECT

ALA WAI GOLF COURSE MULTI-PURPOSE DETENTION PLAN

SHEET IDENTIFICATION
C-103
SHEET 5 OF 31



ALA WAI UPPER LEFT BANK PLAN

SCALE: 1"=10'

A TYPICAL CANAL STAIR ACCESS

SCALE: 1"=2'

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DESIGNED BY: JHH
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SIZE: ANSI D
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PLOT DATE: 10/9/2014
FILE NAME: ALA WAI UPPER LEFT BANK PLAN
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

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ALA WAI WATERSHED PROJECT

ALA WAI UPPER LEFT BANK PLAN

SHEET IDENTIFICATION
C-104
SHEET 6 OF 31

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ALA WAI CANAL

EXISTING SIDEWALK

C
C-311

ALA WAI CANAL UPPER
LEFT BANK FLOODWALL

CANAL EDGE

ROAD EDGE

NEW FLOODGATE

A
C-317

CONSTRUCTION
LIMITS

Ala Wai Golf Course Rd.

CONCRETE SLIDE GATE
STRUCTURES

Ala Wai Blvd.

NEW PUMP STATION 1
SEE SHEETS A-101 FOR PLAN
AND A-301 FOR SECTIONS

STAGING AREA

Ainakea Way

TRUE NORTH
SCALE: 1 In. = 50 FT.

NOTES:

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

ALA WAI UPPER END PLAN
SCALE: 1"=20'

20' 10' 0 20' 40'
SCALE: 1" = 20'

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PLOT DATE: 10/9/2014
FILE NAME: Ala_Wai_C-105xxx.dgn

REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:

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HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

ALA WAI UPPER END PLAN

SHEET IDENTIFICATION
C-105
SHEET 7 OF 31

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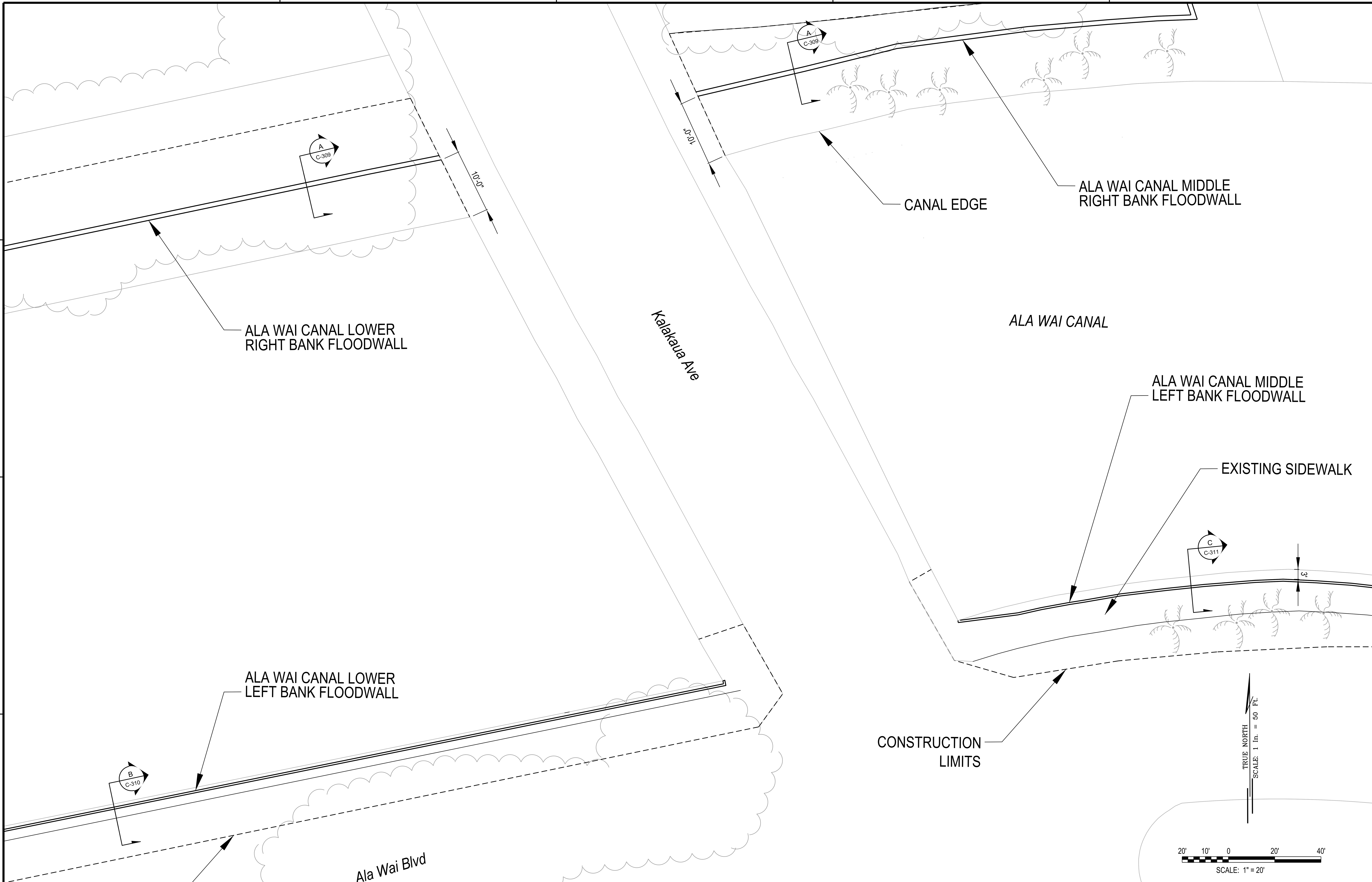

KALAKAUA AVE AND ALA WAI BLVD PLAN

SCALE: 1"=20'

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MARK	DESCRIPTION	DATE	APPR

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ALA WAI WATERSHED PROJECT

KALAKAUA AVE AND ALA WAI BLVD PLAN

SHEET IDENTIFICATION
C-106
SHEET 8 OF 31

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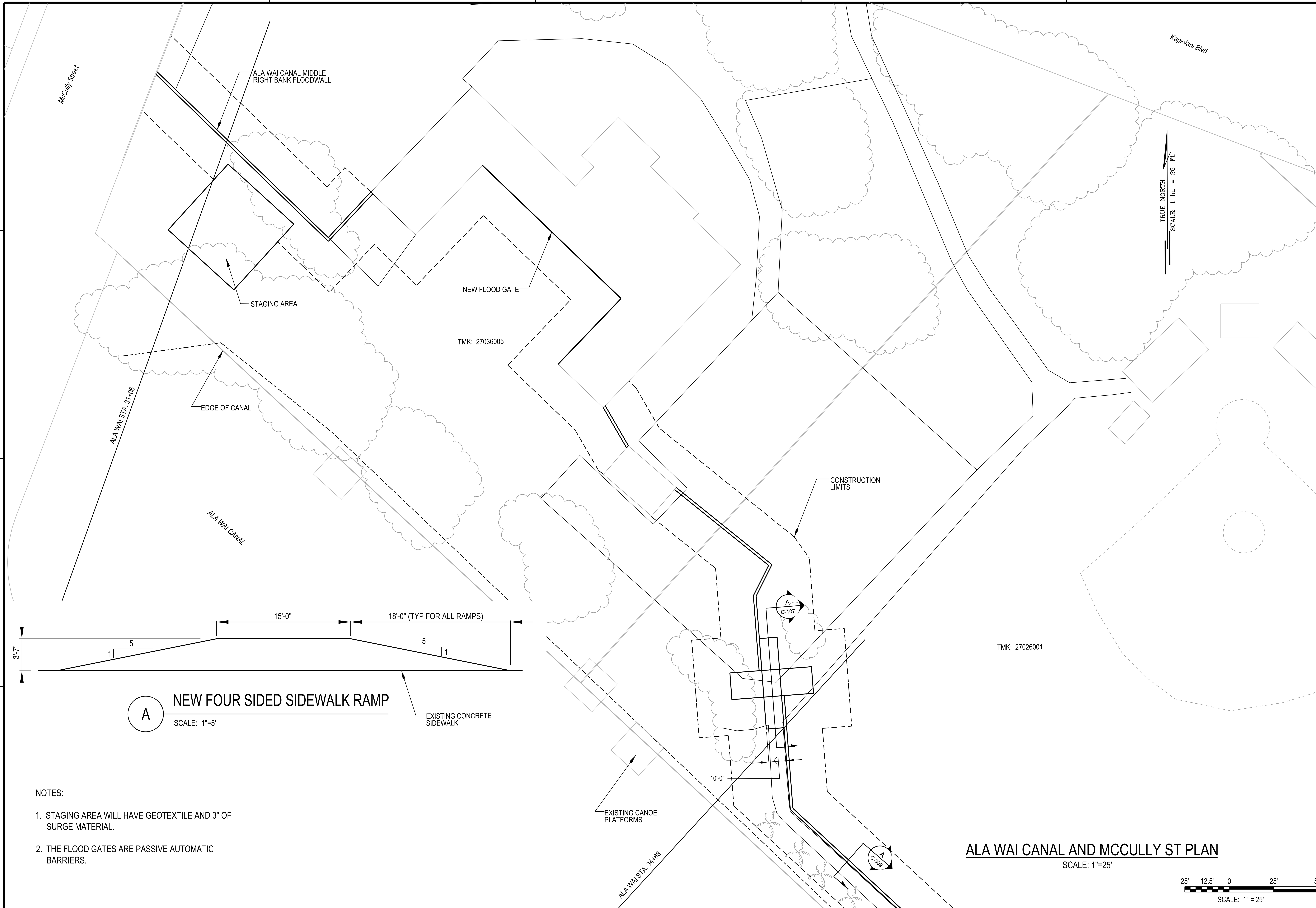

NOTES:

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'

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ALA WAI WATERSHED PROJECT

ALA WAI CANAL AND MCCULLY ST PLAN

SHEET IDENTIFICATION
C-107
SHEET 9 OF 31

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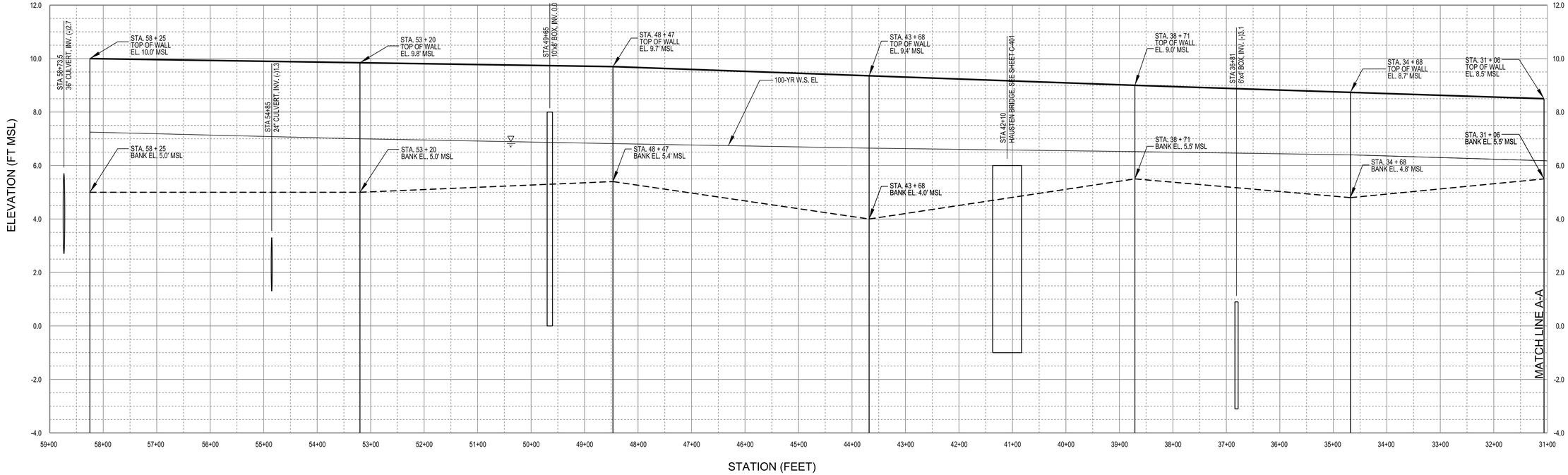

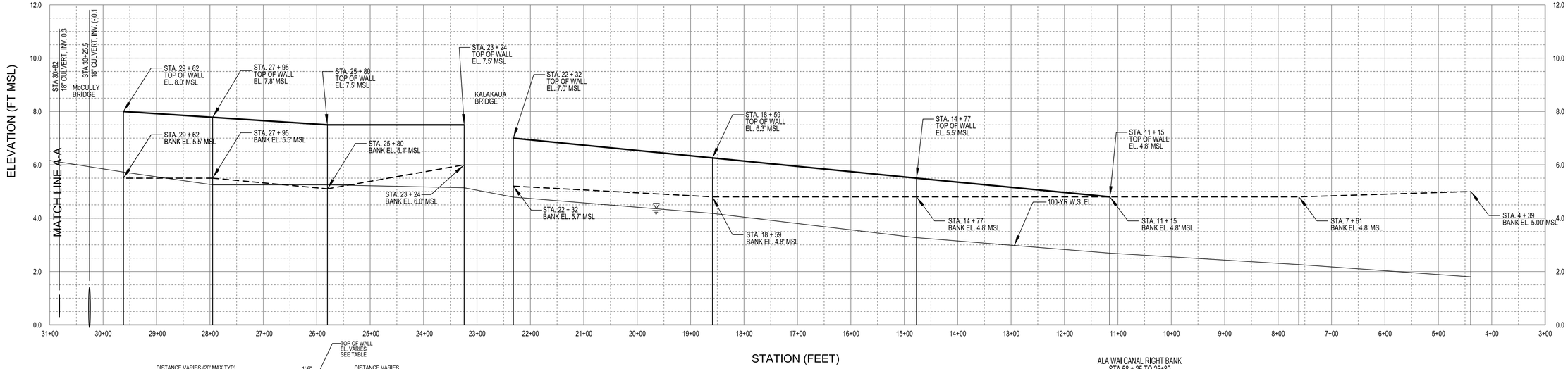

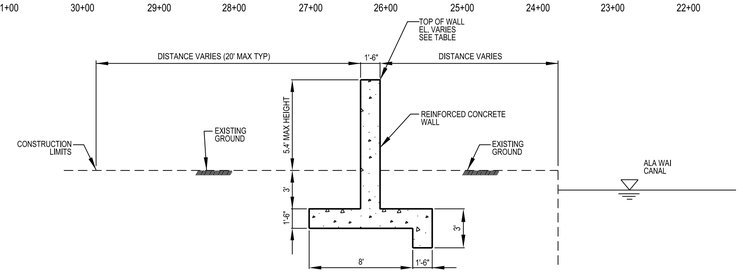

A TYPICAL RIGHT BANK REINFORCED CONCRETE FLOODWALL SECTION

NOT TO SCALE

PROFILE

ALA WAI MIDDLE (ALA2) AND LOWER (ALA1) RIGHT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

ALA WAI CANAL RIGHT BANK
STA 58 + 25 TO 25+80

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
58 + 25	5.0	10.0
53 + 20	4.8	9.8
48 + 47	4.3	9.7
43 + 68	5.4	9.4
38 + 71	3.5	9.0
34 + 68	3.9	8.7
31 + 06	3.0	8.5
MCCLULLY BRIDGE		
29 + 62	2.5	8.0
27 + 95	2.3	7.8
25 + 80	2.4	7.5

ALA WAI CANAL RIGHT BANK
STA 23 + 24 TO 11 + 15

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
23 + 24	1.5	7.5
22 + 32	1.3	7.0
18 + 59	1.5	6.3
14 + 77	0.7	5.5
11 + 15	0.0	4.8

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ALA WAI WATERSHED PROJECT

ALA WAI MIDDLE & LOWER RIGHT BANK FLOODWALLS
PROFILE AND SECTION

SHEET IDENTIFICATION
C-309
SHEET 15 OF 31

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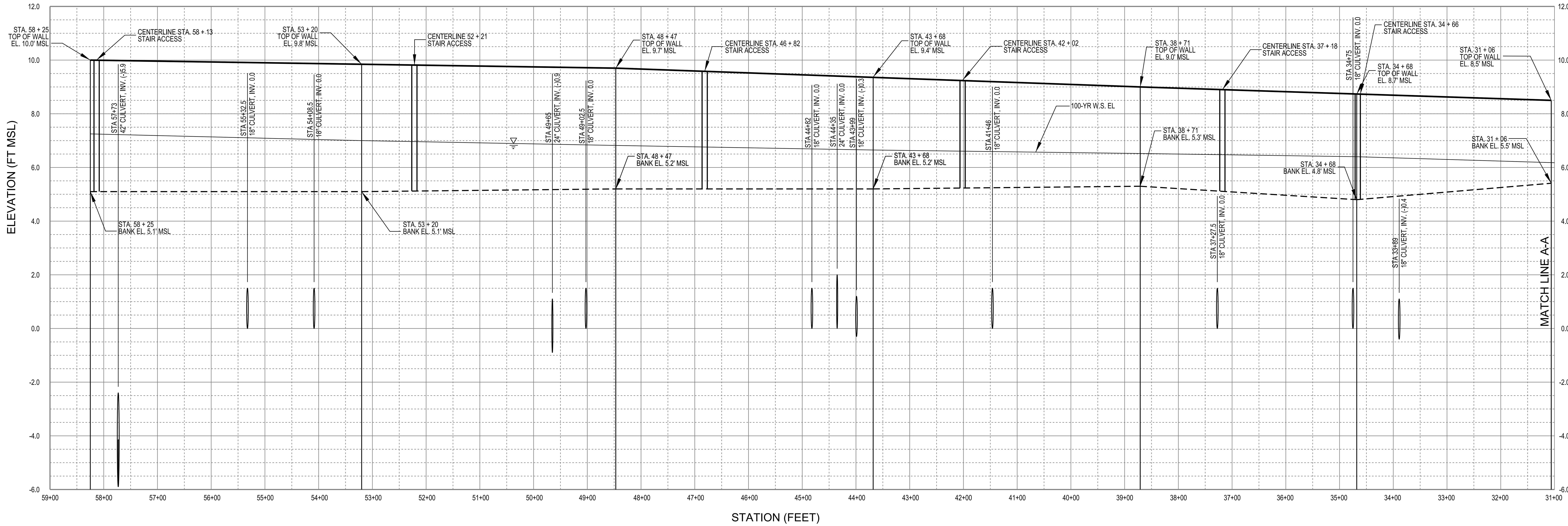
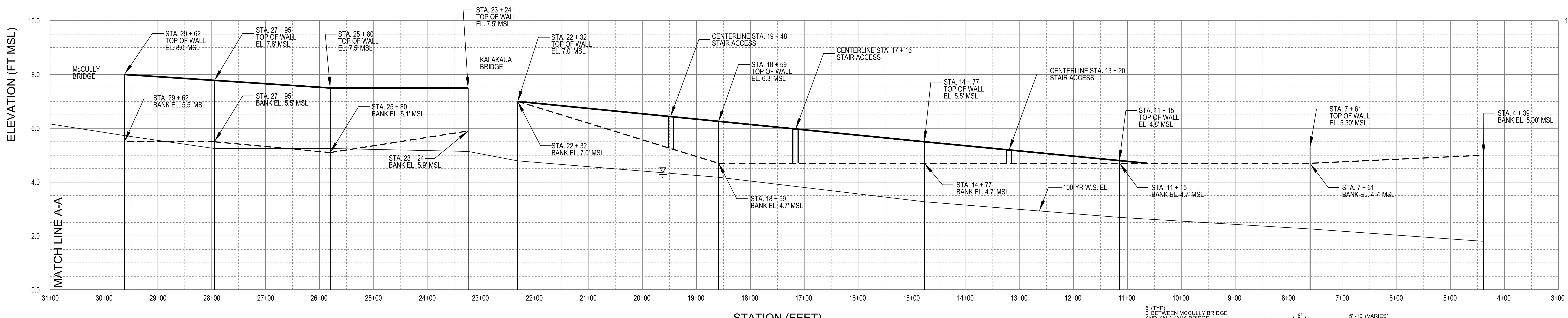




ALA WAI CANAL LEFT BANK
STA TO 58 + 25 TO 25+80

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
58 + 25	4.9	10.0
53 + 20	4.7	9.8
48 + 47	4.5	9.7
43 + 68	4.2	9.4
38 + 71	3.7	9.0
34 + 68	3.9	8.7
31 + 06	3.0	8.5
MCCLULLY BRIDGE		
29 + 62	2.5	8.0
27 + 95	2.3	7.8
25 + 80	2.4	7.5

ALA WAI CANAL LEFT BANK
STA TO 23 + 24 TO 4 + 39

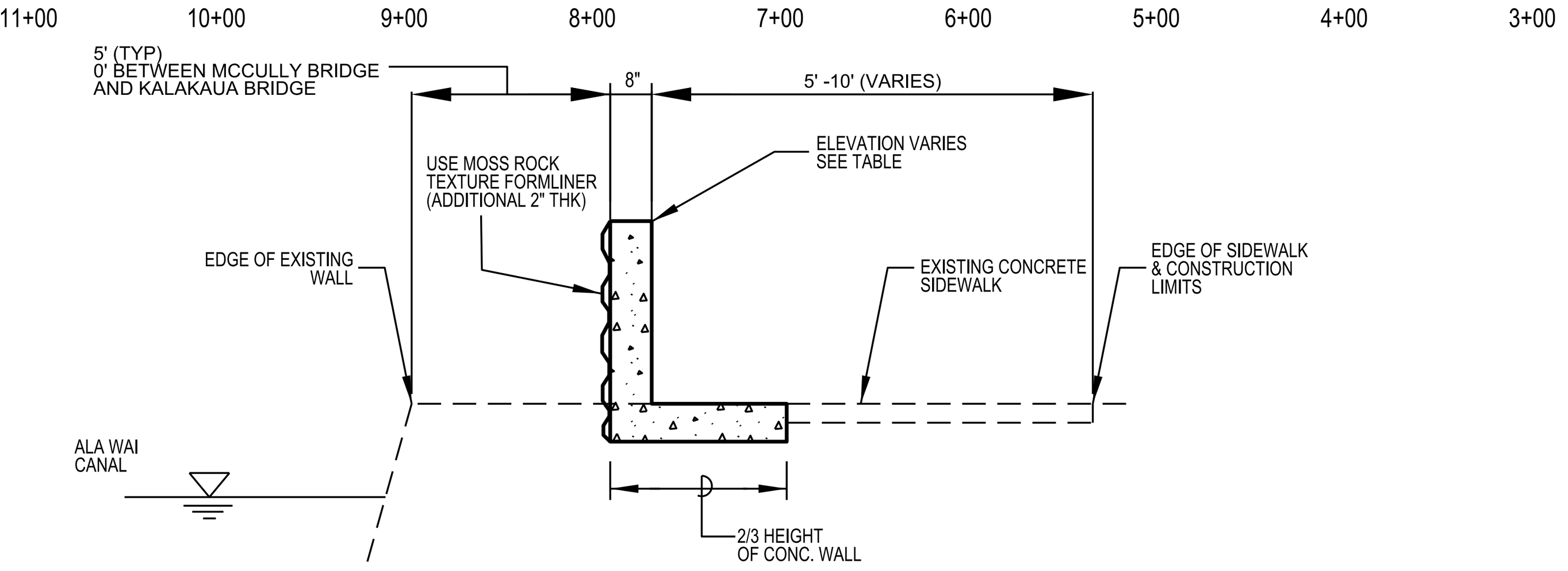
STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
23 + 24	1.6	7.5
KALAKAUA BRIDGE		
22 + 32	0.0	7.0
18 + 59	1.6	6.3
14 + 77	0.8	5.5
11 + 15	0.1	4.8

PROFILE
ALA WAI CANAL MIDDLE (ALA2) AND LOWER (ALA1) LEFT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

NOTES:

1. SEE DETAIL "C" ON SHEET C-311 FOR ALA WAI CANAL MIDDLE (ALA2) TYPICAL LEFT BANK CONCRETE FLOODWALL SECTION.
2. ALA WAI CANAL LOWER (ALA1) IS FROM STATION 23+24 TO STATION 4+39.



B TYPICAL ALA WAI LOWER (ALA1) LEFT BANK CONCRETE FLOODWALL SECTION

NOT TO SCALE

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ALA WAI WATERSHED PROJECT

ALA WAI MIDDLE & LOWER LEFT BANK FLOODWALLS PROFILE AND SECTION

SHEET IDENTIFICATION
C-310
SHEET 16 OF 31

FILE: \\POH-AP09FTS\ProjectWise_DCS_Share\2506\143718_22\Ala_Wai_C-310xxx.dgn
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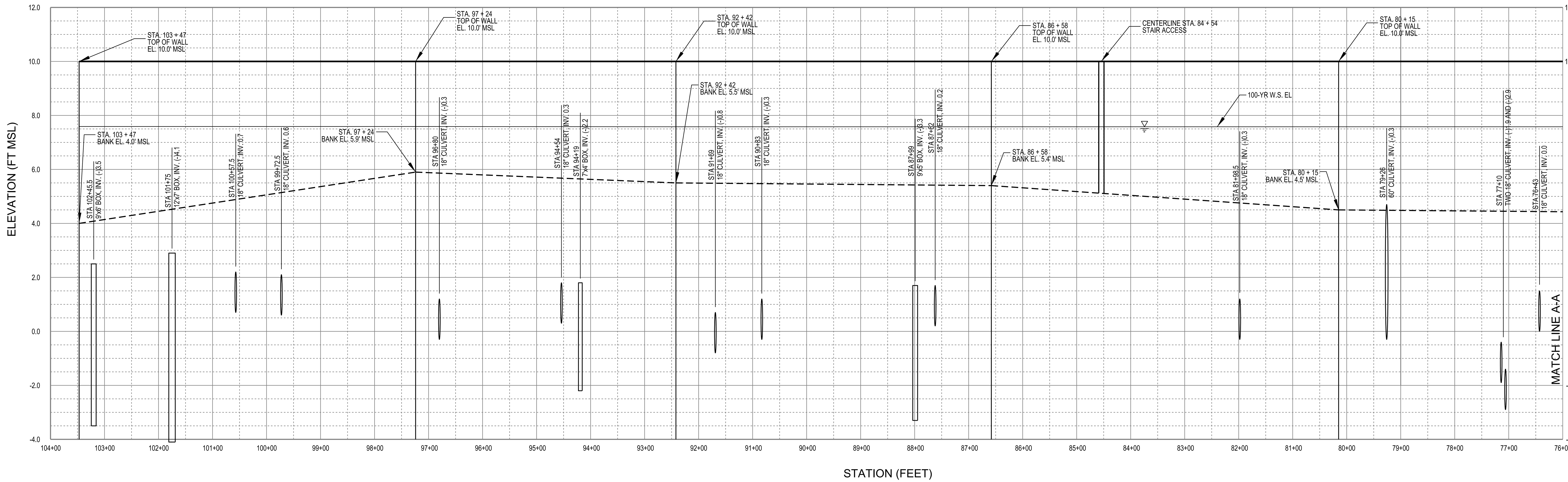

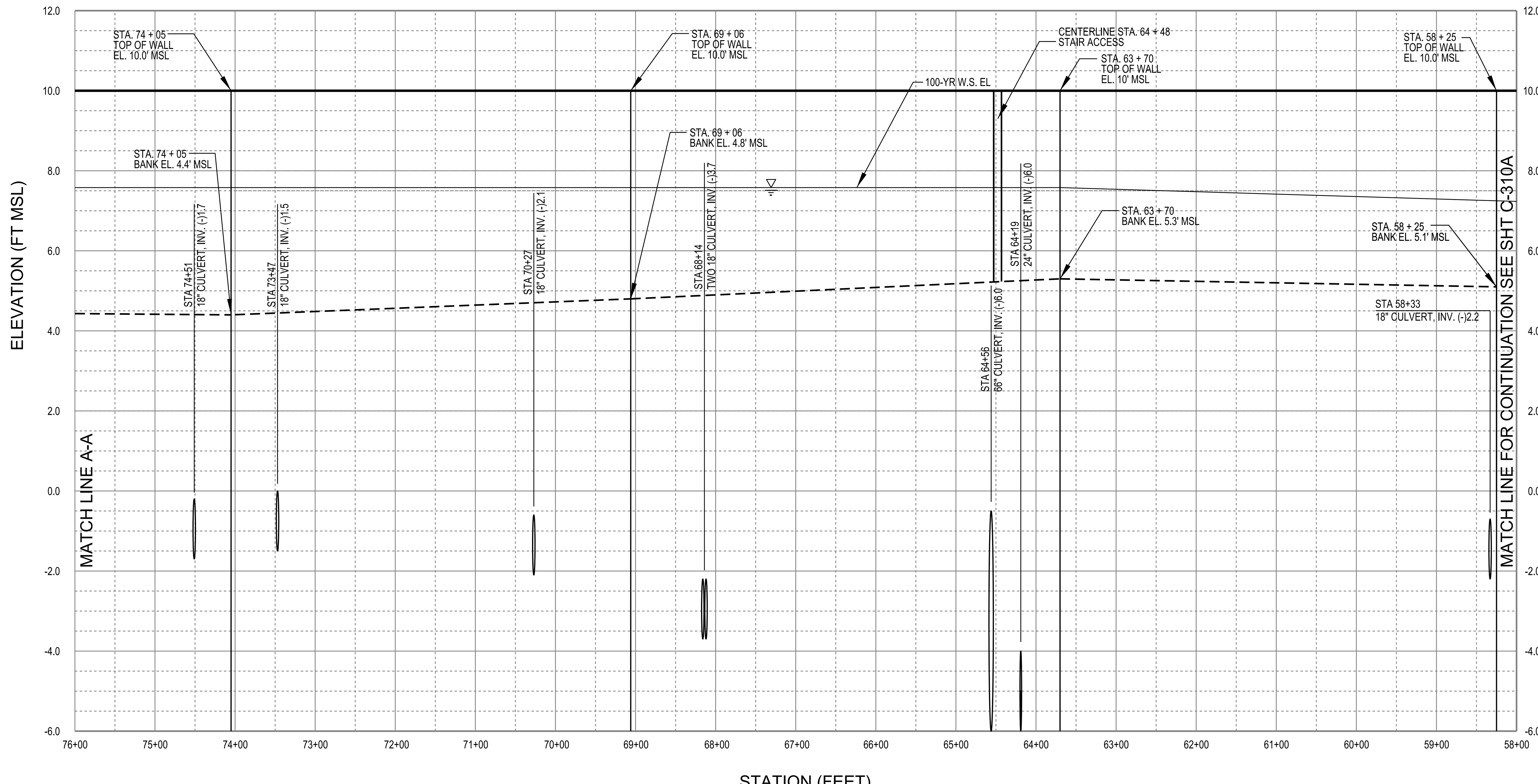

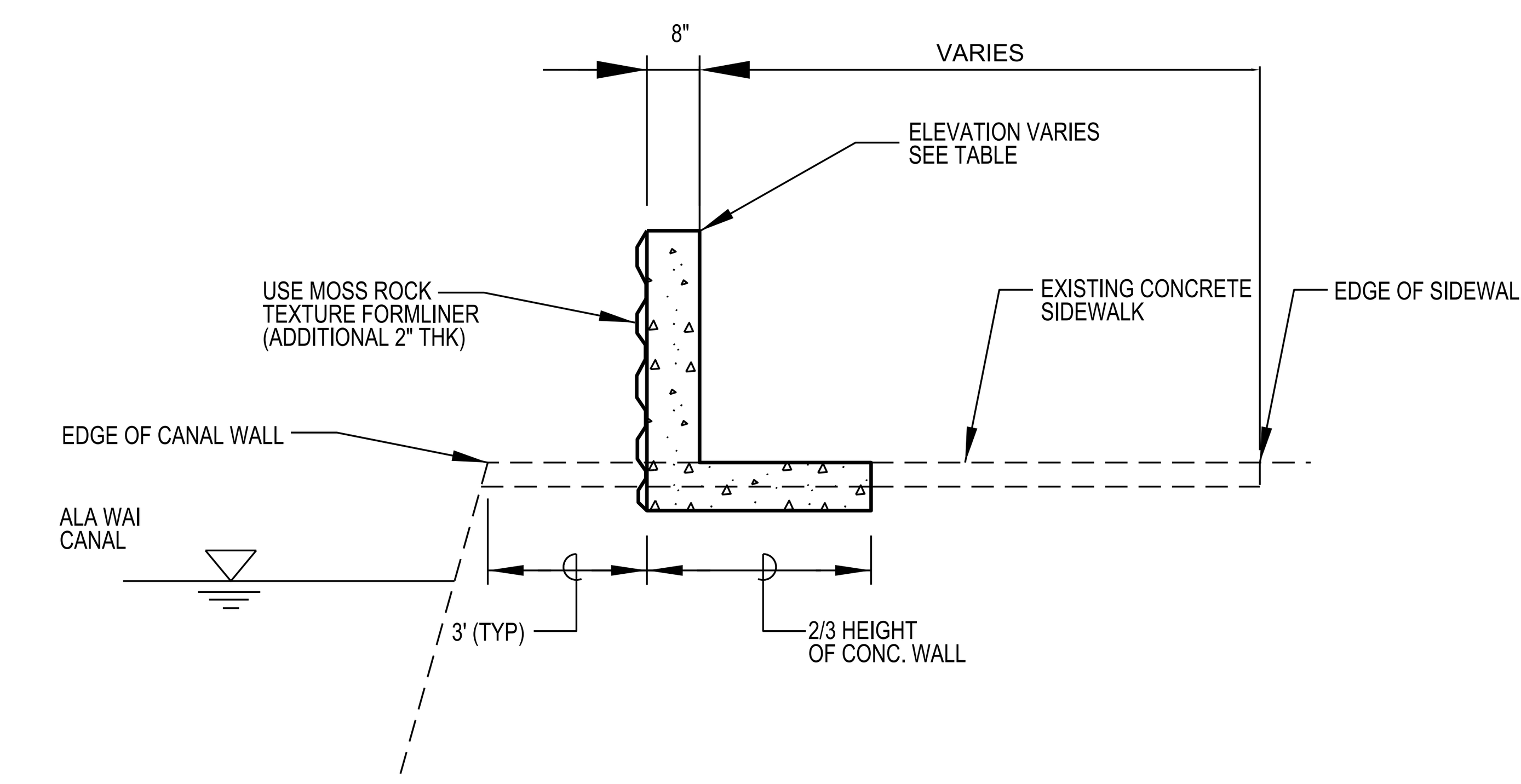

C TYPICAL LEFT BANK CONCRETE FLOODWALL SECTION

NOT TO SCALE

ALA WAI CANAL LEFT BANK
STA 101 + 24 TO 58 + 25

STATION	WALL HEIGHT (FT)	FINISHED WALL ELEVATION (FT MSL)
103 + 47	6.0	10.0
97 +24	4.1	10.0
92 + 42	4.5	10.0
86 + 58	4.6	10.0
80 + 15	5.5	10.0
74 + 05	5.6	10.0
69 + 06	5.2	10.0
63 + 70	4.7	10.0
58 + 25	4.9	10.0

PROFILE
ALA WAI CANAL UPPER (ALA3) LEFT BANK FLOODWALLS

SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 2'

FILE: \\POH-AP09FTS\ProjectWise_DCS_Share\2506\143718_14\Ala_Wai_C-311xxx.dgn
MODEL NAME: C-311A
DATE & TIME: 10/9/2014 3:14:08 PM
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PRINTED BY: POH-AP09FTS$ ()

US Army Corps of Engineers®
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

DESIGNED BY: JHH | DATE: | REVISION:
DRAWN BY: | CHECKED BY: | SOLICIT / CONTRACT NO.:
SUBMITTED BY: | LOCATION CODE
PLOT SCALE: | PLOT DATE: 10/9/2014 | DRAWING NUMBER:
SIZE: ANSI D | FILE NAME: Ala_Wai_C-311xxx.dgn

ALA WAI WATERSHED PROJECT

ALA WAI UPPER LEFT BANK FLOODWALLS
PROFILE AND SECTION

SHEET IDENTIFICATION
C-311
SHEET 17 OF 31

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.

Panel Final BackCheck Response (FPC#4):

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

DRAFT TECHNICAL MEMORANDUM

Stability Evaluation of Proposed Ala Wai Canal Floodwalls

PREPARED FOR:	File
COPY TO:	Jaco Esterhuizen/CVO
PREPARED BY:	Mark Twede/RDD
DATE:	May 24, 2016
PROJECT NUMBER:	461555.06.02.01

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.

TABLE 1
Floodwall Height and Freeboard

Station	Left Bank Floodwall Height Above Existing Grade (feet)	Freeboard Above 100-year Flood (feet)	Right Bank Floodwall Height Above Existing Grade (feet)	Freeboard Above 100-year Flood (feet)
10+50 (downstream end)	0	2	0	2
18+59	1.6	2	1.5	2
23+24 (Kalakaua Bridge)	1.6	2.3	1.8	2.2
31+06 (McCully Bridge)	3	2.3	3	2.3
43+68	4.2	2.7	5.4 (maximum)	2.5
58+25 (end right wall)	4.9	2.8	5	2.8
74+05	5.6	2.4		
101+75 (left wall corner)	5.5	2.4		
103+47 (end left wall)	6.0 (maximum)	2.4		

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 type 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 I1, 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.

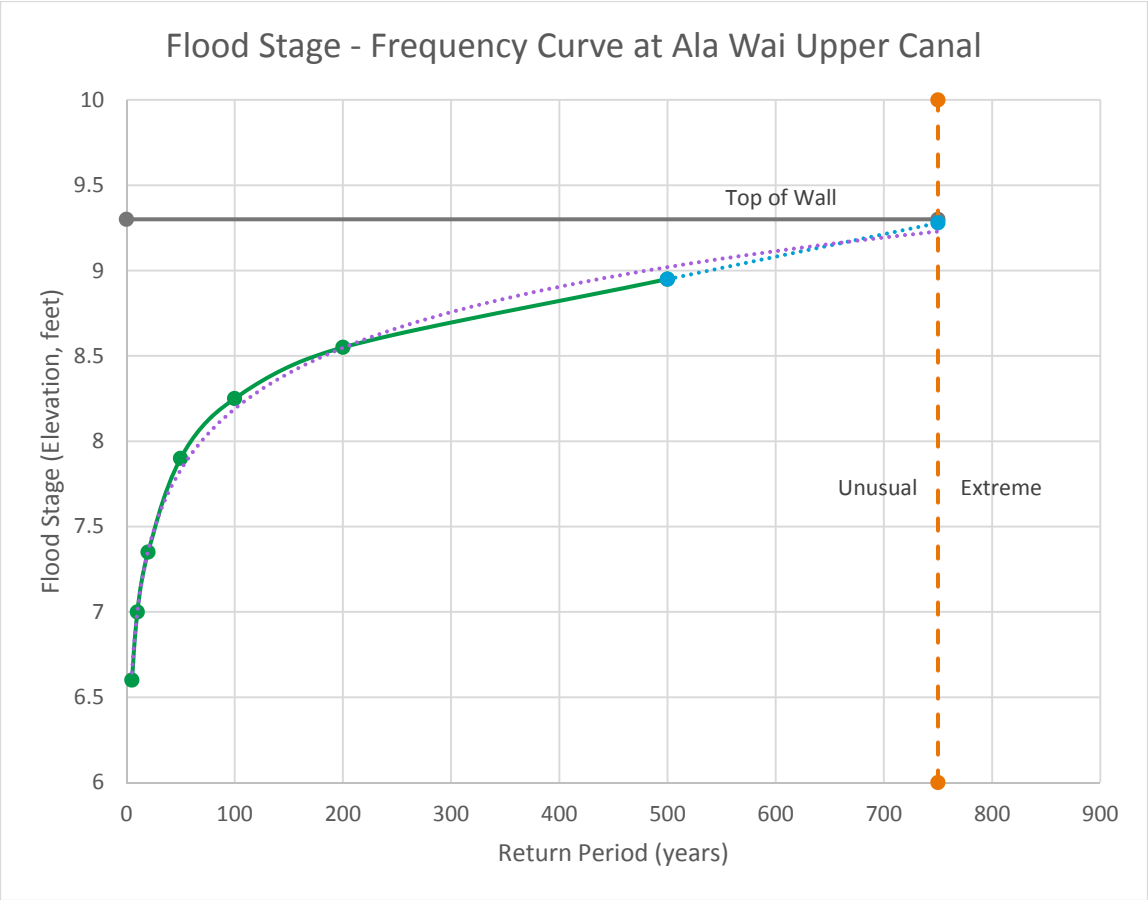


Figure 1. Flood Stage Frequency Curve for the Upper Ala Wai Canal, Extrapolated to 750-year Return Period

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).

TABLE 2
Floodwall Stability Criteria

Case No.	Loading Condition	Sliding Factor of Safety	Overturning Criteria, Minimum Base Area in Compression	Bearing Capacity Factor of Safety
I1	Design Flood	1.5	75 percent	3.0
I2	Water to Top of Wall	1.1	Resultant within base	2.0
I3A	Earthquake (OBE)	1.3	75 percent	2.0
I3B	Earthquake (MCE)	1.1	Resultant within base	>1.0

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.

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.

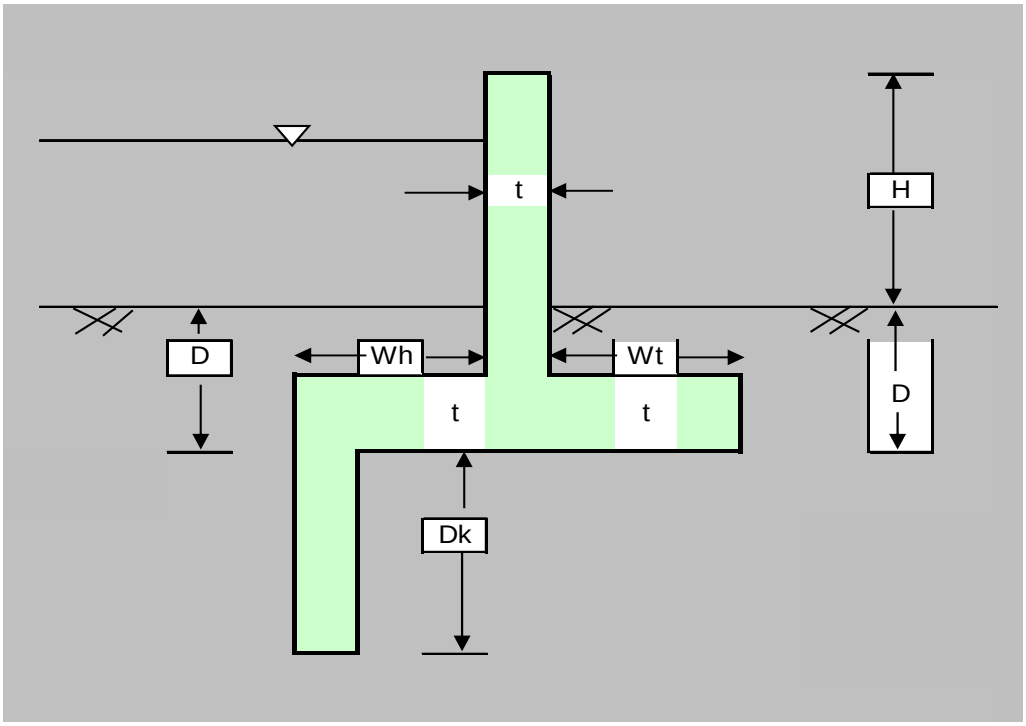


Figure 2. Floodwall Typical Diagram

TABLE 3
Wall Dimension Requirements –Right Bank Floodwall

Start Station	End Station	Wall Height, H (feet)	Depth of Footing, D (feet)	Wall Thickness, t (feet)	Width of Toe, Wt (feet)	Width of Heel, Wh (feet)	Depth of Key, Dk (feet)
11+15	30+00 (McCully Bridge)	0 to 2.5	1.5	1.5	1	1	1
30+00	40+00	3 to 4	2	1.5	1	2.5	2
40+00	59+00	4 to 5.4	2	1.5	2	4	3

TABLE 4
Wall Dimension Requirements –Left Bank Floodwall

Location	End Station	Wall Height, H (feet)	Depth of Footing, D (feet)	Wall Thickness, t (feet)	Width of Toe, Wt (feet)	Width of Heel, Wh (feet)	Depth of Key, Dk (feet)
10+50	30+00 (McCully Bridge)	0 to 2.5	1.5	1.5	1	1	1
30+00	42+00	3 to 4	2	1.5	1	2.5	2
42+00	67+00	4 to 5	2	1.5	1.5	3.5	3
67+00	84+00	5 to 5.6	2	1.5	2	4	3
84+00	100+00	4 to 5	2	1.5	1.5	3.5	3
100+00	103+47	5 to 6	2	1.5	2.5	4.5	3

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

Geolabs Hawaii. 1999. Draft Evaluation of Seawalls. Ala Wai Canal Dredging Project, Honolulu, Oahu, Hawaii. August 2.

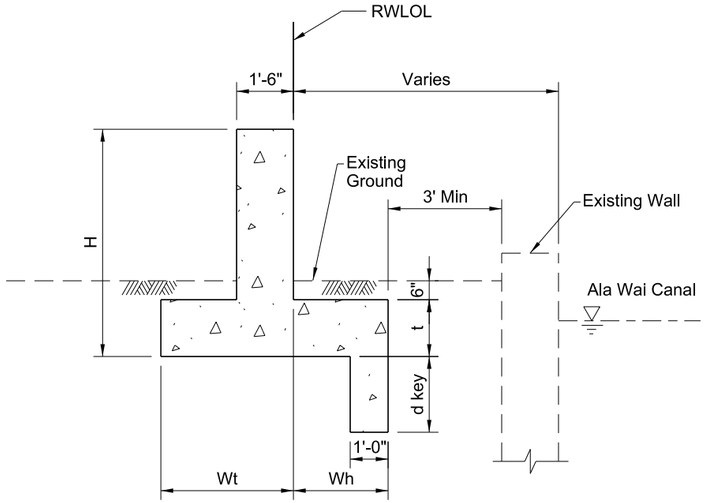
U.S. Army Corps of Engineers (USACE). 2014. Engineer and Construction Bulletin, No. 2014-24. Revision and Clarification of EM 1110-2-2100 and EM 1110-2-2502. 7 November.

U.S. Army Corps of Engineers (USACE). 2005. Engineering Manual 1110-2-2100. ENGINEERING AND DESIGN. Stability Analysis of Concrete Structures. 1 December.

U.S. Army Corps of Engineers (USACE). 1989. Engineering Manual 1110-2-2502. ENGINEERING AND DESIGN. Retaining and Flood Walls. 29 September.

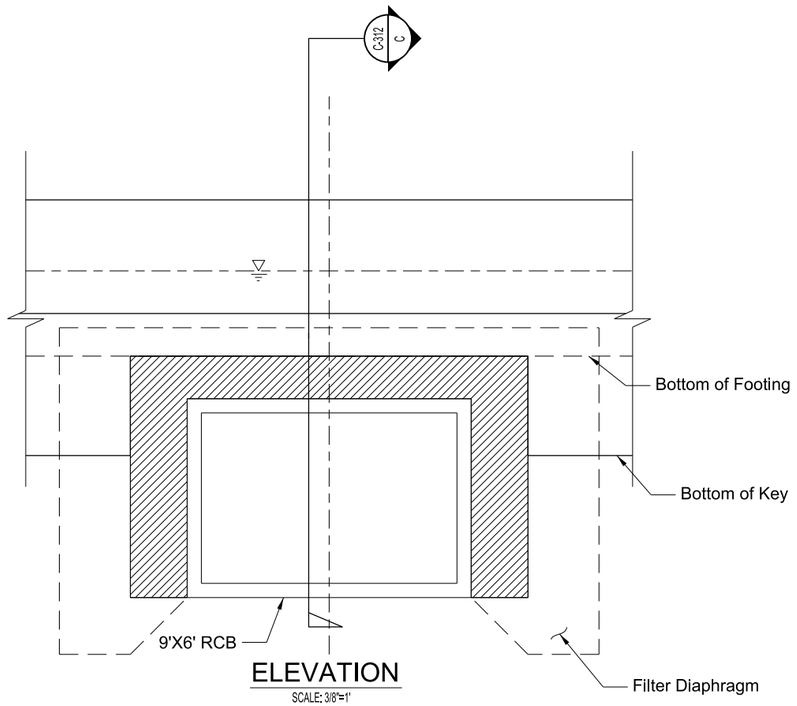
Attachment 4

Updated Ala Wai Canal Floodwalls Details

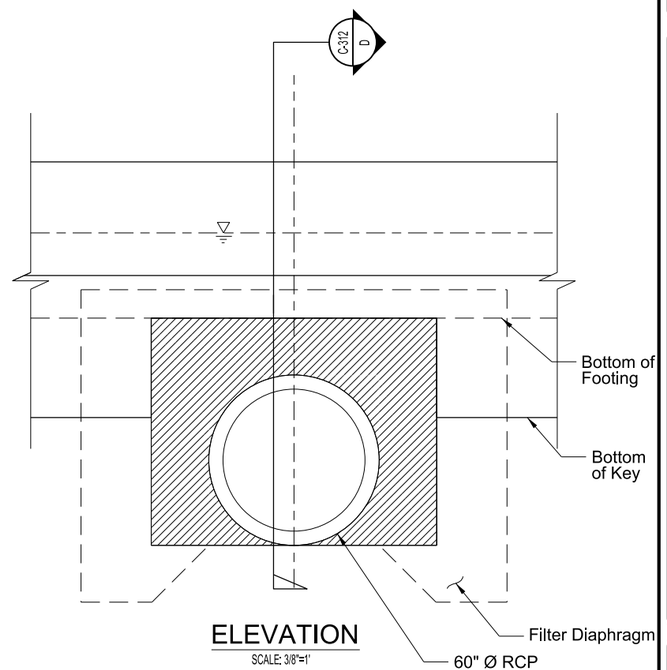


A RIGHT BANK FLOOD WALL
SCALE: 1/2"=1'

LOCATION	H max	d key	t	Wt	Wh
11+15 to 30+00 Right	4	1	1	2.5	1
30+00 to 40+00 Right	6	2	1.5	2.5	2.5
40+00 to 59+00 Right	7.4	3	1.5	3.5	4

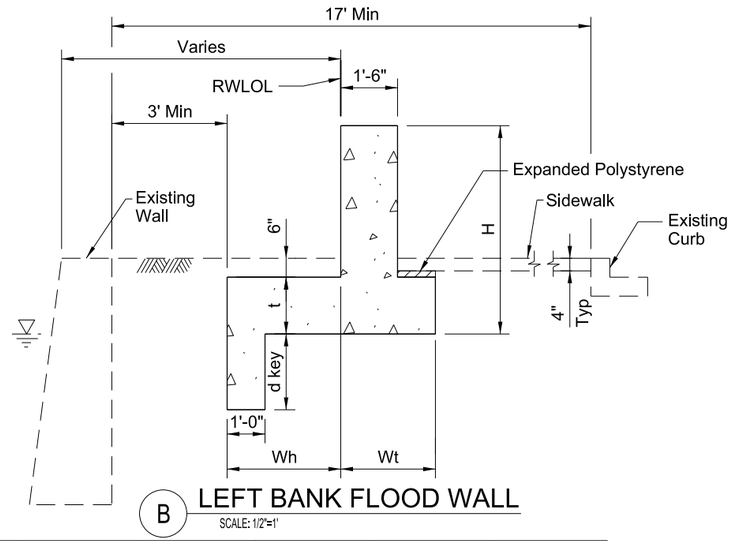


ELEVATION
SCALE: 3/8"=1'



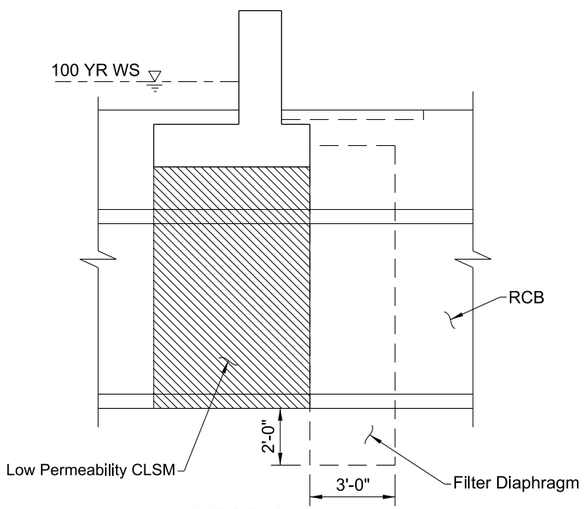
ELEVATION
SCALE: 3/8"=1'

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



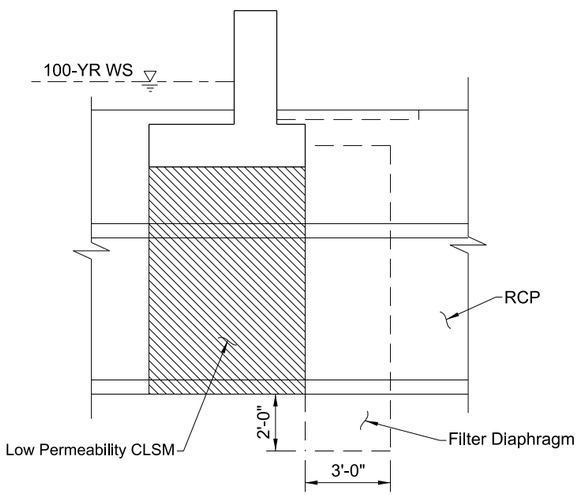
B LEFT BANK FLOOD WALL
SCALE: 1/2"=1'

LOCATION	H max	d key	t	Wt	Wh
10+50 to 30+00 Left	4	1	1	2.5	1
30+00 to 42+00 Left	6	2	1.5	2.5	2.5
42+00 to 67+00 Left	7	3	1.5	3	3.5
67+00 to 84+00 Left	7.6	3	1.5	3.5	4
84+00 to 101+40 Left	7	3	1.5	3	3.5
101+40 to 103+47 Left	8	3	1.5	4	4.5



C SECTION
SCALE: 3/8"=1'

FLOOD WALL OVER BOX CULVERT (TYP)



D SECTION
SCALE: 3/8"=1'

FLOOD WALL OVER PIPE CULVERT (TYP)

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR
MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: J ELWOOD
DRAWN BY: P WALKER
CHECKED BY:
SUBMITTED BY:
DATE:
REVISION:
SOLICIT./ CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
PLOT SCALE: AS SHOWN
PLOT DATE: $DATE$
FILE NAME: $FILE$
SIZE: ANSI D

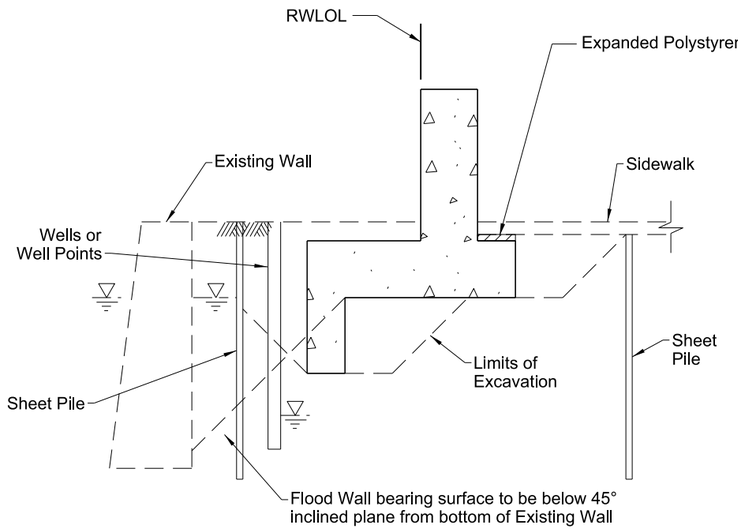
ALA WAI WATERSHED PROJECT

FLOOD WALL DETAILS

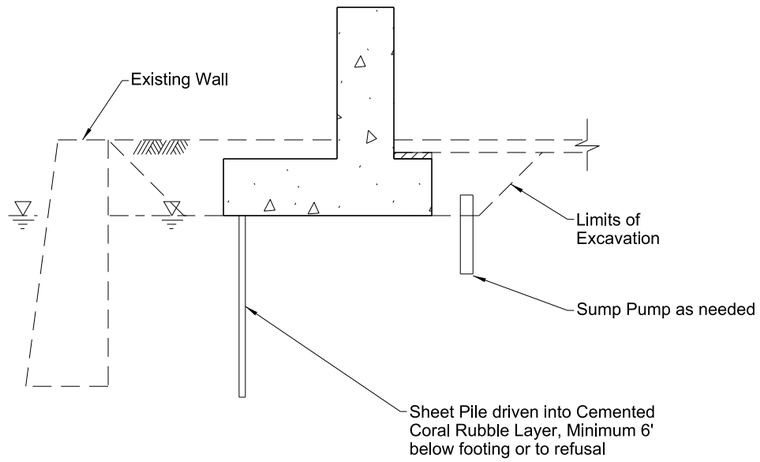
SHEET IDENTIFICATION
C-312

PLOTDRIVER: $PLTDRV$
PEN TABLE: $PENTBL$
PRINTED BY: $USER$

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:



OPTION 1



OPTION 2

CONCEPTUAL DEWATERING REQUIREMENTS FOR LEFT BANK FLOOD WALL

SCALE: 1/2"=1'

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.

FILE: $FILE$
MODEL NAME: $MODELNAME$
DATE & TIME: $DATE$ $TIME$
LAST SAVED BY:
PLOTDRIVER: $PLTDRV$$
PEN TABLE: $PENTBL$$
PRINTED BY: $USER$

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: J ELWOOD
DRAWN BY: P WALKER
CHECKED BY:
SUBMITTED BY:
DATE:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
PLOT SCALE: AS SHOWN
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $FILE$

ALA WAI WATERSHED PROJECT

FLOOD WALL DETAILS

SHEET IDENTIFICATION
C-312A

Attachment 5

Waikiki Buffer Zone

WAIKIKI BUFFER ZONE

Note: Construction activity may cause damage to the Beachwalk WWPS force mains from ground vibrations or soil liquefaction. Prevention, mitigation, and/or monitoring measures may need to be taker. It is the responsibility of the owner/contractor to prevent any impacts or potential damage to the force main.

DASHED – FORCE MAINS

SOLID – GRAVITY

N

0 230 460 690 920

Feet

Prepared by: Dept. of Design & Construction
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