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Honolulu's Largest Wastewater Force Main System

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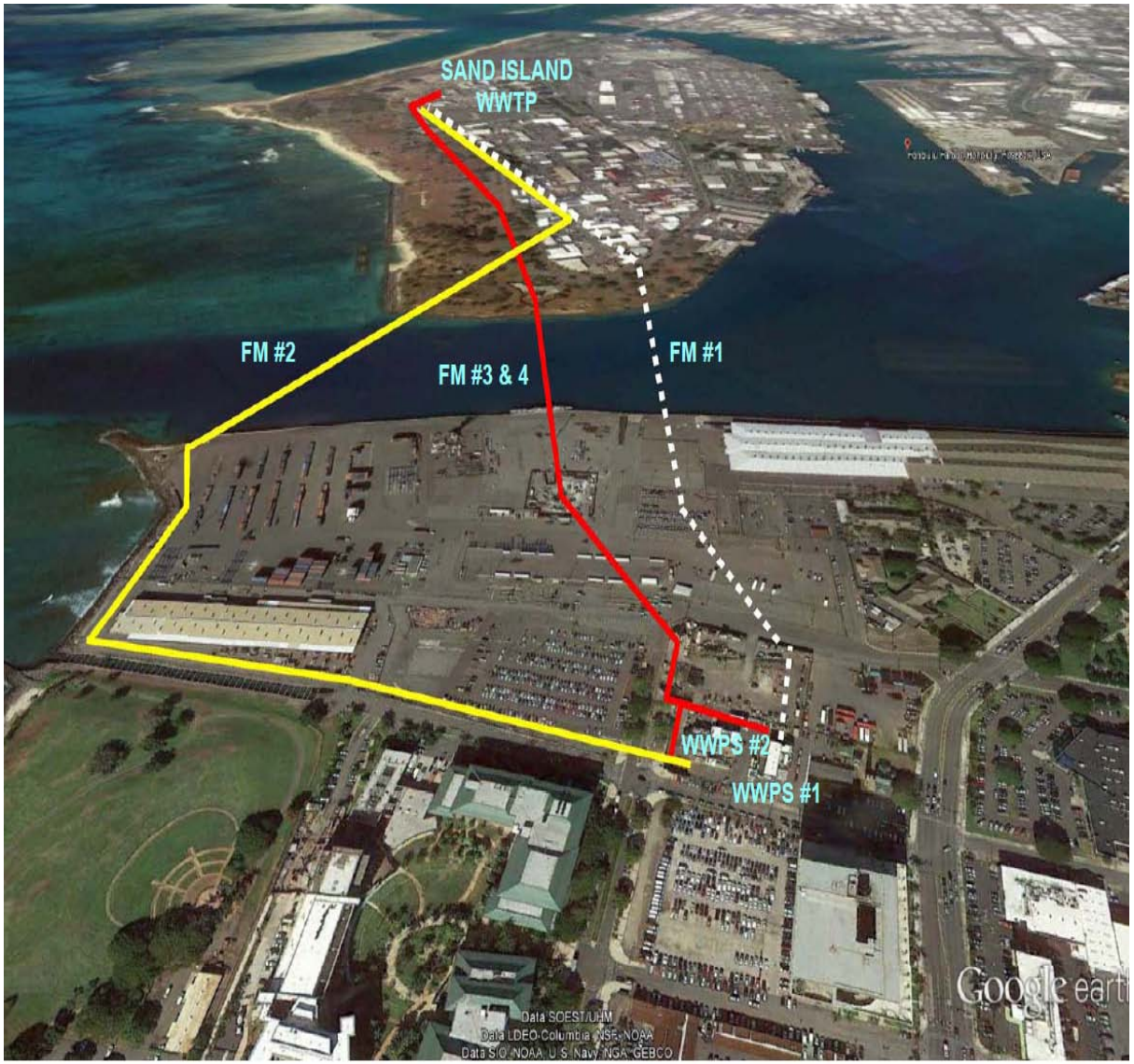
Outline

- Overview
- Design Considerations
- Design Challenges
- Bid Requirements
- Construction



PROJECT TEAM

CITY & COUNTY OF HONOLULU, DEPARTMENTS OF ENVIRONMENTAL SERVICES (ENV) & DESIGN & CONSTRUCTION (DDC)

DESIGN CONSULTANTS

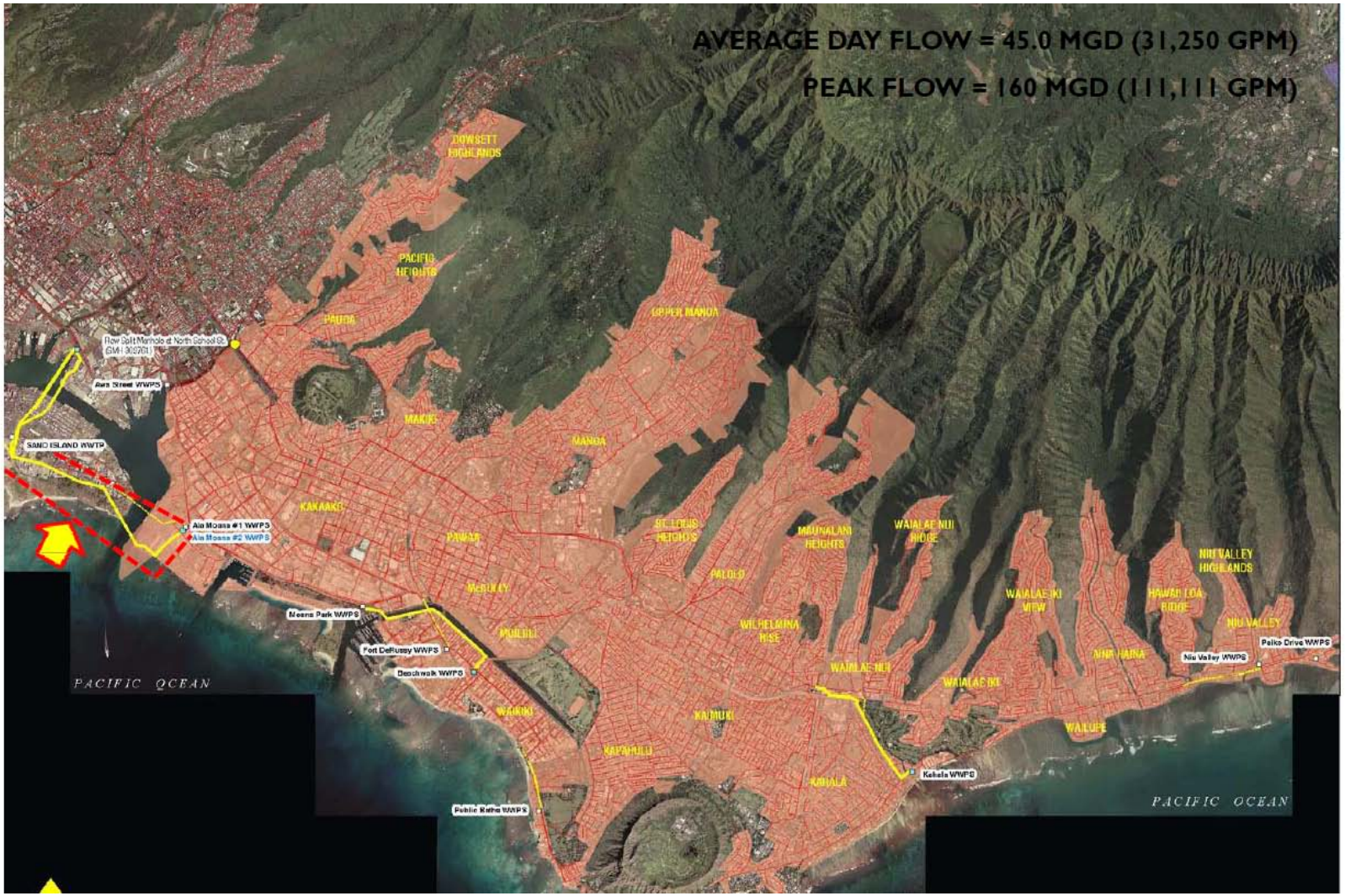
CIVIL/PRIME: Fukunaga & Associates, Inc.
GEOTECHNICAL: Yogi Kwong Engineers, LLC
STRUCTURAL: Shigemura, Lau, Sakanashi, Higuchi & Associates, Inc.
ELECTRICAL: MK Engineers, Ltd.
ENVIRONMENTAL: Element Environmental, LLC
CORROSION PROTECTION: V&A Consulting Engineers, Inc.
SURGE ANALYSIS / CONTROLS: Flow Science, Inc.
LANDSCAPE: Walters, Kimura, Motoda, Inc.
ARBORIST: Steve Nimz and Associates, Inc.

GENERAL CONTRACTOR

FRANK COLUCCIO CONSTRUCTION COMPANY

CONSTRUCTION MANAGER

YOGI KWONG ENGINEERS, LLC



Ala Moana WWPS & Force Main Service Area

Global Consent Decree Project

US EPA/DOJ & State DOH

- Execute Construction Contract by July 31, 2012
- Complete Construction of New Force Main by December 31, 2014

Project Objectives

- GCD – Design and Complete Construction of Force Mains #3 and #4 with Force Main #2 as backup

- Provide a WWPS/Force Main System with sufficient capacity and operational flexibility to handle current and future design conditions

Existing Systems

Force Main #1

- 60” diameter – reinforced concrete pipe
- Built in 1952 (channel crossing in 1958) ~ 60 years old
- 66 mgd capacity
- Pressure rating: 58 feet

Force Main #2

- 66”-78” diameter – reinforced concrete pipe / concrete cylinder pipe
- Built in 1983 ~ 30 years old
- 157± mgd capacity
- Pressure rating: 80 feet
- Break occurred on Sand Island side of channel crossing in 2004

Ala Moana WWPS Force Main System

Design Parameters	
Design Life	50-year
Design Year	2065
FM System Design Peak Flow	225 mgd
FM System Capacity	New FM System sized to convey the Design Peak Flow assuming the largest FM (FM #2) out of service.

Ala Moana WWPS Force Mains					
	Diameter	Working Pressure	Capacity	Year Built	Average and Peak Dry Weather Flow Velocity
AMFM #2	66” – 78” RCP	75 feet	157± mgd	1983 (~30 years old)	
AMFM #3	63” CCGFRP	115 feet	170± mgd 123 mgd (9 fps)	2015	3.28 fps, 3.93 fps
AMFM #4	63” CCGFRP	115 feet	170± mgd 123 mgd (9 fps)	2015	3.28 fps, 3.93 fps

Ala Moana Force Mains #3 & #4 Overall Alignment

Operations

Normal Operations

- WWPS #1 discharging through FM #3
- WWPS #2 discharging through FM #4

Alternative Operations

- Both WWPS discharging through 1 FM to flush that FM

Emergency Operations

- With any force main segment or valve out of service, at least 1 WWPS and 1 FM path can remain available for service

Affected Landowners Approvals/Easements

- Hawaii Community Development Authority (HCDA)
  - Right of Entry / Construction Staging / Easement
- Office of Hawaiian Affairs (OHA)
  - Easement
- State of Hawaii – DLNR – State Parks
  - Right of Entry / Construction / Easement
  - Land & Water Conservation Program Fund (2-yr Construction Period)
- State of Hawaii – DOT – Harbors
  - Right of Entry / Construction / Easement
- State of Hawaii – DOT
  - Construction Staging Area – Sand Island

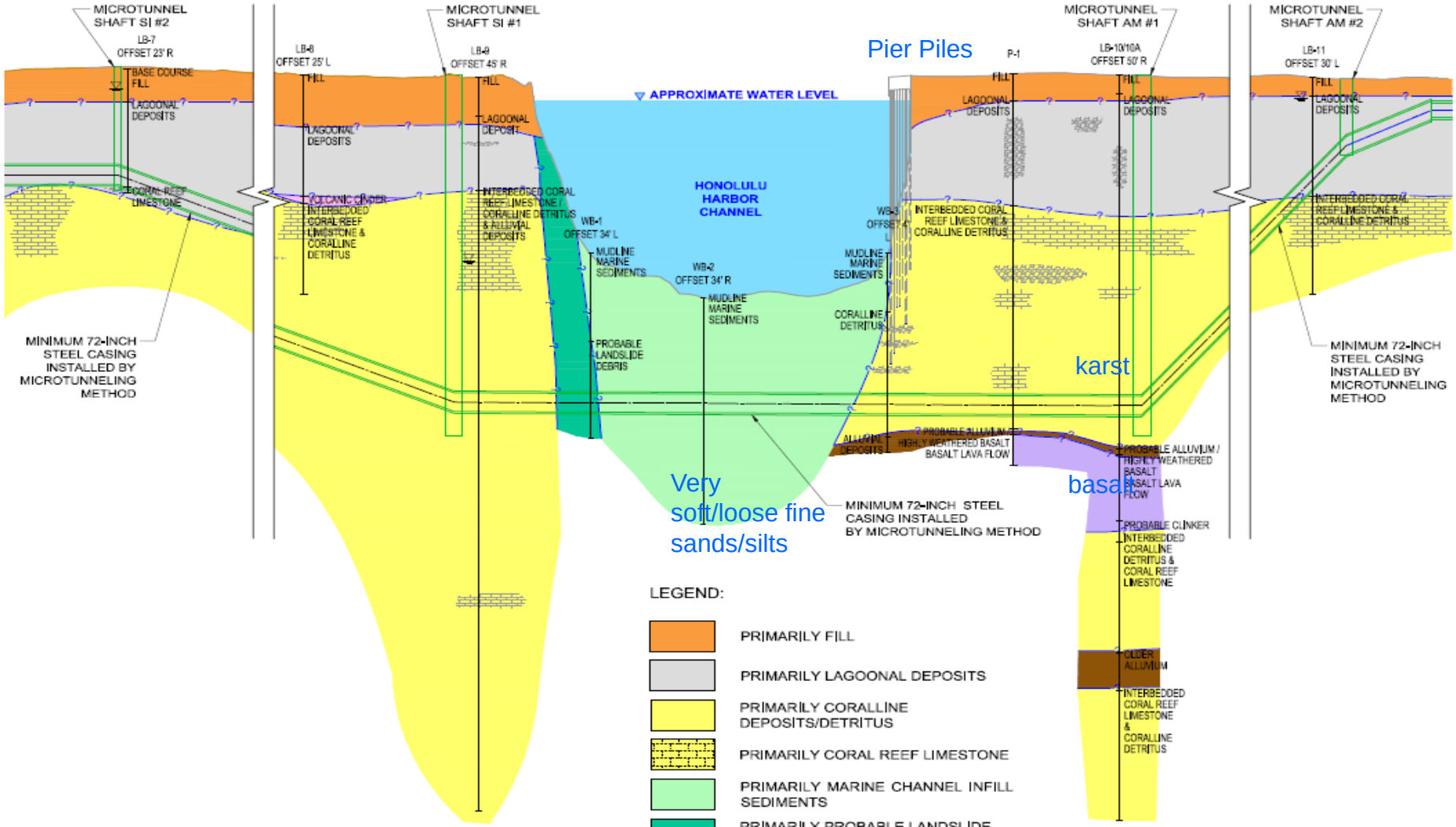
Permits/Approvals Required

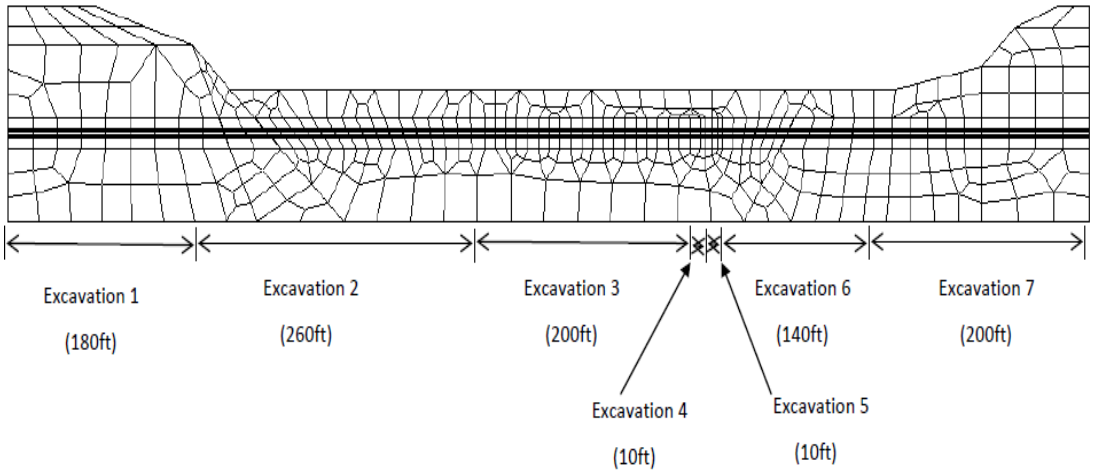
- Coastal Zone Management Program (CZM)
- Conservation District Use Application (DLNR)
- Department of the Army Permit (COE)
- Environmental Assessment/FONSI (OEQC)
- Hawaii Community Development Authority (HCDA)
- Industrial Wastewater Discharge Permit (C&C ENV)
- Land and Water Conservation Fund Program Approval (LWCF) (NPS)
- National Pollutant Discharge Elimination System (NPDES) Permit (DOH)
- Noise Variance Permit (DOH)
- Special Management Area (SMA) Use Permit (City)
- State Historic Preservation Division (DLNR)
- U.S. Coast Guard – work in Harbor (Maritime Security)

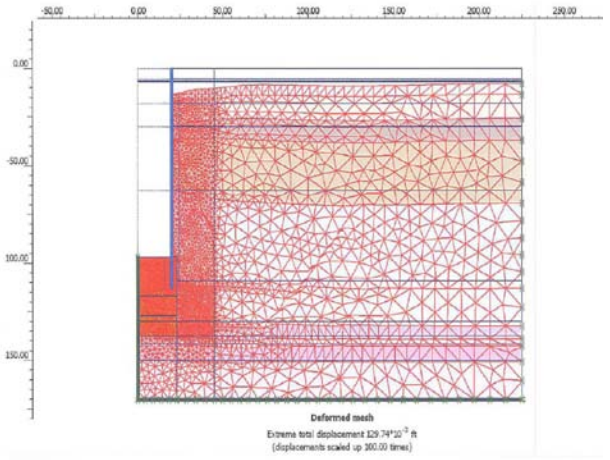
Main Technical Design Challenges

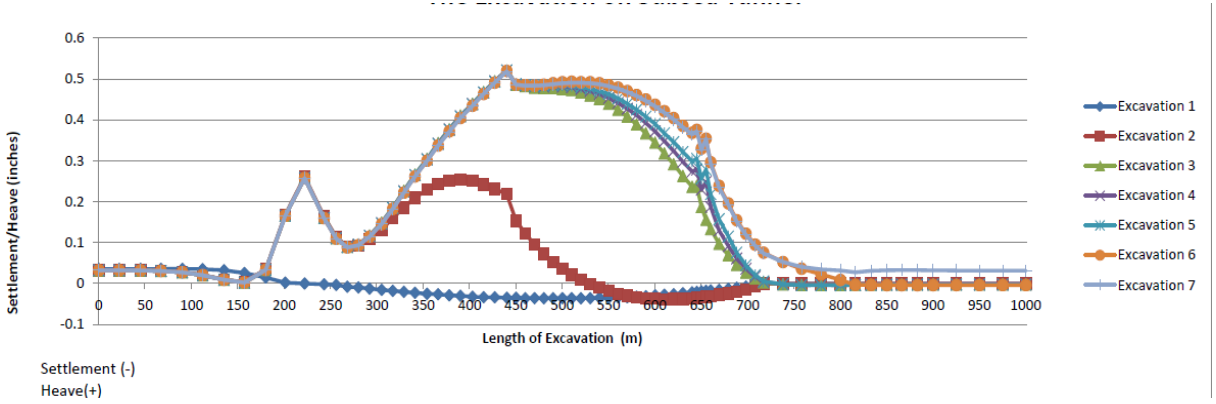
- Geotechnical Challenges
  - Most of the new FM is below sea level – -20 to -80 ft MSL
  - Need to avoid existing pier piles
  - 1,588 lf force main harbor crossing is at elevation (-) 80 ft MSL – include crossing of buried canyon filled with very soft & loose fine sands/silt fine sands (N=0)
  - Variable coralline detritus & limestone with cavities, very hard basalt lavas
  - Potential unsteerable conditions for microtunneling, steep incline drives (10%)
  - Deep shafts – 20 to 100 feet deep, hydrostatic pressure, excavation stability
  - Large piping/valves/vaults – 54 to 81 inch piping systems, buoyancy & settlement concerns during and after installation
  - Not possible to perform emergency recover or ground improvement in harbor channel
- Maintaining wastewater flow during construction and connections
  - Ala Moana WWPS and Sand Island WWTP must remain in service throughout project
  - Provide adequate capacity during construction – bypass piping plans

Project Site General Plan

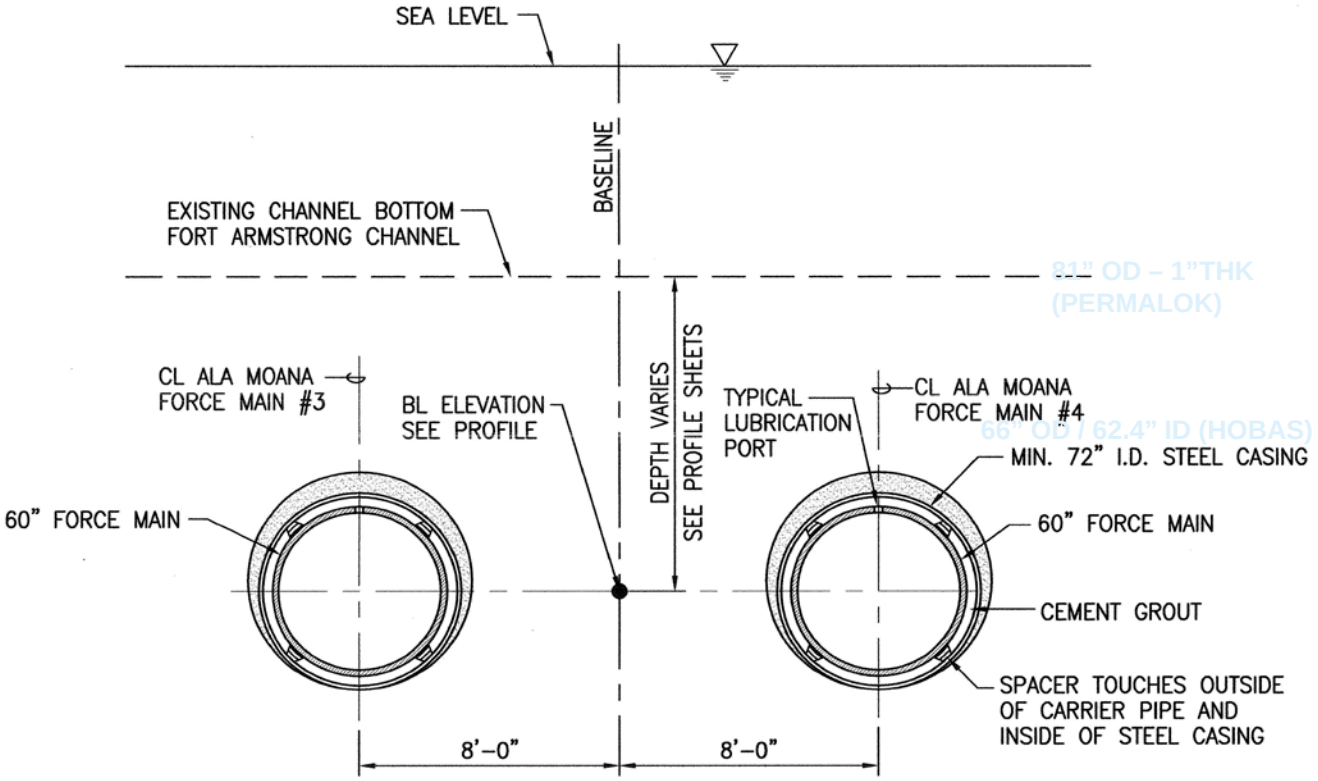

MICROTUNNEL SHAFT SI #2
LB-7 OFFSET 23' R
BASE COURSE FILL
LAGOONAL DEPOSITS
CORAL REEF LIMESTONE
MINIMUM 72-INCH STEEL CASING INSTALLED BY MICROTUNNELING METHOD
MICROTUNNEL SHAFT SI #1
LB-8 OFFSET 25' L
LB-9 OFFSET 45' R
FILL
LAGOONAL DEPOSITS
VOLCANIC CINDER
INTERBEDDED CORAL REEF LIMESTONE & CORALLINE DETRITUS
INTERBEDDED CORAL REEF LIMESTONE / CORALLINE DETRITUS & ALLUVIAL DEPOSITS
APPROXIMATE WATER LEVEL
HONOLULU HARBOR CHANNEL
WB-1 OFFSET 34' L
WB-2 OFFSET 34' R
MUDLINE MARINE SEDIMENTS
PROBABLE LANDSLIDE DEBRIS
Pier Piles
P-1
MICROTUNNEL SHAFT AM #1
LB-10/10A OFFSET 50' R
WB-3 OFFSET 4' L
CORALLINE DETRITUS
ALLUVIAL DEPOSITS
HIGHLY WEATHERED BASALT LAVA FLOW
karst
basalt
PROBABLE ALLUVIUM / HIGHLY WEATHERED BASALT
BASALT LAVA FLOW
PROBABLE CLINKER
INTERBEDDED CORALLINE DETRITUS & CORAL REEF LIMESTONE
OLDER ALLUVIUM
INTERBEDDED CORAL REEF LIMESTONE & CORALLINE DETRITUS
MICROTUNNEL SHAFT AM #2
LB-11 OFFSET 30' L
MINIMUM 72-INCH STEEL CASING INSTALLED BY MICROTUNNELING METHOD
Very soft/loose fine sands/silts
MINIMUM 72-INCH STEEL CASING INSTALLED BY MICROTUNNELING METHOD
LEGEND:
PRIMARILY FILL
PRIMARILY LAGOONAL DEPOSITS
PRIMARILY CORALLINE DEPOSITS/DETRITUS
PRIMARILY CORAL REEF LIMESTONE
PRIMARILY MARINE CHANNEL INFILL SEDIMENTS
PRIMARILY PROBABLE LANDSLIDE SLUMP/DEBRIS
PRIMARILY ALLUVIAL DEPOSITS
PRIMARILY VOLCANIC CINDER
PRIMARILY BASALT LAVA FLOW(S)







Examples of geotechnical analyses performed to develop bid requirements. 3-D FEM analysis of potential steel casing deflection at stages of microtunneling assisted by Tritech, Inc.



B
VARIES | C–1

TYPICAL SECTION –
BL STA. 43+87.96 TO 59+67.96
(MICROTUNNEL WITH STEEL CASING)

SCALE: 1/4"=1'–0"

Sewer Force Main Pipe Considerations

- Design Considerations/Requirements
  - Proven installation/service track records
  - Corrosion Resistance (a must in Hawaii)
  - Low Maintenance (up to 90 feet deep, pressure application)

Pressure Force Main

- Design Requirements
  - Pressure Class PN100 psi
  - Burst Test to 400 psi
  - Stiffness Class SN100 (w/o steel casing support)
- National Standards
  - ASTM D3754 factory pressure test 1 of 100 joints
  - ASTM D2412 parallel plate test (SN CLASS)

Pressure Force Main

- Installation
  - Field Inspected for Observable Defects (by manufacturer's representative and CM inspectors)
  - Field Tested to 150 psi
  - No Specification Conformance Issues observed

Some Bidding Requirements

- Bidders Statement of Qualifications
  - Microtunneling
  - Shafts Design/Construction (Contractors & its retained Structural, Civil, Geotechnical)
  - Jet Grouting
  - Force Mains Connections By-Pass
- Microtunneling
  - Microtunneling Systems, work plan and sequencing to include mitigation of buoyancy uplift, potential microtunneling induced ground movements during and after installation of pipelines, jacking steel casing
  - Provisions to access tunnel heading through access door(s) in MTBM in case of unforeseen obstruction, automated guidance systems
- Shafts
  - Contractor responsible for design & selection of methods. Feasible methods included contiguous reinforced concrete drilled piers with ground improvement by jet grouting, vertical shaft sinking method, and ground water control by a structural concrete bottom slab

Shafts less than 50 feet deep

Jacking Casing Pipe Submittals included certification from manufacturer, for compliance with project requirements


Pipe Submittals included certification from manufacturer,
for compliance with project requirements


90-ft deep shaft, Pier 1
S6
S8

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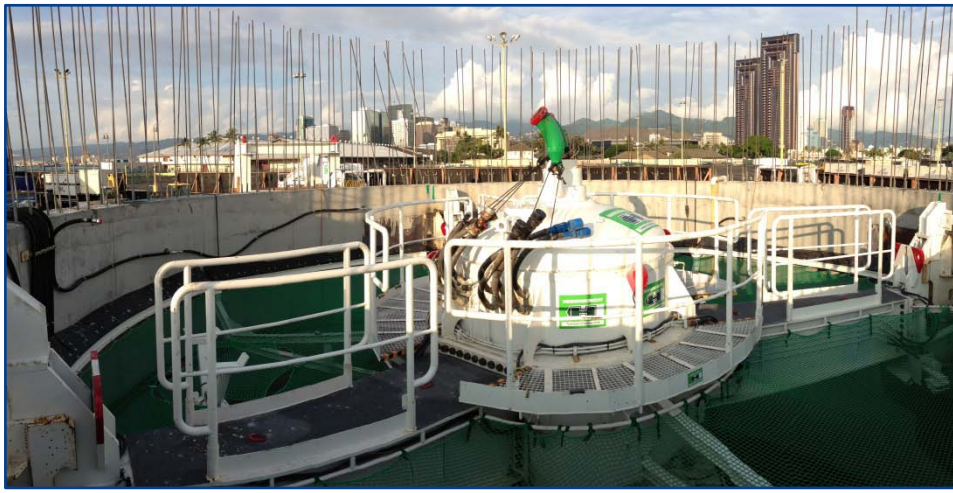
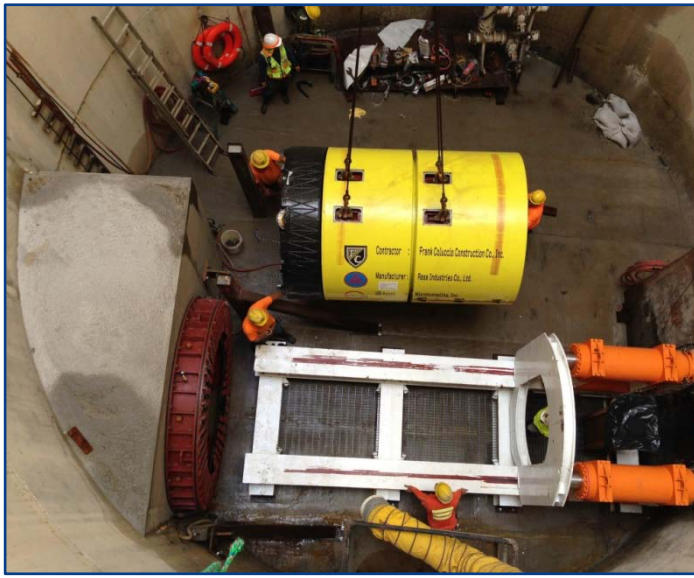
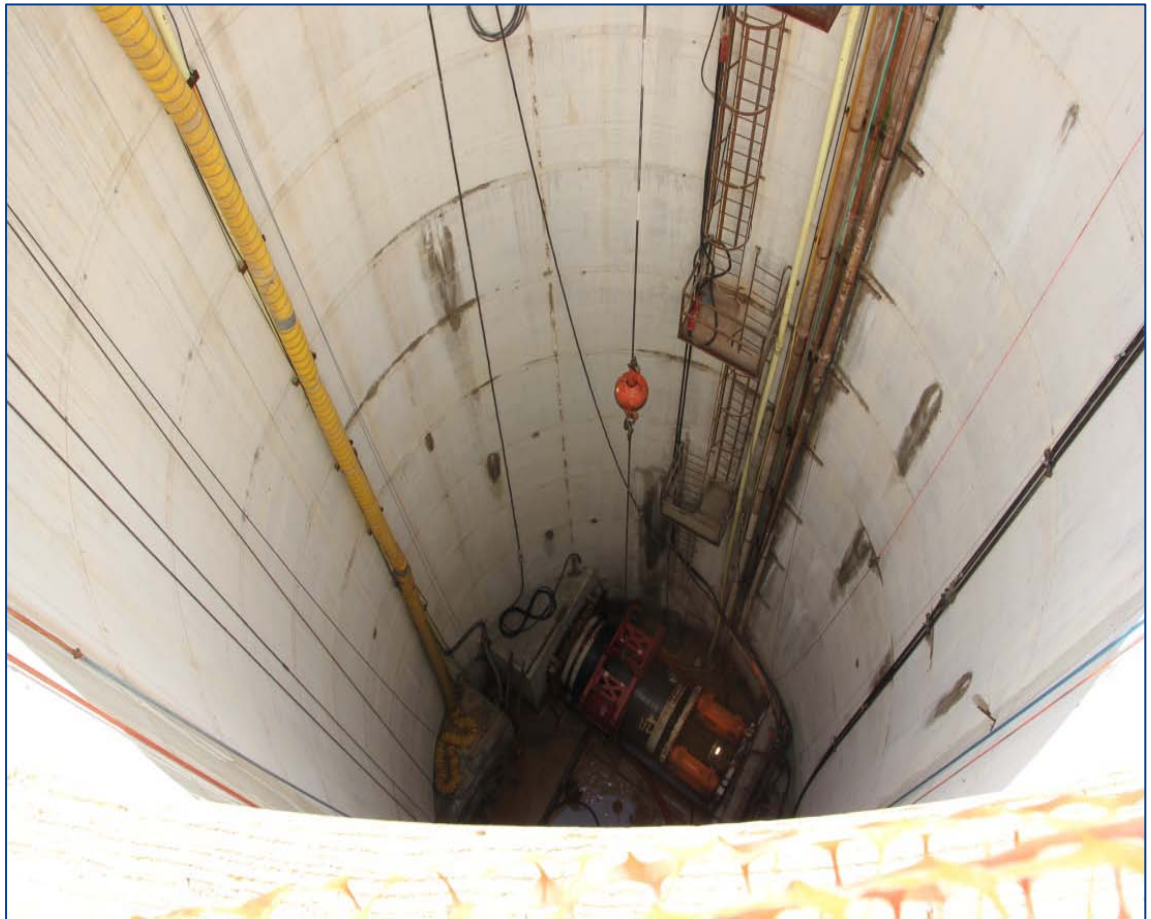
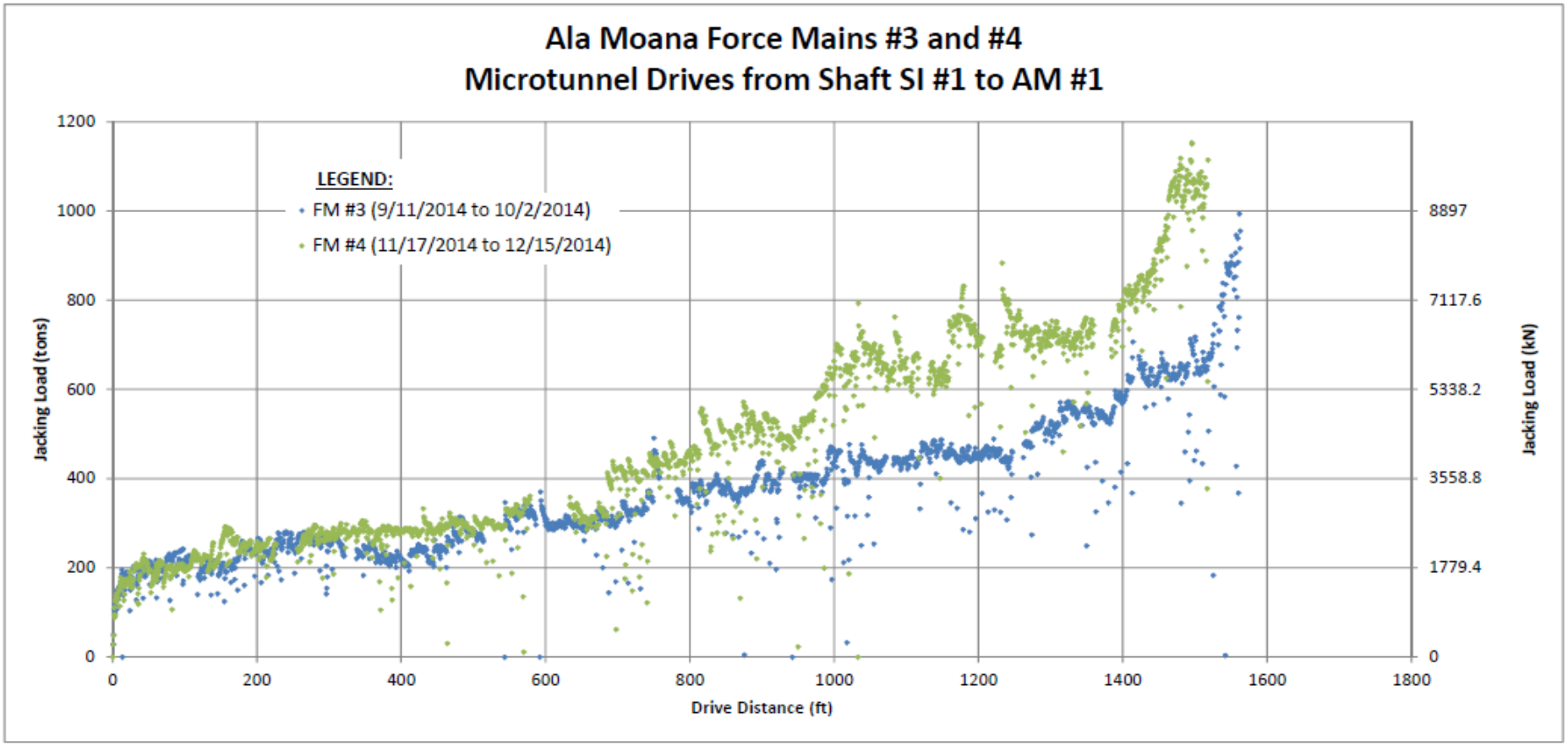




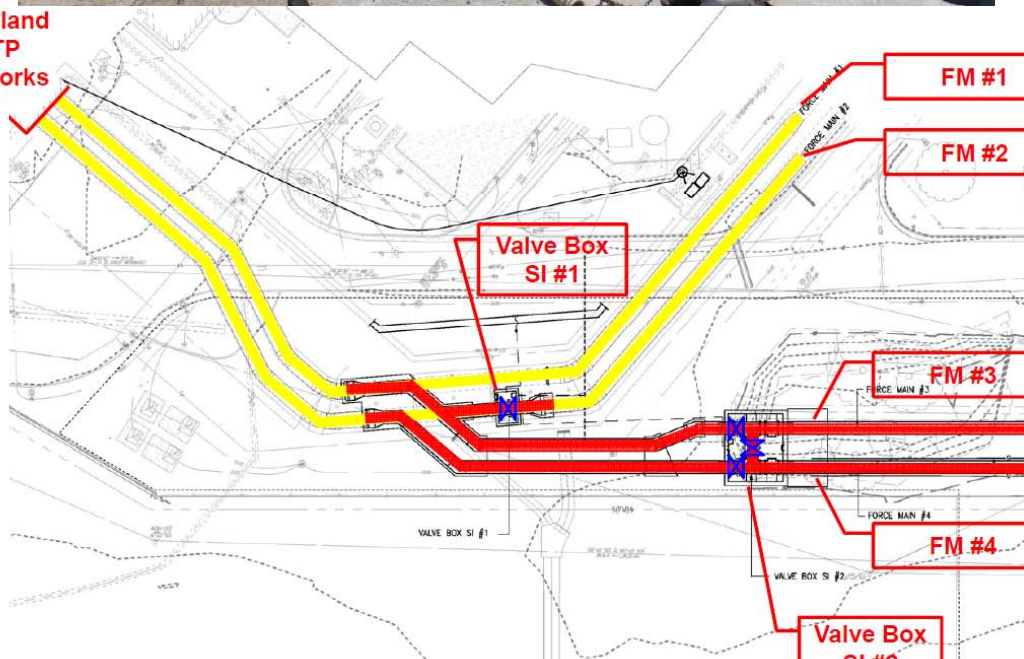


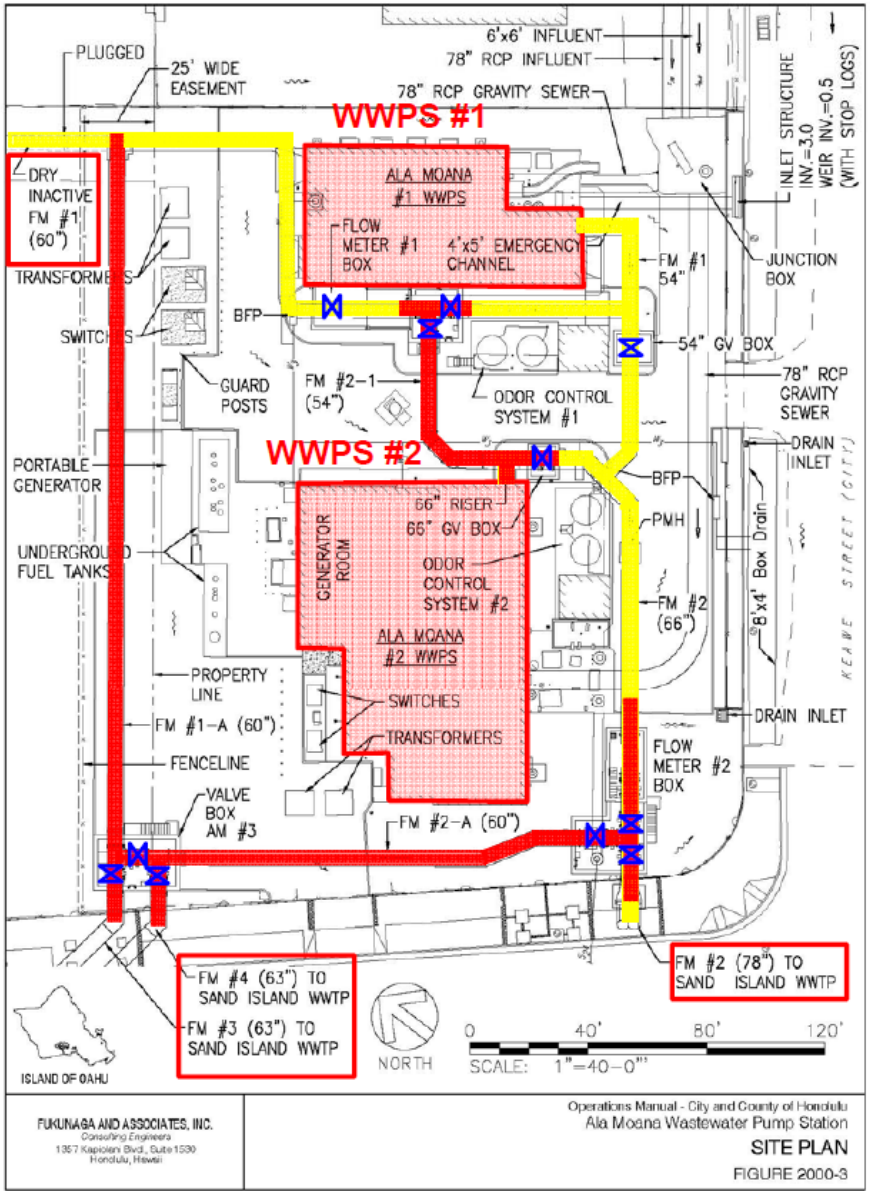


Note: Recorded grade deviations of less than +/- 2 inches over 50 to 100 feet of jacked distances

Installation of carrier sewer force main pipes

Sand Island
WWTP
Headworks




WWPS #1
WWPS #2
ALA MOANA #1 WWPS
ALA MOANA #2 WWPS
6'x6' INFLUENT
78" RCP INFLUENT
78" RCP GRAVITY SEWER
INLET STRUCTURE INV.=3.0 WEIR INV.=0.5 (WITH STOP LOGS)
PLUGGED
25' WIDE EASEMENT
DRY INACTIVE FM #1 (60")
TRANSFORMERS
SWITCHES
BFP
FLOW METER #1 BOX
4'x5' EMERGENCY CHANNEL
FM #1 54"
JUNCTION BOX
54" GV BOX
GUARD POSTS
FM #2-1 (54")
ODOR CONTROL SYSTEM #1
78" RCP GRAVITY SEWER
PORTABLE GENERATOR
DRAIN INLET
66" RISER
66" GV BOX
GENERATOR ROOM
ODOR CONTROL SYSTEM #2
PMH
UNDERGROUND FUEL TANKS
FM #2 (66")
8'x4' Box Drain
KEAWE STREET (CITY)
PROPERTY LINE
SWITCHES
TRANSFORMERS
FM #1-A (60")
DRAIN INLET
FENCELINE
FLOW METER #2 BOX
VALVE BOX AM #3
FM #2-A (60")
FM #4 (63") TO SAND ISLAND WWTP
FM #3 (63") TO SAND ISLAND WWTP
FM #2 (78") TO SAND ISLAND WWTP
ISLAND OF OAHU
NORTH
0 40' 80' 120'
SCALE: 1"=40-0"
FUKUNAGA AND ASSOCIATES, INC.
Consulting Engineers
1357 Kapiolani Blvd., Suite 1530
Honolulu, Hawaii
Operations Manual - City and County of Honolulu
Ala Moana Wastewater Pump Station
SITE PLAN
FIGURE 2000-3

GCD Milestones

- Execute Construction Contract by July 31, 2012
  - Design Completed – May 2011
  - Bids Opened – September 28, 2011
  - Budget Estimate - $167 M
  - Three Bids – Range $117 M - $153 M
  - Contract Award & NTP – November 28, 2011
    - Frank Coluccio Construction Company
- Completed Construction of New Force Main System by December 31, 2014

Thank you

Questions?